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REMEDIAL ACTION WORK PLAN VOLUME I NIROP FRIDLEY MN
9/1/2005
TETRA TECH

# Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-94-D-0888

Rev. 1
09/05

002

# Remedial Action Work Plan

## Naval Industrial Reserve Ordnance Plant
## Fridley, Minnesota

## Contract Task Order 0330

## September 2005


Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406


TETRA TECH NUS, Inc.

# Minnesota Pollution Control Agency

**CERTIFIED MAIL**
**RETURN RECEIPT REQUESTED**

October 6, 2005

Commanding Officer
Southern Division
Naval Facilities Engineering Command
Attn.: Dan Owens, Code ES32
P.O. Box 190010
North Charleston, SC 29419-9010

RE: Naval Industrial Reserve Ordnance Plant Superfund Site

Dear Mr. Owens:

The Minnesota Pollution Control Agency (MPCA) staff has reviewed the final change pages to the Remedial Action Work Plan, dated September 2005, submitted by Mr. Mark Sladic of Tetra Tech NUS, Inc. on behalf of the U.S. Navy in his letter of September 23, 2005. The Remedial Action Work Plan is for Operable Unit 1 of the Naval Industrial Reserve Ordnance Plant (NIROP) Superfund Site and was submitted pursuant to the Federal Facility Agreement, dated March 27, 1991, between the MPCA, the U.S. Environmental Protection Agency, and the U.S. Navy (Navy).

The MPCA staff hereby approves the Response Action Work Plan as modified by the final change pages contained in Mr. Sladic's letter cited above.

If you have any questions regarding this letter, please call me at (651) 296-7818.

Sincerely,

David N. Douglas, Project Manager
Superfund Unit 2
Superfund and Emergency Response Section
Remediation Division

DND:csa

cc: Tom Smith, U.S. Environmental Protection Agency
Mark Sladic, Tetra Tech NUS, Inc.
Venky Venkatesh CH2MHILL Constructors, Inc.

**RESPONSES TO EPA REGION 5 COMMENTS CONCERNING THE REMEDIAL ACTION WORK PLAN, NAVAL INDUSTRIAL RESERVE ORDNANCE PLANE, FRIDLEY, MINNESOTA (09-02-05)**

## GENERAL COMMENTS AND RESPONSES

1. The RAWP appears to present incomplete redline strikeout information. For example, in QAPP Tables A6-2 and A6-3, the method detection limits (MDLs) and reporting limits (RLs) have been changed from those provided in a previous version of the RAWP. However, from the list of revisions it was not possible to determine if these values were supposed to be changed since the previous values are not presented as redline/stikeouts. The only way to determine if these and other similar changes were made is to compare the previous and current versions of the RAWP, which defeats the purpose of presenting redline/strikeouts. Please note, these are examples of this type of discrepancy, and several other similar inconsistencies were also noted elsewhere in the RAWP (e.g., QAPP Table A6-1, RAMP, etc.). The 2005 RAWP or a related submittal should clearly present all appropriate redline/strikeout changes.

**Response 1:**

Tables A6-2 and A6-3 are entirely new, as the information is laboratory specific. The MDLs and RLs should be reviewed on their own merits, not based on changes from the prior laboratory's characteristics. No action is proposed.

2. The QAPP indicates that the laboratory has been changed from EnChem to Columbia Analytical Services (CAS). However, it is unclear if CAS has the proper certifications (Navy, State of Minnesota, etc.), if they have passed any/all necessary laboratory audits, if they have received acceptable results on performance evaluation samples, etc. The QAPP should either be revised to address these concerns or some other relevant documentation should be provided for review. In addition, all applicable standard operating procedures and the CAS Quality Assurance manual should be provided for review.

**Response 2:**

Appendix A of the referenced QAPP includes the laboratory QA Manual and certifications for the new laboratory (CAS/Kelso). Laboratory standard operating procedures are also included in Appendix A of the QAPP.

No action is proposed.

## QAPP SPECIFIC COMMENTS AND RESPONSES

1. Section A7.3.2, Field Completeness Objectives, page A7-4: This section indicates that there are no completeness requirements for the majority of the field parameters. However, in the previous version, these parameters were required to achieve 100% completeness. No justification for this change has been provided. Revise this section to provide adequate justification for the reduced completeness requirements.

**Response 1:**

The requested justification is included in Section A7.3.2. The justification as stated there is:

> "There are no completeness criteria for pH, specific conductance, and temperature, as these are non-critical parameters that are generally determined to verify that appropriate sampling conditions exist prior to sampling."

In addition, the text goes on to state:

> "Although there are no completeness criteria for pH, specific conductance and temperature, the field crew should strive to attain 100 percent completeness because the additional data may be useful for other purposes besides the attainment of project objectives described in this QAPP."

No action is proposed.

2. Section A7.4.1, Representativeness Definition, page A7-5: This section indicates that representativeness will be assessed "to determine whether each datum belongs to the observed data distribution." However, it is unclear what type of assessment will be done. Previously, this section indicated that the assessment would be through outlier testing. Revise this section to indicate what assessment will be done under the current QAPP.

**Response 2:**

Statistical outlier testing sometimes does not identify true outliers and sometimes it flags as outliers values that cannot be verified to be outliers. Therefore, references to outlier testing (which is often interpreted to mean statistical testing) were removed from the referenced text. Because the data will be trended over time, a more powerful approach to outlier identification is actually a comparison of data values over time with knowledge of how samples were collected, and circumstances surrounding the data generation. This type of review, however, is subject to interpretation and professional judgment and there is no standard statistical or other approach that can be defined in advance that will adequately support all possible scenarios. Therefore, to

clarify the intent of the reference statement, the following text has been added as the fourth sentence in Section A7.4.1:

> "Factors considered during this assessment will include adherence to designated SOPs, relative concentrations of analytes from previous and current sampling rounds, and any other factors that are relevant at the time of assessment. If analyte concentrations appear to deviate from a trend line drawn through the data points (after allowing for data uncertainties), the apparently discordant values will be investigated to determine whether they are erroneous. The choice of linear or non-linear trends for this evaluation will be based on the appearance of the data and may include calculation of best fits to various trend line models. Models used must be reasonable concentration decay models applicable to groundwater monitoring."

3. Section A9, Documentation and Records, page A9-1: This section does not address manual integrations. While this may not have been discussed in the previous versions of the QAPP, the laboratory should provide appropriate documentation (i.e., chromatograms before and after the manual integration, the reason for each manual integration, and the analysts initials and date on each manual integration) for every manual integration performed during the analysis of these samples. Please note that this should be done for all site samples and associated calibration standards and QC samples. Revise the QAPP to include this information.

**Response 3:**

The following text has been inserted after the last sentence of Section A9.1.3:

> "When manually integrating chromatographic peaks for site samples, the laboratory should provide appropriate documentation (i.e., chromatograms that include data for retention times before and after the manual integration, the reason for each manual integration, and the analyst's initials and date on each manual integration) for every manual integration performed during the analysis of the samples. This should also be done for associated calibration standards and QC samples."

4. Section B2.1, Field Measurement Procedures, page B2-1: It is unclear exactly when field measurements will be taken. Previously, this section indicated that a "YSI" would be used to measure field parameters. However, this section now indicates that a "YSI" may be used to measure field parameters. Clarify whether this statement means that another or different instrument will be used or if field parameters will not always be analyzed. Ensure that the QAPP

**Response:** See Appendix B of the RAMP portion of the RAWP. Only Problem B (Effectiveness of the capture well system) and Problem C (Groundwater Monitoring for Overall Contamination at NIROP) are relevant to annual groundwater monitoring. An explicit requirement has been added to Section 4.5.2 of the RAMP to discuss attainment of DQOs relative to the DQOs presented in Attachment B. An evaluation of attainment of DQOs will be added to each year's AMR starting with 2005. The DQO discussion will present the Decision Statements for Problem B (Determine whether NIROP groundwater contamination is substantially prevented from leaving the NIROP property after startup of new [pumping] wells) and Problem C (If contaminated groundwater (>100 ppb TCE) is migrating beyond the north and south edges of the capture well line along the NIROP compliance line, evaluate potential system enhancements, source control, etc., as appropriate to improve the containment system. If not, optimize the groundwater monitoring system by selecting different pumping rates, deselecting wells from the list of monitoring/pumping, etc. as appropriate, based on best professional judgment using data analysis tools [identified elsewhere in the DQO notes]. Appendix B indicates that attainment of DQOs will be based on a weight of evidence approach.

The additional text, placed at the beginning of the second to last paragraph of Section 4.5.2 is as follows:

> "DQOs (Problems B and C of Appendix B) will be evaluated and the evaluation will be documented in each AMR, beginning with the 2005 AMR. The process used to conduct this evaluation will be in accord with the applicable DQOs presented in Appendix B. A presentation of the decision statements being evaluated, the evaluation approach, and the results and conclusions of the evaluation will be presented in AMR Section 6.0."

The discussion concerning attainment of DQOs is anticipated to heavily reference the discussions related to topics presented elsewhere in Section 4.0 of the RAMP. The conclusions based on this approach will also be reported in each AMR Section 6.0 – Conclusions and Recommendations. Note that the Navy feels that a thorough evaluation of DQOs is already implicit in Section 4.0; all that changes is that the foregoing process will make it explicit.

In addition, please note that pursuant to the FFA Attachment B, Section IV, the monitoring program requires that only the following items be provided in the AMR:

(1) The results of all water level measurements and parameter analyses for the previous year.

(2) A water level contour map for the regional ground water aquifer for high and low potentiometric and surface water elevations;

(3) A map showing each well with the concentrations of pollutant for each sampling event;

(4) Graphs illustrating the concentrations over the time using data from each sampling event (this graph shall be cumulative showing water quality for all previous years as well as the reporting year); and

(5) A sampling plan for the next year with an assessment of the monitoring parameters; sampling frequencies, and the need for the addition or deletion of monitoring wells.

The Navy far exceeds these requirements on an annual basis with each AMR, as evidenced by Section 4.5.2 of the RAMP. Nonetheless, the Navy will add the new information as described above to each year's AMR.

In addition, the following from the Tetra Tech transmittal letter of 20 July 2005 has been inserted at the end of QAPP Section C1.1.1.2:

> "The Navy will report to the MPCA all major findings of internal audits to include a description of problems identified, corrective actions taken, and ultimate resolution of the problems. Any corrective actions taken in the field to mitigate conditions adverse to quality will be summarized. A description of corrective actions taken on site, if any, will be included in the AMR. In addition, key field personnel changes will also be documented in the AMR. These changes will represent changes to decision makers rather than individual personnel such as sample collectors."

At the beginning of the last sentence of QAPP Section D1.4.1, the following text has been inserted:

> "In addition to the above, a review of the data will be conducted to determine the extent to which data precision, accuracy, completeness, comparability, representativeness, and sensitivity objectives were met. This review will be summarized in the conclusions of the AMR."

**Figure A4-1.**

**Comment:** In Figure A4-1, the MPCA staff requests that the Navy list the CAS/Kelso laboratory contact name.

**Response:**

Figure 4-1 has been revised to list the CAS/Kelso laboratory contact name, as requested. The name is Greg Salata.

**Table A6-3.**

**Comment:** The MPCA staff requests that the Navy reduce the reporting limit for tetrachloroethene to 3.8 µg/L to match the Daily Maximum Limit.

**Response:**

The laboratory reporting limit has been reduced to 3.8 µg/L, as requested, and the new limit is shown on Table A6-3.

**Table A7-1.**

The limits present in Table A7-1 are reasonable in most cases, but some of them are below 50% and a few even at 10%. This is unacceptable to the MPCA for MS/MSD or LCS limits. If the laboratory chooses to use these limits – that may be their internal SOP – the validation and data review will require that data below 50% be rejected and require flagging of data between that point and 70% recovery.

**Response:**

The Navy representative, Dr. Tom Johnston, contacted MPCA representative, Mr. Luke Charpentier, to discuss this comment because the direction in this comment conflicts with MPCA written guidance available on the MPCA web site. The written guidance is as follows:

From the MPCA Draft QAPP Guidance (26 June, 2003):

> "e. The outside limits used by MPCA for data review of spikes, surrogates and control samples are; 75-125% recovery of volatiles (except gases), 75-125% recovery for all metals, 30 – 150% recovery for all semivolatile compounds, and 50 – 150% for other inorganics. These are OUTSIDE limits and should not be used as laboratory control limits in place of Shewart charts or recommended method control limits, but consultants should flag data that fails to meet these limits at a minimum;"

From the Laboratory Data Checklist:

> "The recoveries are compound specific, but generally 30 - 150% for organic and 80 - 120 % for inorganic are expected."

After discussion on this topic, both representatives agreed that the requested 50% limit is not required by the written MPCA guidance. The MPCA representative indicated that rejection of data with recoveries less than 50% would be required, nonetheless. He clarified to indicate that this criterion applies to all LCSs and to valid MSs. Valid MSs are those MSs for which the spike amount (expressed in native sample concentrations units) is at least 25% of the native sample concentration. At this time, Navy has agreed to accept the 50% limit, with reservation, for AMR data only.

The laboratory (CAS/Kelso) has been notified of this requirement.

The Navy will apply the 50% recovery requirement to all AMR VOC data unless the spike amount is less than 25% of the native analyte concentration in the sample. The following new footnote 2 has been added to Table A7-1:

> "(2) Recoveries less than 50 percent will cause data to be rejected during data validation. Values between 50 and 70 percent will be flagged with a "J" qualifier flag. This 50% limit is in conflict with the National Functional Guidelines for Organic Data Review and written MPCA guidance. However, per MPCA request it will be applied for the AMR data set only. The Navy reserves the right to revisit this requirement for all other data uses, or in the event that data of otherwise acceptable quality have being routinely rejected.:

In addition, the "LCS/LCD Samples" header of Table A7-1 has been changed to "LCS/LCSD Samples" and footnote callouts have been renumbered to render them consistent with the revised footnotes.

**Volume II, Quality Assurance Project Plan**

**General Comment**

The MPCA staff requests that the Navy ensure that CAS can reach the required limits on site. It appears CAS can do this without modification to method 8260B, but Navy should verify this with the laboratory QA staff.

**Response:**

CAS/Kelso has been given the opportunity to review the limits provided in the QAPP and they have concurred with the limits.

**References:**

U.S. EPA, 1994. Laboratory Program National Functional Guidelines for Organic Data Review. EPA-540/R-94/012. Office of Solid Waste and Emergency Response, Washington, DC, February 1994.

**RESPONSES TO COMMENTS POSED IN ATTACHMENT III OF THE LETTER DATED AUGUST 15, 2005 FROM MR. D. DOUGLAS TO COMMANDING OFFICER, SOUTHERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND (AUGUST 25, 2005) CONCERNING THE REMEDIAL ACTION WORK PLAN, NAVAL INDUSTRIAL RESERVE ORDNANCE PLANE, FRIDLEY, MINNESOTA (09-02-05)**

**Volume I, Remedial Action Work Plan:**

**Comment, Section 4.1, Objectives, ninth bullet, page 4-1:** The MPCA staff's position does not approve of this objective of the RAWP. The MPCA staff position on this matter can be found in MPCA staff response to "Section 6.1, SUMMARY AND CONCLUSIONS, general Observations, page 6-2, bullet 2" of the MPCA staff response to the 2004 Annual Monitoring Report, dated June 16, 2005.

**Response:** The following parenthetical has been added to the bullet text: (MPCA has advised Navy that MPCA does not endorse any representations of the data regarding NIROP versus UDLP contamination in specific wells at this time.)

**Comment, Section 4.1, Objective, tenth bullet, page 4-2:** The bulleted items are not decision rules. The MPCA staff request that the Navy identify these items as topics instead.

**Response:** The text 'Decision Rule #' has been replaced with 'Topic #' in each case.

**Comment, Tables of Chapter:** The MPCA staff requests that monitoring well MS-46S be deleted from all tables based upon the rationale found in "Section 6.1, SUMMARY AND CONCLUSISONS, Shallow Monitoring Interval, page 6-2, bullet 1, Monitoring Well MS-46S" of the MPCA staff response to the 2004 Annual Monitoring Report.

**Response:** Monitoring Well MS-46S has been deleted from the monitoring network and the static water level measurement schedule. This required deletion from Tables 4-3, 4-4, 4-5, and 4-10.

**Comment, Appendix A, NPDES/SDS Permit, Chapter 7, Section 3, Reporting:** While the Navy has been reporting NPDES system problems in the Annual Monitoring Reports, the NPDES permit requires that the Navy report system problems pursuant to Section 3 of the "Final Revised NPDES/SDS Permit no. MN 0000710, dated October 2, 2003. The Belinda Nichols of the MPCA NPDES staff has informed me that the NPDES staff is not receiving reports of system problems. The MPCA staff requests that the Navy rectify this problem and begin complying with these reporting requirements of the NPDES permit.

**Response:** Navy is reviewing the NPDES permit to verify reporting requirements. In any case, no revisions to the RAWP are required.

**Volume II, Quality Assurance Project Plan:**

**Signatory Page.**

**Comment:** As the Navy is aware, all parties must sign the signatory page of the QAPP. Columbia Analytical Services, in particular, must read the QAPP and agree to it, as CAS is agreeing to language that was written for EnChem.

**Response:** CAS/Kelso was solicited and provided information that was necessary to prepare the QAPP. In addition, the information that was originally written for EnChem was either changed to apply directly to CAS/Kelso or was verified to be consistent with the CAS/Kelso QA manual (Appendix A of the QAPP). However, following receipt of the MPCA comment, CAS/Kelso was given another opportunity to concur (or to disagree) with information affecting them in response to this comment. They concurred with the QAPP content.

As noted in this response, CAS/Kelso will indicate concurrence with the QAPP, via their signature on the cover sheet, when all changes have been incorporated. No action is proposed, other than to obtain CAS/Kelso concurrence with the QAPP.

**References.**

**Comment:** The MPCA staff requests that the Navy check all references to ensure they are accurate as there are references to the EnChem Quality Assurance Manual by Chapter that were not changed in this redline. It may be that the chapters match up between the Columbia Analytical Services (CAS) and the EnChem QA Manual but this should be checked regardless.

**Response:** Cross-references to the CAS/Kelso QA Manual and SOPs were checked. Two cross-references were found to be incorrect. The following changes were made to correct these errors:

- QAPP Section B3.2, Pages B3-3, last sentence: " Section 5.0" was changed to Section 8.0."
- QAPP Section B6.2, Page B6-1, last sentences of first paragraph: "Section 11.0" was changed to "Section 14.0."

**DQOs**

**Comment:** How will Tetra Tech NUS, Inc. consolidate information and report on progress towards meeting the DQOs discussed in the letter from Mark Sladic, dated July 20, 2005? This letter discussed precision, accuracy, completeness, etc., but does not get to the heart of the issue of whether or not the DQOs being answered or addressed. Also, the MPCA staff requests that this matter be discussed in the AMR conclusions.

(1) The results of all water level measurements and parameter analyses for the previous year.

(2) A water level contour map for the regional ground water aquifer for high and low potentiometric and surface water elevations;

(3) A map showing each well with the concentrations of pollutant for each sampling event;

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In addition, the following from the Tetra Tech transmittal letter of 20 July 2005 has been inserted at the end of QAPP Section C1.1.1.2:

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The limits present in Table A7-1 are reasonable in most cases, but some of them are below 50% and a few even at 10%. This is unacceptable to the MPCA for MS/MSD or LCS limits. If the laboratory chooses to use these limits – that may be their internal SOP – the validation and data review will require that data below 50% be rejected and require flagging of data between that point and 70% recovery.

**Response:**

The Navy representative, Dr. Tom Johnston, contacted MPCA representative, Mr. Luke Charpentier, to discuss this comment because the direction in this comment conflicts with MPCA written guidance available on the MPCA web site. The written guidance is as follows:

From the MPCA Draft QAPP Guidance (26 June, 2003):

> "e. The outside limits used by MPCA for data review of spikes, surrogates and control samples are; 75-125% recovery of volatiles (except gases), 75-125% recovery for all metals, 30 – 150% recovery for all semivolatile compounds, and 50 – 150% for other inorganics. These are OUTSIDE limits and should not be used as laboratory control limits in place of Shewart charts or recommended method control limits, but consultants should flag data that fails to meet these limits at a minimum;"

After discussion on this topic, both representatives agreed that the requested 50% limit is not required by the written MPCA guidance. A follow-up discussion between the Navy and MPCA yielded the following comment from Mr. David Douglas to Mr. Daniel Owens dated September 15, 2005 (10:40 AM):

> "Dan, as we discussed, please follow the MPCA draft QAPP guidance dated June 26, 2003 in lieu of MPCA's comment that required that data below 50% recovery be rejected."

In light of this more recent comment the following new footnote 2 has been added to Table A7-1:

> "2 Recoveries less than 75 percent or greater than 125 percent will cause data to be flagged as estimated ("J" flag) during data validation. Recoveries less than the lower of 30 percent or the low recovery limit shown in this table will cause non-detect data to be rejected ("R" flag). For MS and MSD spikes that do not increase the native sample concentrations by at least 25 percent, the spike will be considered invalid and these rules will not apply."

In addition, the "LCS/LCD Samples" header of Table A7-1 has been changed to "LCS/LCSD Samples" and footnote callouts have been renumbered to render them consistent with the revised footnotes.

**Volume II, Quality Assurance Project Plan**

**General Comment**

The MPCA staff requests that the Navy ensure that CAS can reach the required limits on site. It appears CAS can do this without modification to method 8260B, but Navy should verify this with the laboratory QA staff.

**Response:**

CAS/Kelso has been given the opportunity to review the limits provided in the QAPP and they have concurred with the limits.

**References:**

U.S. EPA, 1994. Laboratory Program National Functional Guidelines for Organic Data Review. EPA-540/R-94/012. Office of Solid Waste and Emergency Response, Washington, DC, February 1994.

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**References:**

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# INTRODUCTION

## BACKGROUND

This Remedial Action Work Plan (RAWP) addresses monitoring requirements associated with a groundwater extraction and treatment system at the Naval Industrial Reserve Ordnance Plant (NIROP) in Fridley, Minnesota. The groundwater extraction system is part of Phase I of a two-phased remedial action plan for the groundwater operable unit (OU1), as defined in the Record of Decision (ROD).

The ROD for groundwater at the NIROP Fridley was signed in September 1980 by representatives of the U.S. Navy, the United States Environmental Protection Agency (USEPA) – Region V, and the Minnesota Pollution Control Agency (MPCA). The remedial action specified in the ROD called for the hydraulic containment and recovery of all future migration of contaminated groundwater from the NIROP and the recovery, to the extent feasible, of contaminated groundwater downgradient of the NIROP. The selected remedy included the installation and operation of groundwater containment and extraction wells with a two-phased plan for disposal of groundwater from the well system.

Under Phase I, the groundwater from the containment and extraction system was discharged to an existing sanitary sewer that provided treatment at a local wastewater treatment facility. Under Phase II, a groundwater treatment system was constructed at the NIROP and is operated to provide longer-term groundwater treatment. Treated groundwater from the onsite groundwater treatment facility is discharged to the Mississippi River via a National Pollutant Discharge Elimination System (NPDES) storm sewer discharge.

A groundwater extraction and containment system has been constructed based on design documents approved by the USEPA Region V and the MPCA. The work performed during the construction of the original groundwater extraction system included a pumping capacity test at each extraction well. The results of these tests, which included groundwater sampling and analysis, indicated that groundwater pretreatment would be required prior to discharge of the groundwater to the sanitary sewer owned by the Metropolitan Council Environmental Services (MCES), formerly called the Metropolitan Waste Control Commission (MWCC), to meet discharge limits set by the MCES. Therefore, pretreatment facilities were also constructed at the NIROP for use as needed during the interim Phase I discharge to the sanitary sewer.

The original groundwater extraction well system, consisting of four extraction wells, began operation in September 1992. Evaluations of the effectiveness of the system in achieving hydraulic containment of contaminated groundwater from the site have been performed using water level data from the extensive monitoring well network at the site and from the extraction wells, records of flow rates produced by the extraction wells, and a three-dimensional groundwater flow model that has been developed for the NIROP facility. These evaluations indicated that the four original extraction wells did not provide sufficient hydraulic capture of contaminated groundwater. Based on a work plan approved by the USEPA and the MPCA, two additional groundwater extraction wells were designed and constructed to upgrade the groundwater extraction system. The two additional wells were placed in operation in June 1995.

The concentrations of trichloroethene (TCE) and other volatile organic compounds (VOCs) in the combined discharge from the extraction wells have decreased significantly since startup of the system in 1992. The concentrations decreased to levels where pretreatment of the groundwater was no longer necessary to meet the limits specified in the permit issued by the MCES for discharge to the sanitary sewer. With the approval of the MCES, the pretreatment system was shut down in March 1995.

Construction of the Phase II onsite groundwater treatment facility began in September 1997 and was completed and in operation in December 1998. Treated groundwater is now discharged to the Mississippi River and is no longer discharged to the MCES sanitary sewer.

## PURPOSE AND SCOPE

The purpose of this RAWP is to fulfill the requirements of the Federal Facility Agreement for the NIROP Fridley dated March 1991 and signed by the USEPA Region V, the Navy, and the MPCA.

The scope of this RAWP addresses the monitoring requirements associated with the evaluation of the overall extraction system effectiveness and compliance with the NPDES permit for discharge of treatment groundwater to the Mississippi River. The RAWP does not specifically address monitoring requirements related specifically to operation and maintenance of the groundwater treatment facilities. Although multiple NPDES discharge points are governed by the NDPES permit, this RAWP is concerned only with the Surface Discharge station 002, which is common to both the groundwater extraction and treatment system and NPDES monitoring.

The RAWP consists of the following component documents:

- Part 1 – Remedial Action Monitoring Plan (RAMP)
- Part 2 – Quality Assurance Project Plan (QAPP)

The RAMP contains field sampling procedures, and the QAPP primarily address laboratory procedures.

# Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-94-D-0888

Rev. 1
09/05

# Remedial Action Work Plan

## Naval Industrial Reserve Ordnance Plant
## Fridley, Minnesota

## Contract Task Order 0330

## September 2005


Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

TETRA TECH NUS, Inc.

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# Remedial Action Work Plan

# Volume I
# Remedial Action Monitoring Plan

## Naval Industrial Reserve Ordnance Plant
## Fridley, Minnesota

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## September 2005


Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406


TETRA TECH NUS, Inc.

**REVISION 1**
**SEPTEMBER 2005**

# REMEDIAL ACTION MONITORING PLAN - VOLUME I

NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT
FRIDLEY, MINNESOTA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER **0330**

SEPTEMBER 2005

**PREPARED UNDER THE SUPERVISION OF:**

**MARK SLADIC, P.E.**
**TASK ORDER MANAGER**
**TETRA TECH NUS, INC.**
**PITTSBURGH, PENNSYLVANIA**

**APPROVED FOR SUBMITTAL BY:**

**DEBRA M. HUMBERT**
**PROGRAM MANAGER**
**TETRA TECH NUS, INC.**
**PITTSBURGH, PENNSYLVANIA**

# TABLE OF CONTENTS

**SECTION** **PAGE NO.**

**ACRONYMS** ..... **3**

**1.0 INTRODUCTION** ..... **1-1**
1.1 BACKGROUND ..... 1-1
1.2 PURPOSE AND SCOPE ..... 1-3
1.3 QUALITY ASSURANCE ..... 1-5
1.4 CONTENTS OF RAMP ..... 1-5
1.5 UPDATES ..... 1-6

**2.0 SITE CHARACTERISTICS** ..... **2-1**
2.1 SITE LOCATION AND DESCRIPTION ..... 2-1
2.2 SITE HYDROGEOLOGY AND GROUNDWATER FLOW ..... 2-1
2.3 GROUNDWATER QUALITY ..... 2-2

**3.0 GROUNDWATER EXTRACTION AND TREATMENT FACILITIES** ..... **3-1**
3.1 GROUNDWATER EXTRACTION SYSTEM ..... 3-1
3.2 GROUNDWATER TREATMENT SYSTEM ..... 3-1

**4.0 GROUNDWATER MONITORING** ..... **4-1**
4.1 OBJECTIVES ..... 4-1
4.2 MONITORING LOCATIONS AND FREQUENCIES ..... 4-3
4.3 SAMPLING PROTOCOL ..... 4-3
4.3.1 Preparation ..... 4-3
4.3.2 Preliminary Field Work ..... 4-6
4.3.3 Sample Collection ..... 4-10
4.3.4 Investigation Derived Waste Handling ..... 4-12
4.3.5 Documentation ..... 4-12
4.3.6 Sample Preservation, Handling, and Transportation ..... 4-15
4.4 DATA REDUCTION AND VALIDATION ..... 4-17
4.4.1 Data Reduction and Validation ..... 4-17
4.5 REPORTING AND RECORD KEEPING ..... 4-17
4.5.1 Periodic Monitoring Reports and Progress Reports ..... 4-18
4.5.2 Annual Monitoring Report ..... 4-18
4.5.3 Retention of Records ..... 4-20

# TABLE OF CONTENTS (Continued)

**SECTION** **PAGE NO.**

**5.0 NPDES/SDS EFFLUENT MONITORING ..... 5-1**
5.1 OBJECTIVES ..... 5-1
5.2 MONITORING LOCATIONS AND FREQUENCIES ..... 5-1
5.3 SAMPLING PROTOCOL ..... 5-2
5.3.1 Preparation ..... 5-2
5.3.2 Sample Collection and Field Tests ..... 5-4
5.3.3 Documentation ..... 5-4
5.3.4 Sample Preservation, Handling, and Transport ..... 5-5
5.4 DATA REDUCTION AND VALIDATION ..... 5-5
5.5 REPORTING AND RECORD KEEPING ..... 5-5
5.5.1 Periodic Monitoring Reports and Progress Reports ..... 5-5
5.5.2 Annual Monitoring Report ..... 5-5
5.5.3 Monthly Reports ..... 5-6
5.5.4 Special Discharge Reports ..... 5-7
5.5.5 Performance Curves ..... 5-7
5.5.6 Records Retention ..... 5-7

**REFERENCES ..... R-1**

**APPENDICES**

**A NPDES/SDS PERMIT AND MCES INDUSTRIAL DISCHARGE PERMIT**
**B WELL SELECTION MEETING NOTES**
**C MPCA RISK BASED SITE CHARACTERIZATION AND SAMPLING GUIDANCE**
**D FIELD FORMS**

# TABLES

**NUMBER**

4-1 Groundwater Chemicals and Target Cleanup Levels
4-2 Site-Specific Allowable Air Emission Rates And Groundwater Concentrations
4-3 Monitoring Wells for Monitoring Groundwater Chemical Characteristics
4-4 Summary of Monitoring Well Types for Groundwater Monitoring as Defined in Well Section Meeting March 2002
4-5 Summary of Groundwater Sampling Network Defined in March 2002 Well Selection Meeting
4-6 Practical Quantitation Limits - Groundwater Parameters
4-7 Bottleware, Preservation, and Holding Time Requirements Groundwater Samples
4-8 Sampling Equipment Decontamination Procedures
4-9 Groundwater Wells from Which Water Level Measurements will be Taken
4-10 Monitoring and Extraction Well Construction Data
4-11 Summary of Groundwater Monitoring Program QA/QC Sampling
5-1 Effluent Limitations and Monitoring Requirements Outfall SD002
5-2 Practical Quantitation Limits - Expanded List of Effluent Parameters Analyzed by EPA Method 624
5-3 Bottleware, Preservation, and Holding Time Requirements for Samples Collected from Surface Discharge Station SD002
5-4 Summary of Effluent Monitoring Program QA/QC Sampling for Samples Collected from Surface Discharge Station SD002

# FIGURES

**NUMBER**

2-1 Site Location Map
3-1 Site Plan
3-2 Groundwater Extraction and Treatment System
4-1 Monitoring Well Location Map

# ACRONYMS

| | |
|---|---|
| ACL | Alternative concentration limit |
| ACP | Anoka County Park |
| AER | Air emission rate |
| AMR | Annual Monitoring Report |
| COC | Chain-of-custody |
| CTO | Contract Task Order |
| DQO | Data Quality Objective |
| FS | Feasibility Study |
| FFA | Federal Facility Agreement |
| GWTF | Groundwater Treatment Facility |
| IDW | Investigation derived waste |
| ISCST3 | Industrial Source Complex Short-Term, Version 3 |
| MCES | Metropolitan Council Environmental Services |
| MCL | Maximum Contaminant Level |
| MGD | Million Gallons per Day |
| MPCA | Minnesota Pollution Control Agency |
| MS | Matrix spike |
| MSD | Matrix spike duplicate |
| NIROP | Navil Industrial Reserve Ordnance Plant |
| NPDES | National Pollutant Discharge Elimination System |
| NTU | Nephelometric Turbidity Unit |
| O&M | Operations and Maintenance |
| OU | Operable Unit |
| PCJ | Prairie du Chien Dolomite and Jordan Sandstone |
| PPE | Personal protective equipment |
| PQL | Practical quantitation limit |
| PVC | Polyvinyl chloride |
| QA | Quality assurance |
| QC | Quality Control |
| QAPP | Quality Assurance Project Plan |
| RAB | Restoration Advisory Board |
| RAMP | Remedial Action Monitoring Plan |
| RAWP | Remedial Action Work Plan |

| | |
|---|---|
| RI | Remedial Investigation |
| ROD | Record of Decision |
| SDS | State Disposal System |
| SDWA | Safe Drinking Water Act |
| SOUTHNAVFACENGCOM | Southern Division, Naval Facilities Engineering Command |
| TCE | Trichloroethene |
| TRC | Technical Review Committee |
| TtNUS | TetraTech NUS, Inc. |
| UDLP | United Defense L.P. |
| USEPA | United States Environmental Protection Agency |
| U.S. Navy | United States Navy |
| VOC | Volatile organic compound |

# 1.0 INTRODUCTION

## 1.1 BACKGROUND

This Remedial Action Monitoring Plan (RAMP) was prepared by Tetra Tech NUS, Inc. (TtNUS) for the Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) under Contract Number N62467-94-D-0888, Contract Task Order (CTO) 0057. This RAMP addresses monitoring requirements associated with the groundwater extraction and treatment system at the Naval Industrial Reserve Ordnance Plant (NIROP) in Fridley, Minnesota. The extraction and treatment system includes Phases I and II of a remedial action plan for groundwater [Operable Unit (OU) 1], as defined in the Record of Decision (ROD) for Groundwater Remediation (USEPA, 1990).

The ROD was signed in September 1990 by representatives of the United States Navy (Navy), the U.S. Environmental Protection Agency (USEPA) Region 5, and the Minnesota Pollution Control Agency (MPCA). The remedial action specified in the ROD called for the hydraulic containment and recovery of all future migration of contaminated groundwater from the NIROP and the recovery, to the extent feasible, of contamination downgradient of the NIROP. The selected remedy included the installation and operation of groundwater containment and extraction wells with a two-phased plan for disposal of groundwater from the well system. Contaminated groundwater located off-site and downgradient of the NIROP in Anoka County Park is currently being allowed to naturally dissipate, but this approach is currently under review and evaluation.

Under Phase I, groundwater from the extraction system was discharged to an existing sanitary sewer system for treatment at a local wastewater treatment facility. Under Phase II, a groundwater treatment system was constructed and is being operated to provide longer-term groundwater treatment. Treated groundwater from the on-site treatment facility is discharged to the Mississippi River through a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permitted outfall (Outfall 002) (MPCA, 1996).

The groundwater extraction system and pretreatment facilities began operating in September 1992. Monitoring of these facilities and associated monitoring wells has been performed since startup according to the procedures described in the Remedial Action Work Plan for Groundwater Remediation (RMT, 1995a) that was approved by the USEPA and the MPCA. This document was developed to update and replace the 1995 document.

As required by the ROD, an evaluation of the effectiveness of the groundwater extraction system in achieving hydraulic containment of contaminated groundwater from the site during the initial 90-day operating period was submitted to the USEPA and the MPCA in December 1992 (RMT, 1992). The evaluation concluded that additional groundwater extraction well(s) would be needed to achieve effective hydraulic containment. A work plan for upgrading the original extraction system was prepared (RMT, 1995b) and approved by the USEPA and the MPCA. Two additional extraction wells were installed and placed into operation in June 1995. At that time, the combined groundwater extraction system consisted of six wells.

The concentrations of trichloroethene (TCE) and other volatile organic compounds (VOCs) in the combined discharge from the extraction wells decreased significantly since startup in 1992. The concentrations decreased to levels where pretreatment of groundwater was no longer needed to comply with the Metropolitan Council Environmental Services (MCES) discharge limits. With the approval of the MCES, the pretreatment system was shut down in March 1995, and the combined discharge from the extraction wells was transferred directly to the sanitary sewer.

Construction of the Phase II on-site groundwater treatment facility began in September 1997 and was completed and the facility began operation in December 1998. The discharge to the MCES sanitary sewer system has been stopped, and treated groundwater from this facility is now discharged to the Mississippi River through Outfall 020 (NPDES/SDS Permit MN0000710).

A five-year review of the selected remedy for groundwater outlined in the ROD was signed in September 1998 (USEPA, 1998). A second five-year review was signed in October 2003 (USEPA, 2003). The most recent five-year review recommended the continued operation, maintenance, and upgrade (if necessary) of the groundwater containment and recovery system, with eventual on-site treatment and discharge of treated groundwater in accordance with the NPDES/SDS permit. The Navy achieved on-site treatment with the construction and operation of the on-site treatment facility. Concerns from the five-year review are listed below:

- Modifications to the extraction system were designed and implemented to address capture of contamination at the NIROP Fridley compliance boundary, thereby prohibiting further migration of contaminants into Anoka County Park. In June 2001, the extraction well system was upgraded to more effectively capture and contain contamination at the NIROP Fridley compliance boundary (TtNUS, 2002). The system upgrade included the installation of four new extraction wells (AT-7, AT-8, AT-9, and AT-10) and the shutdown and abandonment of three wells (AT-1, AT-2, and AT-4). Therefore, there are a total of 7 extraction wells operating under the current remedial system.

- Wells were installed downgradient of Anoka County Park at location AT-3A in order to monitor the downgradient impact at this site.

- Data gaps that existed in the monitoring network were closed with the installation of additional groundwater monitoring wells in 1995. The data gaps will continue to be evaluated on an annual basis in the annual monitoring report (AMR). Between the 1998 five year review and March 2003, the Navy provided interim RAWP updates as the partnering team resolved all outstanding issues, to enable completion of each year's AMR.

- Investigation of the Anoka County Park indicated that contamination west of East River Road was not attributable to any source contamination located in Anoka County Park.

- The MPCA conducted a surface water assessment using the new groundwater sampling information and groundwater modeling information to determine if surface water standards and criteria were exceeded. It was determined that groundwater contaminant concentrations in the compliance wells have not significantly improved since the 1998 five year review.

- The five-year review also recommended that the Navy determine what could be done to significantly reduce residual groundwater contamination in Anoka County Park. The Navy was also to determine if a response action would enhance the effectiveness of the selected remedy on residual groundwater in Anoka County Park. The selected action, enhancement of in-situ bioremediation using vegetable oil, is currently being performed by the Navy in cooperation with the USEPA and MPCA.

## 1.2 PURPOSE AND SCOPE

The purpose of this RAMP is to fulfill the requirements of the Federal Facility Agreement (FFA) for the NIROP dated March 1991 and signed by the USEPA Region 5, the Navy, and the MPCA.

The scope of this RAMP addresses the monitoring requirements associated with the selected remedy in the ROD for groundwater remediation. These monitoring requirements include the following: evaluation of the overall groundwater extraction and treatment system, evaluation of the potential for contamination from upgradient sources, compliance with NPDES/SDS permit requirements, and evaluation of impacts to the Mississippi River from the indirect discharge of contaminated groundwater. The RAMP does not address monitoring requirements related to operation and maintenance of the groundwater treatment facilities. An Operations and Maintenance (O&M) Manual (Morrison Knudsen Corporation, 1999) for the

groundwater treatment facility contains information about sampling and analysis requirements for the sanitary sewer discharge and air emissions.

The probable primary source area is the East Plating Shop. Remedial actions should be implemented in that target this area because significant mass removal and/or destruction in the source area will provide substantial benefits to the downgradient groundwater. Groundwater extraction and treatment activities will limit the spread of contamination, but will not eliminate the source. Therefore, source removal/depletion/destruction is the key to successful completion of groundwater remediation activities.

The following documents and data form the basis for the scope of the monitoring program approach and details presented in the RAMP:

- ROD for Groundwater Remediation, Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota (USEPA, 1990).
- Five Year Review Report (USEPA, 1998).
- Five Year Review Report (USEPA, 2003).
- Remedial Investigation Report for the Remedial Investigation/Feasibility Study at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota (RMT, 1987).
- Addendum to the Remedial Investigation Report for the Remedial Investigation/Feasibility Study at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota (RMT, 1988a).
- Feasibility Study Report for the Remedial Investigation/Feasibility Study at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota (RMT, 1988b).
- Addendum to the Feasibility Study Report for the Remedial Investigation/Feasibility Study at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota (RMT, 1988c).
- NPDES/SDS Permit MN0000710 (MPCA, 1996).
- Annual Monitoring Report (AMR) (submitted annually, TtNUS).

- Various correspondence and telephone discussions among the MPCA, USEPA, Navy, United Defense L. P. (UDLP), and TtNUS.

## 1.3 QUALITY ASSURANCE

The USEPA requires that all environmental monitoring and measurement efforts mandated or supported by the USEPA participate in a centrally managed quality assurance (QA) program. Any party generating data under this program has the responsibility to implement minimum procedures to ensure that the precision, accuracy, completeness, comparability, and representativeness of its data are known and documented. To ensure that the responsibility is met uniformly, each party must adhere to a written Quality Assurance Project Plan (QAPP) covering each project it is to perform.

A QAPP that presents the organization, objectives, functional activities, and specific QA and quality control (QC) activities associated with this RAMP is provided in Volume II of the Remedial Action Work Plan (RAWP).

## 1.4 CONTENTS OF RAMP

The contents of this RAMP are as follows:

- Section 1.0 Introduction
- Section 2.0 Site Characteristics
- Section 3.0 Groundwater Extraction and Treatment Facilities
- Section 4.0 Groundwater Monitoring
- Section 5.0 NPDES/SDS Effluent Monitoring
- Appendix A NPDES/SDS Permit and MCES Industrial Discharge Permit
- Appendix B Well Selection Meeting Notes
- Appendix C MPCA Risk Based Site Characterization and Sampling Guidance
- Appendix D Field Forms

The information provided in Sections 4.0 and 5.0 and Appendix B of the QAPP address field sampling procedures.

## 1.5 UPDATES

The Navy intends to incorporate modifications to the proposed list of monitoring wells, the frequency of sampling, and the analyte list for the next year to be reported in each year's AMR. The MPCA and USEPA will review the proposals, and once agreement is reached, this RAMP will be modified to support the modifications. The RAMP may be amended by letter report until this becomes unmanageable, at which time a revised RAMP will be issued.

# 2.0 SITE CHARACTERISTICS

This section contains a brief description of general site characteristics. Additional descriptions can be found in the AMRs and the Remedial Investigation (RI) and Feasibility Study (FS) Reports.

## 2.1 SITE LOCATION AND DESCRIPTION

The NIROP Fridley is located in the northern portion of the Minneapolis/St. Paul Metropolitan Area within the city limits of Fridley, Minnesota (Figure 2-1). Advanced naval weapons systems are designed and manufactured at the NIROP. The northern portion of the facility is government-owned and operated by a private contractor (UDLP – Armament Systems Division), and the remainder of the facility is owned and operated independently by UDLP. The site owner and occupants are likely to change in the future. The government-owned portion of the facility constitutes what is referred to as the NIROP Fridley site.

The site comprises approximately 82.6 acres, most of which is covered with buildings or pavement. The site is situated on a broad, flat glacial drift terrace that is approximately 30 feet above and 2000 feet east of the Mississippi River.

Adjacent land use is commercial and light industrial to the north, industrial to the south, recreational to the west, and commercial/light industrial (including railroads) to the east.

Natural resource use in the area consists of recreational activities in the Anoka County Riverfront Regional Park (Anoka County Park) that is directly across East River Road from the NIROP site and adjacent to the Mississippi River. Use of these resources does not result in access to the NIROP Fridley site, which is highly restricted by the Department of Defense. No federal or state freshwater wetlands are located within 1 mile of the site. No critical habitats of endangered species or national wildlife refuges have been identified near the site.

## 2.2 SITE HYDROGEOLOGY AND GROUNDWATER FLOW

The NIROP Fridley site is underlain by an unconsolidated sand and gravel aquifer that overlies a bedrock aquifer. The water table is 20 to 25 feet below the ground surface in the unconsolidated aquifer, which has a saturated thickness of approximately 100 feet. A discontinuous clayey glacial till layer is present at various depths below the ground surface. The underlying bedrock consists of Prairie du Chien Dolomite and Jordan Sandstone, which are referred to as the PCJ aquifer. The basal unit of the St. Peter Sandstone that overlies the PCJ aquifer across the northern portion of the site acts as a confining layer

where it is present. Where it is absent, the unconsolidated aquifer is hydraulically connected to the PCJ aquifer. Groundwater flow in the unconsolidated aquifer is generally from the northeast to the southwest across the site toward the Mississippi River. The groundwater containment and extraction system has altered the groundwater flow characteristics.

The City of Fridley owns and operates a backup potable water supply well (Fridley Well No. 13) that draws water from the PCJ aquifer immediately north of the NIROP site. The total population served by groundwater within a 3-mile radius of the site is approximately 29,000 residents. Three on-site production wells that are completed in the PCJ aquifer are no longer in use. There are no groundwater supply wells or downgradient users between the Facility and the Mississippi River.

The City of Minneapolis Water Treatment Plant intake, which draws water from the Mississippi River, is located less than 1 mile downstream from the NIROP site. Approximately 500,000 people are served by this treatment plant.

## 2.3 GROUNDWATER QUALITY

Groundwater in portions of the unconsolidated aquifer beneath the NIROP Fridley contains VOCs. The VOCs detected in 2003 are listed as follows (from greatest frequency detected to least detected): TCE, cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), 1,1-dichloroethane (1,1-DCA), tetrachloroethene (PCE), 1,1-dichloroethene (1,1-DCE), and vinyl chloride. The concentrations vary widely across the site; however, TCE has been detected more frequently and at higher concentrations than any other VOC. TCE is therefore assumed to be the primary indicator parameter for monitoring contamination and the remedial system at NIROP Fridley (TtNUS, 2002). Results of laboratory analyses of samples collected from groundwater monitoring and extraction wells during each calendar year are presented and discussed in the AMR that is issued each year.

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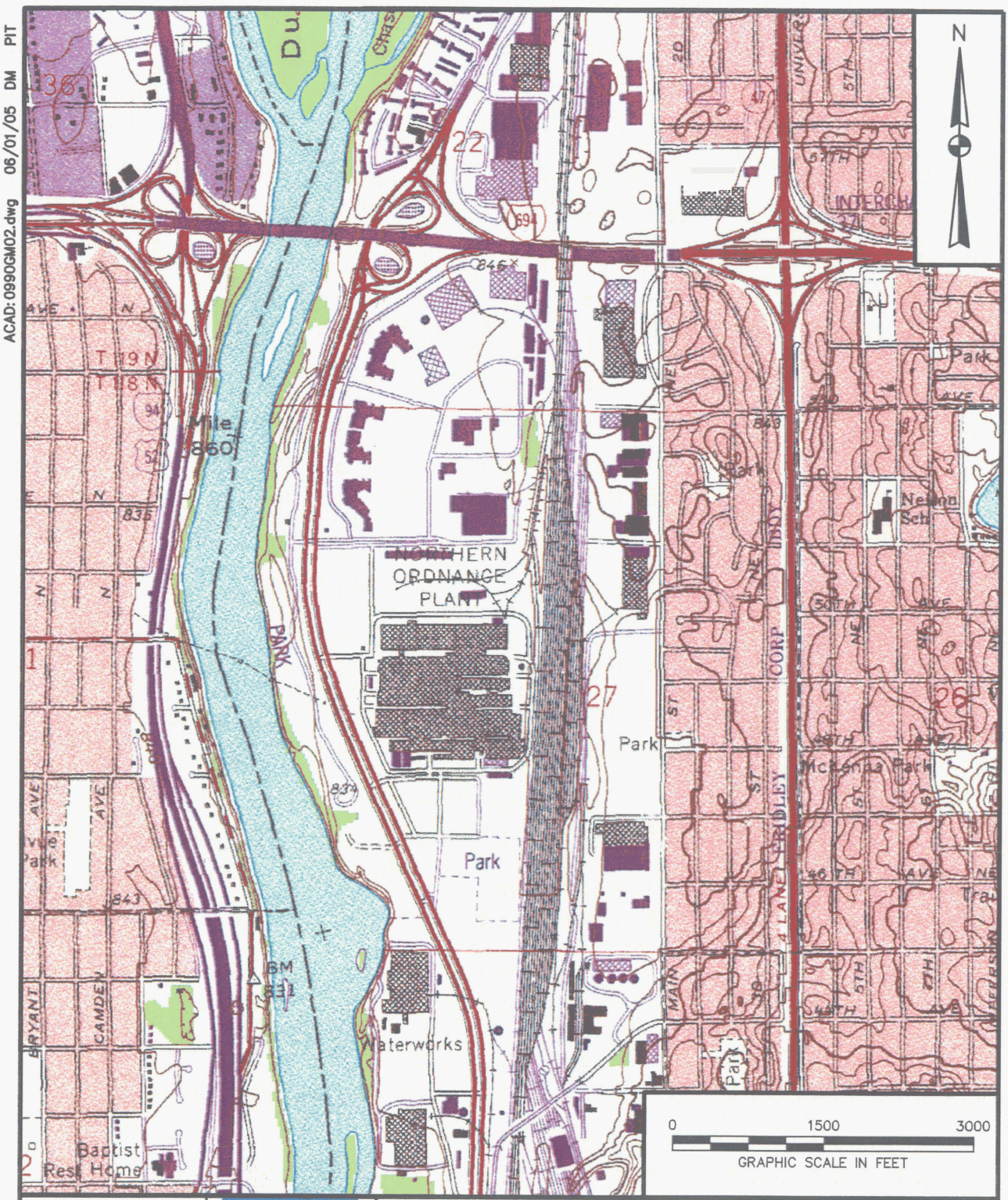


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# 3.0 GROUNDWATER EXTRACTION AND TREATMENT FACILITIES

## 3.1 GROUNDWATER EXTRACTION SYSTEM

The groundwater containment and extraction system consists of seven pumping wells and related piping and appurtenances. A site plan showing the approximate locations of the extraction wells and associated facilities is shown in Figure 3-1.

The extraction wells are identified as well numbers AT-3A, AT-5A, AT-5B, AT-7 AT-8, AT-9, and AT-10. Wells AT-3A, AT-5A, and AT-5B were located and constructed to contain and extract contaminated groundwater along the southwestern portion (downgradient) of the NIROP site. Wells AT-7, AT-8, AT-9, and AT-10 were located and constructed to extract contaminated groundwater along the southwestern portion (downgradient) of the NIROP site. It should be noted that some contaminated groundwater migrated past and beyond the capture zone limit of the extraction wells during the shutdown periods.

A schematic diagram showing the components of the groundwater extraction and treatment facilities is shown on Figure 3-2. The discharge from each of the seven extraction wells is routed via separate pipelines to a Control House located near the security fence on the western side of the plant. Instrumentation provided at the Control House includes a flow rate indicator and a flow volume totalizer for each extraction well discharge. The combined discharge from the seven extraction wells flows via a single pipe to a Treatment Building located near the Control House. Sampling ports are located on the piping for each extraction well and on the combined discharge to the Treatment Building.

## 3.2 GROUNDWATER TREATMENT SYSTEM

The construction of the treatment system involved the adaptation of the former pretreatment system and the installation of additional process equipment to ensure that NPDES discharge permit requirements are met.

The major components of the treatment system include a feed system, air stripping units, and an effluent system (Figure 3-2). The feed system consists of an equalization tank to collect the groundwater pumped from the extraction well system and feed pumps to convey the groundwater from the equalization tank to the air strippers. Four low profile, tray-type air strippers are operated in parallel. The effluent water flows by gravity to the effluent sump, and the exhaust air is vented to the atmosphere. Effluent pumps convey the treated water from the effluent sump to an existing 72-inch diameter storm sewer that discharges to the Mississippi River through NPDES/SDS Outfall 020.

There are no air emission controls for the air strippers. In 2001, the anticipated changes to the air emission rates (AERs) for the groundwater treatment facility were assessed (CH2MHILL, 2001). CH2MHILL determined that the emission rates from the GWTF operation are within the site-specific AERs. Regulatory requirements have been met. Site-specific AERs are emission rate limits that ensure that maximum off-site ambient air impacts are below regulatory-defined allowable off-site concentrations (i.e., increased cancer risk to the public of 1E-05). Site-specific AERs were calculated for carcinogenic compounds that could potentially be emitted from operation of the groundwater treatment facility. The approach involved using the USEPA-approved Industrial Source Complex Short-Term, Version 3 (ISCST3) (Revision 2) atmospheric dispersion model to "back model" from the maximum allowable off-site impact to annual average site-specific AERs. The site-specific AERs and the maximum groundwater production rate were then used to calculate maximum allowable concentrations for groundwater entering the treatment facility. In this manner, groundwater concentrations were used to predict air emissions so that measurement of air emissions was not required. The conservatively estimated allowable groundwater contaminant concentrations were all well above measured groundwater concentrations. Therefore, no emission control measures were required for operating the groundwater treatment facility. Samples of the air stripper influent and effluent were collected during start-up of the groundwater treatment facility to confirm that site-specific AERs were met. Additional samples of influent and effluent are to be collected to meet NPDES permit requirements (Appendix A). To date, AERs have not been exceeded.

It is possible that the extraction well system will be modified in the future. Any system modifications are subject to permit approval and can result in permit modifications. These permit modifications could result in modified AERs.

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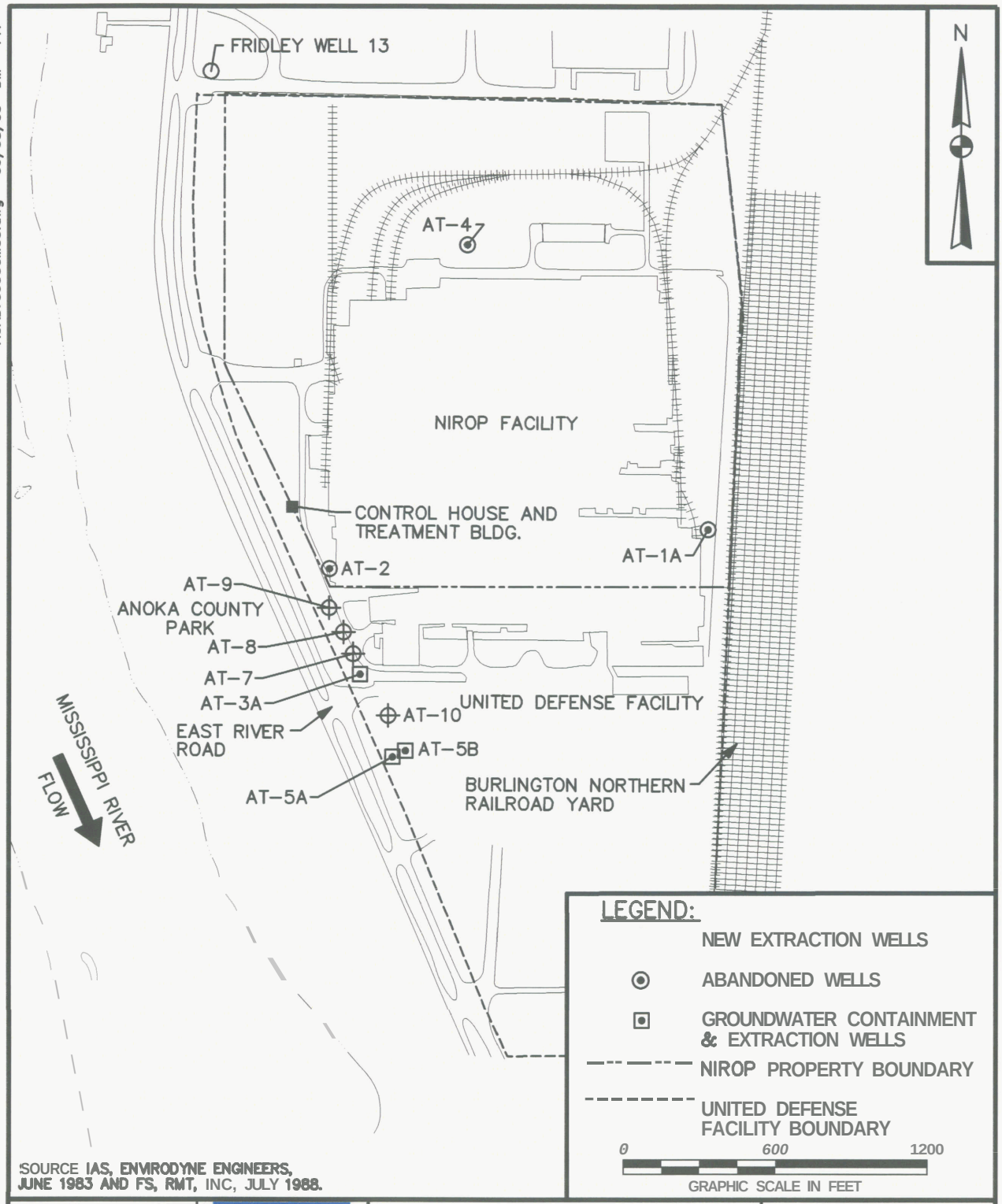


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| SCALE AS NOTED | | NAVFAC | DRAWING NO. FIGURE 3-1 / REV. 0 |

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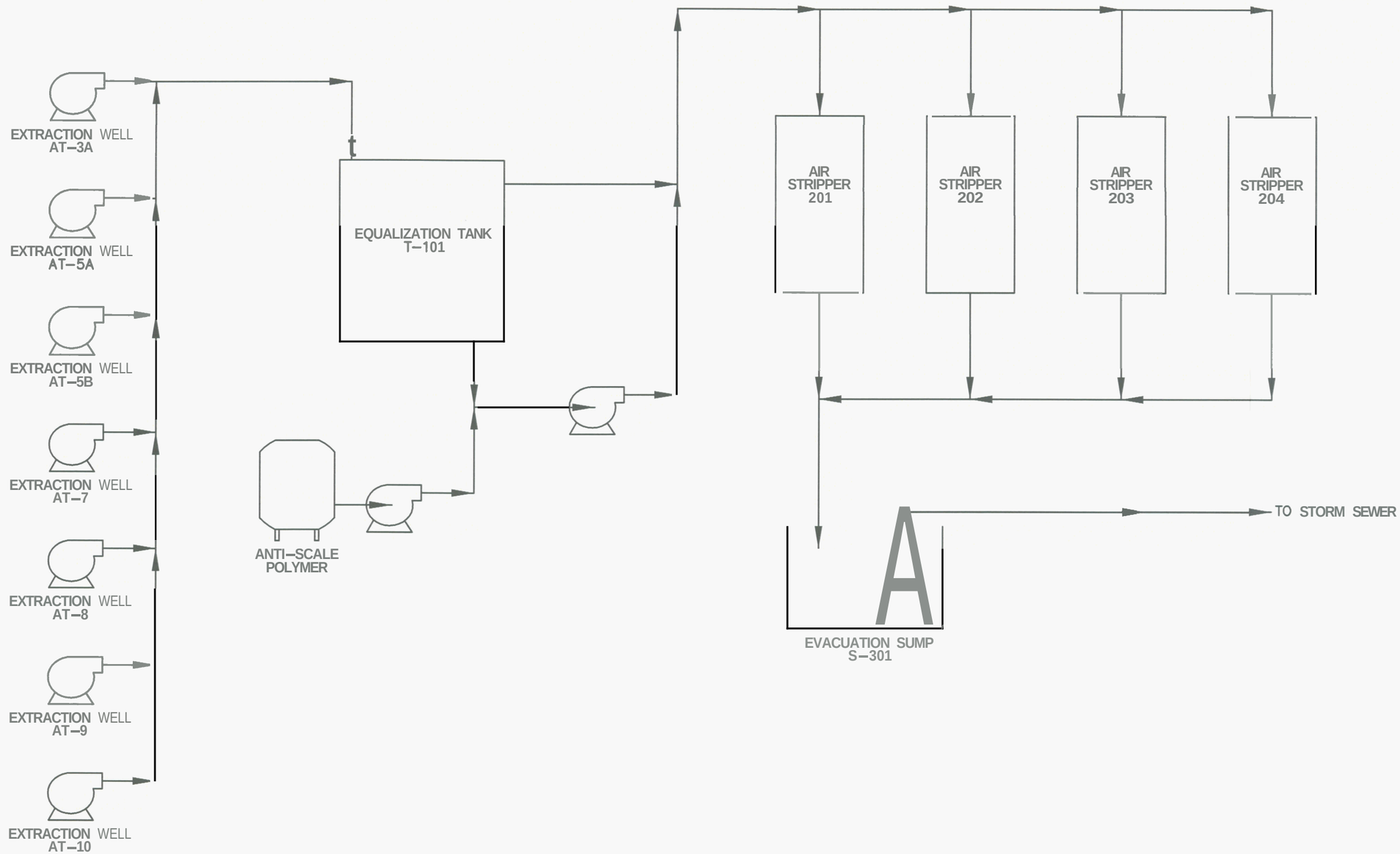


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# 4.0 GROUNDWATER MONITORING

## 4.1 OBJECTIVES

The objective of groundwater remediation is to ultimately restore groundwater quality to Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs). The constituents to be monitored and their respective MCLs are provided in Table 4-1. The objectives of groundwater monitoring are as follows:

- Evaluate the ability of the groundwater extraction system to effectively contain downgradient migration of contaminants and provide water quality improvement.
- Assess the potential for contamination from on-site sources and upgradient (off-site) sources.
- Evaluate air stripper emissions to the atmosphere (pending development of a DQO).
- Evaluate whether the remedies comply with the ROD.
- Evaluate whether the remedies are protective of human health and the environment.
- Evaluate the progress of the remedies in achieving the goals specified in the ROD.
- Evaluate whether project permits are met.
- Evaluate the relative contaminant concentrations along the groundwater flow path in relation to the following: upgradient groundwater conditions, known and potential source areas, capture and non-capture of the groundwater contaminant plume, residual contamination beyond the effectiveness of the capture of the remedial system and discharge to the river, and vertical head relationships and the potential flow of contaminants from one aquifer interval to another.
- Evaluate whether the adjacent UDLP site is contributing some contamination to the southern portion of the study area (MPCA has advised Navy that MPCA does not endorse any representations of the data regarding NIROP versus UDLP contamination in specific wells at this time).

- Install additional monitoring wells and perform lithology studies in the East River Road median to provide data with which to better delineate extraction well capture zone extents and resolve the potential bypass issue.

The objectives for the monitoring system have been further refined based upon the data quality objectives (DQOs) decision-making process that was executed by the NIROP Partnering Team. Meetings held in March 19-23, 2001, July 17-19, 2001, and March 6-7, 2002 were used to better define the objectives and formal decision-making process for the site. As determined in these meetings "Problem C: Groundwater Monitoring for Overall Contamination at NIROP" defines six problem statements/decision rules which should be addressed, at least in part, by groundwater monitoring at this site. The topics addressed by the problem statements/decision rules are generally listed below:

- Topic 1: Determination of capture system performance.

- Topic 2: Determination of contaminant concentrations at Mississippi River compliance wells.

- Topic 3: Determination of change in the plume shape, size, and location.

- Topic 4: Determination of contaminant concentrations relative to surface water and groundwater standards

- Topic 5: Determination of capture system performance, evaluation of system modifications, evaluation of alternative approaches, evaluation of technical impracticability, and/or alternative concentration limit (ACL).

- Topic 6: Determination of practicability of the remedy and evaluate an ACL.

Air stripper emissions to the atmosphere are evaluated using site-specific AERs established to ensure that maximum off-site ambient air impacts are below regulatory-defined allowable off-site concentrations. Table 4-2 presents the allowable air concentrations, AERs, and allowable groundwater concentrations. The allowable groundwater concentration is the level that will not cause the allowable air concentration to be exceeded, based on modeling.

## 4.2 MONITORING LOCATIONS AND FREQUENCIES

The selection of groundwater monitoring locations was designed to meet the objectives listed in Section 4.1. The monitoring wells and sample frequency selected to meet these objectives were selected during the NIROP Partnering Team Well Selection Meeting (DQO Meeting) held March 6-7, 2002 (Appendix B). Figure 4-1 shows the locations of all monitoring and extraction wells at the site. Table 4-3 lists the wells being sampled for monitoring groundwater chemical characteristics by aquifer, and Table 4-4 lists the intended data uses of analytical results from the monitoring wells. The water level monitoring network includes all of the existing on-site and off-site wells (e.g., Anoka County Park) shown on Figure 4-1 (see Section 4.3.2.1).

One additional well is included in the RAMP to address issues not directly related to containment. Fridley Well No. 13, which is currently not in use, is sampled to confirm that the potable water supply from this well will remain unaffected by groundwater contamination from the site.

The sample frequencies are tabulated on Table 4-5. The extraction wells are sampled on a semi-annual basis in April and October. Monitoring wells are sampled on a frequency that varies significantly from quarterly, semi-annually, annually, biennially (occurring once every two years), to once every five years. Table 4-5 details the frequency of sampling each individual well in the monitoring network. Wells sampled quarterly are to be performed as part of the Vegetable Oil Injection treatability study. Wells sampled semi-annually should be sampled concurrently with the extraction wells, in April and October. Wells sampled annually or less frequently should be sampled in October of a given year, concurrent with the extraction of the other monitoring wells.

## 4.3 SAMPLING PROTOCOL

### 4.3.1 <u>Preparation</u>

#### 4.3.1.1 Analyses, Bottleware, and Preservation Requirements

All groundwater samples will be analyzed at a laboratory for VOCs and analyzed in the field for pH, specific conductance, turbidity, and temperature. The specific VOCs and associated practical quantitation limits (PQLs) are provided in Table 4-6. Please note that the eight chemicals of concern (COC) identified on Table 4-6 are the only chemicals which will be analyzed. The chemicals selected include TCE and its degradation (daughter) products, as well as other chemicals historically detected at the site. This list was approved by the NIROP Partnering Team during DQO meetings (see Section 4.1 for more information). Laboratory-supplied sample containers and preservatives are to be used for all

groundwater samples. Table 4-7 provides a summary of the sample analyses, sample containers, preservation methods, holding times, and analytical methods.

Additional information on sample containers and preservation is provided in Appendix C.

Table 4-7 is in agreement with MPCA guidance in Appendix C. If any information is contradictory, sampling will be conducted in accordance with MPCA guidance in Appendix C.

#### 4.3.1.2 Purging and Sampling Equipment

The sampling techniques for all groundwater monitoring associated with the groundwater extraction and treatment system evaluation at the NIROP will be consistent. The groundwater monitoring wells will be purged until stabilized and sampled using a submersible pump. This is discussed in greater detail in Sections 4.3.2.2 and 4.3.3.1. The extraction wells are continuously pumped; therefore, additional purging or stabilization tests will not be required. Groundwater extraction wells will be sampled from taps in the Control House. Fridley Well No. 13 will be purged until the field parameters (See Section 4.3.1.1) stabilize, then it will be sampled by City of Fridley employees. This well will be sampled from a sampling tap in the building housing the well.

#### 4.3.1.3 Quality Assurance for Field Procedures

Particular care will be exercised to avoid the following common ways in which cross contamination or background contamination may compromise groundwater samples:

- Improper storage or transportation of equipment.
- Contaminating the equipment or sample bottles on site by setting them on or near potential contamination sources such as uncovered ground, a contaminated vehicle, or vehicle exhaust.
- Handling bottles or equipment with dirty hands or gloves.
- Inadequate cleaning of well purging or sampling devices.
- Placing equipment directly onto the ground surface.

Field QA samples and procedures used to evaluate the potential for cross contamination are described in Section 4.3.3.

#### 4.3.1.4 Decontamination, Storage, and Transport of Equipment

It is important not to contaminate or alter the sample during collection. Sampling equipment will be pre-cleaned or dedicated and will only be used to collect samples at one location. Clean outer garments will be accessible to field personnel in an area free from potential contamination. Water, laboratory-grade soap, and paper towels will also be kept in a clean location for both regular clean-up and emergency use. Field personnel will wash and dry their hands and all exposed surfaces before leaving the contamination reduction zone. Used paper towels will be placed in the disposal bag. Sample bottles will be pre-cleaned by the manufacturer.

Decontamination of sampling equipment is essential to prevent cross-contamination of samples with the sampling device. Decontamination cleaning solutions are presented in Table 4-8.

It is anticipated that Table 4-8 is in agreement with MPCA guidance in Appendix C. If information is contradictory, sampling will be conducted in accordance with MPCA guidance in Appendix C.

Small-diameter (e.g., 2-inch or 3-inch) submersible pumps will be used to purge and sample water from the monitoring wells. Pumps will be decontaminated using the following procedure:

- Prior to pump use, connect all hoses, sample tubing, and prepare the pump for use.

- Construct a decontamination station consisting of four sections of appropriate length and diameter of PVC pipe. Fill the first section of tube with Alconox/clean water solution. Fill the first tubing with potable water and the remaining tubes with de-ionized water.

- Submerge the pump in the first station with the open hose end also in the same tube to recirculate the solution. Be sure to circulate the solution through the pump and all sample tubing.

- Stand by with additional solution and turn on the pump. Immediately refill the tube to the top to replace solution that enters the tubing. Allow the pump to run for approximately 1 minute after the solution passes through the system one complete cycle. Pumps should not be allowed to run for more than approximately 1 minute at each station or overheating may occur and result in pump damage.

- Move the pump successively through the remaining three stations at 1-minute intervals. The pump must be turned off during each move.

- Inspect for remaining particles or surface film and repeat cleaning and rinse procedures if necessary.

- Clean external hose surfaces by rinsing once with distilled water and place hoses in clean, large plastic garbage bags.

Because the pump is used to both purge and sample the monitoring well, it must be decontaminated after use at each well. Purging and sampling of monitoring wells will begin with the least contaminated wells and proceed to increasingly contaminated wells based on iso-concentration maps presented in the recent year's AMR. For each set of equipment, for example a pump and tubing, both the purging and sampling will be completed for the first well without removing the pump or tubing before beginning purging at subsequent wells. New, clean, plastic drop cloths will be used at each well location to protect equipment from contact with soil around the well.

Water level measuring equipment that contacts the groundwater must also be decontaminated after use at each well (see Table 4-8).

### 4.3.2 Preliminary Field Work

#### 4.3.2.1 Water Level Measurements

Groundwater level measurements will be taken in conjunction with the semi-annual groundwater sampling rounds generally conducted in April and October. During each sampling event, a synoptic round of water level measurements and river stage measurements will be taken at the Facility. Table 4-9 lists the wells, at a minimum, that are to be measured. This list includes the monitoring wells and extraction wells that are sampled for groundwater as well as other wells at the Facility. If possible, these synoptic water level measurements should be performed during the same period as any synoptic water level measurements planned at the adjacent UDLP site. All measurements shall be taken within a 24-hour period of consistent weather conditions to minimize atmospheric/precipitation effects on groundwater levels. The sequence of measuring water levels will be determined in the field by the site technician. Water level measurements shall be recorded on the appropriate field forms in Appendix D.

Monitoring Wells

All groundwater level measurements will be made using a reference point established on the well casing consisting of either an indelible mark or a notch on the highest point on the northern edge of the well

casing. A battery powered water level indicator will be the primary device for water level measurements. The indicator will be a self-contained, transistorized instrument equipped with a cable and sensor that activates a buzzer and a light when it comes in contact with the water. The depth to water will be read from permanent 0.01-foot increment markings on the cable.

Additional information on water level measurements is provided in Appendix C.

Extraction Wells

Water level readings for the groundwater extraction wells will be made by reading the water level indication gauges installed at each well head. If necessary, the protective covers over the pitless adapters will be removed and water level measurements will be taken using the same battery-operated water level indicator used for measurements at the monitoring wells.

Fridley Well No. 13

A stabilization test (see Section 4.3.2.2) may be necessary because Fridley Well No. 13 is not routinely used. During November 1990, the static water level was 33 feet below ground surface and the pumping level was 41 feet. Using these values, the total well volume was calculated as 6,670 gallons. This value will be used for well purging. Additional water level data from the City of Fridley will not be required.

Mississippi River

Water level data for the Mississippi River immediately west of the NIROP Fridley will be collected during each round of water level measurements. Water level measurements will be made by measuring down to the river surface from an existing structure along the riverbank near the NIROP on which a paint mark was established to serve as a reference elevation. The reference elevation was surveyed relative to the benchmark used to establish the reference elevations for the monitoring well network.

#### 4.3.2.2 Purging, Stabilization, and Field Tests

The following section discusses well purging, stabilization, and field test procedures. Additional information is presented in Appendix C, Section 3.4, Field Water Quality Measurements and Section 3.5, Purging and Stabilization.

Monitoring Wells

Monitoring wells shall be purged and sampled in accordance with the MPCA Sampling Standard Operating Procedure included in Appendix C and as described below. These procedures were agreed to by the NIROP Partnering Team during the Data Quality Objective (DQO) Meeting on March 6 and 7, 2002 in Charleston, South Carolina. Based on the Partnering Team decision at that meeting, further evaluation is being conducted of the use of other sampling methods and procedures, including but not limited to, passive diffusion bag samplers in future sampling efforts at the site.

Well purging will be performed to remove stagnant water from the well casing prior to collecting a sample because the stagnant water is not representative of actual groundwater chemistry. The purging will draw in groundwater from the area surrounding a well to obtain a sample more representative of the water quality.

As defined in Section 3.5 of Appendix C, wells that do not have slow recovery rates shall be purged in a manner that, to the extent practical, removes all of the "old" water in the well so it is replaced by fresh groundwater from outside the well.

A submersible and/or bladder pump will be used to purge and sample groundwater from monitoring wells. Wells will be purged at a maximum rate that will not cause more than 2 feet of drawdown. The well will be purged by placing the intake of the pump just below the water table surface.

Purging will be accomplished by removing water from the monitoring well until a minimum of three well volumes have been sampled and field water quality parameters (pH, specific conductance, turbidity, and temperature) have stabilized. These readings will be performed using a water quality meter and flow through cell. If the water quality parameter results are within the following ranges over three consecutive measurements (taken every 3 to 5 minutes), the well has been stabilized:

- pH ± 0.1 standard units
- Specific conductance ± 5 percent
- Temperature ± 0.1$^{o}$C
- Turbidity ≤5 nephelometric turbidity units (NTU)

If the requirements for stable conditions are not met after a total of five well volumes have been removed, appropriate notations should be made in the field log and sampling should begin. Additional information concerning whether or not a well has stabilized can be found in the MPCA sampling protocol in

Appendix C, Section 3.5, Purge and Stabilization. Based on the sensitive nature of the flow-through cell and dissolved oxygen probe, dissolved oxygen is not a stabilization parameter. The ≤5 NTU turbidity criterion to be used is intentionally more restrictive than the ≤10 NTU MPCA requirements in Appendix C to require closer control over suspended matter in the samples.

The field technician shall record all information (e.g., field parameter measurements, field observations, etc.) on the groundwater sample log sheets and field logbook as described in Section 4.3.5. Examples of field log sheets are provided in Appendix D.

Purging will be accomplished using submersible pumps (i.e., Grundfos pump). A calibrated bucket or other container will be used to measure the volume of water removed. Purged water will be placed in drums or tanks, and disposed of via the GWTF, pending permit restrictions and operator consent.

Monitoring well construction data are presented in Table 4-10. The data in this table will be supplemented with information on newly constructed wells as it becomes available. In the field, personnel will use pre-calculated conversion formulas to determine the number of gallons that must be removed to perform purging. The calculation for a well volume is depth to bottom minus depth to water times the pre-calculated gallons per linear foot of casing. These values are as follows:

- 2-inch diameter well - 0.163 gallon per linear foot
- 3-inch diameter well - 0.367 gallon per linear foot
- 4-inch diameter well - 0.653 gallon per linear foot

Additional information on well purging and field tests is provided in Appendix C.

Extraction Wells

The groundwater extraction wells are continuously pumping; therefore, well stabilization tests and additional purging will not be performed.

Fridley Well No. 13

Well purging will be conducted by City of Fridley employees. Well stabilization as previously described for monitoring wells will be performed as accurately as possible based on field conditions. A flow volume totalizer at the pump house will be used to record the water volume pumped for purging. The anticipated pumping rate is approximately 1,000 gallons per minute.

### 4.3.3 Sample Collection

The sampling techniques for all groundwater monitoring associated with the groundwater extraction and treatment system evaluation at the NIROP will be conducted in accordance with information presented in Sections 4.3.1.2 and 4.3.2.2. Tables 4-3, 4-4, and 4-5 provide a summary of the monitoring program for groundwater.

#### 4.3.3.1 Monitoring Wells

To ensure that the water sample being collected is representative of in-situ water, the samples will be collected immediately after the well has been purged. The same pump and placement of the pump used for purging will be used for sample collection. The flow rate from the pump will be the same as was used during purging. The purging methods and pumping rates are discussed in greater detail in Section 4.3.2.2. Procedures for sampling monitoring wells are as follows:

- Verify that sufficient vials are available for each sampling location and that each is properly labeled in accordance with Section 4.3.4.

- Immediately fill the sample vial by allowing the water stream from the pump tubing to strike the inner wall of the vial to minimize formation of air bubbles. Do not rinse the sample vial. The sample should be collected to prevent excessive amounts of agitation and aeration and with a minimum of splashing. Fill each vial until the water forms a positive meniscus at the brim. Allow the vial to overflow slightly before capping. After capping, invert each vial and visually inspect for air bubbles. If air bubbles are present, discard the vial, and repeat the previous steps using a new vial. If no bubbles are present, place samples on ice in cooler immediately and record the appropriate field information on the field logsheets shown in Appendix D. Containers, preservatives, and holding times used for sample collection are shown in Table 4-7. Additional information on groundwater sample collection is provided in Appendix C.

#### 4.3.3.2 Extraction Wells

Sampling procedures for the groundwater extraction wells are the same as those described in Section 4.3.3.1 for monitoring wells with the exception that the samples will be collected from a sampling port rather than from the pump discharge tubing. The first portion (5 to 10 seconds) of water from the tap will not be sampled and will be collected in a bucket, emptied into a drum, and disposed of as investigation

derived waste (IDW). The flow rate from the sampling port will be adjusted to as low as possible for sample collection.

#### 4.3.3.3 Fridley Well No. 13

Sampling procedures will be the same as those described in Section 4.3.3.2 for groundwater extraction wells.

#### 4.3.3.4 Field QA/QC Samples

Field QA/QC samples include equipment rinsate blank, duplicate, and matrix spike (MS)/matrix spike duplicate (MSD) samples (see Table 4-11).

Field equipment rinsate blank and field duplicate samples will be collected and analyzed to assess the quality of the data resulting from the field sampling program. All QA/QC samples will be collected in the same type of container and with the same preservation requirements as the primary groundwater samples. QA/QC samples will be collected at sampling points suspected of having relatively high levels of contamination to provide meaningful information for blank or duplicate sample evaluation. They will be analyzed for the same parameters (i.e., VOCs) as the groundwater samples. Field QA/QC samples are not analyzed for field parameters. All rinsate blank and duplicate samples will be assigned identification aliases on the sample bottle label and on the chain-of-custody (COC) form to avoid alerting laboratories that the sample is a blank or replicate sample. The identity of the blank and duplicate samples will be recorded in the field sampling log.

Trip blanks are used to assess the potential for VOC cross contamination of samples caused by contaminant migration during sample shipment and storage. Trip blanks will be filled and sealed by the laboratory with laboratory-controlled, analyte-free water. Trip blank sample vials will travel with the actual sample vials to and from the field in the cooler, to the well head, etc., so that the blanks are exposed to precisely the same conditions as the actual samples. The trip blanks will never be opened in the field. One set of trip blanks will be returned to the laboratory with each cooler containing samples for VOC analysis.

Equipment rinsate (or field) blanks will be obtained under representative field conditions by collecting the rinse water generated by running analyte-free water through sample collection equipment after decontamination and prior to use. Collection of rinsate blanks should be conducted to simulate actual field sampling methods in a manner that would detect the presence of background or cross contamination

of samples from the ambient environment, preservatives, or sampling equipment. An effort will be made to have the blank sample water contact all equipment surfaces that the sample water will contact. Equipment rinsate blanks will be collected at a frequency of one rinsate blank per day of sampling.

Field duplicate samples will be collected to evaluate the variability of sampling and analytical methods. Field duplicate samples are two samples collected independently at a sampling location. The field duplicate will be collected immediately after the primary groundwater sample is collected. Field duplicate samples will be collected at a frequency of one duplicate per 10 groundwater samples.

In addition to field blanks and field duplicates, MS samples will be collected. Matrix spikes provide information about the effect of the sample matrix on the extraction and measurement methodology. Matrix spikes are performed in duplicate and are referred to as MS/MSD samples. These analysis are performed as internal (i.e., laboratory) QC checks. To accommodate these laboratory QC samples, the field crew must provide extra aliquots of sample as required. These extra sample aliquots will be identified with the same sample location information as the selected groundwater sample(s). MS/MSD samples will be provided to the laboratory with a frequency of one set per 20 groundwater samples.

### 4.3.4 Investigation Derived Waste Handling

It is anticipated that the field investigation will generate three types of IDW; personal protective equipment (PPE), sampling equipment decontamination fluids, and purge water. Based on the activities and types of contaminants present, none of the residues are expected to represent a significant risk to human health or the environment if properly managed. All PPE will be double-bagged and disposed of appropriately. Unless written permission is received, the O&M contractor shall not deposit these materials in dumpsters owned by the Navy or other site entities. All purge water will be disposed by pumping into a GWTF pump house located on Navy property.

### 4.3.5 Documentation

#### 4.3.5.1 Sample Identification

Groundwater sample identification numbers will be unique and will correspond with individual well identifiers. Well identifiers will be preceded with the letters “MS,” except well FMC-33, the groundwater extraction wells (AT-7, AT-8, etc.), and Fridley Well No. 13, to facilitate the computer database management system. Example sample designations for the exceptions will be as follows:

- FMC-33 FMC33
- Fridley Well No. 13 FW13
- AT-3A AT03A
- AT-5A AT05A
- AT-5B AT05B

COC entries and the database management system will not use the dash (-) in the well identification. Quality control samples will be labeled as “QC” samples, followed by a letter that designates the type of sample and a sequential number beginning with 01. QC samples will be “blind” samples used as a QC check on field and laboratory procedures.

Field duplicate samples will be labeled with “D” following the QC prefix and numbered sequentially (QCD01, QCD02, etc.). The locations of duplicate samples will be recorded in field notebooks, on the COC forms not submitted to the laboratory, and groundwater sample logsheets (Appendix D).

Trip blanks will be labeled with “T” following the QC prefix and numbered sequentially (QCT01, QCT02, etc.).

Equipment rinsate (field) blanks will be labeled with “R” following the QC prefix and numbered sequentially (QCR01, QCR02, etc.).

Sequential numbering of duplicates and blanks will be re-initiated at “01” during each sampling round because sample dates will be used to distinguish between sampling events in the computer data files.

Samples that have extra aliquots for MS/MSD analysis will be noted on the COC form.

Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the ballpoint pen would not function in freezing weather.

#### 4.3.5.2 Chain-of-Custody

The possession of samples must be traceable from the time of collection using COC procedures. Specific COC forms must accompany all sample shipping containers to document the transfer of the shipping containers and samples from the field to the laboratory receiving the samples for analysis. The field

sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

An example COC form is provided in Appendix D. The actual form may differ slightly according to the laboratory used. When filling out the COC form, it is important to use only black ink and to write legibly. Errors are to be corrected by drawing a single line through the incorrect information and entering the correct information. All corrections are to be initialed and dated by the person making the corrections. This procedure also applies to words or figures inserted or added to a previously recorded statement. A checklist of information that must be included on the COC form is provided in Appendix B of the QAPP.

#### 4.3.5.3 Field Activity Documentation and Logbooks.

The field logbook and field logsheets will provide the means of recording the data collection activities performed. As such, entries will be described in as much detail as possible so that subsequent data users could reconstruct field activities from the documented information only. Field logbooks are discussed below, and examples of field data logsheets are in Appendix D.

Field logbooks will be bound field survey books or notebooks. Three-ring binders may not be used. Each logbook will be identified by a project-specific number. The title page of each logbook will contain the following:

- Name of the person(s) to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- Project completion date

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather conditions, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigative team personnel, and the purpose of their visit will also be recorded in the field logbook.

Whenever a sample is collected or a measurement is made, a detailed description of the station, including compass and distance measurements, shall be recorded. All entries will be made in indelible black ink, and no erasures will be made. If an incorrect entry is made, the information will be crossed out

with a single strike mark, dated, and initialed by the person making the correction. The number and description of photographs taken, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration. The identification of equipment should include make and model and serial number of all pumps and field meters and the type of any electrodes used.

The following sampling information will also be recorded: make and model of pump; the time of sampling; a sample description; the volume of sample removed from the well; and the number, type, and size of containers, including the type of preservative in each container. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted in the sample description.

Additional information on field documentation is provided in Appendix C, Section 5.0.

#### 4.3.6 Sample Preservation, Handling, and Transportation

This section describes procedures that will be followed between the time samples are collected and the time they are either shipped or delivered to an analytical laboratory.

Samples will be preserved as shown in Table 4-7. All samples will be thermally preserved in the field immediately after sample collection by placing samples in an insulated cooler containing regular ice. Particular care will be taken to assure that paper work and sample labels are not damaged by water. Regular ice, if used, will be placed inside uncontaminated leak-proof plastic containers, and the COC record and other paper work will be placed inside a Ziplock™ bag.

All coolers will be accompanied by a COC form and will contain a complete address and return address on both inside and outside of the chest. The samples will be maintained at approximately 4$^{o}$C during transport to the laboratory. To ensure this, a temperature blank will be included in each cooler shipped. Before transporting samples, field personnel will perform the following tasks:

- Verify that laboratory personnel will be present to receive samples when they arrive.
- Verify that laboratory personnel understand COC and sample storage and preservation requirements.
- Check labeling and documentation to ensure that sample identify will be clear to laboratory personnel.
- Hand deliver or ship samples in a manner that ensures samples will remain cool (approximately 4$^{o}$C) until received by laboratory personnel.
- Maintain COC according to procedures described in Section 4.3.5.

Procedures to be implemented for sample shipment and transfer of custody are as follows:

- Prepare sample containers with pre-applied labels.
- Properly identify and label each sample in the field with indelible, waterproof, black ink.
- Complete COC forms in the field. Indicate sample identification, containers filled, sampling date, sampling time, sample collector's name, and sample preservation. This information will also be noted in the field notebooks maintained for the site.
- Repack shipping containers with samples, COC forms, and ice packs. Each set of samples to be shipped together in a single shipping container is assigned a COC form that travels with the shipping container.
- Include a temperature blank in each cooler.
- Place the COC form in a Ziplock™ bag, seal the bag, and tape it to the inside cover of the cooler.
- Seal and ship containers to the appropriate laboratory. Common carriers or intermediate individuals shall be identified on the COC forms. Copies of all bills-of-lading will be retained.
- Ship by overnight delivery service to the approved laboratory. The correct laboratory shipping address will be confirmed with the laboratory prior to shipment.

The laboratory will receive and check the shipping containers for broken seals or damaged sample containers. If no problems are noted, samples will be logged into the laboratory. The COC form is completed when laboratory personnel sign the form. The laboratory will include a copy of the completed COC form with the analytical data report.

Additional information on sample handling is provided in Appendix C.

## 4.4 DATA REDUCTION AND VALIDATION

### 4.4.1 Data Reduction and Validation

#### 4.4.1.1 Field Measurements and Activities

Raw data from field measurements and sample collection activities will be appropriately recorded in the field logbook. Data will include water level measurements and readings, flow rate readings, pH, specific conductance, turbidity, and temperature. Reduction of field data will consist of transferring data from the field notebooks for use in AMRs and other documents. Validation will consist of cross-checking log versus report entries.

#### 4.4.1.2 Laboratory Data

Data validation consists of a stringent review of the chemical analytical data packages generated by the laboratory. Sample handling and receipt, observance of maximum holding time allowances, performance of the analytical method employed, accuracy of data reporting, and completeness of the deliverables generated are evaluated. Data validation also considers the impact of field-related QC checks. The overall purposes of data validation are to access the validity of the data generated with respect to pre-established criteria and to generate a report detailing noncompliance that warns potential users of limitations in data utility.

Data generated by the laboratory will be validated by qualified chemists in accordance with the most recent edition of the USEPA National Functional Guidelines for Evaluating Organic Analysis, method-specific QC criteria, and the QC limits established by the laboratory QA plan. Professional judgement will also be used. Data validation reports summarizing non-compliant items will be generated, and qualifier flags will be applied to data to alert users of limitations in utility.

Laboratory data generated for the NIROP Fridley remedial action will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data qualifier flags from data validation and the additional comments of data reviewers.

## 4.5 REPORTING AND RECORD KEEPING

Reporting requirements described in the following section are based on the FFA, the previous RAMP, and past AMR.

### 4.5.1 Periodic Monitoring Reports and Progress Reports

The Navy shall submit the analytical and water level results to the USEPA and the MPCA following sampling. This information may be presented and recorded during regularly scheduled Restoration Advisory Board (RAB) meetings.

Per the FFA, the Navy will submit to the USEPA and the MPCA quarterly written progress reports, which may take the form of RAB meeting minutes, that describe the actions the Navy has taken during the previous 3 months to implement the requirements of the FFA. Progress reports shall also describe the activities scheduled to be completed during the upcoming quarter. The progress reports shall include a detailed statement of the manner and extent to which the requirements of the FFA are being met. In addition, the progress reports shall identify any anticipated delays in meeting deadlines or target dates, the reason(s) for the delay(s) and actions taken to prevent or mitigate the delay(s), and any need for additional work.

### 4.5.2 Annual Monitoring Report

The Navy will submit an AMR to the USEPA and MPCA during each year after startup of the groundwater extraction system as required by the FFA. The AMRs will include the following items related to groundwater remediation:

- A description of the current groundwater remediation facilities and any planned modifications.
- Results of all groundwater and river water elevations for the previous year.
- Hydraulic head maps of water table elevations and piezometric surface elevations for the lower sand unit (deep monitoring wells) and bedrock.
- Evaluation of hydraulic containment effectiveness of the extraction well system based on hydraulic head information, capture zone evaluation, and chemical trends.
- A map showing the location of each monitoring well and extraction well.
- Iso-concentration maps and cross-sections (with a cross-section locator map) for TCE developed from the results of the last groundwater sampling round performed each year for all monitoring wells in the approved monitoring network.

- Graphs illustrating TCE concentrations over time using data from each sampling event. The graphs will be cumulative showing groundwater quality for all previous years during extraction system operations as well as the reporting year.

- Laboratory results from chemical analyses of all groundwater samples.

- Evaluation of the statistical significance of groundwater quality data, if applicable.

- QA/QC summary of chemical water quality data including precision, accuracy, and completeness.

- Evaluation of the suitability of the monitoring well network including the need for addition or deletion of monitoring wells.

- Summary of extraction system operation and maintenance.

- Summary of treatment system operation and maintenance.

- A monitoring plan for the next year with an assessment of the monitoring parameters and sampling frequencies.

- Quarterly Progress Reports.

DQOs (Problems B and C of Appendix B) will be evaluated and the evaluation will be documented in each AMR, beginning with the 2005 AMR. The process used to conduct this evaluation will be in accord with the applicable DQOs presented in Appendix B. A presentation of the decision statements being evaluated, the evaluation approach, and the results and conclusions of the evaluation will be presented in AMR Section 6.0. The suitability of individual monitoring wells to assess groundwater quality will be evaluated in each AMR. Hydraulic and chemical monitoring data for each well will be used to assess whether continued use of each well is necessary and appropriate for the overall objectives of the monitoring program. The evaluation will also assess whether additional existing wells need to be added to the monitoring network. If revisions to the monitoring well network are determined to be appropriate, the recommended changes will be included in the AMR. Review and approval of recommended revisions will be obtained from the USEPA and MPCA prior to implementation of changes to the monitoring well network.

Hydraulic containment will be achieved when it can be demonstrated that groundwater gradients in areas within the contaminated groundwater zone are effectively directed toward an extraction well (horizontally and vertically) and as defined in the NIROP Partnering Team DQO meetings. Evaluation of the effectiveness of hydraulic containment will be re-evaluated annually. Groundwater chemistry data will be used to support the evaluation of containment effectiveness, as appropriate. Maps, tables, and/or graphs that depict water table and piezometric head contours will be compared to historical data to estimate the extent of the radius of influence of the groundwater extraction system. Demonstration of containment by measured hydraulic heads may be complemented by use of a 3-dimensional groundwater flow model that has been calibrated to actual site conditions. The model will be used to evaluate whether hydraulic containment has been or will be achieved.

#### 4.5.3 Retention of Records

All documents contained in the Administrative Record, the Public Information Repository, and all final primary and secondary documents as defined in the FFA, shall be preserved by the Navy (and other agencies) for a minimum of 10 years after termination of the FFA. The RAWP is defined as a primary document, and sampling and data results are defined as secondary documents. Therefore, the Navy will retain all groundwater monitoring results for at least 10 years after the FFA is terminated. The FFA can be terminated when the Navy, with USEPA and MPCA concurrence, determines that any final remedial action has been completed in accordance with the requirements of the FFA.

**TABLE 4-1**

**GROUNDWATER CHEMICALS AND TARGET CLEANUP LEVELS**
**NIROP FRIDLEY, MINNESOTA**

| Parameter | Maximum Contaminant Level (µg/L) |
|---|---|
| 1,1-Dichloroethane | -- |
| 1,1-Dichloroethene | 7 |
| 1,2-Dichloroethene (cis-) | 70 |
| 1,2-Dichloroethene (trans-) | 100 |
| Tetrachloroethene | 5 |
| 1,1,1-Trichloroethane | 200 |
| Trichloroethene | 5 |
| Vinyl chloride | 2 |

Maximum contaminant levels (MCLs) per 40 CFR 141.
-- MCL not available.

**TABLE 4-2**

**SITE-SPECIFIC ALLOWABLE AIR EMISSION RATES AND GROUNDWATER CONCENTRATIONS**
**NIROP FRIDLEY**
**FRIDLEY, MINNESOTA[1]**

| Parameter | Allowable Air Concentrations ($\mu g/m^3$) | Allowable Air Emission Rate (µg/sec) | Allowable Groundwater Concentration (µg/L) |
|---|---|---|---|
| 1,1-Dichloroethane | 500 | 1.35E+8 | 2,100,000 |
| 1,1-Dichloroethene | 0.2 | 5.4E+4 | 850 |
| Methylene chloride | 20 | 5.4E+6 | 85,000 |
| Tetrachloroethene | 17.2 | 4.6E+6 | 73,000 |
| Trichloroethene | 5.9 | 1.6E+6 | 25,000 |

Source: Morrison Knudsen Corporation, 1998.

1 By design, this list of air monitoring parameters is not the same list of parameters for groundwater monitoring.

**TABLE 4-3**

**MONITORING WELLS FOR MONITORING GROUNDWATER CHEMICAL CHARACTERISTICS**
**NIROP FRIDLEY, MINNESOTA**


| Unconfined Aquifer | | Upper Confined Aquifer | Prairie du Chien Aquifer |
|---|---|---|---|
| **Shallow Wells** | **Intermediate Wells** | | |
| 1-S | 1-IS | 1-D | 1-PC |
| 2-S | 2-IS | 2-D | 2-PC |
| 3-S | 3-IS | 4-D | 3-PC |
| 5-S | 4-IS | 6-D | 4-PC |
| 6-S | 5-IS | 7-D | 5-PC(1) |
| 7-S | 6-1S | 8-D | MS-28D |
| 8-S | 8-1S | 9-D(2) | MS-29D |
| 9-S | 10-IS | 12-D | MS-30D |
| 11-S | 12-IS | 14-D | MS-31D |
| 14-IS | 13-1S | 15-D | MS-32D |
| 15-S | 15-IS | 16-D | MS-33D |
| 16-S | 16-IS | 17-D | MS-48PC |
| 17-S | AT-3A | AT-5B | MS-50PC |
| 18-S | AT-10 | MS-28D | MS-53PC |
| 19-S(2) | MW-28I | MS-29D | Fridley Well 13 |
| 20-S(3) | MS-29I | MS-30D | |
| 21-S | MS-30I | MS-31D | |
| 23-S | MS-31I | MS-32D | |
| 24-S | MS-32I | MS-33D | |
| 25-S | MS-33I | MS-34D | |
| 26-S | MS-34I | MS-35D | |
| 27-S(5,6) | MS-35I | MS-36D | |
| AT-5A | MS-36I | MS-40D | |
| AT-7 | MS-41I | MS-41D | |
| AT-8 | MS-42I(4) | MS-43D | |
| AT-9 | MS-43I | MS-44D | |
| MS-28S | MS-44I | MS-47D | |
| MS-29S | MS-45I | MS-49D | |
| MS-30S | MS-46I | MS-52D(2) | |
| MS-31S | MS-47I | | |
| MS-32S | MS-49I | | |
| MS-33S | MS-51I(2) | | |
| MS-34S | MS-52I(2) | | |
| MS-35S | | | |
| MS-36S | | | |
| MS-37S | | | |
| MS-38S | | | |
| MS-39S | | | |
| MS-40S | | | |
| MS-41S | | | |
| MS-43S | | | |
| MS-44S | | | |
| MS-45S(5,6) | | | |
| MS-47S(5,6) | | | |
| MS-49S | | | |
| MS-52S(2) | | | |
| UD-63S(3) | | | |
| USGS 2 | | | |

**TABLE 4-3**

**MONITORING WELLS FOR MONITORING GROUNDWATER CHEMICAL CHARACTERISTICS**
**NIROP FRIDLEY, MINNESOTA**


| Unconfined Aquifer | | Upper Confined Aquifer | Prairie du Chien Aquifer |
|---|---|---|---|
| **Shallow Wells** | **Intermediate Wells** | | |
| USGS 5<br>USGS 8 | | | |

NOTE: Many wells have multiple monitoring purposes. If a well is to be eliminated from the monitoring network in the future, all of these purposes must be evaluated before it can be eliminated.

1 Navy is sampling on an annual basis to determine contaminant migration from an upgradient source. This decision is not being dictated by the regulatory agencies or partnering team.

2 The groundwater flow direction in the southern portion of the ACP indicates that the TCE detected in wells MS-52S, MS-52I, and MS-52D and perhaps wells 19-S, MS-51I, and 9-D may originate from the UDLP site. This has been noted in the 1999 AMR (TtNUS, 2000). This statement should be documented with all sample results from these wells in each AMR. MPCA, Navy, and UDLP will distinguish between contamination from NIROP and UDLP in the future.

3 Data from UD-63S will come at the courtesy of UDLP. This data will be collected during the same sampling period as AMR data. If data from UD-63S is not available, then 20-S will be sampled in its place. If this is the case, 20-S will represent the plume edge at this location (i.e., in place of UD-63S).

4 This well has been moved to the shallow zone per the telephone conference on May 13, 2002.

5 Quarterly sampling is being performed by CCI for the Vegetable Oil Treatability Study at a frequency of 0, 2, 5, 8, and 12 months after treatment plus any contingency sample rounds. Sampling began in December 2001.

6 Sampling performed by CCI for the Vegetable Oil Treatability Study will be done in place of AMR sampling, however, this data will be reported in the AMR.

**TABLE 4-4**

**SUMMARY OF MONITORING WELL TYPES FOR GROUNDWATER MONITORING AS DEFINED IN WELL SECTION MEETING MARCH 2002[1,2,3]**
**NIROP FRIDLEY, MINNESOTA**


**Problem C Decision Rule 1**

| Wells Needed to Define Plume Edge (to define 100 ppb of TCE)[2, 4] | | | | | | |
|---|---|---|---|---|---|---|
| **Shallow Wells** | | | | | | |
| 2-S | USGS 2 | MS-40S | NA | NA | NA | NA |
| 5-S | USGS 5 | MS-42I[5] | | | | |
| 6-S | USGS 8 | MS-43S | | | | |
| 17-S | MS-34S | MS-52S[1] | | | | |
| 19-S[1] | UD-63S[1,6] | | | | | |
| 7-S | | | | | | |
| **Intermediate Wells** | | | | | | |
| 3-IS | MS-45I | NA | NA | NA | NA | NA |
| MS-29I | MS-46I | | | | | |
| MS-41I | | | | | | |
| MS-43I | | | | | | |
| MS-44I | | | | | | |
| **Deep Wells** | | | | | | |
| 8-D | MS-36D | MS-43D | NA | NA | NA | NA |
| 9-D | MS-40D | MS-44D | | | | |
| 15-D | MS-41D | MS-47D | | | | |
| MS-35D | | | | | | |
| **Bedrock Wells** | | | | | | |
| NA | NA | NA | NA | NA | NA | NA |

**TABLE 4-4**

**SUMMARY OF MONITORING WELL TYPES FOR GROUNDWATER MONITORING AS DEFINED IN WELL SECTION MEETING MARCH 2002[1,2,3]**
**NIROP FRIDLEY, MINNESOTA**


**Problem C Decision Rule 2, 3, 4**

| Upgradient | Back-ground[3] | Cross-gradient | Plume Edge | In-Plume NIROP | | Wells in the ACP[7] | | Down-gradient | Point of Compliance | Sentinel[6] | Off-Base |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Shallow Wells** | | | | | | | | | | | |
| 15-S | | 16-S | MS-52S[1] | 3-S[8] | | USGS 5 | MS-38S | | USGS-5 | | |
| 21-S | | MS-52S[1] | 5-S | 8-S[8] | | 17-S | MS-39S | | MS-43S | | |
| 23-S | | USGS 8 | 7-S | 9-S[8] | | 24-S | MS-40S | | MS-44S | | |
| | | | 16-S | MS-28S[8] | | 11-S | MS-41S | | 27-S | | |
| | | | 25-S | MS-29S[8] | NA | MS-34S | 18-S | NA | MS-47S | NA | NA |
| | NA | | USGS 5 | MS-30S[8] | | MS-35S | 27-S | | MS-49S | | |
| | | | USGS 8 | MS-31S[8] | | MS-36S | MS-47S | | 19-S[1] | | |
| | | | UD-63S[1,6] | MS-32S[8] | | MS-37S | MS-49S | | | | |
| | | | | MS-33S[8] | | MS-43S | 26-S | | | | |
| | | | | | | MS-44S | 14-IS | | | | |
| | | | | | | MS-45S | 19-S[1] | | | | |
| **Intermediate Wells** | | | | | | | | | | | |
| 1-IS | | 10-IS | MS-43I | 3-IS[8] | | MS-34I | MS-41I | | MS-43I | | |
| 2-IS | | | MS-52I[1,9] | 5-IS([8] | | MS-35I | MS-45I | | MS-44I | | |
| | | | | MS-28I[8] | | MS-36I | MS-46I | | 16-IS | | |
| | NA | | | MS-29I[8] | | MS-43I | MS-47I | | MS-47I | | |
| | | | | MS-30I[8] | NA | MS-44I | MS-49I | NA | MS-49I | NA | NA |
| | | | | MS-31I[8] | | 6-IS | MS-51I[1] | | MS-51I[1] | | |
| | | | | MS-32I[8] | | 8-IS | 4-IS | | | | |
| | | | | MS-33I[8] | | 12-IS | 15-IS | | | | |
| | | | | | | 13-IS | 16-IS | | | | |
| **Deep Wells** | | | | | | | | | | | |
| 1-D | | | 2-D | 12-D[8] | MS-29D[8] | MS-34D | 6-D | | MS-43D | | |
| 14-D | | | 4-D | MS-28D[8] | MS-31D[8] | MS-35D | 7-D | | MS-44D | | |
| | | | | MS-30D[8] | | MS-36D | 8-D | | 16-D | | |
| | NA | NA | | MS-32D[8] | | MS-41D | 9-D[1] | NA | MS-47D | NA | NA |
| | | | | MS-33D[8] | | MS-43D | 15-D | | MS-49D | | |
| | | | | | | MS-44D | 16-D | | 9-D[1] | | |
| | | | | | | MS-47D | 17-D | | | | |
| | | | | | | MS-49D | MS-40D | | | | |
| **Bedrock Wells(3)** | | | | | | | | | | | |
| 1-PC[10]<br>2-PC[10]<br>3-PC[10]<br>Fridley Well 13 | 4-PC[10]<br>5-PC[10] | MS-48PC[10]<br>MS-50PC[10]<br>MS-53PC[10] | Fridley Well 13 | NA | NA | NA | NA | NA | NA | NA | NA |

**TABLE 4-4**

**SUMMARY OF MONITORING WELL TYPES FOR GROUNDWATER MONITORING AS DEFINED IN WELL SECTION MEETING MARCH 2002[1,2,3]**
**NIROP FRIDLEY, MINNESOTA**


Notes:

1 The groundwater flow direction in the southern portion of the ACP indicates that the TCE detected in wells MS-52S, MS-52I, and MS-52D and perhaps wells 19-S, MS-51I, and 9-D may originate from the UDLP site. This has been noted in the 1999 AMR (TtNUS, 2000). This statement should be documented with all sample results from these wells in each AMR. MPCA, Navy, and UDLP will distinguish between contamination from NIROP and UDLP in the future.
2 Many wells have multiple monitoring purposes. If a well is to be eliminated from the monitoring network in the future, all of these purposes must be evaluated before it can be
3 No background wells at the site due to offsite contamination migrating onto the Navy property.
4 Based upon 1999 AMR analytical data.
5 This well has been moved to the shallow zone per the telephone conference on May 13, 2002.
6 Data from UD-63S will come at the courtesy of UDLP. This data may be collected at a different period (~within 6 months of AMR data). If data is not available then 20-S will be sampled in its place. If this is the case 20-S will represent the plume edge at this location (i.e., in place of UD-63S).
7 Refer to the well meeting notes and polygons noted by the Partnering Team on the attached Figures 1, 2, and 3.
8 These wells will be sampled once every 5 years (ie., first round in 2001 and the next sample round will be in 2006).
9 Northwest of NIROP Plant building (western N40 area) monitoring is pending further discussion.
10 The well types for this layer were not identified by the Partnering Team.

NA = None available/not applicable.

**TABLE 4-5**

**SUMMARY OF GROUNDWATER SAMPLING NETWORK[1,2]**
**DEFINED IN MARCH 2002 WELL SELECTION MEETING**
**NIROP FRIDLEY, MINNESOTA**
**PAGE 1 OF 4**

| Well ID | 2001 (Completed) | | 2002 | | | 2003[(3)] | | 2004 | | 2005 | | 2006 | | 2007[(2)] | 2008[(1,2)] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Semi-annual | Annual | Quarterly[(4)] | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | | |
| **NIROP Shallow Wells** | | | | | | | | | | | | | | | |
| 1-S | | | | | X | | | | X | | | | X | Wells selected for groundwater sampling will be determined based upon 2006 sample results. | |
| 2-S | | | | | X | | | | X | | | | X | | |
| 3-S | | X | | | | | | | | | | | X | | |
| 4-S | | | | | | | | | | | | | | | |
| 5-S | | | | | X | | | | X | | | | X | | |
| 6-S | | | | | X | | X | | X | | X | | X | | |
| 7-S | | X | | | X | | | | X | | | | X | | |
| 8-S | | X | | | | | | | | | | | X | | |
| 9-S | | X | | | X | | | | X | | | | X | | |
| 10-S | | | | | | | | | | | | | | | |
| 11-S | | | | | X | | X | | X | | X | | X | | |
| 11-SB | | | | | | | | | | | | | | | |
| 12-S | | | | | | | | | | | | | | | |
| 13-S | | | | | | | | | | | | | | | |
| 14-S | | | | | | | | | | | | | | | |
| 14-IS | | X | | | X | | X | | X | | X | | X | | |
| 15-S | | X | | | X | | | | X | | | | X | | |
| 16-S | | X | | | | | | | | | | | X | | |
| 17-S | | X | | | X | | X | | X | | X | | X | | |
| 18-S | | X | | | | X | | X | | X | | X | | | |
| 19-S[5] | | X | | | X | | X | | X | | X | | X | | |
| 20-S[6] | | X | | | X | | X | | X | | X | | X | | |
| 21-S | | X | | | X | | | | X | | | | X | | |
| 22-S | | | | | | | | | | | | | | | |
| 23-S | | | | | X | | | | X | | | | X | | |
| 24-S | | X | | | X | | X | | X | | X | | X | | |
| 25-S | | | | | X | | X | | X | | X | | X | | |
| 26-S | | X | | | | X | | X | | X | | X | | | |
| 27-S[4,7] | | X | X | | | | X | | X | | X | | X | | |
| MS-28S | | X | | | | | | | | | | | X | | |
| MS-29S | | | | | | | | | | | | | X | | |
| MS-30S | | | | | | | | | | | | | X | | |
| MS-31S | | X | | | | | | | | | | | X | | |
| MS-32S | | X | | | | | | | | | | | X | | |
| MS-33S | | X | | | | | | | | | | | X | | |
| MS-34S | | X | | | X | | X | | X | | X | | X | | |
| MS-35S | | X | | | X | | X | | X | | X | | X | | |
| MS-36S | | X | | | X | X | | X | | X | | X | | | |
| MS-37S | | X | | | X | | X | | X | | X | | X | | |
| MS-38S | | | | | X | | X | | X | | X | | X | | |
| MS-39S | | | | | X | | X | | X | | X | | X | | |
| MS-40S | | X | | | X | | X | | X | | X | | X | | |
| MS-40I | | | | | | | | | | | | | | | |
| MS-41S | | X | | | X | X | | X | | X | | X | | | |
| MS-43S | | X | | | X | | X | | X | | X | | X | | |

**TABLE 4-5**

**SUMMARY OF GROUNDWATER SAMPLING NETWORK[1,2]**
**DEFINED IN MARCH 2002 WELL SELECTION MEETING**
**NIROP FRIDLEY, MINNESOTA**
**PAGE 2 OF 4**

| Well ID | 2001 (Completed) | | 2002 | | | 2003[(3)] | | 2004 | | 2005 | | 2006 | | 2007[(2)] | 2008[(1,2)] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Semi-annual | Annual | Quarterly[(4)] | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | | |
| **NIROP Shallow Wells (Continued)** | | | | | | | | | | | | | | | |
| MS-44S | | X | | | X | X | | X | | X | | X | | Wells selected for groundwater sampling will be determined based upon 2006 sample results. | |
| MS-45S[4,7] | | X | X | | | | X | | X | | X | | X | | |
| MS-47S[4,7] | | X | X | | | | X | | X | | X | | X | | |
| MS-49S | | X | | | X | | X | | X | | X | | X | | |
| MS-52S[5] | | X | | | X | | X | | X | | X | | X | | |
| USGS 1 | | | | | | | | | | | | | | | |
| USGS 2 | | X | | | X | | | | X | | | | X | | |
| USGS 3 | | | | | | | | | | | | | | | |
| USGS 4 | | | | | | | | | | | | | | | |
| USGS 5 | | X | | | X | | X | | X | | X | | X | | |
| USGS 6 | | | | | | | | | | | | | | | |
| USGS 7 | | | | | | | | | | | | | | | |
| USGS 8 | | X | | | X | | X | | X | | X | | X | | |
| USGS 9 | | | | | | | | | | | | | | | |
| AT-5A | X | | | X | | X | | X | | X | | X | | | |
| AT-7 | X | | | X | | X | | X | | X | | X | | | |
| AT-8 | X | | | X | | X | | X | | X | | X | | | |
| AT-9 | X | | | X | | X | | X | | X | | X | | | |
| **NIROP Intermediate Wells** | | | | | | | | | | | | | | | |
| 1-IS | | X | | | X | | | | X | | | | X | | |
| 2-IS | | X | | | X | | | | X | | | | X | | |
| 3-IS | | X | | | X | | X | | X | | X | | X | | |
| 4-IS | | X | | | X | X | | X | | X | | X | | | |
| 5-IS | | X | | | | | | | | | | | X | | |
| 6-IS | | | | | X | | X | | X | | X | | X | | |
| 7-IS | | | | | | | | | | | | | | | |
| 8-IS | | | | | X | | X | | X | | X | | X | | |
| 10-IS | | | | | X | | | | X | | | | X | | |
| 12-IS | | X | | | X | | X | | X | | X | | X | | |
| 13-IS | | | | | X | | X | | X | | X | | X | | |
| 15-IS | | X | | | X | | X | | X | | X | | X | | |
| 16-IS | | X | | | X | | X | | X | | X | | X | | |
| MS-28I | | X | | | | | | | | | | | X | | |
| MS-29I | | X | | | X | | X | | X | | X | | X | | |
| MS-30I | | X | | | | | | | | | | | X | | |
| MS-31I | | | | | | | | | | | | | X | | |
| MS-32I | | X | | | | | | | | | | | X | | |
| MS-33I | | X | | | | | | | | | | | X | | |
| MS-34I | | | | | X | | X | | X | | X | | X | | |
| MS-35I | | X | | | X | | X | | X | | X | | X | | |
| MS-36I | | X | | | X | X | | X | | X | | X | | | |
| MS-41I | | X | | | X | X | | X | | X | | X | | | |
| MS-42I[8] | | | | | X | | X | | X | | X | | X | | |
| MS-43I | | X | | | X | | X | | X | | X | | X | | |

**TABLE 4-5**

**SUMMARY OF GROUNDWATER SAMPLING NETWORK[1,2]**
**DEFINED IN MARCH 2002 WELL SELECTION MEETING**
**NIROP FRIDLEY, MINNESOTA**
**PAGE 3 OF 4**

| Well ID | 2001 (Completed) | | 2002 | | | 2003[(3)] | | 2004 | | 2005 | | 2006 | | 2007[(2)] | 2008[(1,2)] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Semi-annual | Annual | Quarterly[(4)] | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | | |
| **NIROP Intermediate Wells (Continued)** | | | | | | | | | | | | | | | |
| MS-44I | | X | | | X | X | | X | | X | | X | | Wells selected for groundwater sampling will be determined based upon 2006 sample results. | |
| MS-45I | | X | | | X | X | | X | | X | | X | | | |
| MS-46I | | | | | X | | X | | X | | X | | X | | |
| MS-47I | | X | | | X | | X | | X | | X | | X | | |
| MS-49I | | X | | | X | | X | | X | | X | | X | | |
| MS-51I[5] | | X | | | X | | X | | X | | X | | X | | |
| MS-52I[5] | | X | | | X | | X | | X | | X | | X | | |
| AT-3A | X | | | X | | X | | X | | X | | X | | | |
| AT-10 | X | | | X | | X | | X | | X | | X | | | |
| **NIROP Deep Wells** | | | | | | | | | | | | | | | |
| 1-D | | X | | | X | | | | X | | | | X | | |
| 2-D | | | | | X | | | | X | | | | X | | |
| 3-D | | | | | | | | | | | | | | | |
| 4-D | | | | | X | | | | X | | | | X | | |
| 5-D | | | | | | | | | | | | | | | |
| 6-D | | X | | | X | | X | | X | | X | | X | | |
| 7-D | | X | | | X | | X | | X | | X | | X | | |
| 8-D | | X | | | X | | X | | X | | X | | X | | |
| 9-D[5] | | X | | | X | | X | | X | | X | | X | | |
| 10-D | | | | | | | | | | | | | | | |
| 11-D | | | | | | | | | | | | | | | |
| 12-D | | X | | | | | | | | | | | X | | |
| 13-D | | | | | | | | | | | | | | | |
| 14-D | | | | | X | | | | X | | | | X | | |
| 15-D | | X | | | X | X | | X | | X | | X | | | |
| 16-D | | X | | | X | | X | | X | | X | | X | | |
| 17-D | | X | | | X | | X | | X | | X | | X | | |
| MS-28D | | X | | | | | | | | | | | X | | |
| MS-29D | | | | | | | | | | | | | X | | |
| MS-30D | | | | | | | | | | | | | X | | |
| MS-31D | | | | | | | | | | | | | X | | |
| MS-32D | | X | | | | | | | | | | | X | | |
| MS-33D | | X | | | | | | | | | | | X | | |
| MS-34D | | | | | X | | X | | X | | X | | X | | |
| MS-35D | | X | | | X | | X | | X | | X | | X | | |
| MS-36D | | X | | | X | X | | X | | X | | X | | | |
| MS-40D | | X | | | X | | X | | X | | X | | X | | |
| MS-41D | | | | | X | X | | X | | X | | X | | | |
| MS-43D | | | | | X | | X | | X | | X | | X | | |
| MS-44D | | X | | | X | | X | | X | | X | | X | | |
| MS-47D | | X | | | X | | X | | X | | X | | X | | |
| MS-49D | | X | | | X | | X | | X | | X | | X | | |
| MS-52D[5] | | X | | | | | | | | | | | | | |
| USGS 10 | | | | | | | | | | | | | | | |
| AT-5B | X | | | X | | X | | X | | X | | X | | | |

**TABLE 4-5**

**SUMMARY OF GROUNDWATER SAMPLING NETWORK[1,2]**
**DEFINED IN MARCH 2002 WELL SELECTION MEETING**
**NIROP FRIDLEY, MINNESOTA**
**PAGE 4 OF 4**

| Well ID | 2001 (Completed) | | 2002 | | | 2003[(3)] | | 2004 | | 2005 | | 2006 | | 2007[(2)] | 2008[(1,2)] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Semi-annual | Annual | Quarterly[(4)] | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | Semi-annual | Annual | | |
| **NIROP Bedrock Wells** | | | | | | | | | | | | | | | |
| 1-PC | | | | | | | | | | | | | X | Wells selected for groundwater sampling will be determined based upon 2006 sample results. | |
| 2-PC | | | | | X | | | | X | | | | X | | |
| 3-PC | | | | | | | | | | | | | X | | |
| 4-PC | | | | | | | | | | | | | X | | |
| 5-PC[9] | | X | | | X | | X | | X | | X | | X | | |
| MS-48PC | | X | | | | | | | | | | | X | | |
| MS-50PC | | | | | | | | | | | | | X | | |
| MS-53PC | | X | | | X | | | | X | | | | X | | |
| Fridley Well 13 | X | | | | X | | | | X | | | | X | | |
| **NIROP ACP Oil Injection Wells[3]** | | | | | | | | | | | | | | | |
| PES-CW-1 | | | X | | | | | | | | | | | | |
| PES-CW-2 | | | X | | | | | | | | | | | | |
| PES-CW-3 | | | X | | | | | | | | | | | | |
| PES-MW-1 | | | X | | | | | | | | | | | | |
| PES-MW-2 | | | X | | | | | | | | | | | | |
| PES-MW-3 | | | X | | | | | | | | | | | | |
| PES-MW-4 | | | X | | | | | | | | | | | | |
| PES-MW-5 | | | X | | | | | | | | | | | | |
| PES-MW-6 | | | X | | | | | | | | | | | | |
| PES-MW-7 | | | X | | | | | | | | | | | | |
| PES-MW-8 | | | X | | | | | | | | | | | | |
| PES-MW-9 | | | X | | | | | | | | | | | | |
| PES-INJ-1 | | | X | | | | | | | | | | | | |
| PES-INJ-2 | | | X | | | | | | | | | | | | |
| PES-INJ-3 | | | X | | | | | | | | | | | | |
| PES-BG-1 | | | X | | | | | | | | | | | | |
| BG-2 | | | X | | | | | | | | | | | | |
| BG-3 | | | X | | | | | | | | | | | | |
| **UNITED DEFENSE LP WELLS** | | | | | | | | | | | | | | | |
| UD63-S[6] | | | | | X | | | | X | | | | X | | |

Notes:

1. Long-term monitoring will be evaluated each year in the Annual Monitoring Report. Plan for 2007 and 2008 and future will be determined based upon 2006 data.
2. Many wells have multiple monitoring purposes. If a well is to be eliminated from the monitoring network in the future, all of these purposes must be evaluated before it can be eliminated.
3. The next 00-1 Five Year Review Reort is due in 2003, requiring a larger data set.
4. Quarterly sampling will be performed by CCI for the Vegetable Oil Treatability Study at a frequency of 0, 2, 5, 8, 12 months after treatment plus any contingency sample rounds. Sampling began in December 2001.
5. The groundwater flow direction in the southern portion of the ACP indicates that the TCE detected in wells MS-52S, MS-52I, and MS-52D and perhaps wells 19-S, MS-51I, and 9-D may originate from the UDLP site. This has been noted in the 1999 AMR (TtNUS, 2000). This statement should be documented with all sample results from these wells in each AMR. MPCA, Navy, and UDLP will distinguish between contamination from NIROP and UDLP in the future.
6. Data from UD-63S will come at the courtesy of UDLP. This data may be collected at a different period (~within 6 months of AMR data). If data is not available then 20-S will be sampled in its place. If this is the case 20-S will represent the plume edge at this location (i.e., in place of UD-63S).
7. Samping performed by CCI for the Vegetable Oil Treatability Study will be done in place of AMR samping; however, this data will be reported in the AMR.
8. This well has been moved to the shallow zone per the tele-con on May 13, 2002.
9. Navy is sampling on an annual basis to determine the contaminant migration coming from an upgradient source. This decision is not being dictated by the regulatory agencies or Partnering Team.

**TABLE 4-6**

**PRACTICAL QUANTITATION LIMITS – GROUNDWATER PARAMETERS**
**NIROP FRIDLEY, MINNESOTA**

| Analyte | PQL (µg/L) |
|---|---|
| 1,1-Dichloroethane | 0.5 |
| 1,1-Dichloroethene | 0.5 |
| 1,2-Dichloroethene (cis-) | 0.5 |
| 1,2-Dichloroethene (trans) | 0.5 |
| Tetrachloroethene | 0.5 |
| 1,1,1-Trichloroethane | 0.5 |
| Trichloroethene | 0.5 |
| Vinyl chloride | 0.2 |

Analytical Method - SW-846 8260B

**TABLE 4-7**

**BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS**
**GROUNDWATER SAMPLES**
**NIROP FRIDLEY, MINNESOTA**

| Sample Type | Analytical Parameters | Analytical Method | Number of Containers | Type of Container | Preservation Requirements | Holding Time |
|---|---|---|---|---|---|---|
| Monitoring Wells, Extraction Wells, Fridley Well No. 13 | VOCs | SW-846 8260B | 2 | 40 mL glass vial | HCl to pH < 2; Cool to 4$^{o}$C | 14 days |
| Monitoring Wells, Extraction Wells, Fridley Well No. 13 | Field parameters | Field | NA | NA | NA | Analyze immediately |

Notes:
VOCs - Volatile organic compounds (see Table 4-1).
Field parameters - pH, specific conductance, turbidity, and temperature.
NA - Not applicable.
mL - milliliter.
HCl - Hydrochloric acid.

**TABLE 4-8**

**SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES**
**NIROP FRIDLEY, MINNESOTA**

| Equipment | Laboratory-Grade Soap and Water Wash | Alconox/Clean Water Solution | Triple Rinse with Deionized Water |
|---|---|---|---|
| Water Level Indicator | X | - | X |
| Pumps | - | X | X |
| pH meter, conductivity meter, thermometer, turbidity meter | - | - | X |

Note: Tap water will not be from the NIROP Fridley water supply system. City of Minneapolis drinking water will be used. Distilled water may be substituted.

**TABLE 4-9**

**GROUNDWATER WELLS FROM WHICH WATER LEVEL MEASUREMENTS WILL BE TAKEN**
**NIROP FRIDLEY, MINNESOTA**


| Shallow Wells | Intermediate Wells | Deep Wells | Bedrock Wells | Mississippi River Staff Gauge |
|---|---|---|---|---|
| 1-S | 1-IS | 1-D | 1-PC | River Level (1) |
| 2-S | 2-IS | 2-D | 2-PC | |
| 3-S | 3-IS | 4-D | 3-PC | |
| 4-S | 4-IS | 5-D | 4-PC | |
| 5-S | 5-IS | 6-D | 5-PC | |
| 6-S | 6-IS | 7-D | MS-48PC | |
| 7-S | 7-IS | 8-D | MS-50PC | |
| 8-S | 8-IS | 9-D | MS-53PC | |
| 9-S | 10-IS | 10-D | | |
| 10-S | 12-IS | 11-D | | |
| 11-S | 13-IS | 12-D | | |
| 11-SB | 15-IS | 13-D | | |
| 12-S | 16-IS | 14-D | | |
| 13-S | AT-3A | 15-D | | |
| 14-IS | AT-10 | 16-D | | |
| 15-S | MS-28I | 17-D | | |
| 16-S | MS-29I | AT-5B | | |
| 17-S | MS-30I | MS-28D | | |
| 18-S | MS-31I | MS-29D | | |
| 19-S | MS-32I | MS-30D | | |
| 20-S | MS-33I | MS-31D | | |
| 21-S | MS-34I | MS-32D | | |
| 22-S | MS-35I | MS-33D | | |
| 23-S | MS-36I | MS-34D | | |
| 24-S | MS-41I | MS-35D | | |
| 25-S | MS-43I | MS-36D | | |
| 26-S | MS-44I | MS-40D | | |
| 27-S | MS-45I | MS-41D | | |
| AT-5A | MS-46I | MS-43D | | |
| AT-7 | MS-47I | MS-44D | | |
| AT-8 | MS-49I | MS-47D | | |
| AT-9 | MS-51I | MS-49D | | |
| MS-28S | MS-52I | MS-52D | | |
| MS-29S | | USGS10 | | |
| MS-30S | | | | |
| MS-31S | | | | |
| MS-32S | | | | |
| MS-33S | | | | |

## TABLE 4-9

## GROUNDWATER WELLS FROM WHICH WATER LEVEL MEASUREMENTS WILL BE TAKEN
## NIROP FRIDLEY, MINNESOTA


| Shallow Wells | Intermediate Wells | Deep Wells | Bedrock Wells | Mississippi River Staff Gauge |
|---|---|---|---|---|
| MS-34S | | | | |
| MS-35S | | | | |
| MS-36S | | | | |
| MS-37S | | | | |
| MS-38S | | | | |
| MS-39S | | | | |
| MS-40S | | | | |
| MS-40I | | | | |
| MS-41S | | | | |
| MS-42I | | | | |
| MS-43S | | | | |
| MS-44S | | | | |
| MS-45S | | | | |
| MS-46S | | | | |
| MS-47S | | | | |
| MS-49S | | | | |
| MS-52S | | | | |
| USGS 1 | | | | |
| USGS 2 | | | | |
| USGS 3 | | | | |
| USGS 4 | | | | |
| USGS 5 | | | | |
| USGS 6 | | | | |
| USGS 7 | | | | |
| USGS 8 | | | | |
| USGS 9 | | | | |
| PES-MW-1(2) | | | | |
| PES-MW-2(2) | | | | |
| PES-MW-5(2) | | | | |
| PES-CW-2(2) | | | | |

1 At the time of the synoptic groundwater level measurements, a river level measurement will be taken at the Mississippi River Staff guage adjacent to the south storm sewer outfall on the southern end of Anoka County Park.

2 Wells were formerly referred to as follows: VG-MW-1, VG-MW-2, VG-MW-5, and VG-CW respectively. Location of these wells are not shown on Figure 4-1. They can be located on CH2MHill Vegetable Oil Treatability Study Work Plan and Reports.

TABLE 4-10

MONITORING AND EXTRACTION WELL CONSTRUCTION DATA
NIROP FRIDLEY, MINNESOTA


| Well Number | Top of Casing Elevation (ft msl) | Well Depth (ft) | Nominal Well Diameter (in) |
|---|---|---|---|
| NIROP SHALLOW WELLS | | | |
| 1-S | 836.93 | 34.96 | 2 |
| 2-S | 835.91 | 34.27 | 2 |
| 3-S | 836.62 | 34.17 | 2 |
| 4-S | 837.33 | 34.81 | 2 |
| 5-S | 834.92 | 34.67 | 2 |
| 6-S | 835.60 | 34.55 | 2 |
| 7-S | 835.80 | 29.92 | 2 |
| 8-S | 835.59 | 29.32 | 2 |
| 9-S | 836.53 | 29.85 | 2 |
| 10-S | 835.73 | 31.39 | 2 |
| 11-S | 835.75 | 30.39 | 2 |
| 11-SB | 837.28 | 39.44 | 2 |
| 12-S | 838.38 | 34.50 | 2 |
| 13-S | 834.40 | 34.30 | 2 |
| 14-S | 835.82 | 33.65 | 2 |
| 14-IS | 835.21 | NA | ? |
| 15-S | 834.68 | 34.10 | 2 |
| 16-S | 837.12 | 35.13 | 2 |
| 17-S | 835.48 | 38.18 | 2 |
| 18-S | 833.86 | 40.07 | 2.5 |
| 19-S | 834.18 | 44.88 | 2 |
| 20-S | 837.51 | 35.45 | 2 |
| 21-S | 837.50 | 36.74 | 2 |
| 22-S | 837.60 | 37.95 | 2 |
| 23-S | 846.96 | 42.60 | 2 |
| 24-S | 836.19 | 36.78 | 2 |
| 25-S | 835.14 | 37.75 | 2 |
| 26-S | 834.06 | NA | 2 |
| 27-S | 832.74 | NA | 2 |
| AT-2 | 834.99 | 66.01 | 10 |
| AT-4 | 836.44 | NA | 8 |
| AT-5A | 835.57 | NA | 8? |
| AT-7 | 836.30 | 40.41 | 8 |
| AT-8 | 835.18 | 38.30 | 8 |
| AT-9 | 836.82 | 53.81 | 8 |
| MS-28S | 834.81 | 27.30 | 2 |
| MS-29S | 834.68 | 27.26 | 2 |
| MS-30S | 834.83 | 27.45 | 2 |
| MS-31S | 834.81 | 27.49 | 2 |

TABLE 4-10

MONITORING AND EXTRACTION WELL CONSTRUCTION DATA
NIROP FRIDLEY, MINNESOTA


| Well Number | Top of Casing Elevation (ft msl) | Well Depth (ft) | Nominal Well Diameter (in) |
|---|---|---|---|
| **NIROP SHALLOW WELLS (Continued)** | | | |
| MS-32S | 834.76 | 26.11 | 2 |
| MS-33S | 834.72 | 27.05 | 2 |
| MS-34S | 834.31 | 26.76 | 2 |
| MS-35S | 834.22 | 26.77 | 2 |
| MS-36S | 834.80 | 44.70 | 2 |
| MS-37S | 834.21 | 47.73 | 2 |
| MS-38S | 834.64 | 41.69 | 2 |
| MS-39S | 834.76 | 41.27 | 2 |
| MS-40S | 834.61 | 40.74 | 2 |
| MS-40I | 834.64 | 60.44 | 2 |
| MS-41S | 834.82 | 43.41 | 2 |
| MS-43S | 834.42 | 38.86 | 2 |
| MS-44S | 833.53 | 35.70 | 2 |
| MS-45S | 832.13 | 34.90 | 2 |
| MS-47S | 834.83 | 39.90 | 2 |
| MS-49S | 834.16 | 39.92 | 2 |
| MS-52S | 833.14 | 40.04 | 2 |
| MS-54S | 835.51 | 36.5 | 2 |
| MS-56S | 835.03 | 36.5 | 2 |
| USGS 1 | 835.63 | 40.69 | 2 |
| USGS 2 | 837.39 | 40.52 | 2 |
| USGS 3 | 834.24 | 44.89 | 2 |
| USGS 4 | 831.84 | 45.47 | 2 |
| USGS 5 | 832.86 | 44.85 | 2 |
| USGS 6 | 836.83 | 39.95 | 2 |
| USGS 7 | 835.47 | 45.22 | 2 |
| USGS 8 | 836.10 | 44.96 | 2 |
| USGS 9 | 836.50 | 44.88 | 2 |
| **NIROP INTERMEDIATE WELLS** | | | |
| 1-IS | 835.12 | 77.65 | 2? |
| 2-IS | 837.89 | 77.11 | 2? |
| 3-IS | 837.21 | 77.21 | 2? |
| 4-IS | 833.34 | 76.73 | 2? |
| 5-IS | 837.86 | 63.69 | 2? |
| 6-IS | 836.53 | NA | ? |
| 7-IS | 837.02 | NA | ? |
| 8-IS | 836.65 | NA | ? |
| 10-IS | 836.87 | NA | ? |
| 11-IS | NA | NA | NA |

TABLE 4-10

MONITORING AND EXTRACTION WELL CONSTRUCTION DATA
NIROP FRIDLEY, MINNESOTA


| Well Number | Top of Casing Elevation (ft msl) | Well Depth (ft) | Nominal Well Diameter (in) |
|---|---|---|---|
| NIROP INTERMEDIATE WELLS (Continued) | | | |
| 12-IS | 834.94 | NA | 2 |
| 13-IS | 834.96 | NA | 2 |
| 15-IS | 833.67 | 77.86 | 2 |
| 16-IS | 832.77 | NA | 2 |
| AT-1A | 838.53 | 65.23 | 6 |
| AT-3A | 836.10 | NA | 8 |
| AT-10 | 837.11 | 84.96 | 8 |
| MS-28I | 834.83 | 85.52 | 2 |
| MS-29I | 834.67 | 81.15 | 2 |
| MS-30I | 834.85 | 67.77 | 2 |
| MS-31I | 834.81 | 96.59 | 2 |
| MS-32I | 834.69 | 84.74 | 2 |
| MS-33I | 834.74 | 75.87 | 2 |
| MS-34I | 834.35 | 79.32 | 2 |
| MS-35I | 834.21 | 81.76 | 2 |
| MS-36I | 834.70 | 83.12 | 2 |
| MS-41I | 834.82 | 92.52 | 2 |
| MS-42I | 835.33 | 54.36 | 2 |
| MS-43I | 834.32 | 82.05 | 2 |
| MS-44I | 833.62 | 81.84 | 2 |
| MS-45I | 832.07 | 91.75 | 2 |
| MS-46I | 831.61 | 87.03 | 2 |
| MS-47I | 834.55 | 80.91 | 2 |
| MS-49I | 834.02 | 86.75 | 2 |
| MS-51I | 833.66 | 76.94 | 2 |
| MS-52I | 833.25 | 81.08 | 2 |
| MS-54I | 835.58 | 76.5 | 2 |
| MS-55I | 834.61 | 79.5 | 2 |
| MS-56I | 834.87 | 76.5 | 2 |
| NIROP DEEP WELLS | | | |
| 1-D | 836.55 | 115.54 | 2 |
| 2-D | 835.89 | 111.10 | 2 |
| 3-D | 837.35 | 80.92 | 2 |
| 4-D | 834.65 | 120.63 | 2 |
| 5-D | 835.83 | 117.27 | 2 |
| 6-D | 835.54 | 129.98 | 2 |
| 7-D | 835.61 | 117.46 | 4 |
| 8-D | 833.92 | 127.49 | 4 |
| 9-D | 834.22 | 123.82 | 4 |

TABLE 4-10

MONITORING AND EXTRACTION WELL CONSTRUCTION DATA
NIROP FRIDLEY, MINNESOTA


| Well Number | Top of Casing Elevation (ft msl) | Well Depth (ft) | Nominal Well Diameter (in) |
|---|---|---|---|
| **NIROP DEEP WELLS (Continued)** | | | |
| 10-D | 834.61 | 104.18 | 3 |
| 11-D | 837.37 | 132.00 | 3 |
| 12-D | 837.63 | 132.61 | 3 |
| 13-D | 835.59 | 102.22 | 3 |
| 14-D | 837.75 | 93.04 | 3 |
| 15-D | 834.01 | NA | ? |
| 16-D | 833.08 | NA | 2 |
| 17-D | 835.24 | NA | ? |
| AT-5B | 835.62 | NA | 8 |
| MS-28D | 834.80 | 114.69 | 2 |
| MS-29D | 834.69 | 136.67 | 2 |
| MS-30D | 834.81 | 99.33 | 2 |
| MS-31D | 834.81 | 127.19 | 2 |
| MS-32D | 834.75 | 126.20 | 2 |
| MS-33D | 834.76 | 120.29 | 2 |
| MS-34D | 834.35 | 135.30 | 2 |
| MS-35D | 834.45 | 132.66 | 2 |
| MS-35DPZ | 834.26 | 131.74 | 2 |
| MS-36D | 834.79 | 134.16 | 2 |
| MS-40D | 834.70 | 135.25 | 2 |
| MS-41D | 834.89 | 134.57 | 2 |
| MS-43D | 834.27 | 112.94 | 2 |
| MS-44D | 833.58 | 119.87 | 2 |
| MS-47D | 834.51 | 132.35 | 2 |
| MS-49D | 833.87 | 129.19 | 2 |
| MS-52D | 833.27 | 140.03 | 2 |
| USGS 10 | 836.85 | 130.30 | 2 |
| **NIROP BEDROOK WELLS** | | | |
| 1-PC | 836.93 | 207.92 | 8.0-4.0 |
| 2-PC | 837.91 | 178.08 | 8.0-4.0 |
| 3-PC | 838.53 | 159.58 | 8.0-4.0 |
| 4-PC | 834.63 | 182.21 | 8.0-4.0 |
| 5-PC | 834.33 | 192.84 | 8.0-4.0 |
| MS-48PC | 831.5 | 166.9 | 2 |
| MS-50PC | 833.88 | 172.12 | 2 |
| MS-53PC | 832.64 | 169.16 | 2 |
| Fridley Well 13 | NA | NA | NA |

TABLE 4-10

MONITORING AND EXTRACTION WELL CONSTRUCTION DATA
NIROP FRIDLEY, MINNESOTA


| Well Number | Top of Casing Elevation (ft msl) | Well Depth (ft) | Nominal Well Diameter (in) |
|---|---|---|---|
| **NIROP ACP OIL INJECTION WELLS** | | | |
| PES-CW-1 | 832.01 | 42.93 | 2 |
| PES-CW-2 | 833.02 | 43.04 | 2 |
| PES-CW-3 | 835.47 | 42.86 | 2 |
| PES-MW-1 | 832.49 | 47.79 | 3 |
| PES-MW-2 | 832.41 | 47.68 | 3 |
| PES-MW-3 | 832.80 | 42.74 | 3 |
| PES-MW-4 | 832.57 | 42.72 | 3 |
| PES-MW-5 | 832.60 | 42.89 | 3 |
| PES-MW-6 | 832.41 | 47.71 | 3 |
| PES-MW-7 | 832.58 | 52.78 | 3 |
| PES-MW-8 | 832.64 | 42.80 | 3 |
| PES-MW-9 | 832.85 | 42.73 | 3 |
| PES-MW-10A | 832.17 | ? | 3 |
| PES-MW-10B | 832.11 | ? | 3 |
| PES-MW-11A | 832.28 | ? | 3 |
| PES-MW-12A | 833.89 | ? | 3 |
| PES-MW-12B | 833.80 | ? | 3 |
| PES-MW-13A | 832.15 | ? | 3 |
| PES-MW-14A | 831.74 | ? | 3 |
| PES-MW-14B | 831.84 | ? | 3 |
| PES-INJ-1 | 832.42 | 47.84 | 3 |
| PES-INJ-2 | 832.87 | 52.96 | 3 |
| PES-INJ-3 | 832.71 | 52.73 | 3 |
| PES-BG-1 | 832.75 | 46.87 | 3 |
| PES-BG-2 | 832.73 | 47.03 | 3 |
| PES-BG-3 | 832.56 | 46.84 | 3 |
| **UNITED DEFENSE LP WELLS** | | | |
| UD63-S | 837.00 | 32.09 | 2 |
| **MISCELLANEOUS USGS WELLS** | | | |
| MWW1 | 818.52 | 56.49 | 2.0 |
| MWW2 | 819.49 | 20.50 | ? |
| MWW3 | 836.14 | 41.07 | ? |
| MWW4 | 832.01 | 57.80 | 2.0 |
| MWW5 | 831.39 | NA | ? |
| MWW6 | 831.05 | 29.55 | 2.0 |
| MWW9 | 833.29 | 24.00 | 2.0 |
| MWW10 | 822.01 | 28.60 | ? |
| MWW11 | 820.65 | 58.25 | 2.0 |
| MWW12 | 833.40 | 63.00 | 2.0 |

TABLE 4-10

MONITORING AND EXTRACTION WELL CONSTRUCTION DATA
NIROP FRIDLEY, MINNESOTA


| Well Number | Top of Casing Elevation (ft msl) | Well Depth (ft) | Nominal Well Diameter (in) |
|---|---|---|---|
| **MISCELLANEOUS USGS WELLS (Continued)** | | | |
| MWW13 | 833.33 | 33.06 | 2.0 |
| MWW14 | 836.25 | 54.85 | 2.0 |
| MWW15 | 834.81 | 27.50 | 2.0 |
| MWW16 | 814.35 | 70.00 | 2.0 |
| MWW17 | 814.37 | 28.00 | 2.0 |
| MWW18 | 819.22 | 73.00 | 2.0 |
| MWW19 | 820.60 | 30.70 | 2.0 |
| MWW20 | 811.01 | 44.00 | 2.0 |
| MWW21 | 809.87 | 2.00 | 2.0 |

NA = Not available.
? = Information unclear or incomplete.
msl = Mean sea level.

## TABLE 4-11

## SUMMARY OF GROUNDWATER MONITORING PROGRAM QA/QC SAMPLING
## NIROP FRIDLEY, MINNESOTA

| Sample Type | Analytical Parameters(1) | Analytical Method | No. of Samples | No. of Field Duplicates(2) | No. of Rinsate Blanks(3) | No. of Trip Blanks(4) | No. of MS/MSD Samples | Frequency(5) |
|---|---|---|---|---|---|---|---|---|
| Monitoring Well | VOCs | SW-846 8260B | 44 | 5 | 4 | 4 | 3 | Varies per well |
| Extraction Well | VOCs | SW-846 8260B | 7 | 1 | 0 | 1(6) | 1 | Twice a year |
| Fridley Well No. 13 | VOCs | SW-846 8260B | 1 | 1 | 0 | 1(6) | 1 | Once a year |

Notes:

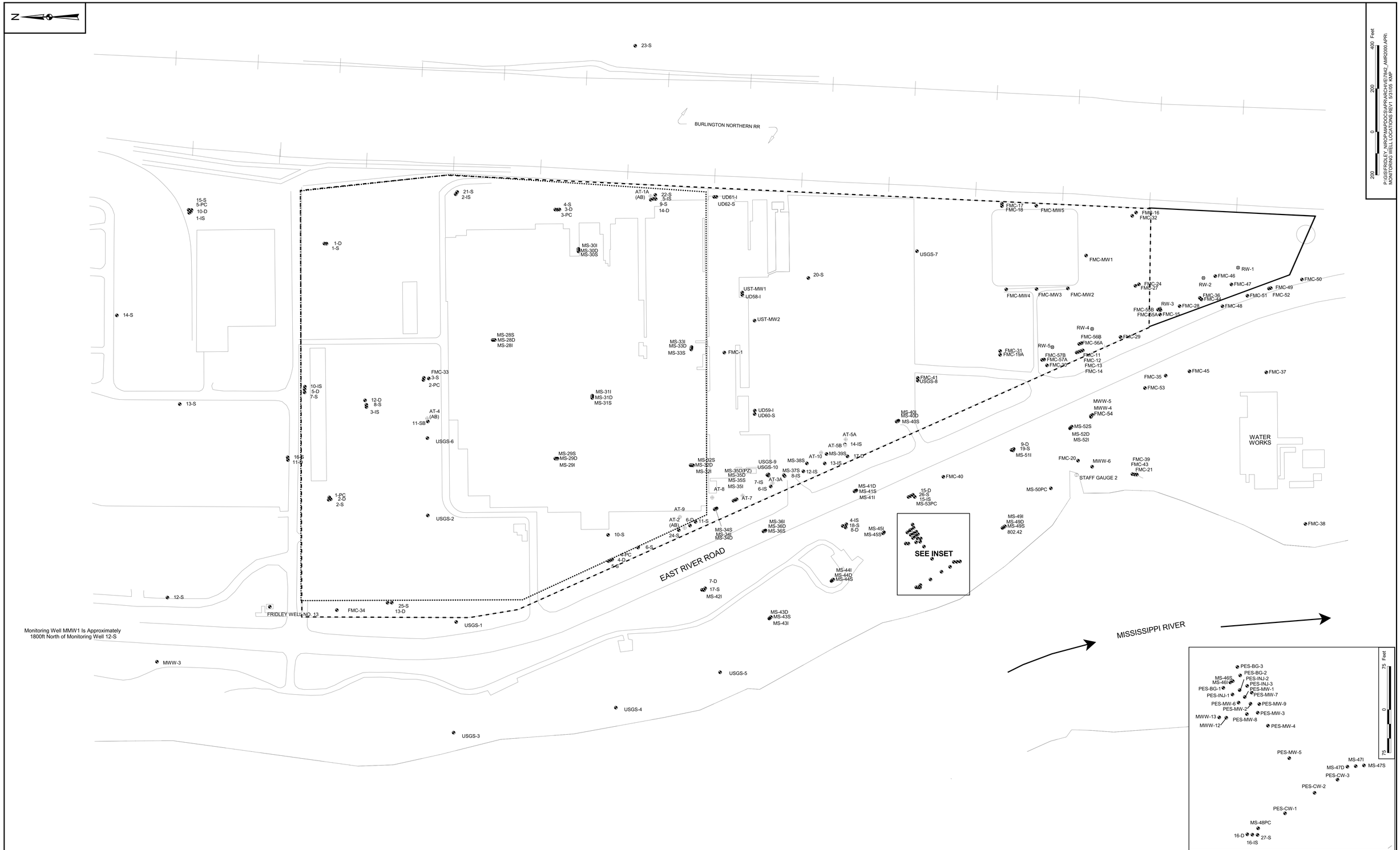
1 VOCs – volatile organic compounds (see Table 4-1); QA/QC samples not collected for field parameters.
2 The number of field duplicate samples collected varies per the sampling event.
3 Equipment rinsate blanks will be collected once daily during monitoring well sampling. Rinsate blanks will not be collected during sampling of extraction wells and Fridley Well No. 13 as these wells have dedicated pumps in place.
4 The number of trip blanks is estimated. One cooler containing VOC samples per day is anticipated.
5 See Table 4-5 for more information.
6 Trip blank shown for groundwater extraction well and Fridley Well No. 13 is intended for sampling rounds if only these wells are sampled. When more than one type of well is sampled (monitoring well, extraction well, Fridley well), additional trip blanks are not required, as long as the rate of one trip blank per cooler is met.

**TABLE 4-12**

**NIROP VEGETABLE OIL PILOT SCALE STUDY**
**NIROP FRIDLEY, MINNESOTA**

| Well ID | Northing | Easting | TOC Elevation | Ground Elevation |
|---|---|---|---|---|
| PES-CW-1 | 1,077,292.3391 | 2,810,688.6130 | 832.01 | 829.08 |
| PES-CW-2 | 1,077,241.0576 | 2,810,724.0289 | 833.02 | 829.98 |
| PES-CW-3 | 1,077,201.4011 | 2,810,746.9311 | 835.47 | 832.61 |
| PES-MW-1 | 1,077,362.2130 | 2,810,890.3032 | 832.49 | 829.70 |
| PES-MW-2 | 1,077,352.2659 | 2,810,878.6781 | 832.41 | 829.73 |
| PES-MW-3 | 1,077,339.7787 | 2,810,863.0861 | 832.80 | 830.06 |
| PES-MW-4 | 1,077,322.0128 | 2,810,840.5161 | 832.57 | 829.85 |
| PES-MW-5 | 1,077,284.9770 | 2,810,784.1402 | 832.60 | 829.71 |
| PES-MW-6 | 1,077,372.8329 | 2,810,880.5686 | 832.41 | 829.70 |
| PES-MW-7 | 1,077,350.1165 | 2,810,897.9350 | 832.58 | 829.80 |
| PES-MW-8 | 1,077,358.5313 | 2,810,860.6699 | 832.64 | 829.84 |
| PES-MW-9 | 1,077,337.0208 | 2,810,878.0602 | 832.85 | 830.12 |
| PES-INJ-1 | 1,077,383.5294 | 2,810,894.6650 | 832.42 | 829.58 |
| PES-INJ-2 | 1,077,371.1601 | 2,810,902.3448 | 832.87 | 829.91 |
| PES-INJ-3 | 1,077,357.9781 | 2,810,909.5938 | 832.71 | 829.98 |
| PES-BG-1 | 1,077,399.3260 | 2,810,906.2155 | 832.75 | 829.88 |
| PES-BG-2 | 1,077,370.1213 | 2,810,927.8737 | 832.73 | 829.70 |
| PES-BG-3 | 1,077,374.9384 | 2,810,942.4126 | 832.56 | 829.72 |
| PES-MW-10A | 1,077,342.3297 | 2,810,904.4668 | 832.17 | 830.02 |
| PES-MW-10B | 1,077,345.3464 | 2,810,906.3567 | 832.11 | 829.87 |
| PES-MW-11A | 1,077,320.3398 | 2,810,900.3860 | 832.28 | 830.10 |
| PES-MW-12A | 1,077,205.4348 | 2,810,881.8568 | 833.89 | 831.64 |
| PES-MW-12B | 1,077,208.6827 | 2,810,882.5631 | 833.80 | 831.52 |
| PES-MW-13A | 1,077,420.0024 | 2,810,927.9904 | 832.15 | 829.75 |
| PES-MW-14A | 1,077,291.9775 | 2,810,872.9834 | 831.74 | 829.76 |
| PES-MW-14B | 1,077,295.6864 | 2,810,871.9715 | 831.84 | 829.71 |

Information on the pilot test wells is provided for information purposes only. To date, these have not been incorporated into the water level measurements or annual sampling programs.




LEGEND

- Extraction Well
- Monitoring Well
- Piezometer
- Recovery Well
- Staff Gauge
- United Defense LP (UDLP) Property Boundary
- Naval Industrial Reserve Ordnance Plant (NIROP) Boundary

AB = Abandoned

| DRAWN BY | DATE |
|---|---|
| J. BELLONE | 2/22/01 |
| CHECKED BY | DATE |
| M. MENGEL | 3/3/05 |
| COST/SCHEDULE-AREA | |
| SCALE | |
| AS NOTED | |

NAVFAC

MONITORING WELL LOCATION MAP
NIROP FRIDLEY, MINNESOTA

| CONTRACT NO. | OWNER NO. |
|---|---|
| 0016 | 0366 |
| APPROVED BY | DATE |
| APPROVED BY | DATE |
| DRAWING NO. | REV. |
| FIGURE 4-1 | 1 |

# 5.0 NPDES/SDS EFFLUENT MONITORING

## 5.1 OBJECTIVES

The objective of effluent monitoring is to confirm compliance with discharge limitations in NPDES/SDS Permit MN0000710 issued to UDLP. The permit is for all direct discharges from NIROP Fridley to the Mississippi River. This permit was issued on October 31, 1996 and reviewed in September 2000. This section discusses only monitoring at SD 002 where the effluent from the GWTF is discharged to the River. The parameters to be monitored, the discharge limits, and the frequency of monitoring for SD 002 are discussed in Section 5.2.

All samples collected to determine compliance with the permit shall be analyzed by CAS/Kelso, a laboratory certified by the Minnesota Department of Health as provided by Minnesota Rules Part 4740.2040, Certified Test Categories.

## 5.2 MONITORING LOCATIONS AND FREQUENCIES

The monitoring location (SD 002) is based on the NPDES/SDS permit. If the outfall is flooded because of a high water level in the Mississippi River, samples shall be collected from the nearest upgradient manhole (or other appropriate accessible location) that is not flooded. The permit states that samples taken in compliance with the monitoring requirements shall be at a point representative of the discharge to the river.

The discharge limitations and monitoring requirements for SD 002 are provided in Table 5-1. The flow rate is to be reported daily, temperature is to be reported monthly, selected VOCs are to be measured once a month, and full VOC analysis is to be conducted twice a year. Monitoring for iron and manganese, which was previously specified in the permit, has been eliminated. The list of analytes is presented in Table 5-1.

Other NPDES Requirements:

Complete VOC monitoring shall be conducted on the effluent twice annually. EPA Method 624 or Minnesota Method 645E, or equivalent shall be used for all analyses. Method 624 was selected as the preferred method.

The pH shall not be less than 6.0 nor greater than 9.0 and shall be monitored by grab samples analyzed immediately. These upper and lower limits are not subject to averaging and shall be met at all times.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

The discharge shall not contain oil or other substances in amounts sufficient to create a visible color film on the surface of the receiving water.

The permittee shall install and maintain outlet protection measures at the discharge stations to prevent erosion.

## 5.3 SAMPLING PROTOCOL

### 5.3.1 Preparation

#### 5.3.1.1 Analysis, Bottleware, and Preservation Requirements

The effluent samples will be analyzed in the laboratory for VOCs and analyzed in the field for flow and temperature. The specific VOCs and the associated PQLs are identified in Table 5-2. Laboratory-supplied sample containers and preservatives are to be used for all effluent samples. Table 5-3 provides a summary of the sample analyses, sample containers, preservation methods, holding times, and analytical methods.

Additional information on sample containers and preservation is provided in Appendix B.

#### 5.3.1.2 Sampling Equipment

The sampling equipment is designed to minimize agitation or aeration of the sample to prevent loss of volatile compounds.

#### 5.3.1.3 Quality Assurance for Field Procedures

Particular care will be exercised to avoid the following common ways in which cross contamination or background contamination may compromise effluent samples:

- Improper storage or transportation of equipment.

- Contaminating the equipment or sample bottles on site by setting them on or near potential contamination sources such as uncovered ground, a contaminated vehicle, or vehicle exhaust.
- Handling bottles or equipment with dirty hands or gloves.
- Inadequate cleaning of sampling devices.
- Placing equipment directly onto the ground surface.

Particular care must also be exercised to prevent the loss of VOCs from agitation and aeration of the sample. Field QA procedures to evaluate potential cross contamination are described in Section 5.3.2.

#### 5.3.1.4 Decontamination, Storage, and Transport of Equipment

It is important not to contaminate or alter the sample during collection. The sampling devices must be clean. Clean outer garments will be accessible to field personnel in an area free from potential contamination. Water, soap, and paper towels will also be kept in a clean location for both regular clean-up and emergency use. Personnel decontamination procedures are as follows:

- Protective disposable outer garments will be removed and placed in disposable plastic bags at the perimeter of the exclusion zone (vicinity of the outfall) before each departure from the exclusion zone.

- If disposable outer boots are worn, they will be removed first then gloves will be removed. If reusable rubber or neoprene boots are worn, they will be washed and rinsed before leaving the contamination reduction zone.

- Field personnel will wash and dry their hands and all exposed surfaces before leaving the contamination reduction zone. Used paper towels will be placed in the disposal bag.

- The plastic bags containing waste materials will be disposed daily. Unless written permission is received, the O&M contractor shall not deposit these materials in dumpsters owned by the Navy or other site entities.

Decontamination of sampling equipment will not be required because this equipment will be pre-cleaned or dedicated and will only be used to collect samples at one location. The pH meter probe and thermometer will be triple-rinsed with distilled water before and after each use. Sample bottles will be pre-cleaned by the manufacturer.

### 5.3.2 Sample Collection and Field Tests

Table 5-4 provides a summary of the monitoring program for effluent.

#### 5.3.2.1 Effluent Samples

Methods for determining pH and temperature are described in Appendix B.

Procedures for sampling the discharge from Outfall 020 are as follows:

Verify that sufficient sample bottles are available and that each is properly labeled.

- Fill the glass VOC sample vials. Do not rinse the sample vial. The sample should be collected to prevent excessive amounts of agitation and aeration and with a minimum of splashing. Fill each vial until the water forms a positive meniscus at the brim. Allow the vial to overflow slightly before capping. After capping, invert each vial and visually inspect for air bubbles. If air bubbles are present, discard the vial, and repeat the previous steps using a new vial.
- Place sample on ice in cooler immediately.

Containers, preservatives, and holding times used for sample collection are shown in Table 5-3.

Additional information on effluent sample collection is provided in Appendix B.

#### 5.3.2.2 Field QA/QC Samples

Field QA/QC samples are the same as described in Section 4.3.3.4 for groundwater samples except that equipment rinsate blanks will not be required because there is only one sample location and pre-cleaned or dedicated sampling devices will be used.

### 5.3.3 Documentation

#### 5.3.3.1 Sample Identification

The sample number for NPDES/SDS Outfall SD002 is SD002.

QC samples will be identified in the same manner as described for groundwater monitoring (Section 4.3.3.4) except that equipment rinsate blanks will not be required.

#### 5.3.3.2 Chain-of Custody

COC procedures will be the same as described for groundwater monitoring (Section 4.3.5.2).

#### 5.3.3.3 Field Activity Documentation and Logbooks

The procedures described in Section 4.3.5.3 for groundwater monitoring will also be used for effluent monitoring.

### 5.3.4 Sample Preservation, Handling, and Transport

Samples will be preserved as shown in Table 5-3. The other aspects of sample handling and transport are the same as described in Section 4.3.6 for groundwater monitoring.

## 5.4 DATA REDUCTION AND VALIDATION

Data reduction and validation procedures described for groundwater monitoring in Section 4.4.1 will also be used for effluent monitoring.

## 5.5 REPORTING AND RECORD KEEPING

Reporting requirements described in the following section are based on the FFA, the previous RAMP, and the NPDES permit.

### 5.5.1 Periodic Monitoring Reports and Progress Reports

The requirements for these reports are the same as described in Section 4.5.1.

### 5.5.2 Annual Monitoring Report

In addition to the information required in Section 4.5.2, NPDES/SDS monitoring results will be included in the AMR. The AMR will include an evaluation of compliance with NPDES/SDS permit conditions and Discharge Monitoring Reports (see Section 5.5.3). The O&M contractor will not be preparing this comprehensive report, but will be required to make information available to other Navy contractors in a timely fashion to support production of this report.

### 5.5.3 Monthly Reports

All monitoring results obtained following the provisions of the NPDES/SDS permit shall be summarized on a monthly basis and reported on the designated Discharge Monitoring Report Forms provided by the MPCA. Reports shall be submitted and received or postmarked no later than the 21st day of the month following the month during which monitoring was completed. Reports shall be signed by an authorized representative of the permittee.

Signed copies of these reports shall be submitted to the MPCA at the following address (the Navy may request distribution of additional copies to various parties):

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194
Attn: W.Q. Point Source Compliance

The results of the monitoring shall be reported in the units specified in the permit (same as presented in Tables 5-1 and 5-2). The reports or written statements shall be submitted even if no discharge occurred during the reporting period.

The report shall include the following:

- A description of any modifications to the wastewater collection, treatment, or disposal facilities
- Any substantial changes in operational procedures
- Any other significant activities that alter the nature or frequency of the discharge
- Any other material factors affecting compliance with the conditions of the permit

For each measurement taken or sample collected, the following information shall be recorded:

- The exact place, date, and time of sampling
- The dates the analyses were performed
- The person who performed each analysis
- The analytical techniques, procedures, and methods used
- The results of such analyses

### 5.5.4 Special Discharge Reports

Special discharge reports must be submitted to the MCES on a quarterly basis even when no discharge occurs. The requirements are substantially similar to the NPDES reports described in Section 5.5.3.

### 5.5.5 Performance Curves

The O&M contractor will tabulate site data to prepare the following performance curves for the Navy on a monthly basis:

- A plot of cost-per-gallons-treated versus time (months)
- A plot of cost-per-pound-of-contaminant-mass-removed versus time (months)
- A plot of cumulative-contaminant-mass-removed versus cumulative cost
- A plot of influent-contaminants-concentration versus time (months)

### 5.5.6 Records Retention

According to the NPDES/SDS permit, all records and documents that relate to the permit shall be retained for a minimum of 3 years; however, the records retention requirements (i.e., 10 years) provided in Section 4.5.3 supercede this permit requirement and will be followed.

**TABLE 5-1**

**EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS**
**OUTFALL SD002**
**NIROP FRIDLEY**
**FRIDLEY, MINNESOTA**

| Parameter | Daily Allowable Maximum | Measurement Frequency | Sample Type |
|---|---|---|---|
| **Chemical Analytes** | | | |
| 1,1,1-Trichloroethane | 200 µg/L | Once monthly | Grab |
| 1,1-Dichloroethane | 70 µg/L | Once monthly | Grab |
| 1,1-Dichloroethene | 6.0 µg/L | Once monthly | Grab |
| 1,2-Dichloroethene (cis-) | 70 µg/L | Once monthly | Grab |
| 1,2-Dichloroethene (trans-) | 100 µg/L | Once monthly | Grab |
| Methylene chloride (dichloromethane) | 5 ug/L | Once monthly | |
| Tetrachloroethene | 3.8 µg/L | Once monthly | Grab |
| Trichloroethene | 5.0 µg/L | Once monthly | Grab |
| Expanded VOC analysis (1) | NS | Twice yearly | Grab |
| **Physical Measurements** | | | |
| Flow (MGD) | -- | Continuous Monitoring(2) | -- |
| pH | 6 - 9 | | |
| Temperature | 26.5°C(80°F) | Monthly | Grab |

Notes:

1 Laboratory sheet is to be submitted with Discharge Monitoring Report form. See Table 5-2 for expanded list of VOCs.
2 For brief periods of flow meter maintenance and other down time (e.g., 1 to 3 day several times per year), alternative methods of flow measurements may be used as long as such methods provide representative flow measurements.

NS = Not specified.
MGD = Million gallons per day

**TABLE 5-2**

**PRACTICAL QUANTITATION LIMITS – EXPANDED LIST OF EFFLUENT PARAMETERS ANALYZED BY EPA METHOD 624**
**NIROP FRIDLEY, MINNESOTA**


| Analyte | PQL (µg/L)[1] |
|---|---|
| **VOCs** | |
| 1,1,2,2-Tetrachloroethane | 5 |
| 1,1,2-Trichloroethane | 5 |
| 1,2-Dichlorobenzene | 5 |
| 1,2-Dichloroethane (EDC) | 5 |
| 1,2-Dichloropropane | 5 |
| 1,3-Dichlorobenzene | 5 |
| 1,4-Dichlorobenzene | 5 |
| 2-Butanone (MEK) | 20 |
| 2-Chloroethyl Vinyl Ether | 10 |
| 2-Hexanone | 20 |
| 4-Methyl-2-pentanone (MIBK) | 20 |
| Acetone | 20 |
| Acetonitrile | 10 |
| Acrolein | 50 |
| Acrylonitrile | 10 |
| Benzene | 5 |
| Bromodichloromethane | 5 |
| Bromoform | 5 |
| Bromomethane | 5 |
| Carbon Disulfide | 5 |
| Carbon Tetrachloride | 5 |
| Chlorobenzene | 5 |
| Chloroethane | 5 |
| Chloroform | 5 |
| Chloromethane | 5 |
| 1,3-Dichloropropene (cis-) | 5 |
| Dibromochloromethane | 5 |
| Dichlorodifluoromethane | 5 |
| Ethylbenzene | 5 |
| m,p-Xylenes | 5 |
| Methyl tert-Butyl Ether | 0.5 |
| o-Xylene | 5 |
| Pentachloroethane | 5 |

**TABLE 5-2**

**PRACTICAL QUANTITATION LIMITS – EXPANDED LIST OF EFFLUENT PARAMETERS ANALYZED BY EPA METHOD 624**
**NIROP FRIDLEY, MINNESOTA**


| Analyte | PQL (µg/L)[1] |
|---|---|
| Styrene | 5 |
| Toluene | 5 |
| 1,3-Dichloropropene (trans-) | 5 |
| Trichlorofluoromethane | 5 |
| Trichlorotrifluoroethane | 5 |
| Vinyl Acetate | 10 |
| Vinyl Chloride | 5 |
| Methylene Chloride (dichloromethane)[2] | 5 |
| Tetrachloroethene (PCE)[2] | 5 |
| Trichloroethene (TCE) [2] | 5 |
| 1,2-Dichloroethene (cis-)[2] | 5 |
| 1,2-Dichloroethene (trans-)[2] | 5 |
| 1,1-Dichloroethane[2] | 5 |
| 1,1-Dichloroethene[2] | 5 |
| 1,1,1-Trichloroethane (TCA)[2] | 5 |

Notes:

1 Typical Practical Quantitation Limit (PQL).
2 These compounds are monitored once a month; the expanded list of VOCs is monitored twice a year.

**TABLE 5-3**

**BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS FOR SAMPLES COLLECTED FROM SURFACE DISCHARGE STATION SD002 EFFLUENT SAMPLES NIROP FRIDLEY, MINNESOTA**

| Analytical Parameter | Analytical Method | Number of Containers | Type of Container | Preservation Requirements | Holding Time |
|---|---|---|---|---|---|
| Permit-specified VOCs(1) | USEPA 624 | 2 | 40 mL glass vial | HCl to pH < 2; Cool to 4°C | 14 days |
| Full VOCs(2) | USEPA 624 | 3 | 40 mL glass vial | HCl to pH < 2; Cool to 4°C | 14 days |
| pH and Temperature | Field measurement | NA | NA | NA | Analyze immediately |

Notes:

1 Includes 1,1-dichloroethane; 1,1-dichloroethene; 1,2-dichloroethene (cis- and trans-); methylene chloride; tetrachloroethene; 1,1,1-trichloroethane; and trichloroethene.
2 See Table 5-2 for full EPA 6024 monitoring list.

VOCs – Volatile Organic Compounds.
mL – milliliter.
HCl – Hydrochloric acid.
NA – Not applicable.

**TABLE 5-4**

**SUMMARY OF EFFLUENT MONITORING PROGRAM QA/QC SAMPLING FOR SAMPLES COLLECTED FROM SURFACE DISCHARGE STATION SD002 NIROP FRIDLEY, MINNESOTA**

| Analytical Parameters | No. of Samples | No. of Field Duplicates | Number of Rinsate Blanks(1) | Number of Trip Blanks(2) | No. of Matrix Spike/Matrix Spike Duplicates |
|---|---|---|---|---|---|
| Permit-specified VOCs(3) | 1 | 1 | 0 | 1 | 1 |
| Full VOCs(4) | 1 | 1 | 0 | 1 | 1 |
| Temperature and pH | 1 | 0 | 0 | NA | NA |

Notes:

1 Rinsate blanks will not be collected because only one location is sampled, and disposable or pre-cleaned sampling equipment will be used.
2 Assumes only effluent samples are being collected. If groundwater and/or surface water samples are being collected during the sampling event, additional trip blanks may not be required at a rate of one trip blank per cooler.
3 Permit-specified VOCs: 1,1-dichloroethane; 1,1-dichloroethene; 1,2-dichloroethene (cis- and trans-); methylene chloride; tetrachloroethene; 1,1,1-trichloroethane; and trichloroethene.
4 See Table 5-2 for full USEPA 624 monitoring list.

VOC - Volatile organic compound.

# REFERENCES

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RMT, Inc. (RMT), 1987. Remedial Investigation Report for the Remedial Investigation/Feasibility Study at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota, Madison, WI.

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RMT, 1995a. Remedial Action Workplan for Groundwater Remediation at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota, Revision 3, Final, Madison, WI.

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USEPA, 1988b. Statistical Methods for Evaluating the Attainment of Superfund Cleanup Standards; Volume 2: Groundwater, Draft 2.0.

USEPA, 1990. Record of Decision for Groundwater Remediation at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota, Region 5, Chicago, IL.

USEPA, 1998. Five Year Review Report, Naval Industrial Reserve Ordnance Plant Site, Fridley, Minnesota, Pursuant to CERCLA, Region 5, Chicago, IL.

# APPENDIX A

## NPDES/SDS PERMIT AND
## MCES INDUSTRIAL DISCHARGE PERMIT

NPDES Permit No. MN 0000710

J490126
Cat III C

# Minnesota Pollution Control Agency

October 2, 2003

CERTIFIED MAIL NO. 7001 0320 0004 2646 3914
RETURN RECEIPT REQUESTED

Mr. David W. Anderson, Director
Unites States Navy/
Naval Sea Systems Command
1333 Isaac Hill Avenue Southeast
Washington Navy Yard, DC 20376-0001

Mr. Douglas Hildre, Environmental Affairs Manager
Armament Systems Division of
United Defense L.P.
4800 East River Road
Minneapolis, MN 55421-1498

RE: Final Reissued NPDES/SDS Permit No. MN 0000710
Naval Industrial Reserve Ordnance Plant (NIROP)

Dear Messrs. Anderson and Hildre:

Enclosed is the final reissued National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit for the above subject facility.

'Please review the final permit carefully, paying special attention to effluent limitations and monitoring and reporting criteria. This final permit incorporates the changes we discussed at our September 18, 2003 meeting.

Compliance with this permit is effective with the date of issuance. If you have any questions regarding any of the terms and conditions of the permit, please contact Deborah Schumann of my staff at (651) 297-5791.

Sincerely,

Don Smith, P.E.
Supervisor
Majors Air and Construction Section
Majors and Remediation Division

DS/DAS:lao

Enclosures: Final Permit

cc: Joel Sanders, Commanding Officer Southern Division (w/enclosure)

**STATE OF MINNESOTA**
**Minnesota Pollution Control Agency**
**Majors and Remediation Division**

# National Pollutant Discharge Elimination System (NPDES) and State Disposal System (SDS) Permit MN0000710

**PERMITTEE:** UNITED STATE NAVY SOUTHERN DIVISION and UNITED DEFENSE L.P.

**FACILITY NAME:** Naval Industrial Reserve Ordnance Plant

**RECEIVING WATERS:** Mississippi River

**CITY:** Fridley **COUNTY:** Anoka

**ISSUANCE DATE:** October 2,2003 **EXPIRATION DATE:** September 30, 2008

3

The state of Minnesota, on behalf of its citizens through the Minnesota Pollution Control Agency (MPCA), authorizes the Permittees named above to discharge the waste streams described herein to the receiving waters named above, in accordance with the requirements of this permit

The goal of this permit is to protect water quality according to Minnesota and U.S. statutes and rules, including Minn. Stat. chs. 115 and 116, Minn. R. chs. 7001, 7050 and 7060, and the U.S. Clean Water Act.

This is the reissuance of an existing permit. This permit is effective on the issuance date given above and supersedes the previous permit issued for this facility on January 2, 1996 and modified on November 20, 1997. This permit and the authorization to discharge shall expire at midnight on September 30, 2008.

Ann M. Foss for Minnesota Pollution Control Agency
Major Facilities Section Manager
Majors and Remediation Division

If you have questions on this permit, including the specific permit requirements, permit reporting or permit compliance status, please contact:

Minnesota Pollution Control Agency
Majors and Remediation Division
520 Lafayette Road North
St. Paul, MN 55155-4194
Telephone: (651) 297-2274
Fax: (651) 297-8683
Telephone Device for Deaf (TTY): (651) 282-5332

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## Table of Contents

Page

Permitted Facility Description
- Written Description ..... 3
- Remediation Process Flow Diagram ..... 4
- Aerial Photo of Permitted Facility ..... 5
- Topographic Map of Permitted Facility ..... 6

Summary of Stations ..... 7

Limits and Monitoring Requirements ..... 8

Chapter 1. Surface Discharge Station Requirements – General ..... 10
Chapter 2. Waste Stream Station Requirements – General ..... 11
Chapter 3. .Station Requirements – Specific ..... 11
Chapter 4. Contaminated Ground Water Pumpout, NPDES/SDS ..... 11
Chapter 6, Non-Contact Cooling Water, NPDESISDS, ..... 12
Chapter 6. General Industrial Storm Water, NPDES/SDS ..... 13
Chapter 7. Total Facility Requirements ..... 19

Required Submittals ..... 33

## FACILITY AND DISCHARGE ACTIVITY DESCRIPTION

The Naval Industrial Reserve Ordnance Plant (NIROP) is located at 4800 East River Road, Fridley, Anoka County, Minnesota. The principal activity at this facility is the development, design, engineering, fabrication, and testing of advanced military weapons systems and components.

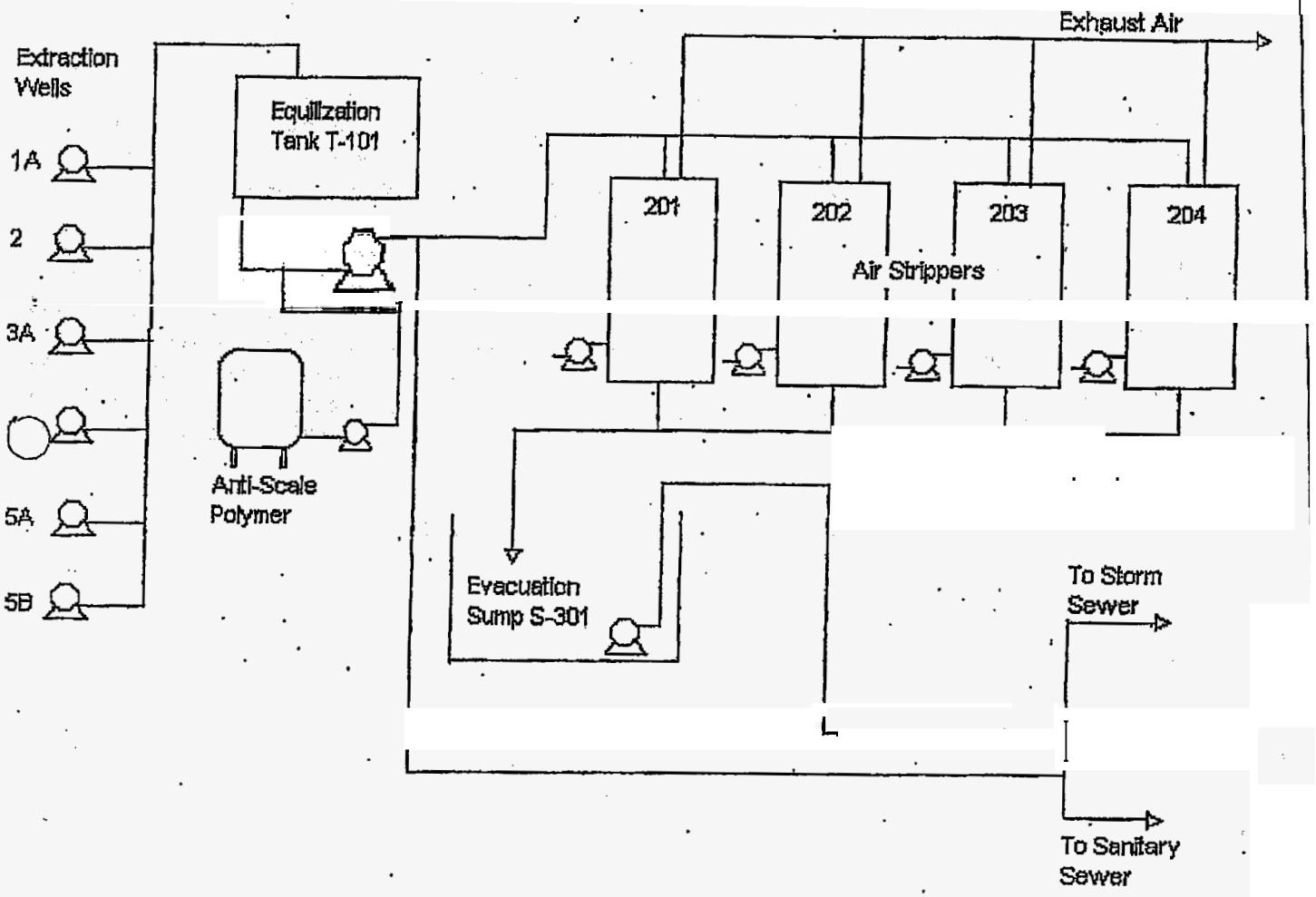
The waste streams authorized for discharge by this permit consists of once-through, non-contact cooling water, storm water runoff, and treated contaminated ground water.

The water source for the non-contact cooling water is the city of Fridley municipal water supply, although the Permittee has considered using some of the treated ground water for cooling purposes prior to discharge. Cooling water is discharged to the Mississippi River via two outfalls. The first waste stream, directed to Outfall SD 002, includes an average of 100,000 gallons par day non-contact cooling water. The second waste stream, directed to Outfall SD 003, discharges an average of 3,000 gallons per day non-contact cooling water.

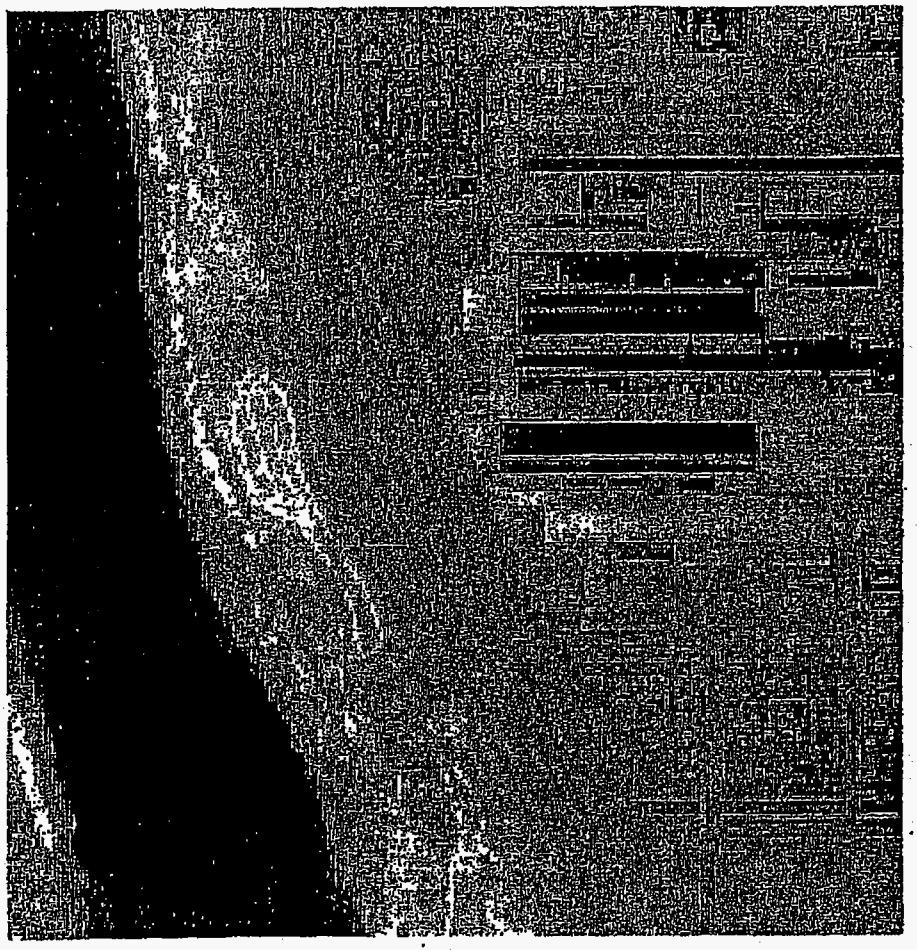
Groundwater at the NIROP site has been contaminated with chlorinated compounds, including Methylene choride, Trichloroethene, Tetrachloroethene, 1,2 dichloroethene (cis), 1,2 dichloroethene (trans); and 1,1 dichloroethane. Water quality analysis have shown levels of TCE and and 1,2-DCEs which are of some concern. The treatment process consists of four low profile air strippers, three operating in parallel to meet the permitted effluent limitations for this waste stream. The fourth is held in reserve in the event one of the other three needs maintenance. The treated effluent combines with the non-contact cooling water for a combined discharge to outfall SD 002. The average discharge volume for this outfall is 683,000 gallons per day; the maximum discharge volume is 1,600,000 gallons per day.

Sanitary wastes and industrial process wastes are not included as part of this permit.

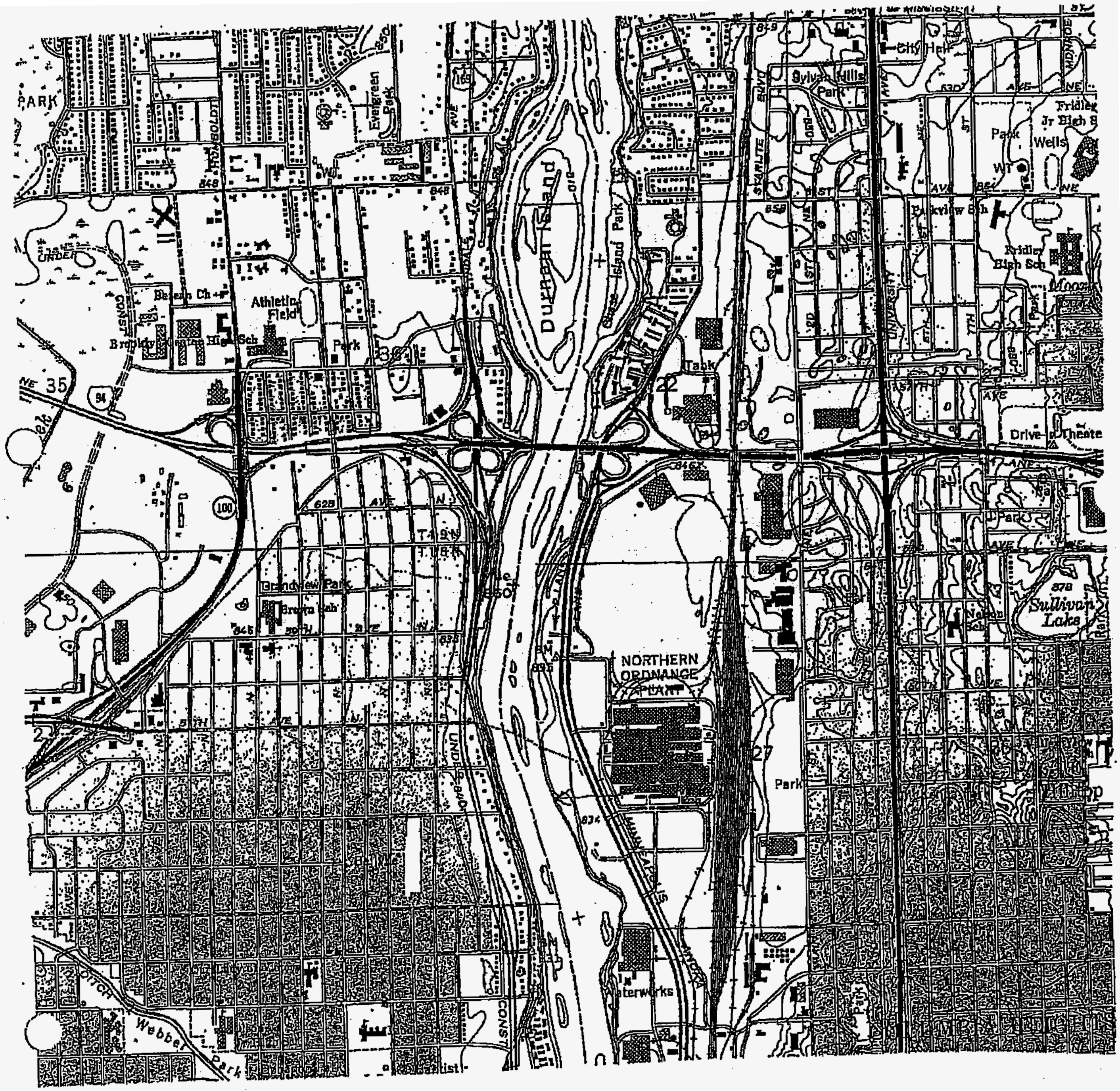
Remediation Process Flow Diagram



## Aerial Photo of Permitted Facility



Topographic Map of Discharge Locations



# Summary of Stations



## urface Discharge Stations

| ion | Type of Station | Local Name |
|---|---|---|
| SD002 | Effluent To Surface Water | NCCW & GrndWater Remediation |
| SD003 | Effluent To Surface Water | Non-contact Cooling Water |

## Vaste Stream Stations

| Station | Type of Station | Local Name |
|---|---|---|
| WS001 | Internal Waste Stream | NCCW during periods of no Ground Water |

# Limits and Monitoring Requirements



*The* Permittee **shall** comply with the limits and monitoring requirements as specified below.

SD 002: NCCW & GrndWater Remediation

| Parameter | Limit | Units | Limit Type | Effective Period | Sample Type | Frequency | Notes |
|---|---|---|---|---|---|---|---|
| 1,1,1-Trichloroethane | 200 | ug/L | Daily Maximum | Jan-Dec | Grab | 1 x Month | |
| 1,1-Dichloroethane | 70 | ug/L | Daily Maximum | Jan-Dec | Grab | 1 x Month | |
| 1,1-Dichloroethylene (Vinylidene chloride) | 6 | ug/L | Daily Maximum | Jan-Dec | Grab | 1 x Month | |
| 1,2-Dichloroethylene (cis-) | 70 | ug/L | Daily Maximum | Jan-Dec | Grab | 1 x Month | |
| 1,2-Dichloroethylene (trans-) | 100 | ug/L | Daily Maximum | Jan-Dec | Grab | 1 x Month | |
| Flow | Monitor Only | mgd | Calendar Month Average | Jan-Dec | Measurement | 1 x Day | |
| Flow | Monitor Only | MG | Calendar Month Total | Jan-Dec | Measurement | 1 x Day | |
| Methylene Chloride (Dichloromethane) | 5 | ug/L | Daily Maximum | Jan-Dec | Grab | 1 x Month | |
| Organic Compounds, Volatile | Monitor Only | ug/L | Calendar Month Total | Jul, Nov | Grab | 1 x Month | 2 |
| pH | 9.0 | SU | Calendar Month Maximum | Jan-Dec | Grab | 1 x Month | |
| pH | 6.0 | SU | Calendar Month Minimum | Jan-Dec | Grab | 1 x Month | |
| Temperature, Water | 26.5 | Deg C | Single Value | Jan-Dec | Grab | 1 x Month | |
| Tetrachloroethylene (Perchloroethylene) | 3.8 | ug/L | Daily Maximum | Jan-Dec | Grab | 1 x Month | |
| Trichloroethylene (TCE or Trichloroethene) | 5 | ug/L | Daily Maximum | Jan-Dec | Grab | 1 x Month | |

SD 003: Non-contact Cooling Water

| Parameter | Limit | Units | Limit Type | Effective Period | Sample Type | Frequency | Notes |
|---|---|---|---|---|---|---|---|
| Chlorine, Total Residual | 0.10 | mg/L | Daily Maximum | Jan-Dec | Grab | 1 x Month | |
| Copper, Total (as Cu) | Monitor Only | mg/L | Single Value | Mar, Jun, Sep, Dec | Grab | 1 x Month | 1 |
| Flow | Monitor Only | mgd | Calendar Month Average | Jan-Dec | Measurement | 1 x Day | |
| Flow | Monitor Only | MG | Calendar Month Total | Jan-Dec | Measurement | 1 x Day | |
| pH | 9.0 | SU | Calendar Month Maximum | Jan-Dec | Grab | 1 x Month | |
| pH | 6.0 | SU | Calendar Month Minimum | Jan-Dec | Grab | 1 x Month | |
| Temperature, Water | 26.5 | Deg C | Calendar Month Average | Jan-Dec | Grab | 1 x Month | |

W[illegible]1: NCCW during periods of no Ground Water

| Parameter | Limit | Units | Limit Type | Effective Period | Sample Type | Frequency | Notes |
|---|---|---|---|---|---|---|---|
| Flow | Monitor Only | mgd | Calendar Month Average | Jan-Dec | Measurement, Continuous | 1 x Day | |
| Flow | Monitor Only | MG | Calendar Month Total | Jan-Dec | Measurement, Continuous | 1 x Day | |

# Limits and Monitoring Requirements



The Permittee shall comply with the limits and monitoring requirements as specified below.

/S 001: NCCW during periods of no Ground Water

| Parameter | Limit | Units | Limit Type | Effective Period | Sample Type | Frequency | Notes |
|---|---|---|---|---|---|---|---|
| H | 9.0 | SU | Calendar Month Maximum | Jan-Dec | Grab | 1 x Month | |
| H | 6.0 | SU | Calendar Month Minimum | Jan-Dec | Grab | 1 x Month | |
| emperature, Water | 26.5 | Deg C | Calendar Month Average | Jan-Dec | Grab | 1 x Month | |

otes:
-- Sampling can occur at any time during the calendar quarter, but shall be reported on the quarter's last month DMR form.

-- Submit Laboratory Sheet with DMR form.

## Chapter 1. Surface Discharge Station Requirements - General

### 1. Sampling Location

1.1 Samples for Station SD 002 shall be taken at the outfall prior to discharge to the Mississippi River. If the Mississippi River level is too high to collect a sample at this outfall, sample shall be collected in the manhole nearest to the discharge to the river.

Samples for Station SD 002 shall be representative of the ground water remediation waste stream or the ground water mediation waste stream combined with non-contact cooling water.

1.2 Samples far Station SD 003 shall be taken at the outfall prior to discharge to the Mississippi River. If the Mississippi River level is too high to collect a sample at this outfall, sample shall be collected in the manhole nearest to the discharge to the river.

### 2. Surface Discharges

2.1 Floating solids or visible foam shall not be discharged in other than trace amounts.

2.2 Oil or other substances shall not be discharged in amounts that create a visible color film.

2.3 The Permittee shall install and maintain outlet protection measures at the discharge stations to prevent erosion.

### 3. Discharge Monitoring Reports

3.1 The Permittee shall submit monitoring results for discharges in accordance with the limits and monitoring requirements for this station. If no discharge occurred during the reporting period, the Permittee shall check the "No Discharge" box on the Discharge Monitoring Report (DMR).

system occurs during a reporting period, the Permittee shall check the "No Discharge? box for the SD 002 and report the cooling water waste stream on WS 001.

Discharge"

## Chapter 2, Waste Stream Station Requirements - General

### 1. Sampling Location

1.1 Samples for Station WS 001 shall be taken at the outfall prior to discharge to the Mississippi River. If the Mississippi River level is too high to collect a sample at this outfall, sample shall be collected in the manhole nearest to the discharge to the river.

### 2, Discharge Monitoring Reports

2.1 The Permittee shall submit monitoring results in accordance with the limits and monitoring requirements for this station during reporting periods when the surface water discharge via SD 002 consists solely of non-contact cooling water. If no discrete non-contact cooling water occurred during the reporting period, the Permittee shall check the "No Discharge" box on the designated Discharge Monitoring Report (DMR) form.

### 3. Sampling Frequency

3.1 Sampling and reporting for Station WS 001 shall occur during reporting periods in which there is no combining of the non-contact cooling water waste stream with discharges from the ground water remediation system.

## Chapter 3. Station Requirements - Specific

### 1. Surface Discharge Stations

1.1 SD 002: Submit a monthly DMR monthly by 21 days after the end of each calendar month following permit issuance.

1.2 SD 003: Submit a monthly DMR monthly by 21 days after the end of each calendar month following permit issuance.

### 2. Waste Stream Stations

2.1 WS 001: Submit a monthly DMR monthly by 21 days after the end of each calendar month following permit issuance,

## Chapter 4. Contaminated Ground Water Pumpout, NPDES/SDS

### 1. New Proposed Contaminated Ground Water Pumpout

1.1 The Permittee shall submit a written application and obtain a major modification of this permit prior to beginning the discharge of contaminated ground water from a new outfall in accordance with the *Permit Modifications* section of this permit.

1.2 A fourth air stripping unit shall be maintained on-site at all times in order to perform preventive or emergency maintenance on the other units.

2. Special Requirements

2.1 The permittee shall dechlorinate the effluent if necessary to meet the Total Residual Chlorine effluent limitation.

2.2 Total Residual Chlorine must be analyzed immediately. This means within 15 minutes or less of sample collection.

2.3 A Method Detection Limit (MDL) must be established for this parameter.

2.4 The Reportable Limit must be established for this parameter. This should be based on the Method Detection Limit and laboratory, analyst, and equipment used in the analysis. The Reportable Limit cannot be greater than 0.1 mg/L.

2.5 The Method Detection Limit and Reportable Limit should be reassessed when the method, equipment, laboratory, or analyst changes.

2.6 Monitoring results below the Reportable Limit should be reported as "<" the Reportable Limit. For example, if the Reportable Limit is 0.1 mg/L and a parameter is not detected at a value of 0.1 mg/L or greater, the concentration shall be reported as "<0.1mg/L." The symbol "<" means "less than."

2.7 The equipment should be checked against a known standard at least monthly.

## Chapter 6. General Industrial Storm Water, NPDES/SDS

1. Authorization

1.1 A facility engaged in industrial activity, and meeting the terms and conditions of this permit is authorized to discharge storm water to the waters of the state, as authorized by the State of Minnesota, on behalf of its citizens through the Minnesota Pollution Control Agency. The goal of this chapter is to protect water quality in accordance with Minnesota and U.S. statutes and rules.

2. Definitions

2.1 "Best Management Practices" (BMP) means practices to prevent or reduce the pollution of the waters of the state, including schedules of activities, prohibitions of practices, and other management practices and also includes treatment requirements, operating procedures and practices to control plant site runoff, spillage or leaks, sludge, or waste disposal or drainage from material storage, as defined in Minn. Rules pt. 7001.1020, subp. 5.

Examples of BMPs can be found in Protecting Water Quality in Urban Areas, MPCA 1989, and Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices, U.S. EPA 1992.

## Chapter 6. General Industrial Storm Water, NPDES/SDS

### 2. Definitions

2.2 "Impervious Surface" means a constructed hard surface that either prevents or retards the entry of water into the soil and causes water to run off the surface in greater quantities and at an increased rate of flow than prior to development. Examples include rooftops; sidewalks; patios; driveways; parking lots; storage areas; and concrete, asphalt, or gravel roads.

2.3 "Non-structural BMPs" refers to practices that will reduce or eliminate pollutants to storm water and do not require installation of permanent structural devices to treat runoff. Examples of non-structural BMPs include but are not limited to parking lot and street sweeping; employee training; changing material handling practices; installation of silt fence, minimizing materials exposed to storm water through inventory reduction, tarping, or moving of material indoors.

2.4 "Plan" for the purposes of this Chapter, Plan refers to the Storm Water Pollution Prevention Plan developed in accordance with the General Storm Water Permit for Industrial Activity Permit.

whether

and toxicity characteristics) to determine the material's pollution potential.

2.6 "Structural BMPs" refers to the installation of devices that will reduce or eliminate pollutants to storm water through installation of permanent structural devices to treat or control runoff. Examples of structural BMPs include but are not limited to installation of storm water diversion berms or channels; sedimentation basins (retention or detention basins); oil/water separators; grit chambers; roofs, awnings or buildings to cover significant material.

### 3. horn water Pollution Prevention Plan

3.1 In accordance with the terms and conditions of this permit of the General Storm Water Permit for Industrial Activity Permit MN G610000 and General Storm Water Permit for Industrial Activity Permit MN G611000, the Permittee shall develop and implement, or have developed and implemented, a Storm Water Pollution Plan (Plan) to address the specific conditions at the industrial facility. The goal of the Plan is to eliminate or minimize contact of storm water with significant materials that may result in pollution of the runoff. If contact cannot be eliminated or

## Chapter 6, General Industrial Storm Water, NPDES/SDS

### 3. Storm Water Pollution Prevention Plan

3.2 The following are general requirements of the Plan:

A. Complete a drainage map. The map should indicate the following items at or adjacent to the facility:

i) drainage areas and directions of storm water runoff (indicated by arrows);
ii) discharge outfalls from the site (structures that carry storm water runoff from the facility such as ditches or storm sewers);
iii) the name and location of waters of the state that receive facility storm water runoff (if waters of the state are too distant from the facility to be indicated on the site map, indicate the name, direction and shortest distance to the lake, river, stream or wetland that receives runoff from the site);
iv) areas where significant materials are exposed to storm water;
v) locations of storm sewer inlets and an indication of which, if any, structures have floor drains or loading dock drains that are connected to storm sewers; and
vi) locations and types of Best Management Practices (BMPs) currently installed at the facility to reduce or eliminate pollutants to storm water.

3.3 Complete an inventory of exposed significant materials. Indicate the types of significant materials handled or stored at the site that may potentially contact storm water. The following examples of materials that, if exposed to storm water, must be included in the inventory.

i) raw materials, such as fuels, solvents, petroleum products, detergents, plastic pellets, materials used in food processing or production; stockpiled sand, salt or coal;
ii) by-products or intermediate products, such as wood dust, chips or bark; screened limestone, taconite or gravel by-product, recycled blacktop;
iii) finished materials, such as metallic products, including scrap metal and recycled or scrap motor vehicle parts, old process equipment/machinery, taconite pellets;
iv) waste products, such as ashes, sludge, solid and lipid waste, slag;
v) hazardous substances designated under section 101(14) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA);
vi) any chemical the facility is required to report under section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA).

## Chapter 6. General Industrial Storm Water, NPDES/SDS

### 3, Storm Water Pollution Prevention Plan

3.4 Evaluate facility areas for exposure of significant materials to storm water. In creating the inventory of exposed significant materials, the Permittee must, at a minimum evaluate the following areas at the industrial site (as well as other areas where appropriate) to determine whether or not significant materials are exposed in these areas:

i) vehicle and equipment maintenance, parking sad storage areas including fueling and washing/cleaning areas, to determine if there is discolored soil in these areas as a result of fuel and lubricant leaks and spills;
ii) liquid storage tanks and other bulk material stockpile areas;.
iii) loading and unloading areas;
iv). outdoor manufacturing, processing or storage areas and industrial plant yards, to determine if there is discolored soil in these areas as a result of leaked or spilled solvents, fuels, or lubricants;
v) dust or particulate generating areas including dust collection devises that may release dust;
vi) rooftops contaminated by industrial activity or operation of a pollution control device; .
vii) on-site waste disposal areas, such as waste ponds, dumpsters, solid waste storage or management areas; and
viii) exposed (non-vegetated) soil areas where there is a potential for erosion to occur.

3.5 Describe appropriate BMPs, including structural and non-structural BMPs, that will be used at the facility to minimize or eliminate pollution of storm water at the site. The description must include an objective for each BMP, as well as a description of how to evaluate proper functioning of the BMP and any maintenance requirements of the BMP. BMPs should target significant materials and areas identified in the sections above. The following general categories of BMPs shall be considered and one or more shall be incorporated into the facility's Plan if significant materials are exposed to storm water on-sib:

i) Source reduction: reduce or eliminate the significant materials that are exposed to storm water. Materials management practices should be evaluated to determine if and how inventories of exposed materials can be reduced or eliminated. This can include dean-up of old equipment yards, periodic checking of dust control equipment to ensure there is no accumulation of dust in the area around the control equipment, removal and treatment of petroleum contaminated soil, consolidation of materials from many different areas into one area, and training employees regarding proper handling and disposal of materials. Significant materials may also be moved indoors or covered with a tarp or structure to eliminate contact with precipitation.
ii) Diversion: divert storm water drainage away from exposed significant materials through use of curbing, berms, sewers or other forms of drainage control or elevate exposed significant material above surrounding drainage.
iii) Treatment: where contact of storm water with significant materials is unavoidable, use treatment devised to reduce the concentration and amount of pollutants in the discharged storm water. Such devised include oil/water separators, storm water detention/retention ponds, and vegetated swales.

## Chapter 6. General Industrial Storm Water, NPDES/SDS

### 3. Storm Water Pollution Prevention Plan

3.6 Evaluate all discharge conveyances from the site (storm sewers, pipes, tile lines, ditches, etc.) to determine if liquids other than storm water are being discharged from these devises. This shall be done during dry weather when storm water discharge is not occurring. The evaluation should cover sewer inlets and floor drains to determine which inlets/drains are connected to sanitary.

could cause breakdowns or failures resulting in discharges of pollutants (e.g. hydraulic leaks, torn bag-house filters) to surface waters.

3.8 Develop a spill prevention and response procedure. In order to develop this procedure, the Permittee shall evaluate where spills have occurred and where they have the potential to occur. Determine drainage points of potential spill areas and develop appropriate spill prevention and containment measures, should a spill occur. Detailed procedures for cleaning-up spills shall be identified and made available to appropriate personnel.

3.9 Identify personnel responsible for managing and implementing the Plan as well as those responsible for the reporting requirements of this permit. This should include the facility contact person, Identified personnel must be available at reasonable times of operation.

3.10 The Permittee shall evaluate the completeness and accuracy of the Plan on an annual basis and make changes and adjustments as necessary. A summary of this evaluation shall be included as part of the annual report due to the Agency in March.

3.11 The Permittee shall, when requested by the Commissioner, submit within a reasonable time the information and reports that are relevant to compliance with this Chapter, including the Plan, inspection reports, annual reports, and BMP plans and specifications.

## Chapter 6. General Industrial Storm Water, NPDES/SDS

### 4. Inspection and Maintenance

4.1 'Site inspections shall be conducted at least once *every* two months during non-frozen conditions. Inspections shall be conducted by an appropriately trained person at the facility site. The purpose of inspections is to; *1)* determine whether structural and non-structural BMPs require maintenance or changes, and 2) *evaluate* the completeness and accuracy of the Plan. At least one inspection during a reporting period shall be conducted during snow melt and one W e storm water is discharging from *the facility*. Inspections shall be documented. The Permittee may use an inspection form provided by the MPCA for 'this purpose. Indicate the date and time of the inspection as well as the name of the inspector on the inspection form.

4.2 The following compliance items will be inspected, and documented where appropriate:

a.s evaluate the *facility to* determine that the Plan accurately reflects site conditions as described in
the Storm Water Pollution Prevention Plan Section of this Permit and document *any* inaccuracies;

b.e evaluate the facility to determine whether new exposed materials have been added to the site since completion of *the* Plan and document any new significant materials;

is discolored or otherwise visibly contaminated and document observations;

d. determine if the non-structural and structural BMPs as indicated in the Plan are installed and

e. determine if new or additional non-structural or structural BMPs are necessary to reduce or eliminate polluted runoff.

4.3 If conditions are observed at the site that require changes in the Plan, such changes shall be *made* to the Plan prior to submission of the annual report for that calendar year.

If the findings of a site inspection indicate that BMPs are not meeting the objectives as identified in the Stom Water Pollution Prevention Plan Section o f or BMPs Addendum to this Permit, corrective actions must be initiated within 30 days and the BMPs restored to full operation or new BMPs implemented/installed as soon as field conditions allow.

### 5. Annual Report

5.2 Submit a Storm Water Annual Report by March 31 *of* each year following permit issuance.

## Chapter 6. General Industrial Storm Water, NPDES/SDS

### 6. Records

6.1 The Plan shall be retained for the duration of the permit. A copy of the Plan shall remain on the permitted site whenever Permittee staff are available on the site, and be available upon request. The Permittee shall maintain the following records for the period of permit coverage:

dates of inspections;
findings of inspections;
corrective actions taken;
documentation of all changes to the Plan;
a copy of annual reports.

### 7. Discharges

7. Discharges

7.1 All discharges of storm water associated with industrial activity shall be composed entirely of storm water. A discharge containing a hazardous substance in an amount equal to or in excess of MPCA.

This permit does not authorize the discharge of hazardous substances or oil resulting from an on-site spill.

## Chapter 7. Total Facility Requirements

### 1. Definitions

1.1 "Calendar Month Average" is calculated by adding all daily values measured during a calendar month and dividing by the number of daily values measured during that month. The "Calendar Month Average" limit is an upper limit.

1.2 Submit an application for permit reissuance by 180 days before permit expiration.

1.3 "Act" means the federal Clean Water Act, amended, 33 U.S. Code 1251 et seq.

1.4 "Agency" means the Minnesota Pollution Control Agency (MPCA).

1.5 "Calendar Month Maximum" is the highest value of single samples taken throughout the month. The "Calendar Month Maximum" is an upper limit.

1.6 "Calendar Month Minimum" is the lowest value of single samples taken throughout the month. The "Calendar Month Minimum" is a lower limit.

1.7 "Calendar Month Total" is calculated by adding all daily values measured during a calendar month. It is usually expressed in mass or volume units. The "Calendar Month Total" is an upper limit.

## Chapter 7, Total Facility Requirements

### 1. Definitions

18 "Daily Maximum" means the maximum allowable discharge of pollutant during a calendar day, Where daily maximum limitations are expressed in terms of a concentration, the daily discharge is the arithmetic average measurement of the pollutant concentration derived from all measurements taken that day. The "Daily Maximum" is an upper limit.

1.9 "Discharge" means the conveyance, channeling, runoff, or drainage of waste water, including storm water and snow melt from a site.

1.10 "Grab" sample type is an individual sample collected from one location at one point in time.

1.11 "Maximum" sample type means the greatest sample value recorded during the designated monitoring period.

1.12 "MPCA" means the Minnesota Pollution Control Agency, or Minnesota Pollution Control Agency staff as delegated by the Minnesota Pollution Control Agency.

1.13 "NPDES" means National Pollutant Discharge Elimination System which is the program for issuing, modifying, revoking, reissuing, terminating, monitoring, and enforcing permits and imposing and enforcing pretreatment requirements under sections, 307, 318, 402 and 405 of the Clean Water Act, United States Code, title 33, sections 1317, 1328, 1342 and 1345.

1.14 "Operator" means a person who owns or leases property to conduct activities on that property.

1.15 "Permittee" means the entity identified as Permittee on the cover letter authorizing coverage under this permit.

1.16 "Sewage Sludge" means solid, semisolid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes, and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works. Sewage sludge that is acceptable and beneficial for recycling on land as a soil conditioner and nutrient source is also known as biosolids.

1.17 "Storm Water" means storm water runoff, snow melt runoff, and surf runoff and drainage.

1.18 "Upset" means an exceptional incident in which the permit discharge limits are unintentionally and temporarily exceeded due to factors beyond the reasonable control of the Permittee.

1.19 "Waters of the State" means all streams, lakes, ponds, marshes, wetlands, watercourses, waterways, wells, springs, reservoirs, aquifers, irrigation systems drainage systems and all other bodies or accumulations of water, surface or underground, natural or artificial, public or private, which are contained within, flow through, or border upon the state or any portion thereof.

## Chapter 7. Total Facility Requirements

### 2. Sampling and Analyses

2.1 Samples and measurements required by this permit shall be representative of the monitored activity and shall be analyzed by a laboratory certified by the Minnesota Department of Health for the applicable permitted parameters. Analyses of pH, temperature and total residual chlorine do not need to be completed by a certified laboratory.

2.2 Sample preservation and test procedures far the analysis of pollutants shall conform to 40 CFR Part 136 and Minnesota Rules, part 7041.3200.

2.3 Volatile organics shall be analyzed using Minnesota Department of Health Method 465E, EPA Method 624 or equivalent method.

2.4 All monitoring and analytical instruments used to monitor as required by this permit shall be calibrated and maintained at a frequency necessary to ensure accuracy. The Permittee shall measure flows to ensure accuracy within plus or minus ten percent of the true flow values. The Permittee shall maintain written records of all calibrations and maintenance.

2.5 The "sample type", "sampling frequency" and "effective period" identified in the Limits and Monitoring section of this permit together designate the minimum required monitoring frequency.

2.6 If a Permittee monitors more frequently than required by this permit, the results and the frequency of monitoring shall be reported on the Discharge Monitoring Report (DMR) or other form fox that reporting period.

2.7 For upsets, spills or any other discharge that may cause pollution of the waters of the state, the Permittee shall take at least one (1) grab sample for permitted effluent parameters two (2) times per week. If the Permittee believes that measuring these parameters is inappropriate due to known information about the discharge, the monitoring may be modified in consultation with the MPCA. Where there is reason to believe a pollutant other than those limited in the permit is present, the Permittee shall sample for that pollutant. Appropriate sampling shall be determined in consultation with the MPCA.

2.8 If sampling by the Permittee of the groundwater remediation system waste stream indicates a violation of any discharge limitation specified in this permit, the Permittee shall immediately repeat the sampling and analysis and submit the results of the repeat analysis to the MPCA, within 10 days of becoming aware of the violations.

### 3. Reporting

3.1 The Permittee shall report monitoring results for the completed reporting period in the units specified by this permit on a Discharge Monitoring Report (DMR) form or other report form provided by the MPCA.

## Chapter 7. Total Facility Requirements

### 3 Reporting

3.2 The Permittee shall report monitoring results below the reporting limit (RL) of a particular instrument as "<" the value of the RL. For example, if an instrument has a RL of 0.1 mg/L and a parameter is not detected at a value of 0.1 mg/L or greater, the concentration shall be reported as "<0.1 mg/L." "Non-detected", "undetected", "below detection limit" and "zero" are unacceptable reporting results, and are permit reporting violations.

3.3 A Discharge Monitoring Report (DMR) shall be submitted for each station even if no discharge occurred during the reporting period. The Permittee shall report 'No Discharge', 'No Flow' or 'No Materials Generated' on a DMR or other monitoring report form only if no discharge, flow or materials are generated during the entire reporting period.

The schedule for reporting can be found on the Submittals Summary section of this permit. Submittal date shall be the earlier of the date received by the MPCA or the postmarked date.

3.4 The Permittee shall report the following in a separate submittal from the Discharge Monitoring Report (DMR):

a. any substantial changes in operational procedures;

b. activities which alter the nature or frequency of the discharge; and

c. material factors affecting compliance with the conditions of this permit.

3.5 Laboratory analyses sheets shall be submitted upon request.

3.6 The Permittee shall sign the reports and documents submitted to the MPCA by the Permittee. (Minnesota Rules, pt. 7001.0150, subp. 2.D)

3.7 A person who falsifies, tampers with, or knowingly renders inaccurate a monitoring device or method required to be maintained under this permit is subject to penalties provided by federal and state law. (Minnesota Rules, pt. 7001.1090, subp. 1.G)

3.8 The Permittee shall report noncompliance with the permit not reported under Minnesota Rules, part 7001.0150, subpart 3, item K as apart of the next report which the Permittee is required to submit under this permit. If no reports are required within 30 days of the discovery of the noncompliance, the Permittee shall submit the information listed in Minnesota Rules, part 7001.0150, subpart 3, item K within 30 days of the discovery of the noncompliance. (Minnesota Rules, pt. 7001.0150, subp. 3L)

3.9 A person who knowingly makes a false statement, representation, or certification in a record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance is subject to penalties provided by federal and state law set forth, (Minnesota Rules, pt. 7001.1090, subp. 1.H)

## Chapter 7. Total Facility Requirements

### 4. Records

4.1 The Permittee shall maintain records for each sample and measurement. The records shall include the following information:

a. the exact place, date and time of the sample or measurement;

b. the date of analysis;

c. the name of the person who performed the sample collection, measurement, analysis, or calculation;

d. the analytical techniques, procedures and methods used; and

e. the results of the analysis.

4.2 The Permittee shall keep the records required by this permit for at least three (3) years, including any calculations, original recordings from automatic monitoring instruments, and laboratory sheets. The Permittee shall extend these record retention periods upon request of the MPCA and/or during the course of an unresolved enforcement action. (Minnesota Rules, pt. 7001.0150, subp. 2.C)

4.3 Except for data determined to be confidential according to Minnesota Statutes, ch. 116.075, subd. 2, all reports required by this permit shall be available for public inspection at the MPCA St. Paul office. Effluent data shall not be considered confidential. Confidential material shall be submitted according to Minnesota Rules, pt. 7000.1300.

4.4 The Permittee shall, when requested by the MPCA, submit within a reasonable time the information and reports that are relevant to the control of pollution regarding the construction, modification, or operation of the facility covered by the permit or regarding the conduct of the activity covered by the permit. (Minnesota Rules, pt. 7001.0150, subp. 3.H)

### 5. Compliance Responsibility

5.1 The Permittee shall perform the actions or conduct the activity authorized by the permit in accordance with and in compliance with the conditions of the permit. (Minnesota Rules, pt. 7001.0150, subp. 3.B)

5.2 Whether or not this permit includes effluent limitations for toxic pollutants, the Permittee shall not discharge a toxic pollutant except according to Code of Federal Regulations, title 40, sections 400 to 460 and Minnesota Rules, parts 7050.0100 to 7050.0221 and 7052.0010 to 7052.0110 (applicable to toxic pollutants in the Lake Superior Basin) and any other applicable MPCA rules. (Minnesota Rules, pt. 7002.0190, subp. 1.A)

# Chapter 7. Total Facility Requirements

## 7. Upset Defense

7.1 In the event of temporary noncompliance by the Permittee with an applicable effluent limitation resulting from an upset at the Permittee's facility due to factors beyond the control of the Permittee, the Permittee has an affirmative defense to an enforcement action brought by the agency as a result of the noncompliance if the Permittee demonstrates by a preponderance of competent evidence:

a. the specific cause of the upset;

b. that the upset was unintentional;

c. that the upset resulted from factors beyond the control of the Permittee and did not result from operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or increases in production which are beyond the design capability of the treatment facilities;

d. that at the time of the upset the facility was being properly operated;

e. that the Permittee properly notified the commissioner of the upset in accordance with Minnesota Rules, part 7001.0150, subpart 3, item I; and

f. that the Permittee implemented the remedial measures required by Minnesota Rules, part 7001.0150, subpart 3, item J. (Minnesota Rules, pt. 7001.1090, subp. 1.L)

## 8. Duty to Notify and Avoid Water Pollution

8.1 The Permittee shall notify the Minnesota Department of Public Safety Duty Officer at (800)422-0798 or (651)649-5451 immediately of the discharge, accidental or otherwise, of any substance or material under its control which, if not recovered, may cause pollution of waters of the state. Notification is not required for a discharge of five (5) gallons or less of petroleum. (Minnesota Statutes, section 115.061)

8.2 The Permittee shall report to the Duty Officer all pertinent information regarding the discharge. Refer to the MPCA "Emergency Notification Guidance for Wastewater Treatment Systems" for further information.

8.3 The Permittee shall take all reasonable steps to minimize the adverse impacts to human health, public drinking water supplies or to the environment resulting from the discharge. This may include restricting or preventing untreated or partially treated wastewater, or plant chemicals from entering waterways, containing spilled materials, recycling by-passed wastewater through the plant, or using auxiliary treatment methods. (Minnesota Statutes, section 115.061)

8.4 The Permittee shall maintain a plan designed to adequately notify the public of potential health threats due to discharges of untreated or partially treated wastewater. The Permittee shall notify the public in accordance with the plan.

## Chapter 7. Total Facility Requirements

### 9, Facilities Operation

9.1 The Permittee shall properly operate and maintain the systems used to achieve permit compliance. Proper operation and maintenance includes effective performance, adequate funding, adequate staffing and training, and adequate process and laboratory controls, including appropriate quality assurance procedures. (Minnesota Rules, pt. 7001.0350, subp. 3.F)

9.2 The Permittee is responsible for insuring system reliability and shall install adequate backup or support systems to achieve permit compliance and prevent the discharge of untreated or inadequately treated waste. These systems may include alternative power sources, auxiliary treatment works and sufficient storage volume for untreated wastes. (Minnesota Rules, pt. 7001.0150, subp. 3.F)

9.3 In the event of a reduction or loss of effective treatment of wastewater at the facility, the Permittee shall control production or curtail its discharges to the extent necessary to maintain compliance with the terms and conditions of this permit. The Permittee shall continue this control or curtailment until the wastewater treatment facility has been restored or until an alternative method of treatment is provided. (Minnesota Rules, pt. 7001, 1090, subp. 1.C)

9.4 The Permittee shall store, transport and dispose of biosolids, sediments, residual solids, filter backwash, screenings, oil, grease and other substances so that pollutants do not enter surface waters or ground waters of the state.

9.5 The Permittee's discharge shall not cause any nuisance conditions, acutely toxic conditions to aquatic life or other adverse impact on the receiving water.

9.6 The Permittee shall comply with all applicable water quality, air quality, solid waste and hazardous waste statutes and rules in the operation and maintenance of the facility.

9.7 The Permittee shall schedule maintenance of the treatment works during non-critical water quality periods to prevent degradation of water quality.

9.8 In-plant control tests shall be conducted at a frequency adequate to ensure continuous efficient operation of the treatment facility.

### 10. Chemical Additives

10.3 The Permittee shall receive prior written approval from the MPCA before increasing the use of a chemical additive authorized by this permit, or wing a chemical additive not authorized by this permit. "Chemical additive" includes processing reagents, water treatment products, cooling water additives, freeze conditioning agents, chemical dust suppressants, detergents and solvent cleaners used for equipment and maintenance cleaning, among other materials.

10.2 The Permittee shall request approval for an increased or new use of a chemical additive 60 days before the proposed increased or new use.

## Chapter 7. Total Facility Requirements

### 10. Chemical Additives

10.3 This written request shall include the following information for the proposed additive,

a Material Safety Data Sheet

b. A complete product use and instruction label.

c. The commercial and chemical names of all ingredients.

d. Aquatic toxicity and human health or mammalian toxicity data including a carcinogenic, mutagenic or teratogenic concern or rating.

e. Environmental fate information including, but not limited to, persistence, half-life, intermediate breakdown products, and bioaccumulation data.

f. The proposed method, concentration, and average and maximum rates of use.

10.4 This permit may be modified to restrict the use or discharge of a chemical additive.

### 11. Inspection And Entry

11.1 The Permittee shall allow a representative of the MPCA, in accordance with Section 308 of the Act and Minnesota Statutes, section 115.04, (1992), and upon presentation of proper credentials, to:

a. enter the premises where the facility is located or activity conducted

b. review and copy the records required by this permit;

c. inspect the facilities, systems, equipment, practices or operations regulated or required by this permit;

d. sample or monitor to determine compliance; and

e. bring equipment upon the Permittee's premises necessary to conduct surveys and investigations. (Minnesota Rules, p t 7001.0150, subp. 3.I)

### 12. Permit Modifications

12.1 Changes to the facility or operation of the facility may require a permit modification. The Permittee shall submit an application describing the changes to the facility or operation to the MPCA and receive a permit modification prior to implementing the changes. The Permittee must submit the permit modification application fee in accordance with Minnesota Rules, part 7002.0250 with the application.

## Chapter 7. Total Facility Requirements

### 12. Permit Modifications

12.2 The following changes may require a permit modification:

a. Increased use or new use of a chemical additive.

b. Changes in the characteristics, concentrations or frequency of the wastewater flow, which may include significant changes in the pollutants or additional groundwater wells:

12.3 The procedures as set forth in Minnesota Rules, pt. 7001.0100 through 7001.0130, including public notice, apply to applications for permit modifications, with the following exceptions:

a Modifications solely as to ownership or control as described in Minnesota Rules, pt. 7001.0190, subp. 2

b. Minor modifications as described in Minnesota Rules, pt. 7001.0190, subp. 3.

12.4 No permit may be assigned or transferred by the holder without the approval of the MPCA. A person to whom the permit has been transferred shall comply with the conditions of the permit. (Minnesota Rules, pt. 7001.0150, subp. 3.N)

### 13. Construction

13.1 Construction related to facility modifications, additions or expansions that is not expressly authorized by this permit requires a permit modification. If the construction project requires an Environmental Assessment Worksheet under Minnesota Rules, ch. 4410, no construction shall begin until a negative declaration has been issued and all approvals have been received or implemented. (Minnesota Rules, pt. 7001.0030)

13.2 No construction shall begin until the Permittee has received written approval of plans and specifications for the construction from the MPCA.

## Chapter 7. Total Facility Requirement

### 14. Permit Modification, Suspension or Revocation

14.1 This permit may be modified, suspended, or revoked for the following reasons:

a. A violation of permit requirements.

b. Misrepresentation or failure to disclose fully all relevant information to obtain the permit.

c. A change in a condition that alters the discharge.

d. The establishment of a new or amended pollution standard, limitation or effluent guideline that is applicable to the permitted facility or activity.

e. Failure to pay permit fees.

f. Other reasons listed in Minnesota Rules, pt. 7001.0170.

### 15. Permit Reissuance

15.1 If the Permittee has submitted a timely application for permit reissuance, the Permittee may continue to conduct the activities authorized by this permit, in compliance with the requirements of this permit, until the MPCA takes final action on the application, unless the MPCA determines one of the following:

a. The Permittee is not in substantial compliance with the requirements of this permit, or with a stipulation agreement or compliance schedule designed to bring the Permittee into compliance with this permit.

b. The MPCA, as a result of an action or failure to act by the Permittee, has been unable to take final action on the application on or before the expiration date of the permit.

c. The Permittee has submitted an application with major deficiencies or has failed to properly supplement the application in a timely manner after being informed of deficiencies. (Minnesota Rules, pt 7001.0160)

15.2 If the Permittee does not intend to continue the activities authorized by this permit after the expiration date of this permit, the Permittee shall notify the MPCA. The MPCA may require the Permittee to apply for reissuance or a major modification of this permit to authorize facility closure.

### 16. Property Rights

16.1 The permit does not convey a property right or an exclusive privilege. (Minnesota Rules, pt. 7001.0150, subp. 3.C)

# Required Submittals

## Ine-Time Submittals

Du ... te / Requirement

/3/2008. Submit an application for permit reissuance by 180 days before permit expiration.

## 'eriodic Submittals

requency / Requirement

nnually. Submit a Storm Water Annual Report by March 31 of each year following permit issuance.

Ionthly. Submit a monthly DMR monthly by 21 days after the end of each calendar month following permit issuance. (SD 002)

Ionthly. Submit a monthly DMR monthly by 21 days after the end of each calendar month following permit issuance. (SD 003)

Ionthly. Submit a monthly DMR monthly by 21 days after the end of each calendar month following permit issuance. (WS 001)

# APPENDIX B

# DATA QUALITY OBJECTIVES

**NIROP FRIDLEY DATA QUALITY OBJECTIVES**
**PROBLEM B: EFFECTIVENESS OF CAPTURE WELL SYSTEM**
**and**
**PROBLEM C: GROUNDWATER MONITORING FOR OVERALL CONTAMINATION AT NIROP (I.E., LONG TERM MONITORING)**

**Notes:**

- This version of the notes represents all changes made in accordance with meetings and telephone discussions up to and including the 08-21-01 teleconference. A record of meetings and teleconferences is provided in Attachment 1.

- The partnering Team (PT) agrees that development of Data Quality Objectives (DQOs) is important to focus the planning effort and to obtain as much agreement as possible concerning the strategy and criteria for completing each investigative effort. The team also acknowledges that DQO process outputs are commonly based on assumptions that could be invalid or the DQOs themselves could be flawed, for example, because of incomplete knowledge of site conditions at the time of planning. If this proves to be the case, adjustments might be required to complete an investigation satisfactorily. Deviations from the plan should be documented and justified.

- Where feasible, reference is made to existing documents to minimize the amount of detail that needed to be recorded. To save time, issues already established or addressed previously, such as budget and schedule constraints, were deliberately omitted unless they would have bearing on the development of strategies for solving the problems.

- Quality control (QC) samples (type, number, etc.) will be specified in accordance with Environmental Protection Agency (EPA) and Minnesota Pollution Control Agency (MPCA) guidance in the Long Term Monitoring (LTM) work plan (WP).

- The DQOs began with a review of past activities and a discussion of the problem to be solved at Fridley. It was quickly determined that there is more than one problem. The problems were separated into problems A, B, C, and D. If more problems are identified at a later date, they will be labeled alphabetically as was done for the first four problems. The notes in this document begin with a statement of general DQOs and are followed by the DQOs specific to Problem B, Effectiveness of Well Capture System. The DQOs for the other problems are provided in separate documents.

- Formatting and renumbering of attachments necessary to render this set of DQOs self-consistent was conducted by T. Johnston (TtNUS) after the notes were approved on 08-21-01. Changes made were minimal and do not affect the technical content beyond the approved changes in the 08-21-01 teleconference.

**DQO Step 1. State the Problem (General Section)**

Conceptual Site Model (CSM): The Naval Industrial Reserve Ordnance Plant, Fridley (NIROP) has been located in the northwestern portion of the Minneapolis/St. Paul Metropolitan area, in the city of Fridley, Minnesota since 1941. The NIROP facility was the first government-owned, contractor-operated (GOCO) facility. The facility is divided into two (2) areas on the basis of ownership. The government owned NIROP site (NIROP) consists of approximately 80.3 acres to the north. This area consists of the ordnance manufacturing building and the property to the north of the building, known as the "North 40." The NIROP is contiguous and adjacent to buildings and property just to the south, owned and operated by United Defense, Limited Partnership (UDLP). The UDLP property is 55.4 acres. Anoka County Riverfront Park (ACP) to the west along the Mississippi River consists of approximately 59.8 acres. The NIROP site is situated 30 feet above and 800 feet east of the Mississippi River, and approximately 4000 feet up river from the Minneapolis Water Works river intake. Past disposal activities on the NIROP facility have resulted in soil and ground water contamination. There is trichloroethene (TCE) contamination in NIROP

upgradient wells (shallow, intermediate, deep and bedrock aquifers) indicating contamination may be coming onto the NIROP site. Ten-ppb contour lines were drawn for shallow/intermediate and deep zones:

| | |
|---|---|
| Shallow = 20' - 30' | (approximate depth) |
| Intermediate = 30' - 80' | (approximate depth) |
| Deep = 80' - 120' | (approximate depth) |
| Bedrock = 120' - 180' | (actual depth) |

Four extraction wells were installed in 1992 and two additional wells were installed in 1995 for hydraulic containment of the TCE plume (capture and containment). Extra wells will be added this year (2001) to prevent apparent "blow-by" of TCE past extraction wells. The area of contamination beyond the capture well system is not dissipating as expected. The Minneapolis Water Works downstream of the site on the Mississippi River has experienced a maximum TCE concentration of 1.9 ug/L. The UDLP has a plume and extraction wells on their property, also. Regulators are working with UDLP to get them up to the same level as the Navy with regard to water treatment/containment.

Pages 1 and 2 of he Record of Decision (ROD) state:

> "This action addresses the principal threat posed by the NIROP by preventing endangerment of public health, welfare, or the environment by implementation of this Record of Decision through hydraulic containment and recovery of all future migration of contaminated ground water from the NIROP and by recovery, to the extent feasible, of contamination downgradient of the NIROP."

Also on page 2, the ROD speaks of "effective" hydraulic containment in the context of " ...hydraulic containment and recovery of all future migration of contaminated ground water from the NIROP..." The ROD goes on to say on page 3:

> "A portion of the aquifer within the Anoka County Parkland closest to the Mississippi River may not fall within the zone of capture of the ground water recovery system. However, should this occur, contaminants in any uncaptured portion of the aquifer are expected to dissipate by natural means over time to levels that are protective of human health and the environment..."

The five-year review speaks of "substantial" containment. This term was used in the five-year review to reflect that "total" (i.e., 100%) hydraulic containment, as required by the ROD, is not likely to be provable. The meaning of "substantial" is not agreed upon. Total containment is interpreted by the partnering team as to not knowingly leave blow-by. How this is determined is addressed under Problem B, Effectiveness of Well Capture System.

**Issue:** How to define the degree of containment necessary to achieve substantial hydraulic containment must be decided.

Based on an overly conservative analysis, which has since been deleted from annual monitoring reports, it was once estimated that up to 1 ton per year of TCE was flowing into the Mississippi River. The Navy extraction wells have removed a total of 12.5 tons of TCE between 1992 and 1999

Based on the five-year review, a recommendation was made to evaluate whether a remedy existed for the Anoka County Park (ACP) plume, and to evaluate the remedy (pp. 8 and 9 of the 5-yr review report).

At the 5-yr Review the following objectives were reiterated from the ROD:

> "Installation and operation of a groundwater containment and recovery system to hydraulically contain TCE contaminated groundwater to prevent further migration and to ultimately restore groundwater quality in the aquifer to MCLs. Installation and operation of a groundwater containment and recovery system to recover, to the extent feasible, TCE contaminated groundwater beneath Anoka County Park."

The Five Year Review goes on to recommend the following related to ACP:

- "...
- ...

- The Navy will determine if any potential sources of contamination exist in Anoka County Park that may impact residual groundwater contamination levels in the area where residual groundwater contamination is present by September 1999.
- …
- The Navy will determine what can be done to promote reduction of residual groundwater contamination in Anoka County Park to a level that will significantly reduce residual groundwater contamination, and determine if a response action will enhance the effectiveness of the selected remedy as it relates to residual groundwater in Anoka County Park by September 1999, and if warranted, will conduct a response action that will significantly reduce residual groundwater contamination and enhance the effectiveness of the selected remedy as it relates to residual groundwater contamination from NIROP in Anoka County Park by September 2000."

Note the emphasis on contamination *leaving NIROP* as opposed to *entering the river.*

*Assumption:* Preventing NIROP groundwater contamination from leaving the property is protective of the Mississippi River.

*Assumption:* FMC/UDLP contamination is distinct from NIROP contamination, even though it could be difficult to separate the two.

*Assumption:* Soil is outside the scope of this groundwater (GW) operable unit (OU).

*Assumption:* The Prairie du Chien aquifer is not contaminated.

**Note:** There are four basic problems and hence four different decision statements. From this point on, each problem is dealt with individually, beginning on the next page. The problems are as follow:

1. **Problem A:** Anoka County Park Vegetable Oil VOC Reduction Pilot Study
2. **Problem B:** Effectiveness of Capture Well System and Capture Zone Analysis
3. **Problem C:** Groundwater Monitoring for Overall Contamination at NIROP (i.e., LTM)
4. **Problem D:** Exit Strategy (identified during the July DQO meeting)

The Effectiveness of Capture Well System and Capture Zone Analysis Problem is presented here. The other problems are presented in separate DQO notes, one set for each problem.

Consensus #1 (C1): The DQO notes will not be meeting minutes. The DQO notes will be an ongoing (work in progress) document which documents the meeting's decisions.

C2: The work of each day will be drafted after each day's meeting and reviewed at the beginning of the next morning. The team will have a summary of comments at the end of each am and pm. The team will recap the meeting's decisions at meeting closure to ensure we get team buy-in on site.

C3: Be trustful of one another.

C4: Changes to DQO notes: Insert a footnote on the bottom of DQO notes page, indicating the date the notes were approved.

Action Item #1 (AI #1): Team will be notified via email if there is a conference call scheduled to address an action item. Team members will decide if they will be involved.

AI2: Initiating party of conference call (AI #1) will notify all involved parties that a conference call will take place (including date, time, topic).

## PROBLEM B: EFFECTIVENESS OF CAPTURE WELL SYSTEM

### DQO Step 1. State the Problem

See the DQO Step **1.** General Section at beginning of this document

Original emphasis of project: Capture system was installed per the Record of Decision (ROD) to prevent movement of the plume off the NIROP property. It was assumed that in doing so the plume would dissipate downgradient and reduce discharge to the river.

*Assumption:* There is no intent to change the ROD as a result of or as part of this phase of the project.

### DQO Step 2. State the Decision

*Study Question:*
Is the capture system with the newly installed wells effective at preventing groundwater contamination from passing through the capture system?

*Potential Actions:*
1. If adequate capture is effected:
   - Continue to use the system to prevent migration of contaminated groundwater to the river.
   - Optimize the cost-effectiveness of the well capture system while maintaining adequate capture. Potential factors for consideration include: optimizing the number of capture wells that must be operated, optimizing the pumping rate of the capture wells, optimizing the number of monitoring wells that must be sampled, optimizing the frequency of sampling, etc., to reduce operating costs.
2. If adequate capture is not effected, consider enhancing the system further to increase the degree of contaminated groundwater capture.

***Issue:*** Ultimately, the Navy would like to shut the pump and treat containment system off (exit strategy). We will deal with this question later. The ROD says that the ultimate goal is that all groundwater contaminant concentrations must be reduced to their MCLs throughout the aquifer. It may be found that this is 'technically impracticable' (TI).

ROD language for Issue, above. The text is provided here (from page **44** of the ROD):
"**…** At this site, there is a medium to high uncertainty that cleanup targets can be achieved within reasonable time frame. Despite extensive recovery efforts, very low concentrations of TCE may persist in the aquifer above the target cleanup level. If at some time in the future, the Navy believes that achieving the target cleanup level (MCL) is technically impracticable, at that time the Navy will apply for an Alternate Concentration Limit (ACL) in accordance with guidance for implementation of ACLs. The Navy plans to use a mathematical formula to determine if concentrations have dropped to an asymptotic level. This asymptotic level will be used to show technical impracticability**…**In addition, if it is shown, based on the facts at the time, that upgradient sources are contributing VOCs to the ground water, the U.S. Navy will request approval of an alternate cleanup target level or approval to terminate ground water recovery operations."

*Decision Statement:*
Determine whether NIROP groundwater contamination is substantially prevented from leaving the NIROP property after startup of new wells.

If it is, continue to optimize the capture well system

If it is not**…** evaluate the need for enhancing the system.

### DQO Step 3. Inputs to the Decision

*Measurements to be made:*

- Hydraulic heads
- Chemical Concentrations (8 analytes proposed by Navy - TCE and daughter products - MPCA and EPA have to agreed to this). Analytes are tabulated below with some additional information.
- Physical parameters (aquifer parameters (pump test data))
- Stratigraphy
- Removal rate (how much chemical is removed in a given time)
- Draw down
- Historical data (Hydraulic and chemical)
- Pumping rate
- Borehole flow velocity
- Tracer study (could help interpret data)
- 3D Numerical Model - MOD Flow
- Plume dimension and location
- Concentrations that constitute contamination and delineate the plume

**Analyte List**

| Analyte[1] | Frequency of Detection (all data to date) | Range of Detection (ug/L) | Location of Maximum Concentration (date and round in [ ] ) |
|---|---|---|---|
| 1,1,1-Trichloroethane | 202/1436 | 0.2 – 690 | 003-TW-033-01 |
| 1,1-Dichloroethane | 418/1436 | 0.2 – 170 | M05PC-[90_R11] |
| 1,1-Dichloroethene | 142/1436 | 0.2 – 380 | 003-TW-033-01 |
| cis-1,2-dichloroethene | 143/317 | 0.2 – 2440 | 18-S-[88_R01] |
| trans-1,2-dichloroethene | 100/385 | 0.2 – 4700 | 18-S-[86_R04] |
| Tetrachloroethene | 484/1436 | 0.2 – 560 | PC-5-[99_R11] |
| Trichloroethene | 1187/1436 | 0.4 – 140000 | GW-01 |
| Vinyl Chloride | 32/1278 | 0.2 – 40 | 003-TW-P09-01 |

***Data Analysis Tools:***

**Note:** Data analysis tools discussed in Attachment 2 will be used in a weight-of -evidence approach. Multiple combinations of these tools may be used to evaluate capture. Hal Davis (USGS) presented a capture zone analysis to help the Partnering Team understand the site physical model and the utility *of* aquifer test analyses, flow nets, etc. This document is filed separately.

**Note:** The partnering team approved the implementation of the USGS' plan titled "Proposal for Determining the Capture Area of Recovery Wells" (see meeting handout).

**DQO Step 4. Define the Study Area Boundaries**

**Note:** The Navy is responsible only for the NIROP site groundwater plume. The boundaries need to be defined.

***Note:*** Delineation of the southern NIROP plume should be worked out between UDLP, Navy, MPCA and EPA. MPCA has offered to mediate a discussion among the parties.

*Suggestions:*

Current 1OO-ppb TCE contour is the part of the plume to be evaluated.

Geographical Boundaries:

Area bounded by:

- Capture wells AT-9 and AT-5A/B plus capture zone to the outside of those wells.
- Region upgradient of capture well line and downgradient of capture well line.

**Assumption:** It is assumed that some contamination could "leak" past the exterior capture wells along the north and south edges of the capture well line, but the amount of contamination doing so is minimal compared to the contaminant concentrations bounded by the 100 ppb TCE contour line.

**Assumption:** The levels of contamination at the edge of the plume (area between 100 ppb and 5 ppb TCE) along the north and south edges of the capture well line will continue to decline with time compared with the known contaminant concentrations between wells AT-9 and AT-5A and AT-5B.

***Issue:*** The extent of the upgradient and downgradient regions must be established.

*Populations:*
Groundwater both upgradient and downgradient of capture well line in the shallow, intermediate, and deep aquifer zones (all are interconnected to some extent).
There are shallow, intermediate and deep plume monitoring intervals within the aquifer system. The shallow and intermediate zones are relatively separated (limited vertical mixing).

*Action Item: Temporal boundary: shall be moved to Problem D, Exit strategy, DQO*

**DQO Step 5. State the Decision Rule**

*Decision Rule:*
If the capture well system is effective at substantially preventing the flow of contaminated groundwater from NIROP beyond the capture well system, then optimize the system by selecting different pump rates, deselecting wells from the list of monitoring/pumping, etc., as appropriate based on best professional judgment using data analysis. If the capture well system is not effective at substantially preventing the flow of contaminated groundwater from NIROP beyond the capture well system, evaluate potential system enhancements, source control, etc., as appropriate.

**Note:** Effectiveness will be judged on a weight of evidence based on the analysis tools identified in DQO Step 3, as deemed appropriate. Weight of evidence and best professional judgment will be based primarily on decision making tools of greatest value as identified in Attachment 1. Weight of evidence will include the following evaluations:

- Cone of depression
- Drawdown data
- Final surface after pumping (establish contours first then add flowpath lines).

After completing this evaluation, USGS will write a report describing the methods of analysis and presenting conclusions regarding capture zones. A conclusion regarding the degree on containment will be made. The report will be reviewed by technical team members.

**DQO Step 6. Establish Error Tolerances**

Because of the great number of variables involved in evaluating the capture well system effectiveness, it is not feasible to use the standard DQO statistical approach to establishing the sampling plan. Instead,

as stated in DQO Step 5, a weight of evidence approach will be used. To the extent that statistical tools are judged to be useful in evaluating data and characteristics of this problem, they may be invoked. Confidence limits, other statistical performance requirements, etc., will be established at that time.

**DQO Step 7. Optimize the Design**

**Well Selection Meeting**
**(DQO Meeting #3)**
**NIROP Fridley**
**Charleston, SC**
**March 6 - 7, 2002**

**(Finalized per 6/26/02 tele-con)**

**Attendees**

Jeff Meyers – Navy
Cliff Casey – Navy
John Betcher – MPCA (1, 2)
Rick Kuthau – EPA contractor (2)
Hal Davis – USGS
Venky Venkatesh - CH2MHill/CCI
Keith Henn – TtNUS (2)
Mark Sladic - TtNUS (2)
Tom Johnston - TtNUS
Paul Rice - ICLD
Craig Thomas - US EPA V (2)

Notes:
(1) J. Betcher has proxy to discuss any issue and make decisions for MPCA, because David Douglas could not attend the meeting.
(2) Participants in the 6/26/02 teleconference.

The purpose of this meeting was to select monitoring wells, sampling procedures, and other related items to complete NIROP Fridley data quality objectives (DQOs) Problem C. The results of this meeting will be the basis for the 2002 RAWP. The "previous DQO meetings" (including decision rules) noted in this document refer to meetings held on March 19-23, 2001 and July 17-19, 2001.

Tools were discussed to assist in the well selection process. Based upon discussion at the previous DQO meetings, geostats were introduced by the Navy as a tool. The EPA and MPCA raised questions about the validity of using geostatistics or other computerized means (e.g., MAROS software) of evaluating the site data given the complexity of the geology and hydrogeology at the site. MPCA and EPA expressed concerns that the geostatistical evaluation of the monitoring network that was done in the past was no longer relevant. However, as identified in the meeting, the Navy was prepared to discuss an updated geostatistical evaluation of the site which included the numerous additions made to the monitoring network based upon the 1999 AMR data. MPCA and EPA asked that if the Navy intends to identify new information or tools in the meeting that it be sent out ahead of the meeting for review. The MPCA expressed the concern that the complexity of the site hydrogeology may violate some of the assumptions of geostatistics. For purposes of this meeting, it was agreed that only hand contouring (triangulation and no geostats) and professional judgement will be used to establish contaminant isoconcentration contours. The discussion did cover the use of geostatistics in the future, including the possibility of the team receiving training in geostatistics. However, this decision was postponed until later in the meeting. At the end of the meeting, it was determined by the group that since the team had been successful in identifying monitoring purposes and needs for individual wells, the use of geostatistics was not necessary and would not be pursued any further. The group decided that MAROS software will not be used.

*Assumption:* TCE concentrations are assumed to be the best indicator parameter of, plume size, shape, and location at this time since the majority of VOC contamination in ground water is TCE. This will be tested in the 2001 Annual Monitoring Report (AMR). All eight COCs (which include TCE degradation

products) identified in previous DQO meetings will be evaluated:. Unless this evaluation shows that the assumption is not correct (e.g., if daughter products of TCE increase or are expected to increase based on remedy) TCE will be used as the indicator parameter for the NIROP plume for the AMR reports.

*Assumption:* In previous DQO meetings it was agreed that the 100 ppb TCE contour would be used to establish the capture zone performance, at least until site is near closure, at which time a more stringent criterion regarding the identification and bounding of contamination will apply. This assumption will be evaluated annually in the AMR (March, 2002).

*Assumption:* The well selection performed is based up 1999 AMR data and 2001 potentiometric surface contour maps. It was determined that this data is the most current agreed representation of the site conditions.

*Assumption:* Annual reviews of well selection will take place in each AMR. Modifications will be made based upon new or more complete data sets, as needed.

*Assumption:* It was noted in the 6/26/02 telecon that many wells have multiple monitoring purposes (as defined below). If a well is to be eliminated from the monitoring network in the future all of these purposes must be evaluated before it can be eliminated.

## Development of a Decision Tree

The team discussed the types of information needed to achieve the project objectives. Later the team decided that, instead of dealing in the abstract, the team should actually go through a well selection process. Through this process the factors that are important would tabulated to develop a decision tree. An attempt was made to capture the thinking behind well selection and to establish how data would be used to support decision making for the 6 decision rules identified in previous DQO meetings. During the selection process the following general factors were identified with the understanding that particular circumstances could cause other factors to be important:

- Relative well concentrations (a desire to bias toward wells with higher concentrations wells)
- Upgradient concentrations
- Proximity of wells to each other (a concern over redundant data due to wells located close together)
- Bracketing important concentration contours with “clean” and “dirty” samples.
- Historical data, especially temporal and spatial trends
- Geology of the site (e.g., the influence of low permeability zones on contaminant movement)
- Representativeness of wells for various purposes (e.g., the capture system vs. plume edge)
- Data variability (e.g., site variability, sampling variability)
- NIROP versus non-NIROP contamination

Where appropriate, wells were classified as cross-gradient, upgradient, in-plume, etc (Tables 1 and 2). Some wells were selected based on inclusion in more than one classification and may therefore have multiple classifications. The text below ties the well selections to the 6 decision rules and provides rationale.

**Decision Rule #C1 (Capture system performance):**

### Shallow Wells

These wells are listed in Table 1

Because MS-40S and MS-401 both monitor the shallow monitored interval, and MS-40S has historically had higher concentrations between the two wells, it was decided that MS-40S would adequately monitor the 100 ug/l contour and MS-401 would not need to be monitored.

Well data from UD-63S will come at the courtesy of UDLP. See Table 3 for this information.

Well 2-S was selected over 16-S as the better well to measure the 100 ppb TCE contour in this area. If future evidence (e.g., hydraulic data) does not validate this assumption, this can be reconsidered.

MPCA plans to have UDLP install wells downgradient of the paint shop where 12,000 ppb TCE was encountered.

The Navy will need copies of UDLP reports to understand if there is a possible influence of UDLP contamination on NIROP plume conditions. The data will be evaluated to determine if it will be useful to attempt to separate UDLP from NIROP-related contamination. See notes in Tables 1, 2, and 3 regarding NIROP wells which may represent UDLP contamination.

*Action* :Navy must request UDLP reports from UDLP (or the MPCA).

The Navy noted that based upon negotiations with UDLP, UDLP will perform O&M responsibilities at the NIROP for four years.

*Action:* Navy should elevate the resolution of separating UDLP and NIROP plumes through David Douglas of MPCA.

*Intermediate Wells:*
Wells are identified in Table 1.
There is no aquifer material in the intermediate interval to the south of AT-5A/B, thus there are no wells in this area.

The group determined, that there is a data gap in the intermediate zone north of MS-431. North of this well no intermediate wells exist to determine the 100 ug/l and other lesser concentration contours. Contours in this area are inferred on AMR maps. A note of this monitoring data gap was made for latter discussion. This data gap will be discussed in a separate conference call. As noted in the summary of the 5/13/02 teleconference call this area and the appropriate amount of data needed to monitor this area is still being evaluated by the partnering team.

## Deep wells

Wells are presented in Table 1.

*Assumption:* The group hasn't completely established the degree of data variability and trends in a select number of wells. The team will continue to track the information collected to better assess this. Nevertheless, the characteristics are understood enough based upon the 1999 AMR data to select wells at this time.

*Prairie du Chien Wells*
These wells are discussed separately below.

**Decision Rule C2 (Compliance Wells:)**
Concentrations in these wells will be compared to surface water standards. Annual sampling should be conducted to provide enough data to establish trends and facilitate these comparisons. The wells are identified in Table 2.

**Decision Rules C3 (Change in Plume Size, Shape, etc.) and C4 (Meet Cleanup Criteria)**

## Shallow Wells

*Expectation:* "Exterior" wells can be dropped from monitoring as the plume shrinks. No decision criteria were developed for how decisions would be made to drop monitoring wells.

The isoconcentration that will be used to bound the plume for this decision is 5 ppb. This was based upon assumption identified earlier (page 1) indicating that TCE is a sufficient indicator parameter. If this assumption proves to be invalid in each year's AMR then further evaluation will be needed. Other factors than simply TCE will need to be taken into account to make these decisions. The concentration of other

compounds will need to be evaluated and the combined risk from multiple compounds will be part of the decision. It might be possible that criteria are exceeded for compounds other than TCE. The issue of verification of results and the number of sampling events required to verify that concentrations are below limits has not been discussed.

Based upon stable concentrations, upgradient wells have been given a low priority until final closeout of the site, at which time better definition of what contamination might be coming onto the site will become an important consideration. **As** a result, less frequent sampling can be used on these wells.

In-plume wells were selected for the shallow aquifer and are presented in Table 2.

*Assumption:* Since a capture system is in place monitoring source areas within the plume is less of a priority and can be monitored less frequently. Therefore it was agreed that the sampling frequency for in plume wells should be once per 5 years. The next sample round should be in 2006.

Discussion of ACP "in-plume" wells was deferred to later and are discussed in detail below.

## Intermediate Wells

Wells were selected and are presented in Table 2.

Well 3-IS is a dual purpose well (in-plume well and plume edge to define the 100 ppb of TCE) is will be sampled annually.

**A** monitoring gap North of MS-431 was identified by the group in the intermediate zone. The monitoring gap results in uncertainty in location of the 100 ug/l and other concentration contours. The 100 ug/l contour is being used to evaluate system performance. This is being evaluated by the partnering team at the present time.

## Deep Wells

Wells were selected and are presented in Table 2.

Based upon the 6/26/02 telecon, it was determined that well 4-D will be sampled every two years. The sole purpose of including this well is to define the 5 ppb line for TCE.

Sampling frequencies for MS-29D and MS-31D were not discussed in the rntg. Consistent with other in-plume wells a sampling frequency of 1/5 yr is recommended by TtNUS (see Table 3).

*Prairie du Chien Wells*

These wells are discussed separately below.

**Decision Rules C5 (Enhance System Performance or Evaluate ACL's) and C6 (Technical Impracticability)**

Well selection for this decision rule will be addressed in the ROD and 5 Year review process. If it is agreed by all parties that alternate concentration limits should be considered , the 5-year monitoring interval will not be frequent enough and will be addressed later.

***Prairie du Chien Wells – Decision Rules C3, C4 and C6***

TCE concentrations have ranged from non-detect to 7.9 ppb (5.5 ppb was incorrectly noted in the meeting) in wells monitored. PCE was detected at 560 ppb in well 5-PC (upgradient to NIROP).

Based on these results (especially the low concentrations of in plume wells), the current sample frequency is not necessary. The team agreed that these wells should be sampled once per 5 years (Table 2). Although not required by the regulatory agencies, 5-PC will be sampled annually to establish temporal upgradient concentrations due to offsite sources.

Based upon the 6/26/02 telecon, it was determined that there is a need to monitor the condition of the PC more frequently than every 5 years in select wells. This is largely based on the importance of the PC aquifer as a regional aquifer. Two PC wells (2-PC and MS-53PC) will be sampled on a frequency of once every two years. The addition of these wells will allow the condition of the PC aquifer to be monitored on a more frequent basis and determination of trends will emerge faster than would be the case by sampling every five years. Specifically, MS-53PC will be sampled more frequently because it is located downgradient from the Navy. Similar to monitoring 5-PC, 2-PC will be sampled more frequently to track migration of offsite contamination onto the Navy property.

**ACP Well Selection**

General Factors Considered When Selecting ACP Wells

- Blow by across the NIROP compliance line into ACP
- Representation of contamination not captured by the capture system in ACP wells
- System complexity
- Using certain wells to monitor the concentrations along the compliance line and using these wells to determine capture performance.
- Trends: There is only one data set available. Significant changes have taken place in ACP. Therefore it will be difficult to eliminate wells from the monitoring program. At least 6 data points are commonly used to establish a temporal trend.
- Data will be useful in making future ACP remedy decisions.

*Note:* Water levels will be measured in all existing monitoring wells to be used to construct equipotential maps for AMR reports and for evaluation of remedial actions.

Capture system performance monitoring: All wells (18-S, 26-S, MS-36S, MS-41S, 4-IS, MS-361, MS-41I, MS-451, 15-D, 36-D, and MS-41D) inside the noted polygons (solid) in the shallow, intermediate, and deep intervals (Figures 1, 2, and 3, respectively) will be sampled annually. Those wells noted with an " * " will be sampled semi-annually (see Table 3 for more information).

ACP plume monitoring All wells inside the noted polygons (dashed) in the shallow, intermediate, and deep intervals (Figures 1, 2, and 3, respectively) will be sampled annually. Wells MS-44S and MS-441 will also be sampled semi-annually for ACP monitoring (in addition to those wells listed above for semi-annual sampling above; see Table 3 for more information).

Vegetable oil pilot scale test monitoring wells are not an issue here because we don't know degree of success for that project.

**General Summary of Sampling Frequency**

Semi-annual sampling will begin in the Spring of 2003. This was decided because the work plan and QAPP will not be able to be prepared and reviewed in time for Spring 2002 sampling.

| 2001 (completed) | 2002 | 2003* | 2004 | 2005 | 2006 | 2007 | 2008* |
|---|---|---|---|---|---|---|---|
| 5yr | | | | | 5yr | | |
| | 2yr | | 2yr | | 2yr | | |

* Indicates five-year review

The 5 ppb contour line was examined. Based on numerous rounds of historical results, the upgradient concentrations values have not changed appreciably. Therefore, the sampling frequency for wells used to establish the 5 ppb contour line do not need to be sampled annually. Once every 2 years was selected as a reasonable frequency.

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| Well Class | Frequency |
|---|---|
| Veg oil wells (identified and sampled by CCI) | Quarterly |
| Wells noted " *" in the ACP | Semiannual |
| All wells not in the other categories | Annual |
| NIROP plume edge wells, and wells not needed to define 100 ppb isoconcentration contour for TCE | Biennial (occurring once every two years) |
| In-plume NIROP wells | Every 5 years |
| PC Wells | Every 5 years with noted exceptions |

**North 40 Concerns:**
Three trenches with leaked barrels were discovered in the early 1980's NIROP site investigation. In the OU2 RI, investigators drilled through a barrel and an emergency removal was done which identified leaked barrels.
Two questions that have been raised are:

1. Where is contamination going and what is the ground water flow direction?
   Resolution: Modeling shows a more direct flow path to Mississippi River whereas hand drawn contours show a more southerly then westerly path to river. The gradient is flat in the N40 and one contour line generally is drawn through the area. Due to the flat gradients it is difficult to definitively identify the groundwater flow direction. Consensus was reached that we should rely on real measured hydraulic heads and professional interpretation of the data over modeling output. We might rethink the MS-421 data and construction to verify contours (rethink the monitored interval of this well).

2. Do we need to install additional 2 nests of wells initially included in the budget?
   Resolution - Action: Keith Henn provided additional lithology data and a N40 monitoring well review to the technical team by April 10,2002. This was followed by a conference call on May 13 2002 at 11:00 am EST to initiate discussion on how to resolve the North 40 monitoring issue and also the intermediate zone monitoring gap issue. Attendees of this meeting were Henn, Kulthau, Davis, Thomas, and Betcher. Casey did not attend the call.

   Two topics were discussed [resolution included in () below]:
   a) Whether MS-421 is monitoring the Shallow or Intermediate Interval. (The technical team concluded that MS-421 monitors the shallow interval and not the intermediate interval. The team noted that by moving this well to the shallow interval there are no monitoring wells in the intermediate zone to monitor groundwater to the north of MS-431 and any groundwater downgradient from the N40 area).
   b) Information to assist in determining if additional wells are needed downgradient from the North 40 (The information was provided, however the need for wells was not resolved. The regulatory agencies will draft a proposal on the number of wells needed and the rationale from their point of view and submit this to the Navy for discussion. Likewise TtNUS will confer further with the Navy).

**Groundwater Sampling Methods**
Keith Henn presented the issues around the various sampling methods. First, it was asked if our sampling objective at this point in LTM is to (1) represent an exposure point concentration similar to drinking water use, or (2) whether the measured concentrations should measure relative concentrations and temporal trends to determine the effectiveness of the remedial system. Slides were used illustrating typical NIROP wells which show a lot of variability in earlier data but less variability in later data.

Discussion ensued about whether use PDBs would be allowed for sample collection. The Navy maintained that data variability may be due in part to the current sampling techniques employed while PDBs could remove much of this variability. The MPCA added that much of the variability in the field may had been removed by standardization of the purge and sample method and that the MPCA provided field

oversight to help to insure that a consistent method was being used. It was also identified that vertical stratification within a well can require characterization of each monitoring well before PDB placement for each well could be determined. The costs of this additional up front work have not been quantified nor has the time needed to do this work determined. It was determined that some wells were located near zones of higher contamination. The MPCA believes that PDBs would not be able to monitor these situations as well as purge and sample methods.

Craig was not comfortable with them, in part, because some studies show that they do not address stratification issues. EPA was also concern that the well screens may not be ideally positioned vertically to capture maximum concentrations of contaminants in the subsurface, but that extended purging helps to capture contamination that may lie slightly above or below the well screen. The use of PDBs would not allow for the creation of such an extended sampling zone from the currently installed wells. Two options were presented by TtNUS which could avoid the stratification issue yet measuring an "average" concentration using the PDB: (1) Use of multiple PDBs with averaging across PDBs or (2) use a longer PDB bag in one well. It was proposed that the site could be periodically "rebaselined" using conventional sample methods to verify PDB performance or to draw correlations between PDBs and purge and sample techniques. PDBs coupled with "rebaselining" would help us meet the objective of measuring exposure point concentrations *and* determine the trends in the system to measure remedy performance. It was stated that trying to use average concentrations by averaging multiple sample results or using long 10 foot bags defeated one advantage of the PDB method which is to determine concentrations from discreet intervals in short screened wells. TtNUS said that PDB can be used to monitor discrete intervals, but are not limited to this - so 'defeating' the 'advantage' is not really relevant.

MPCA stated they were inclined not to approve the use of PDBs because the up front work to characterize each well had not been done. In addition, numerous modifications have been made to the well monitoring and extraction well systems. The sampling methods have been standardized for purge and sample method so concentrations can be compared with past sampling information. The concern that changing sampling methods would add more confusion to data interpretation. Consensus was reached that PDBs would not be used.

All agreed that the next RAWP should specify conventional purge and sample method (same as used in 2001) as the selected sampling method. An option was left to further evaluate the use of PDBs in the future, especially in light of the apparent increased use of PDBs in other states.

Action: Cliff was to verify that Parsons actually prefers purge and sample for the Vegetable Oil Pilot Scale Test sampling.

**Attachment 1. DQO Meeting Record, 2001**

**DQO Meeting Attendees:**

| | | Meeting Dates | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Name** | **Affiliation** | **3/21 - 3/24, C[3]** | **5/24, T** | **7/12, T** | **7/17-19, F** | **8/21, T** | | |
| Joel Sanders | SOUTHDIV | X | | | X | X | | |
| Thomas Bloom | USEPA | X | | | X[4] | X | | |
| Hal Davis | USGS | X | | | X | | | |
| Keith Henn | TtNUS | X | X | | X | X | | |
| Mark Sladic | TtNUS | X | X | | X | X | | |
| Cliff Casey | SOUTHDIV | X | | | X | | | |
| B. Venky Venkatesh[1] | CH2MHILL | X | X | | X | X | | |
| Brian Lewis | TtNUS | X | | X | | X | | |
| John Betcher[2] | MPCA | X | | | X | X | | |
| David Douglas[2] | MPCA | X | | | X | X | | |
| Rick kuhlthau[1] | Techlaw | X | | | X | | | |
| Tom Johnston | TtNUS | X | X | X | X | X | | |
| Paul Rice | Galileo | | | | X | | | |
| Todd Weidemeyer | Parsons | | X | | | | | |
| Dan Griffiths | Parsons | | X | | | | | |
| Mike Troian | MPCA | | | X | | | | |

(1) Not present in the DQO meeting on Friday, March 23, 2001.

(2) Left the DQO meeting on Friday, March 23, 2001 after addressing their comments. The meeting lasted about half an hour beyond that point to address comments of other meeting participants.

(3) The first day of this meeting was a day of DQO training presented by John Warren and Tom Dixon of EPA headquarters.

(4) Arrived late on Tuesday.

C Charleston, SC
F Fridley, MN
T Teleconference

Attachment 2.

EVALUATION OF DIFFERENT METHODS FOR DETERMINING CAPTURE OF THE GROUND-WATER RECOVERY SYSTEM AT THE NIROP FACILITY, FRIDLEY, MINNESOTA

INTRODUCTION

This document discusses 9 different methods that could be used to estimate the capture zone of the ground-water recovery system. Each of the methods is list in the table below and then discussed individually. In reality, no one method may work best for all wells and the best result would be to use several methods in combination.

| METHOD | PROBABILITY THAT METHOD WILL SUCCEED IN DETERMINING IF CAPTURE IS OR IS NOT OCCURRING. | | | | | | |
|---|---|---|---|---|---|---|---|
| | AT9 | AT8 | AT7 | AT3 | AT10 | AT5A | AT5B |
| Aquifer testing to determine Capture zone around wells | Good | Good | Good | Good | Good | Good | Good |
| Analytical equation | Poor | Fair | Fair | Fair | Poor | Good | Good |
| MODFLOW (if the model matches the heads and aquifer complexity within the vicinity of pumping wells) | Good | Good | Good | Good | Good | Good | Good |
| Otherwise | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor |
| Potentiometric maps and flowlines | Good/ Fair | Good/ Fair | Good/ Fair | Good/ Fair | Good/ Fair | Good | Good |
| Borehole flow meter | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor |
| Ground-water heat flow | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor |
| Tracer tests | Poor | Poor | Poor | Fair | Poor | Poor | Poor |
| Basic ground-water inorganic Chemistry | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor | Fair/ Poor |
| Contaminant concentration Changes over time | Fair | Fair | Fair | Fair | Fair | Fair | Fair |

***DISCUSSION OF METHODS***

Aquifer testing to determine capture zone around wells
This method was discussed in detail in the project proposal "Proposal for Determining the Capture Area of Recovery Wells at the NIROP Facility, Fridley, Minnesota", so it will not be discussed further here.

Analytical equation
Analytical equations such as those described by Grubb (1993), Javendel and Tsang (1986), and Todd (1976) can be used to determine the capture zone of a pumping well. These equations assume steady-state pumping and steady-state flow conditions in the aquifer, as well as uniform aquifer properties in the capture zone. Well AT5A is a very good candidate for this method, an aquifer test was conducted on the well and indicated that it fits the assumptions of the equation. Well AT5B should also be a good candidate because the aquifer has a definite upper boundary,

possible uniform permeability, and no nearby lateral boundaries. Wells AT9 and AT10 are probably the worst candidates for this method because of the immediate proximity of lateral low-permeability clay layers. The method may work satisfactorily for wells AT3, AT7, and AT8, the aquifer conditions do not fit the assumptions of the method perfectly, but are probably close enough to yield useful results.

## MODFLOW

If the MODFLOW model closely matches the heads in the vicinity of the pumping wells, uses the known aquifer parameters from the aquifer tests and step-drawdown tests, and is able to accurately represent the distribution of clays around the pumping wells then the model should do a good job of predicting the capture zones.

### Flownets

The flownet method could yield useful results because it is able to incorporate some aquifer complexity.

### Borehole flow meter

This method has been discussed in considerable detail at the technical meetings and everyone probably has already formed an opinion on their accuracy. I have given all the wells a ranking of fair/poor based on the fact that some of the data already collected was contradictory.

### Ground-water heat flow

All the wells were given a ranking of fair to poor because heat flow data is generally hard to interpret. However the data is already being collected and even a relatively simplistic interpretation may yield some useful results.

### Tracer tests

All the wells, except AT3A, were given a ranking of poor. Based on the evaluation conducted in the planning of the "Proposal for Determining the Capture Area of Recovery Wells at the NIROP Facility, Fridley, Minnesota" it appears that there are few well-placed monitoring wells for tracer injection. In addition, any tracer tests woul probably be long-term projects, which would add to difficulty of their execution.

### Basic ground-water inorganic chemistry

Given the highly permeable sands and relatively fast flows the ground water would be expected to have relatively uniform chemical propertied which is why I ranked all the wells fair/poor. But this ranking is obviously speculative and this method may give results that are better than expected. If basic water quality data has been collected in the past it may show that the method has merit.

### Contaminant concentration changes over time

In the long term the contamination levels in the down gradient wells should trend downward and this would be evidence that the recovery system is achieving significant capture. If the contamination levels in the down gradient wells remain high for an extended period of time then this would be evidence that significant amounts of contamination are not being captured.

However, it may take a significant amount time for this trend to develop even if the recovery system is achieving complete capture. Low permeability zones in the vicinity of and up gradient of the monitoring wells could be storing and later releasing contamination, thus causing the measured contamination levels to remain high for a significant period of time.

## References

Todd, D.K., 1976, Groundwater Hydrology, John Wiley and Sons, 535 p.
Grubb, 1993, Analytical Model for Estimation of Steady State Capture Zones of Pumping Wells in Confined and Unconfined Aquifers, Ground Water, v 31, No. 1, p.27
Javendel and Tsang, 1986, Capture-zone type curves: A tool for aquifer cleanup, Ground Water, V. 24, No. 5, pp 616-625

**Approved** 8-21-01

## Problem C. Groundwater Monitoring for Overall Contamination at NIROP

### DQO Step 1. State the Problem

Concerns:

- NIROP groundwater contamination exceeds surface water and ground water ARARs and criterion to be considered (TBCs) as identified in the 5-yr review.
- Need to evaluate whether ROD remedy is protective of human health & environment
- Must obtain info to:
    - evaluate capture,
    - evaluate pilot study effectiveness
    - establish extent of contamination (horizontal and vertical)
    - evaluate integrity of compliance line at the river.
    - evaluate progress in aquifer restoration

Problem Statement : We want to optimize the groundwater monitoring program while providing sufficient data to determine whether the following are being achieved:

1. Contaminated groundwater is prevented from leaving the site
2. Contaminated groundwater is prevented from reaching the Mississippi River.
3. Change in the shape, size, and location, of plume are being tracked.
4. Contaminant levels are being evaluated relative to surface water and groundwater standards.
5. Performance of remedial system is assessed (System = Existing ongoing remedial actions and any future remedial actions which are implemented).
6. Practicability of achieving complete remediation is assessed (won't completely address this under groundwater optimization).

### DQO Step 2. State the Decision

Overall Decision Statement: Determine whether endangerment of public heath and the environment, welfare through hydraulic control and recovery of all future migration of contaminated groundwater from NIROP & recovery to the extent feasible of downgradient contaminated groundwater has been prevented (paraphrased from the ROD).

Note: MPCA may be approached with a proposal for a variance if action levels are not achieved using the best available technology.

Note: Groundwater receptors considered at NIROP:

- Those that drink water from the aquifer beneath or downgradient of NIROP
- Those that drink water from the Minneapolis water supply
- Organisms living in the Miss. River.

Issue: There may be other ways to protect receptors.

Decision Statement

1. If contaminated groundwater (>100 ppb TCE) is migrating beyond the north and south edges of the capture well line along the NIROP compliance line, (see assumptions, Step **4,** Problem B) ,evaluate potential system enhancements, source control, etc., as appropriate to improve the containment system. If not, optimize groundwater monitoring system by selecting different pumping rates,

deselecting wells from the list of monitoring/pumping, etc., as appropriate, based on best professional judgment using data analysis tools described in Attachment 2 (of Problem B: Effectiveness of Capture Well System).

Note: The "capture well line" (wells AT-3, 5A/B, 7, and *8)* is located as close as physically possible to the "NIROP compliance line".

2. If groundwater with contaminants exceeding surface water criteria is entering the river, evaluate/implement a remedy to prevent this (This is related to Problem A: ACP Vegetable Oil VOC Reduction Pilot Study). If contaminated groundwater is not entering the river optimize groundwater monitoring program further.
3. If the change in shape, size, concentration, and location of plume indicate that the remedy is deficient or groundwater monitoring is insufficient, then make adjustments to mitigate the deficiency (action depends on conditions). **If** no change in shape, size, and location, of plume that would indicate that a deficiency is observed then optimize groundwater monitoring program further.
4. If groundwater COC concentrations are > their respective groundwater regulatory limits then continue the remedy, evaluate remedial alternatives (e.g., LUC, etc.), and/or petition for ACL. If not, recommend NFRAP and stop treatment.
5. If cleanup performance for the entire remedial system is unsatisfactory then enhance system performance, evaluate technical impracticability of the system, evaluate remedial alternatives (e.g., LUC, etc.), and/or petition for ACL. If the cleanup performance is satisfactory, further optimize the remedial system, if possible.
6. If achievement of cleanup goals is practicable then continue applying the remedy. If not then demonstrate technical impracticability of the cleanup goals and petition for an ACL.

Note: Item 6 above will only be evaluated when site conditions warrant such an evaluation (e.g.,. remedial system is reaching asymptotic performance levels that do not meet action levels).

Note: Include discussion of applicability of additivity assumption in the Minnesota HRL guidance at the end the remedy in the "Inputs to decision".

**DQO Step 3. Inputs to the Decision**

- SW-846 Method *8260* (as specified in approved QAPP) abbreviated list for groundwater samples (8 COCs shown below)

**Analyte List**

| Analyte[1] | Frequency of Detection (all data to date) | Range of Detection (ug/L) | Location of Maximum Concentration (date and round in [ ] ) |
|---|---|---|---|
| 1,1,1-Trichloroethane | 202/1436 | 0.2 – 690 | 003-TW-033-01 |
| 1,1-Dichloroethane | 418/1436 | 0.2 – 170 | M05PC-[90_R11] |
| 1,1-Dichloroethene | 142/1436 | 0.2 – 380 | 003-TW-033-01 |
| cis-1,2-dichloroethene | 143/317 | 0.2 – 2440 | 18-S-[88_R01] |
| trans-1,2-dichloroethene | 100/385 | 0.2 – 4700 | 18-S-[86_R04] |
| Tetrachloroethene | 484/1436 | 0.2 – 560 | PC-5-[99_R11] |
| Trichloroethene | 1187/1436 | 0.4 – 140000 | GW-01 |
| Vinyl Chloride | 32/1278 | 0.2 – 40 | 003-TW-P09-01 |

*o*

- MDLs to meet regulatory limits (e.g., Decision Statement *#2,* lower DL for VC in compliance wells)
- Well stabilization parameters (according to approved Remedial Action Workplan QAPP, Remedial Action Monitoring Plan)

- Surface water and groundwater quality standards (Attachment TBD)
- Mass removal calculations from extraction wells only (Decision Statement #5)
- Extraction well pumping rates and volumes (cumulative across all wells and individual wells, Decision Statements #1, 3, 4, 5 and 6)
- Water levels from monitoring wells (Decision Statements #1, 3, 4, 5 and 6))
- River gauge measurements (Decision Statements #1, 3, 4, 5 and 6)
- Cost of Operation and Maintenance for GWTF (Decision Statements #1, 4, 5 and 6)
- Potential remedial technology list (Decision Statement #4, 5 and 6)
- Feasibility study of alternatives (Decision Statement #4, 5 and 6)
- Technical impracticability guidance (Decision Statement #4, 5 and 6)

**Note (Added by Keith Henn, evening of 7/19/01):** Consensus: Because mass flux calculation results along the compliance line are no longer needed this calculation will no longer be performed and included in the AMR.

**DQO Step 4. Define Site Boundaries**

***Spatial Boundaries***

All Decision Statements:
- Primary Concern: Unconsolidated aquifer (shallow, intermediate, and deep monitored intervals).
- PDC was evaluated to assess potential downward migration.

Assumption: For purposes of general plume tracking, TCE is representative of the distribution of all contaminants (i.e., all 8 COCs).

Action Item: Partnering team to validate the above assumption by looking for coincidences of plume shape for all 8 COCs. Tag maps will be included in the 2001 AMR to achieve this objective. If assumption is not validated we will re-evaluate DQOs.

Decision Statement #1
- Zone of the NIROP plume that exhibits >100 ppb of TCE for contaminated groundwater beyond the north and south edges of the capture well line along the NIROP compliance line, see assumptions, Step 4, Problem B)

Decision Statement #2
- Zone of the NIROP plume that exhibits any of the 8 COCs > surface water regulatory limits along Mississippi River compliance line of NIROP plume.

Decision Statement #3
- Include PDC aquifer
- Mostly interested in plume edges of NIROP plume (see Problem B Effectiveness of Capture Well System, Step 4 Note).

Assumption: There are no spatial resolution requirements for establishing the location of the plume boundary.

Decision Statement #4
- Extent of TCE-contaminated ground water that is > regulatory limits for unconsolidated and PDC aquifers.

Assumption: TCE is representative of all 8 COCs for purposes of defining perimeter of the plume, however, in the interior of the plume all 8 COCs will be used.

Decision Statements #5 and #6

- Extent of all 8 [COC]s in NIROP plume > regulatory limits for unconsolidated and PDC aquifers.
- Also interested in interior of plume.

***Temporal Boundaries***

Note: Refer to Navy's Guide to Optimal Groundwater Monitoring, Table 4-2 for guidance.

General considerations:

- Temporal boundaries may be well-specific.
- Temporal boundaries may depend on how much data is available (how many rounds of data).

Duration of sampling program:

- Refer to Problem D: Exit Strategy
- Frequency of sampling (can be handled under Step 7). Includes consideration of:
  - Slope of the concentration trend line (approaching asymptote)
  - Sample data variability (i.e., noise)
  - Sampling program changes that are necessary because of containment or treatment system changes
  - Spatial density of sampling points relative to hydrogeologic complexity and proximity to source areas.

Decision Statement #1

- Refer to all general considerations. No other decision–specific temporal boundaries.

Decision Statement #2

- Duration of sampling program is such that we will monitor until we are able to achieve compliance with surface water criteria, including verification.

Decision Statements #3, 4, 5, and 6

- Refer to all general considerations. No other decision –specific temporal boundaries.

**DQO Step 5. Decision Rules**

1. If contaminated ground water (>100 ppb TCE) is migrating beyond the north and south edges of the capture well line along the NIROP compliance line, see assumptions, Step 4, Problem B) based upon the weight of evidence using water level data, TCE concentration trends, and capture zone analysis, then evaluate potential system enhancements, source control, etc., as appropriate.. If not, then optimize the system by selecting different pump rates, deselecting wells from the list of monitoring/pumping, etc., as appropriate based on best professional judgment using data analysis tool identified in Attachment 5. (this is related to Problem B: Effectiveness of Capture Well System).
2. Continue to study/implement a remedy (e.g., Vegetable Oil) until the ground water contaminant concentrations for each COC in all compliance wells are below their respective surface water criterion. (This is related to Problem A: ACP Vegetable Oil VOC Reduction Pilot Study). If contaminated ground water is not entering the river optimize ground water monitoring program further.

Action Item: Partnering Team will involve statisticians to assist the team in identifying how we are going to determine whether groundwater concentrations are below surface water criterion for Decision Rules #2 and 4. Not completed as of August 23, 2001, however progress has been made with EPA statistician (A. Lubin)

3. If the change in shape, size, concentration, and location of plume based upon the weight of evidence using water level data, TCE concentration trends, and capture zone analysis, indicates that the

remedy is deficient or groundwater monitoring is insufficient, then make adjustments to mitigate the deficiency (action depends on conditions). If no change in shape, size, and location, of plume that would indicate that a deficiency is observed, then optimize the ground water monitoring program further.

4. If ground water concentrations in the unconsolidated aquifer are > their respective ground water limits for any of the 8 COCs in any NIROP site well then continue the remedy, evaluate remedial alternatives (e.g., LUC, etc.), and/or petition for ACL. If not, recommend NFRAP and stop treatment.
5. If cleanup performance for the entire remedial system does not achieve cleanup goals within a reasonable timeframe after source reduction/removal/control, then enhance system performance, evaluate technical impracticability of the system, evaluate remedial alternatives (e.g., LUC, etc.), and/or petition for ACL. If the cleanup performance is satisfactory, further optimize the remedial system, if possible.
6. If achievement of cleanup goals is practicable then continue applying the remedy. If not then demonstrate technical impracticability of the cleanup goals and petition for an ACL.

Note: Decision Rule #6 will be evaluated per the technical impracticability guidance.

**DQO Step *6*. Establish Decision Error Tolerance Levels**

Note: The Partnering Team has deferred this step to the statisticians. In this process the statisticians will review and use the Navy's Guide to Optimal Groundwater Monitoring as a guide and to address this problem.

**DQO Step 7. Optimize the Design**

**Well Selection Meeting**
**(DQO Meeting #3)**
**NIROP Fridley**
**Charleston, SC**
**March *6 - 7,2002***

**(Finalized per *6/26/02* tele-con)**

**Attendees**

Jeff Meyers – Navy
Cliff Casey – Navy
John Betcher – MPCA (1, 2)
Rick Kuthau – EPA contractor (2)
Hal Davis – USGS
Venky Venkatesh - CH2MHill/CCI
Keith Henn – TtNUS (2)
Mark Sladic - TtNUS (2)
Tom Johnston - TtNUS
Paul Rice - ICLD
Craig Thomas - US EPA V (2)

Notes:
(3) J. Betcher has proxy to discuss any issue and make decisions for MPCA, because David Douglas could not attend the meeting.
(4) Participants in the 6/26/02 teleconference.

The purpose of this meeting was to select monitoring wells, sampling procedures, and other related items to complete NIROP Fridley data quality objectives (DQOs) Problem C. The results of this meeting will be the basis for the 2002 RAWP. The "previous DQO meetings" (including decision rules) noted in this document refer to meetings held on March 19-23, 2001 and July 17-19, 2001.

Tools were discussed to assist in the well selection process. Based upon discussion at the previous DQO meetings, geostats were introduced by the Navy as a tool. The EPA and MPCA raised questions about the validity of using geostatistics or other computerized means (e.g., MAROS software) of

evaluating the site data given the complexity of the geology and hydrogeology at the site. MPCA and EPA expressed concerns that the geostatistical evaluation of the monitoring network that was done in the past was no longer relevant. However, as identified in the meeting, the Navy was prepared to discuss an updated geostatistical evaluation of the site which included the numerous additions made to the monitoring network based upon the 1999 AMR data. MPCA and EPA asked that if the Navy intends to identify new information or tools in the meeting that it be sent out ahead of the meeting for review. The MPCA expressed the concern that the complexity of the site hydrogeology may violate some of the assumptions of geostatistics. For purposes of this meeting, it was agreed that only hand contouring (triangulation and no geostats) and professional judgement will be used to establish contaminant isoconcentration contours. The discussion did cover the use of geostatistics in the future, including the possibility of the team receiving training in geostatistics. However, this decision was postponed until later in the meeting. At the end of the meeting, it was determined by the group that since the team had been successful in identifying monitoring purposes and needs for individual wells, the use of geostatistics was not necessary and would not be pursued any further. The group decided that MAROS software will not be used.

*Assumption:* TCE concentrations are assumed to be the best indicator parameter of plume size, shape, and location at this time since the majority of VOC contamination in ground water is TCE. This will be tested in the 2001 Annual Monitoring Report (AMR). All eight COCs (which include TCE degradation products) identified in previous DQO meetings will be evaluated. Unless this evaluation shows that the assumption is not correct (e.g., if daughter products of TCE increase or are expected to increase based on remedy) TCE will be used as the indicator parameter for the NIROP plume for the AMR reports.

*Assumption:* In previous DQO meetings it was agreed that the 100 ppb TCE contour would be used to establish the capture zone performance, at least until site is near closure, at which time a more stringent criterion regarding the identification and bounding of contamination will apply. This assumption will be evaluated annually in the AMR (March, 2002).

*Assumption:* The well selection performed is based up 1999 AMR data and 2001 potentiometric surface contour maps. It was determined that this data is the most current agreed representation of the site conditions.

*Assumption:* Annual reviews of well selection will take place in each AMR. Modifications will be made based upon new or more complete data sets, as needed.

*Assumption:* It was noted in the 6/26/02 telecon that many wells have multiple monitoring purposes (as defined below). If a well is to be eliminated from the monitoring network in the future all of these purposes must be evaluated before it can be eliminated.

## Development of a Decision Tree

The team discussed the types of information needed to achieve the project objectives. Later the team decided that, instead of dealing in the abstract, the team should actually go through a well selection process. Through this process the factors that are important would tabulated to develop a decision tree. An attempt was made to capture the thinking behind well selection and to establish how data would be used to support decision making for the 6 decision rules identified in previous DQO meetings. During the selection process the following general factors were identified with the understanding that particular circumstances could cause other factors to be important:

- Relative well concentrations (a desire to bias toward wells with higher concentrations wells)
- Upgradient concentrations
- Proximity of wells to each other (a concern over redundant data due to wells located close together)
- Bracketing important concentration contours with “clean” and “dirty” samples.
- Historical data, especially temporal and spatial trends
- Geology of the site (e.g., the influence of low permeability zones on contaminant movement)
- Representativeness of wells for various purposes (e.g., the capture system vs. plume edge)

- Data variability (e.g., site variability, sampling variability)
- NIROP versus non-NIROP contamination

Where appropriate, wells were classified as cross-gradient, upgradient, in-plume, etc (Tables 1 and 2). Some wells were selected based on inclusion in more than one classification and may therefore have multiple classifications. The text below ties the well selections to the 6 decision rules and provides rationale.

**Decision Rule #C1 (Capture system performance):**

## Shallow Wells

These wells are listed in Table 1

Because MS-40S and MS-401 both monitor the shallow monitored interval, and MS-40S has historically had higher concentrations between the two wells, it was decided that MS-40S would adequately monitor the 100 ug/l contour and MS-401 would not need to be monitored.

Well data from UD-63S will come at the courtesy of UDLP. See Table 3 for this information.

Well 2-S was selected over 16-S as the better well to measure the 100 ppb TCE contour in this area. If future evidence (e.g., hydraulic data) does not validate this assumption, this can be reconsidered.

MPCA plans to have UDLP install wells downgradient of the paint shop where 12,000 ppb TCE was encountered.

The Navy will need copies of UDLP reports to understand if there is a possible influence of UDLP contamination on NIROP plume conditions. The data will be evaluated to determine if it will be useful to attempt to separate UDLP from NIROP-related contamination. See notes in Tables 1, 2, and 3 regarding NIROP wells which may represent UDLP contamination.

*Action :* Navy must request UDLP reports from UDLP (or the MPCA).

The Navy noted that based upon negotiations with UDLP, UDLP will perform O&M responsibilities at the NIROP for four years.

*Action:* Navy should elevate the resolution of separating UDLP and NIROP plumes through David Douglas of MPCA.

*Intermediate Wells:*
Wells are identified in Table 1.
There is no aquifer material in the intermediate interval to the south of AT-5A/B, thus there are no wells in this area.

The group determined, that there is a data gap in the intermediate zone north of MS-431. North of this well no intermediate wells exist to determine the 100 ug/l and other lesser concentration contours. Contours in this area are inferred on AMR maps. A note of this monitoring data gap was made for latter discussion. This data gap will be discussed in a separate conference call. As noted in the summary of the 5/13/02 teleconference call this area and the appropriate amount of data needed to monitor this area is still being evaluated by the partnering team.

## Deep wells

Wells are presented in Table 1.

*Assumption:* The group hasn't completely established the degree of data variability and trends in a select number of wells. The team will continue to track the information collected to better assess this.

Nevertheless, the characteristics are understood enough based upon the 1999 AMR data to select wells at this time.

*Prairie du Chien Wells*
These wells are discussed separately below.

**Decision Rule C2 (Compliance Wells:)**
Concentrations in these wells will be compared to surface water standards. Annual sampling should be conducted to provide enough data to establish trends and facilitate these comparisons. The wells are identified in Table 2.

**Decision Rules C3 (Change in Plume Size, Shape, etc.) and C4 (Meet Cleanup Criteria)**

## Shallow Wells

*Expectation:* "Exterior" wells can be dropped from monitoring as the plume shrinks. No decision criteria were developed for how decisions would'be made to drop monitoring wells.

The isoconcentrationthat will be used to bound the plume for this decision is 5 ppb. This was based upon assumption identified earlier (page 1) indicating that TCE is a sufficient indicator parameter. If this assumption proves to be invalid in each year's AMR then further evaluation will be needed. Other factors than simply TCE will need to be taken into account to make these decisions. The concentration of other compounds will need to be evaluated and the combined risk from multiple compounds will be part of the decision. It might be possible that criteria are exceeded for compounds other than TCE. The issue of verification of results and the number of sampling events required to verify that concentrations are below limits has not been discussed.

Based upon stable concentrations, upgradient wells have been given a low priority until final closeout of the site, at which time better definition of what contamination might be coming onto the site will become an important consideration. As a result, less frequent sampling can be used on these wells.

In-plume wells were selected for the shallow aquifer and are presented in Table 2.

*Assumption:* Since a capture system is in place monitoring source areas within the plume is less of a priority and can be monitored less frequently. Therefore it was agreed that the sampling frequency for in plume wells should be once per 5 years. The next sample round should be in 2006.

Discussion of ACP "in-plume" wells was deferred to later and are discussed in detail below.

## Intermediate Wells

Wells were selected and are presented in Table 2.

Well 3-IS is a dual purpose well (in-plume well and plume edge to define the 100 ppb of TCE) is will be sampled annually.

A monitoring gap North of MS-43I was identified by the group in the intermediate zone. The monitoring gap results in uncertainty in location of the 100 ug/l and other concentration contours. The 100 ug/l contour is being used to evaluate system performance. This is being evaluated by the partnering team at the present time.

## Deep Wells

Wells were selected and are presented in Table 2.

Based upon the 6/26/02 telecon, it was determined that well 4-D will be sampled every two years. The sole purpose of including this well is to define the 5 ppb line for TCE.

Sampling frequencies for MS-29D and MS-31D were not discussed in the mtg. Consistent with other in-plume wells a sampling frequency of 1/5 yr is recommended by TtNUS (see Table 3).

*Prairie du Chien Wells*
These wells are discussed separately below.

**Decision Rules C5 (Enhance System Performance or Evaluate ACL's) and C6 (Technical Impracticability)**
Well selection for this decision rule will be addressed in the ROD and 5 Year review process. If it is agreed by all parties that alternate concentration limits should be considered , the 5-year monitoring interval will not be frequent enough and will be addressed later.

***Prairie du Chien Wells –Decision Rules C3. C4 and C6***
TCE concentrations have ranged from non-detect to 7.9 ppb (5.5 ppb was incorrectly noted in the meeting) in wells monitored. PCE was detected at 560 ppb in well 5-PC (upgradient to NIROP).

Based on these results (especially the low concentrations of in plume wells), the current sample frequency is not necessary. The team agreed that these wells should be sampled once per 5 years (Table 2). Although not required by the regulatory agencies, 5-PC will be sampled annually to establish temporal upgradient concentrations due to offsite sources.

Based upon the 6/26/02 telecon, it was determined that there is a need to monitor the condition of the PC more frequently than every 5 years in select wells. This is largely based on the importance of the PC aquifer as a regional aquifer. Two PC wells (2-PC and MS-53PC) will be sampled on a frequency of once every two years. The addition of these wells will allow the condition of the PC aquifer to be monitored on a more frequent basis and determination of trends will emerge faster than would be the case by sampling every five years. Specifically; MS-53PC will be sampled more frequently because it is located downgradient from the Navy. Similar to monitoring 5-PC, 2-PC will be sampled more frequently to track migration of offsite contamination onto the Navy property.

**ACP Well Selection**
General Factors Considered When Selecting ACP Wells
- Blow by across the NIROP compliance line into ACP
- Representation of contamination not captured by the capture system in ACP wells
- System complexity
- Using certain wells to monitor the concentrations along the compliance line and using these wells to determine capture performance.
- Trends: There is only one data set available. Significant changes have taken place in ACP. Therefore it will be difficult to eliminate wells from the monitoring program. At least 6 data points are commonly used to establish a temporal trend.
- Data will be useful in making future ACP remedy decisions.

*Note:* Water levels will be measured in all existing monitoring wells to be used to construct equipotential maps for AMR reports and for evaluation of remedial actions.

Capture system performance monitoring: All wells (18-S, 26-S, MS-36S, MS-41S, 4-IS, MS-361, MS-41I, MS-451, 15-D, 36-D, and MS-41D) inside the noted polygons (solid) in the shallow, intermediate, and deep intervals (Figures 1, 2, and 3, respectively) will be sampled annually. Those wells noted with an " * " will be sampled semi-annually (see Table 3 for more information).

ACP plume monitoring All wells inside the noted polygons (dashed) in the shallow, intermediate, and deep intervals (Figures 1, 2, and 3, respectively) will be sampled annually. Wells MS-44S and MS-441 will also be sampled semi-annually for ACP monitoring (in addition to those wells listed above for semi-annual sampling above; see Table 3 for more information).

Vegetable oil pilot scale test monitoring wells are not an issue here because we don't know degree of success for that project.

**General Summary of Sampling Frequency**
Semi-annual sampling will begin in the Spring of 2003. This was decided because the work plan and QAPP will not be able to be prepared and reviewed in time for Spring 2002 sampling.

| 2001 (completed) | 2002 | 2003* | 2004 | 2005 | 2006 | 2007 | 2008* |
|---|---|---|---|---|---|---|---|
| 5yr | | | | | 5yr | | |
| | | | | | | | |

The 5 ppb contour line was examined. Based on numerous rounds of historical results, the upgradient concentrations values have not changed appreciably. Therefore, the sampling frequency for wells used to establish the 5 ppb contour line do not need to be sampled annually. Once every 2 years was selected as a reasonable frequency.

Summary of Sampling Frequencies (see Tables and Figures 1, 2, 3 for more info)

| Well Class | Frequency |
|---|---|
| Veg oil wells (identified and sampled by CCI) | Quarterly |
| Wells noted " *" in the ACP | Semiannual |
| All wells not in the other categories | Annual |
| NIROP plume edge wells, and wells not needed to define 100 ppb isoconcentration contour for TCE | Biennial (occurring once every two years) |
| In-plume NIROP wells | Every 5 years |
| PC Wells | Every 5 years with noted exceptions |

**North 40 Concerns:**
Three trenches with leaked barrels were discovered in the early 1980's NIROP site investigation. In the OU2 RI, investigators drilled through a barrel and an emergency removal was done which identified leaked barrels.
Two questions that have been raised are:

1. Where is contamination going and what is the ground water flow direction?
   Resolution: Modeling shows a more direct flow path to Mississippi River whereas hand drawn contours show a more southerly then westerly path to river. The gradient is flat in the N40 and one contour line generally is drawn through the area. Due to the flat gradients it is difficult to definitively identify the groundwater flow direction. Consensus was reached that we should rely on real measured hydraulic heads and professional interpretation of the data over modeling output. We might rethink the MS-421 data and construction to verify contours (rethink the monitored interval of this well).

3. Do we need to install additional 2 nests of wells initially included in the budget?
   Resolution - Action: Keith Henn provided additional lithology data and a N40 monitoring well review to the technical team by April 10, 2002. This was followed by a conference call on May 13 2002 at 11:00 am EST to initiate discussion on how to resolve the North 40 monitoring issue and also the intermediate zone monitoring gap issue. Attendees of this meeting were Henn, Kulthau, Davis, Thomas, and Betcher. Casey did not attend the call.

   Two topics were discussed [resolution included in () below]:

c) Whether MS-421 is monitoring the Shallow or Intermediate Interval. (The technical team concluded that MS-421 monitors the shallow interval and not the intermediate interval. The team noted that by moving this well to the shallow interval there are no monitoring wells in the intermediate zone to monitor groundwater to the north of MS-431 and any groundwater downgradient from the N40 area).

d) Information to assist in determining if additional wells are needed downgradient from the North 40 (The information was provided, however the need for wells was not resolved. The regulatory agencies will draft a proposal on the number of wells needed and the rationale from their point of view and submit this to the Navy for discussion. Likewise TtNUS will confer further with the Navy).

**Groundwater Sampling Methods**

Keith Henn presented the issues around the various sampling methods. First, it was asked if our sampling objective at this point in LTM is to (1) represent an exposure point concentration similar to drinking water use, or (2) whether the measured concentrations should measure relative concentrations and temporal trends to determine the effectiveness of the remedial system. Slides were used illustrating typical NIROP wells which show a lot of variability in earlier data but less variability in later data.

Discussion ensued about whether use PDBs would be allowed for sample collection. The Navy maintained that data variability may be due in part to the current sampling techniques employed while PDBs could remove much of this variability. The MPCA added that much of the variability in the field may had been removed by standardization of the purge and sample method and that the MPCA provided field oversight to help to insure that a consistent method was being used. It was also identified that vertical stratification within a well can require characterization of each monitoring well before PDB placement for each well could be determined. The costs of this additional up front work have not been quantified nor has the time needed to do this work determined. It was determined that some wells were located near zones of higher contamination. The MPCA believes that PDBs would not be able to monitor these situations as well as purge and sample methods.

Craig was not comfortable with them, in part, because some studies show that they do not address stratification issues. EPA was also concern that the well screens may not be ideally positioned vertically to capture maximum concentrations of contaminants in the subsurface, but that extended purging helps to capture contamination that may lie slightly above or below the well screen. The use of PDBs would not allow for the creation of such an extended sampling zone from the currently installed wells. Two options were presented by TtNUS which could avoid the stratification issue yet measuring an "average" concentration using the PDB: (1) Use of multiple PDBs with averaging across PDBs or (2) use a longer PDB bag in one well. It was proposed that the site could be periodically "rebaselined" using conventional sample methods to verify PDB performance or to draw correlations between PDBs and purge and sample techniques. PDBs coupled with "rebaselining" would help us meet the objective of measuring exposure point concentrations *and* determine the trends in the system to measure remedy performance. It was stated that trying to use average concentrations by averaging multiple sample results or using long 10 foot bags defeated one advantage of the PDB method which is to determine concentrations from discreet intervals in short screened wells. TtNUS said that PDB can be used to monitor discrete intervals, but are not limited to this - so 'defeating' the 'advantage' is not really relevant.

MPCA stated they were inclined not to approve the use of PDBs because the up front work to characterize each well had not been done. In addition, numerous modifications have been made to the well monitoring and extraction well systems. The sampling methods have been standardized for purge and sample method so concentrations can be compared with past sampling information. The concern that changing sampling methods would add more confusion to data interpretation. Consensus was reached that PDBs would not be used.

All agreed that the next RAWP should specify conventional purge and sample method (same as used in 2001) as the selected sampling method. An option was left to further evaluate the use of PDBs in the future, especially in light of the apparent increased use of PDBs in other states.

Action: Cliff was to verify that Parsons actually prefers purge and sample for the Vegetable Oil Pilot Scale Test sampling.

**Approved** 8-21-01

**TABLE 1**

**PROBLEM C DECISION RULE 1**
**SUMMARY OF MONITORING WELL TYPES") FOR GROUNDWATER MONITORING**
**DEFINED IN WELL SELECTION MEETING MARCH 2002**
**NIROP FRIDLEY**

| | Wells Needed to Define Plume Edge (to define 100 ppb of TCE) (2, 4) | | | | | | |
|---|---|---|---|---|---|---|---|
| **NIROP Shallow Wells** | | | | | | | |
| | 2-S | USGS 2 | MS-40S | | | | |
| | 5-S | USGS 5 | MS-42I (3) | | | | |
| | 6-S | USGS 8 | MS-43S | | | | |
| | 17-S | MS-34S | MS-52S(1) | | | | |
| | 19-S(1) | UD-63S(1,5) | | | | | |
| | 7-S | | | | | | |
| | | | | | | | |
| **NIROP Intermediate Wells** | | | | | | | |
| | 3-IS | MS-45I | | | | | |
| | MS-29I | MS-46I | | | | | |
| | MS-41I | | | | | | |
| | MS-43I | | | | | | |
| | MS-44I | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | 8-D | MS-36D | MS-43D | | | | |
| | 9-D | MS-40D | MS-44D | | | | |
| | 15-D | MS-41D | MS-47D | | | | |
| | MS-35D | | | | | | |
| | | | | | | | |
| **NIROP Bedrock Wells** | | | | | | | |
| | Not applicable | | | | | | |
| | | | | | | | |
| | | | | | | | |

Notes:
(1) The groundwater tlow direction in the southern portion ot the ACP indicates that the TCE detected in wells MS-52S, MS-521, and MS-52D and perhaps wells 19-S, MS-511, and 9-D may originate from the UDLP site. This has been noted in the 1999 AMR (TtNUS, *2000).* This statement should be documented with all sample results from these wells in each AMR. MPCA, Navy, and UDLP will distinguish between contamination from NIROP and UDLP in the future.
(2) Based upon 1999 AMR analytical data.
(3) This well has been moved to the shallow zone per the tele-con on May 13, 2002.
(4) Many wells have multiple monitoring purposes. If a well is to be eliminated from the monitoring network in the future all of these purposes must be evaluated before it can be eliminated.
(5) Data from UD-63S will come at the courtesy of UDLP. This data may be collected at a different period (–within 6 or *so* months of AMR data). If data is not available then 20-S will be sampled in its place. If this is the case 20-S will represent the plume edge at this location (i.e., in place of UD-63S).

TABLE 2

**PROBLEM C DECISION RULE 2.3 4**
**SUMMARY OF MONITORING WELL TYPES(1,7) FOR GROUNDWATER MONITORING**
**DEFINED IN WELL SELECTION MEETING MARCH 2002**
**NIROP FRIDLEY**

| Upgradient | Back-ground''' | Cross-gradient | Plume Edge | In-Plume NIROP | | Wells in the ACP (8) | | Down-gradient | Point of Compliance | Sentinel'') | Off-Base |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **NIROP Shallow Wells** | | | | | | | | | | | |
| | | 16-S | MS-52S(3) | 3-S(4) | | USGS 5 | MS-38S | | USGS-5 | | |
| 15-S | | MS-52S(3) | 5-S | 8-S(4) | | 17-S | MS-39S | | MS-43S | | |
| 21-S | | USGS 8 | 7-S | 9-S(4) | | 24-S | MS-40S | | MS-44S | | |
| 23-S | | | 16-S | MS-28S(4) | | 11-S | MS-41S | | 27-S | | |
| | | | 25-S | MS-29S(4) | | MS-34S | 18-S | | MS-47S | | |
| | | | USGS 5 | MS-30S(4) | | MS-35S | 27-S | | MS-49S | | |
| | | | USGS 8 | MS-31S(4) | | MS-36S | MS-47S | | 19-S (3) | | |
| | | | UD-63S(2,3) | MS-32S(4) | | MS-37S | MS-49S | | | | |
| | | | | MS-33S(4) | | MS-43S | 26-S | | | | |
| | | | | | | MS-44S | 14-IS | | | | |
| | | | | | | MS-45S | 19-S (3) | | | | |
| | | | | | | MS-46S | | | | | |
| **NIROP Intermediate Wells** | | | | | | | | | | | |
| 1-IS | | 10-IS | MS-43I | 3-IS(4) | | MS-34I | MS-41I | | MS-43I | | |
| 2-IS | | | MS-52I(3) | 5-IS(4) | | MS-35I | MS-45I | | MS-44I | | |
| | | | (5) | MS-28I(4) | | MS-36I | MS-46I | | 16-IS | | |
| | | | | MS-29I(4) | | MS-43I | MS-47I | | MS-47I | | |
| | | | | MS-30I(4) | | MS-44I | MS-49I | | MS-49I | | |
| | | | | MS-31I(4) | | 6-IS | MS-51I (3) | | MS-51I (3) | | |
| | | | | MS-32I(4) | | 8-IS | 4-IS | | | | |
| | | | | MS-33I(4) | | 12-IS | 15-IS | | | | |
| | | | | | | 13-IS | 16-IS | | | | |
| **NIROP Deep Wells** | | | | | | | | | | | |
| 1-D | | none available | 2-D | 12-D (4) | MS-29D (4) | MS-34D | 6-D | | MS-43D | | |
| 14-D | | | 4-D | MS-28D (4) | MS-31D (4) | MS-35D | 7-D | | MS-44D | | |
| | | | | MS-30D (4) | | MS-36D | 8-D | | 16-D | | |
| | | | | MS-32D (4) | | MS-41D | 9-D (3) | | MS-47D | | |
| | | | | MS-33D (4) | | MS-43D | 15-D | | MS-49D | | |
| | | | | | | MS-44D | 16-D | | 9-D (3) | | |
| | | | | | | MS-47D | 17-D | | | | |
| | | | | | | MS-49D | MS-40D | | | | |
| **NIROP Bedrock Wells(6)** | | | | | | | | | | | |
| 1-PC (6) | 4-PC (6) | MS-48PC (6) | | | | | | | | | |
| 2-PC (6) | 5-PC (6) | MS-50PC (6) | | | | | | | | | |
| 3-PC (6) | | MS-53PC (6) | | | | | | | | | |
| Fridley Well 13 | | | | | | | | | | | |

Notes:

(1) No backgroundwells at the site due to offsite contamination migrating onto the Navy property.
(2) Data from UD-63S wilt come at the courtesy of UDLP. This dala may be collected at a different period (~within 6 or so months of AMR data). If data is not available then 20-S will be sampled in its place. If this is the case 20-S will represent the plume edge at this location (i.e., in place of UD-63S).
(3) The groundwater flow direclion in the southern portion of the ACP indicates that Ihe TCE detected in wells MS-52S, MS-52I, and MS-52D and perhaps wells 19-S, MS-51I, and 9-D may originate from the UDLP site. This has been noted in the 1999 AMR (TINUS, 2000). This statement should be documented with all sample results from these wells in each AMR. MPCA. Navy. and UDLP will distinguish between contamination from NIROP and UDLP in the future.
(4) These wells will be sampled once every 5 years beginning in 2001 (ie., the next sample round will be in 2006).
(5) Northwest of NIROP Plant building (western N40 area) monitoring is pending further discussion.
(6) The well types for this layer were not identified by the Parntering Team.
(7) Many wells have multiple monitoring purposes. If a well is lo be eliminated from the moniloring network in the future all of these purposes must be evaluated before it can be eliminated.
(8) Refer to the well meeting notes and polygons noted by the partnering team on the attached Figures 1, 2, and 3.

TABLE 3

SUMMARY OF GROUNDWATER SAMPLING NETWORK"
DEFINED IN MARCH 2002 WELL SELECTION MEETING
NIROP FRIDLEY


| | 2001 (completed) | | 2002 | | | 2003[1] | | 2004 | | 2005 | | 2006 | | 2007[2] | 2008[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | semi-annual | annual | quarterly[3] | semi-annual | annual | semi-annual | annual | semi-annual | annual | semi-annual | annual | semi-annual | annual | | |
| **NIROP Shallow Wells** | | | | | | | | | | | | | | | |
| 1-S | | | | | X | | | | X | | | | X | | |
| 2-S | | | | | X | | | | X | | | | X | | |
| 3-S | | X | | | | | | | | | | | X | | |
| 4-S | | | | | | | | | | | | | | | |
| 5-S | | | | | X | | | | X | | | | X | | |
| 6-S | | | | | X | | X | | X | | X | | X | | |
| 7-S | | X | | | X | | | | X | | | | X | | |
| 8-S | | X | | | | | | | | | | | X | | |
| 9-S | | X | | | X | | | | X | | | | X | | |
| 10-S | | | | | | | | | | | | | | | |
| 11-S | | | | | X | | X | | X | | X | | X | | |
| 11-SB | | | | | | | | | | | | | | | |
| 12-S | | | | | | | | | | | | | | | |
| 13-S | | | | | | | | | | | | | | | |
| 14-S | | | | | | | | | | | | | | | |
| 14-IS | | X | | | X | | X | | X | | X | | X | | |
| 15-S | | X | | | X | | | | X | | | | X | | |
| 16-S | | X | | | | | | | | | | | X | | |
| 17-S | | X | | | X | | X | | X | | X | | X | | |
| 18-S | | X | | | | X | | X | | X | | X | | | |
| 19-S[7] | | X | | | X | | X | | X | | X | | X | | |
| 20-S[4] | | X | | | X | | X | | X | | X | | X | | |
| 21-S | | X | | | X | | | | X | | | | X | | |
| 22-S | | | | | | | | | | | | | | | |
| 23-S | | | | | X | | | | X | | | | X | | |
| 24-S | | X | | | X | | X | | X | | X | | X | | |
| 25-S | | | | | X | | X | | X | | X | | X | | |
| 26-S | | X | | | | X | | X | | X | | X | | | |
| 27-S[3,6] | | X | X | | | | X | | X | | X | | X | | |
| MS-28S | | X | | | | | | | | | | | X | | |
| MS-29S | | | | | | | | | | | | | X | | |
| MS-30S | | | | | | | | | | | | | X | | |
| MS-31S | | X | | | | | | | | | | | X | | |
| MS-32S | | X | | | | | | | | | | | X | | |
| MS-33S | | X | | | | | | | | | | | X | | |
| MS-34S | | X | | | X | | X | | X | | X | | X | | |
| MS-35S | | X | | | X | | X | | X | | X | | X | | |
| MS-36S | | X | | | X | X | | X | | X | | X | | | |
| MS-37S | | X | | | X | | X | | X | | X | | X | | |
| MS-38S | | | | | X | | X | | X | | X | | X | | |
| MS-39S | | | | | X | | X | | X | | X | | X | | |
| MS-40S | | X | | | X | | X | | X | | X | | X | | |
| MS-40I | | | | | | | | | | | | | | | |
| MS-41S | | X | | | X | X | | X | | X | | X | | | |
| MS-43S | | X | | | X | | X | | X | | X | | X | | |
| MS-44S | | X | | | X | X | | X | | X | | X | | | |
| MS-45S[3,6] | | X | X | | | | X | | X | | X | | X | | |
| MS-46S | | X | | | X | | X | | X | | X | | X | | |
| MS-47S[3,6] | | X | X | | | | X | | X | | X | | X | | |
| MS-49S | | X | | | X | | X | | X | | X | | X | | |
| MS-52S[7] | | X | | | X | | X | | X | | X | | X | | |
| USGS 1 | | | | | | | | | | | | | | | |
| USGS 2 | | X | | | X | | | | X | | | | X | | |
| USGS 3 | | | | | | | | | | | | | | | |
| USGS 4 | | | | | | | | | | | | | | | |
| USGS 5 | | X | | | X | | X | | X | | X | | X | | |
| USGS 6 | | | | | | | | | | | | | | | |
| USGS 7 | | | | | | | | | | | | | | | |
| USGS 8 | | X | | | X | | X | | X | | X | | X | | |
| USGS 9 | | | | | | | | | | | | | | | |
| AT-5A | X | | | X | | X | | X | | X | | X | | | |
| AT-7 | X | | | X | | X | | X | | X | | X | | | |
| AT-8 | X | | | X | | X | | X | | X | | X | | | |
| AT-9 | X | | | X | | X | | X | | X | | X | | | |
| | | | | | | | | | | | | | | | |
| **NIROP Intermediate Wells** | | | | | | | | | | | | | | | |
| 1-IS | | X | | | X | | | | X | | | | X | | |
| 2-IS | | X | | | X | | | | X | | | | X | | |
| 3-IS | | X | | | X | | X | | X | | X | | X | | |
| 4-IS | | X | | | X | X | | X | | X | | X | | | |
| 5-IS | | X | | | | | | | | | | | X | | |
| 6-IS | | | | | X | | X | | X | | X | | X | | |

Wells selected for groundwater sampling will be determined based upon 2006 sample results.

TABLE 3

SUMMARY OF GROUNDWATER SAMPLING NETWORK[2,9]
DEFINED IN MARCH 2002 WELL SELECTION MEETING
NIROP FRIDLEY
Page 2 of 3

| | 2001 (completed) | | 2002 | | | 2003[1] | | 2004 | | 2005 | | 2006 | | 2007[2] | 2008[1,2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | semi-annual | annual | quarterly[3] | semi-annual | annual | semi-annual | annual | semi-annual | annual | semi-annual | annual | semi-annual | annual | | |
| 7-IS | | | | | | | | | | | | | | Wells selected for groundwater sampling will be determined based upon 2006 sample results. | |
| 8-IS | | | | | X | | X | | X | | X | | X | | |
| 10-IS | | | | | X | | | | X | | | | X | | |
| 12-IS | | X | | | X | | X | | X | | X | | X | | |
| 13-IS | | | | | X | | X | | X | | X | | X | | |
| 15-IS | | X | | | X | | X | | X | | X | | X | | |
| 16-IS | | X | | | X | | X | | X | | X | | X | | |
| MS-28I | | X | | | | | | | | | | | X | | |
| MS-29I | | X | | | X | | X | | X | | X | | X | | |
| MS-30I | | X | | | | | | | | | | | X | | |
| MS-31I | | | | | | | | | | | | | X | | |
| MS-32I | | X | | | | | | | | | | | X | | |
| MS-33I | | X | | | | | | | | | | | X | | |
| MS-34I | | | | | X | | X | | X | | X | | X | | |
| MS-35I | | X | | | X | | X | | X | | X | | X | | |
| MS-36I | | X | | | X | X | | X | | X | | X | | | |
| MS-41I | | X | | | X | X | | X | | X | | X | | | |
| MS-42I[8] | | | | | X | | X | | X | | X | | X | | |
| MS-43I | | X | | | X | | X | | X | | X | | X | | |
| MS-44I | | X | | | X | X | | X | | X | | X | | | |
| MS-45I | | X | | | X | X | | X | | X | | X | | | |
| MS-46I | | | | | X | | X | | X | | X | | X | | |
| MS-47I | | X | | | X | | X | | X | | X | | X | | |
| MS-49I | | X | | | X | | X | | X | | X | | X | | |
| MS-51I[7] | | X | | | X | | X | | X | | X | | X | | |
| MS-52I[7] | | X | | | X | | X | | X | | X | | X | | |
| AT-3A | X | | | X | | X | | X | | X | | X | | | |
| AT-10 | X | | | X | | X | | X | | X | | X | | | |
| | | | | | | | | | | | | | | | |
| **NIROP Deep Wells** | | | | | | | | | | | | | | | |
| 1-D | | X | | | X | | | | X | | | | X | | |
| 2-D | | | | | X | | | | X | | | | X | | |
| 3-D | | | | | | | | | | | | | | | |
| 4-D | | | | | X | | | | X | | | | X | | |
| 5-D | | | | | | | | | | | | | | | |
| 6-D | | X | | | X | | X | | X | | X | | X | | |
| 7-D | | X | | | X | | X | | X | | X | | X | | |
| 8-D | | X | | | X | | X | | X | | X | | X | | |
| 9-D[7] | | X | | | X | | X | | X | | X | | X | | |
| 10-D | | | | | | | | | | | | | | | |
| 11-D | | | | | | | | | | | | | | | |
| 12-D | | X | | | | | | | | | | | X | | |
| 13-D | | | | | | | | | | | | | | | |
| 14-D | | | | | X | | | | X | | | | X | | |
| 15-D | | X | | | X | X | | X | | X | | X | | | |
| 16-D | | X | | | X | | X | | X | | X | | X | | |
| 17-D | | X | | | X | | X | | X | | X | | X | | |
| MS-28D | | X | | | | | | | | | | | X | | |
| MS-29D | | | | | | | | | | | | | X | | |
| MS-30D | | | | | | | | | | | | | X | | |
| MS-31D | | | | | | | | | | | | | X | | |
| MS-32D | | X | | | | | | | | | | | X | | |
| MS-33D | | X | | | | | | | | | | | X | | |
| MS-34D | | | | | X | | X | | X | | X | | X | | |
| MS-35D | | X | | | X | | X | | X | | X | | X | | |
| MS-36D | | X | | | X | X | | X | | X | | X | | | |
| MS-40D | | X | | | X | | X | | X | | X | | X | | |
| MS-41D | | | | | X | X | | X | | X | | X | | | |
| MS-43D | | | | | X | | X | | X | | X | | X | | |
| MS-44D | | X | | | X | | X | | X | | X | | X | | |
| MS-47D | | X | | | X | | X | | X | | X | | X | | |
| MS-49D | | X | | | X | | X | | X | | X | | X | | |
| MS-52D[7] | | X | | | | | | | | | | | | | |
| USGS 10 | | | | | | | | | | | | | | | |
| AT-5B | X | | | X | | X | | X | | X | | X | | | |
| | | | | | | | | | | | | | | | |
| **NIROP Bedrock Wells** | | | | | | | | | | | | | | | |
| 1-PC | | | | | | | | | | | | | X | | |
| 2-PC | | | | | X | | | | X | | | | X | | |
| 3-PC | | | | | | | | | | | | | X | | |
| 4-PC | | | | | | | | | | | | | X | | |
| 5-PC[5] | | X | | | X | | X | | X | | X | | X | | |
| MS-48PC | | X | | | | | | | | | | | X | | |

**TABLE 3**

**SUMMARY OF GROUNDWATER SAMPLING NETWORK[2,9]**
**DEFINED IN MARCH 2002 WELL SELECTION MEETING**
**NIROP FRIDLEY**
**Page 3 of 3**

| | 2001 (completed) | | 2002 | | | 2003[1] | | 2004 | | 2005 | | 2006 | | 2007[2] | 2008[1,2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | semi-annual | annual | quarterly[3] | semi-annual | annual | semi-annual | annual | semi-annual | annual | semi-annual | annual | semi-annual | annual | | |
| MS-50PC | | | | | | | | | | | | | X | Wells selected for groundwater sampling will be determined based upon 2006 samp | |
| MS-53PC | | X | | | X | | | | X | | | | X | | |
| Fridley Well 13 | X | | | | X | | | | X | | | | X | | |
| | | | | | | | | | | | | | | | |
| **NIROP ACP Oil Injection Wells[3]** | | | | | | | | | | | | | | | |
| PES-CW-1 | | | X | | | | | | | | | | | | |
| PES-CW-2 | | | X | | | | | | | | | | | | |
| PES-CW-3 | | | X | | | | | | | | | | | | |
| PES-MW-1 | | | X | | | | | | | | | | | | |
| PES-MW-2 | | | X | | | | | | | | | | | | |
| PES-MW-3 | | | X | | | | | | | | | | | | |
| PES-MW-4 | | | X | | | | | | | | | | | | |
| PES-MW-5 | | | X | | | | | | | | | | | | |
| PES-MW-6 | | | X | | | | | | | | | | | | |
| PES-MW-7 | | | X | | | | | | | | | | | | |
| PES-MW-8 | | | X | | | | | | | | | | | | |
| PES-MW-9 | | | X | | | | | | | | | | | | |
| PES-INJ-1 | | | X | | | | | | | | | | | | |
| PES-INJ-2 | | | X | | | | | | | | | | | | |
| PES-INJ-3 | | | X | | | | | | | | | | | | |
| PES-BG-1 | | | X | | | | | | | | | | | | |
| BG-2 | | | X | | | | | | | | | | | | |
| BG-3 | | | X | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **UNITED DEFENSE LP WELLS** | | | | | | | | | | | | | | | |
| UD63-S[4] | | | | | X | | | | X | | | | X | | |

Notes:
1. Five year Review Report
2. LTM will be evaluated each year in the Annual Monitoring Report. Plan for 2007 and 2008 will be determined based upon 2006 data.
3. Quarterly sampling Will be performed by CCI tor the Veg. Oil Treatability Study at a frequency of 0, 2, 5.8, 12 months plus any contingency sample rounds. Sampling began in December 2001.
4. Data from UD-63S will come at the courtesy of UDLP. This data may be collected at a different period (-within 6 or so months of AMR data). If data is not available then 20-S will be sampled in its place. If this is the case 20-S will represent the plume edge at this location (i.e., in place of UD-63S).
5. Navy is sampling on an annual basis to determine the Contaminant migration coming from an upgradient source. This decision is not being dictated by the regulatory agencies or partnering team.
6. Samping performed by CCI for the Veg. Oil Treatability Study will be done in place of AMR samping. However, this data will be reported in the AMR.
7. The groundwater flow direction in the southern portion of the ACP indicates that the TCE detected in wells MS-52S, MS-52I, and MS-52D and perhaps wells 19-S, MS-51I, and 9-D may originate from the UDLP site. This has been noted in the 1999 AMR (TtNUS, 2000). This statement should be documented with all sample results from these wells in each AMR. MPCA, Navy, and UDLP will distinguish between contamination from NIROP and UDLP in the future.
8. This well has been moved to the shallow zone per the tele-con on May 13, 2002.
9. Many wells have multiple monitoring purposes. If a well is to be eliminated from the monitoring network in the future all of these purposes must be evaluated before it can be eliminated.

# APPENDIX C

# MPCA RISK BASED SITE CHARACTERIZATION AND SAMPLING GUIDANCE

# Superfund and Voluntary Investigation and Cleanup Programs Minnesota Pollution Control Agency

## Sampling Standard Operating Procedure at the Naval Industrial Reserve Ordnance Plant Remedial Action Work Plan

**Rev. 0; Dated 10/02**

# TABLE OF CONTENTS


**1.0 INTRODUCTION** ..... **4**

**2.0 ADVANCE PREPARATION FOR SAMPLING** ..... **4**
2.1 Selection Of Analytical Parameters ..... 4
2.2 Detection Limits ..... 4
2.3 Quality Assurance For Field Procedures ..... 4
2.4 Sampling Containers And Preservatives ..... 5
2.5 Purging And Sampling Equipment ..... 5
2.6 Decontamination. Storage And Transport Of Equipment ..... 5
2.7 Selection Of Sample Collection Techniques ..... 6
2.8 Order of Sampling ..... 6

**3.0 PRELIMINARY FIELD WORK** ..... **6**
3.1 Field Inspections And Field Decisions ..... 6
3.2 Detection Of Immiscible Layers ..... 6
3.3 Water-Level Measurements ..... 7
3.4 Field Water-Quality Measurements ..... 7
3.5 Purging And Stabilization ..... 8

**4.0 SAMPLE COLLECTION** ..... **9**
4.1 Pump Setting ..... 9
4.2 Sample Filtration ..... 9
4.3 Filling Sample Containers ..... 9
4.4 Field Blanks and Replicates ..... 10
Field Blank Samples ..... 10
Field Replicate Samples ..... 11
Field Split Samples ..... 11

**5.0 DOCUMENTATION OF SAMPLING EVENT** ..... **11**
5.1 Sample Identification ..... 11
5.2 Chain Of Custody ..... 12
Field Chain of Custody Documentation ..... 12
Chain of Custody During Shipping and Transfer of Samples ..... 12
5.3 Field Sampling Log ..... 13
5.4 Exceptions To Sampling Protocol ..... 13
5.5 Field Conditions ..... 13

**6.0 SAMPLE PRESERVATION. HANDLING AND TRANSPORT** ..... **13**
6.1 Sample Preservation ..... 13
6.2 Sample Handling And Transport ..... 13

# LIST OF TABLES

Table I: Sample Containers, Filling Method, Preservation and Holding Times ..... 14

# LIST OF FIGURES

Figure I: Location of Sampling Points ..... 15

# LIST OF APPENDICES

APPENDIX A: SELECTED ANALYTICAL PARAMETERS, METHOD NUMBERS AND REPORTING LIMITS ..... 16

# REFERENCES

**Ref. 1:** Remedial Action Work Plan at the Naval Industrial Reserve Ordnance Plant (NIROP), Fridley, Minnesota, October 2002 and any updates thereto, prepared by Tetra Tech NUS. Inc.

# Superfund and Voluntary Investigation and Cleanup Programs

## Sampling Standard Operating Procedure at the Naval Industrial Reserve Ordnance Plant REMEDIAL ACTION WORK PLAN

## 1.0 INTRODUCTION

This document outlines procedures to be used for ground water quality measurements and for collecting and handling ground water samples obtained from monitoring wells at the Naval Industrial Reserve Ordnance Plant (NIROP), Fridley. Minnesota during the remedial action. Deviations from these procedures may be required by unforeseen circumstances that develop during the sampling event(s). Such deviations will be approved by the lead technical staff or the field crew leader as described below. When regulatory or lead technical staff approvals cannot be obtained in advance. deviations from the established procedures will be evaluated as soon as possible after sampling and the need for re-sampling will be evaluated. Deviations from the specified procedures will be clearly noted on the sampling information form (SIF) used for the sampling of each well and will be included in the Remedial Action Report.

This document will be used in con-junction with the ***Remedial Action*** Work ***Plan, Naval Industrial Reserve Ordnance Plant (NIROP). Fridley. Minnesota, October*** 2002 and any updates thereto, prepared by Tetra Tech NUS, Inc. (Ref. 1).

## 2.0 ADVANCE PREPARATION FOR SAMPLING

Selection of analytical parameters. laboratory arrangements, the order of sampling wells, field measurement and sampling techniques. equipment selection and other quality assurance measures are based on the sampling objectives presented in the main body of the Work Plan.

### 2.1 Selection of Analytical Parameters

Samples will be collected for analysis of the parameters shown in Table 4-6 and Table 5-2 of Ref. 1 to fulfill requirements of the MPCA Superfund and/or Voluntary Investigation and Cleanup (VIC) programs. Samples will be collected from the wells listed in Table 4-3 of Ref. 1. A summary of the groundwater sampling network is provided in Table 4-5 of Ref. I.

Analytical techniques for organic compounds were selected primarily on the basis of ability to detect potential contaminants at low levels.

### 2.2 Detection Limits

Practical quantitation limits are listed in Table 4-6 and Table 5-2 of Ref. I.

### 2.3 Quality Assurance for Field Procedures

Particular care will be exercised to avoid the following common ways in which cross contamination or background contamination may compromise ground water samples:

- improper storage or transportation of equipment
- contaminating the equipment or sample bottles on site by setting them on or near or downwind of potential contamination sources such as uncovered ground, a contaminated vehicle, or vehicle or generator exhaust
- handling bottles or equipment with dirty hands or gloves

- inadequate cleaning of well purging or sampling devices

Field methods quality assurance verification procedures are described below in Section **4.4,** "Field Blanks, Replicates and Split Samples". Field personnel should work under the assumption that contamination exists in land surface, soil and vegetation near sampling points, wash water, etc. Therefore, exposure to these media will be minimized by taking at least the following precautions:

- minimizing the amount of rinse water left on washed materials
- minimizing the time sampling containers are exposed to airborne dust or volatile contaminants in ambient air
- placing equipment on clean. ground-covering materials instead of on the land surface

Clean gloves made of appropriately inert material will be worn by all field crew. Gloves will be kept clean while handling saniplinp-related materials. The gloves will be replaced by a new pair between each sampling site.

## 2.4 Sampling Containers and Preservatives

Laboratory-supplied sampling containers and preservatives to be used for samples from all wells are shown in Table 4-7 and Table 5-3 of Ref. 1. The Lahoratory Quality Assurance Project Plan (Lab-QAPP) (Appendix A of Ref. 1, Volume **11)** includes specific procedures for the following: sample container cleaning. testing, labeling and storage; preparation and addition of preservatives. Preservatives for volatile organic samples are added to the sample container in the tield. Chemical preservatives for all other parameters are added in the laboratory before samples are collected.

## 2.5 Purging and Sampling Equipment

Well purging and sampling equipment includes the following:

- decontaminated submersible pumps and/or bladder pumps
- decontaminated pump discharge lines
- other equipment such as rope. gloves, generators, air compressors (with air/oil filter), etc.

## 2.6 Decontamination, Storage and Transport of Equipment

Decontaminated pump tubing will be used each time each well is sampled. Between sampling events, the tubing will be stored in a sealed. chemically inert plastic bag. Pump bladders will be decontaminated by circulating decontamination fluids through the pump as described below.

All sampling-related equipment including filtration devices, personal protection gear and materials coming into contact with actual sampling equipment or with sampling personnel will be decontaminated. Decontamination will be performed before and after working at each sampling point, at a decontamination station in the field or **at** each individual sampling point in the field. All equipment will be handled in a manner that will minimize cross-contamination between wells and avoid introducing surface contamination or ambient air contamination into a well.

Before mobilizing for field work or performing any decontamination, a source of "control" water and organic-free deionized water for decontamination will be selected and evaluated. The evaluation process will include sufficient laboratory analysis to assess the suitability of the proposed water. The proposed decontamination water will only be used for decontamination if analyses indicate it is appropriate for the complete set of target parameters. In the event that use of a desorbing agent is necessary. the desorbing agent will be reagent grade isopropyl alcohol. Equipment will be decontaminated in the following manner:

A. Equipment that does not contact sample water or the inside of the well:

- clean (inside and out ) with an Alconox/clean-water solution - applied with a scrub brush where practical
- rinse with clean "control" water
- inspect for remaining particles or surface film and repeat cleaning and rinse procedures if necessary

B. Equipment that contacts sample water or the inside of the well:

- clean (inside and out where possible) with an Alconox/clean-water solution - applied with a scrub brush made of inert materials
- rinse with potable water
- rinse with isopropyl alcohol
- rinse with organic-free deionized water
- inspect for remaining particles or surface film and repeat cleaning and rinse procedures if necessary
- shake off remaining water and allow to air dry

The internal surfaces of pumps and tubing that cannot be adequately cleaned by the above methods alone will also be cleaned by circulating decontamination fluids through them. The'fluids will be circulated through this equipment in the order shown above under "B".

Wastewater from well purging and equipment cleaning will be containerized on-site until analytical results are obtained to determine proper disposal. Disposable personal protective and sampling equipment will be containerized on-site and staged inside NIROP building for disposal at a sanitary landfill after characterization.

When transporting or storing equipment after cleaning, the equipment will be protected in a manner that minimizes the potential for contarnination. The tubing will be placed in a clean, inert plastic bag or wrapped in aluminum foil.

## 2.7 Selection of Sample Collection Techniques

Sample collection techniques outlined in this document have been tailored to the goals of this sampling event and the individual characteristics of this site. A summary of the sampling goals and the pertinent site, well and contaminant characteristics is given in the Work Plan.

## 2.8 Order of Sampling

The ground water monitoring wells will be purged and sampled in the following order: contingency wells, monitoring wells (starting from the most downgradient well), injection wells, and background well to minimize cross' contamination.

# 3.0 PRELIMINARY FIELD WORK

## 3.1 Field Inspections and Field Decisions

Before purging or sampling, all wells should be inspected to verify that:

- all sampling points are safely accessible;
- all wells are in satisfactory condition;
- current water levels indicate a gradient consistent with the preliminary order of well sampling;
- the existing health and safety plan procedures are appropriate for actual site conditions;
- well depth and that the annular seal is intact at the surface.

Any unusual conditions including the presence of wind-blown dust or odor in the ambient air should be recorded on the SIF.

## 3.2 Detection of Immiscible Layers

Air inside a well suspected of significant contamination will be tested immediately with an organic vapor-detecting device such as PID or FID. The measurement will be recorded on the SIF. If immiscible layers of contaminants (free product "floaters" or "sinkers") are suspected or if odors or an oil sheen are observed, procedures will be followed to characterize the distribution of contaminants in the water-yielding zone adjacent to the well screen. Because free product can accumulate anywhere from the top to the bottom of the water column, the normal sequence of purging and sampling will be preceded by a free-product evaluation step to allow for the best characterization of contamination. An attempt to measure the thickness of any free product will be made using the following equipment:

electric water-level probe or oil/water interface probe. General procedures for detection and sample collection of immiscible layers will be in accordance with guidance provided in U.S. EPA RCRA Ground-Water Monitoring: Draft Technical Guidance, November 1992, Section 7.2.3. Specific detailed procedures actually used in response to site/well conditions will be recorded on the SIF and included in the Remedial Action Report. The presence of and characteristics of any detected immiscible layers will be noted on the SIF.

A bailer will be used to collect any pre-purging samples from the water table surface and a thief sampler will be used to collect any pre-purging discrete-interval samples from below the top of the water column. In addition to any discrete-interval samples collected, an additional sample will be collected from near the middle of the water column after normal purging. Analytical needs for these three samples: will be reviewed with the Superfund Program technical representative to determine which analyses are required for each sample. Visual screening or sequential analysis of samples may eliminate the need to analyze all samples collected in some circumstances.

## 3.3 Water-Level Measurements

Prior to any well evacuation or sampling, initial static water levels will be measured and recorded for all wells. This. is done to facilitate selection of the proper pump intake depths for purging and sampling and calculation of the ground water flow direction.

During initial static water level measurement, a minimum of two water level measurements will be made at each well. The two water level measurements will be made in rapid succession. If there is poor agreement between the first and second static water level measurements (i.e., a difference of more than 0.01 feet). data will be re-evaluated for measurement errors, unsuspected pumping that may be causing transient changes in gradient, etc. If the discrepancy cannot be rectified, a third static water level measurement will be made at each questionable sampling point to assess the true water level, verify non-steady state conditions, etc.

The sampling crew will make water-level measurements at all appropriate monitoring wells and piezometers within the shortest time interval practical to provide comparable numbers by which to calculate the ground water gradient. A time limit exceeding 8 hours will be considered a reportable protocol exception for this sampling event. An additional water level measurement will be taken immediately after sampling to evaluate potential cascading problems. These water levels will be entered on the SIF.

Water levels will be measured with an electric water-level probe. The depth-to-water should be referenced to the measuring point marked at the top of the innermost well casing. Where a measuring point has not been marked at the top of the casing, the measuring point will be assumed to be at the top of the innermost casing on the north side of the casing. When reporting absolute water level elevation, this measurement will be converted to water level elevation (MSL) from the surveyed elevation of the top of well casing. Water level measurement data will be recorded on the SIF.

## 3.4 Field Water-Quality Measurements

Specific conductance, pH, temperature, and turbidity will be measured in the field immediately before sample collection. All measurements will be recorded on the SIF. Purging and stabilization information will also be noted on the SIF.

All measurements except for turbidity will be taken within a closed flow cell device designed to allow measurement of these parameters while minimizing changes in temperature, pressure, and dissolved gases from the in-situ aquifer environment. The flow cell has the following characteristics:

- Air tight fittings for installation of all probes.
- Intake is connected directly to the pump discharge line.
- Resides in a water bath kept at a temperature close to the in-situ ground water temperature.
- A discharge line of sufficient length that is connected to the flow cell with an airtight connection.
- A maximum volume of no greater than five times the per minute volumetric rate of inflow to the cell to maintain measurement sensitivity to temporal changes in water quality.
- A minimum volume of 350 mL to provide enough thermal mass to minimize external temperature effects.

- The flow cell will be shielded from strong winds and on hot days it will be shielded from direct sunlight

The operation of the probes will be as follows:

1. The flow of extracted ground water through the flow cell will be maintained as continuous and steady as practical throughout the measurement period.
2. Discharge rates through the flow cell are kept low enough to prevent streaming potential problems with probes.
3. All probes will be fully immersed without touching the sides of the airtight. non-metallic flow cell.
4. All probes will be allowed to equilibrate with fresh well .water for a minimum of five minutes before recording measurements.

Specific procedural details lor measurement of individual field water quality parameters are outlined in the manufacturer's instruction/owner's manual. General care, maintenance, calibration procedures, and operation of each measurement device will also follow manufacturer's specifications as detailed in the instructiodowner's manual for each device.

## 3.5 Purging and Stabilization

Before a well is sampled lor the dissolved phase. it will be purged as described above to ensure that samples contain fresh formation water While the well is being purged, water quality parameters described above in Section 3.4, "Field Water-Quality Measurements". and the quantity of water purged will be recorded on the SIF.

A purging rate that will minimize drawdown while allowing the well to be purged in a reasonable length of time will be used and recorded on SIF Care will be taken to avoid any significant amount of cascading or turbulence in the well.

Wells with extremely slow recharge rates due to tight formation materials will require alternate purging and sampling methods. If normal purging is clearly impractical, the well will be pumped to near dryness and allowed to partially recover for a maximum of one hour. Sampling will then commence as soon as possible after evacuation.

Wells that do not have extremely slow recharge rates will be purged and sampled as described below. Purging will be conducted in a manner that. to the extent practical, removes all the "old" water in the well so it is replaced by fresh ground water from outside the well installation. Wells will be purged at a maximum purge rate not to exceed the draw down of more than two (2) feet.

1. The well will be purged by placing the pump just below the water table. (NOTE: It is possible that for some shallow wells that the water level will be within the screen. If this is the case, the same procedure for purging and sampling can be used although in some cases the pump will have to be within the screened interval due to necessity.)
2. Repeated vertical adjustment of the purging equipment intake will be avoided if possible, but may be necessary as the water level drops.
3. Decontaminated submersible pumps and/or bladder pumps will be used for purging and sampling.
4. Sampling will immediately follow purging and stabilization.

Field water quality parameters will be measured for stabilization after each water-column volume is purged. The following target criteria for three consecutive measurements (one water-column volume apart) will be used to demonstrate stabilization:

- pH +/- 0.1 units
- temperature +/- 0.1 degrees Celsius
- specific conductance (temperature corrected EC) +/- 5%
- turbidity: less than or equal to 10 NTU

Samples for laboratory analysis will be collected only after a minimum of 3 water-column volumes have been purged and stabilization of field water-quality parameters has been demonstrated by meeting the target criteria defined in the

preceding paragraph. If field parameters do not stabilize after approximately five water-column volumes, then field staff will check operator procedures, equipment functioning and well construction information for potential problems. In particular, field staff will re-evaluate whether or not water is being withdrawn from the appropriate depth to effectively evacuate the well.

If all the checks produce no new insight, a decision might be made to collect samples after five or more water-column volumes have been purged even if field measurements have not stabilized. Before authorizing the laboratory to analyze samples. the meaningfulness and value of completing laboratory analysis of the sampling suite will be evaluated hy reviewing the results of field measurements. well construction data. site hydrogeology, etc. Where such data is presented. it will be clearly documented that stabilization was not achieved: at a minimum, this fact will be reported on the SIF and in the Remedial Action Report.

**As** with water from well development. purge water will be properly stored. tested. and disposed of in accordance with all applicable rules including Minnesota Rule 7060. Fifty-five gallon drums will be located at each of the wells to collect water removed from the wells during development and sampling. No significant amount of well water will be emptied or discharged onto the ground surface unless analytical data are available and indicate that the water is not contaminated. After water analyses become available, and appropriate disposal alternatives are evaluated, the water will be disposed of in an environmentally safe manner that does not conflict with any applicable rules.

## 4.0 SAMPLE COLLECTION

This section describes procedures for setting the sampling pump and collecting ground water samples. Field data for these items will be recorded on the SIF for each sampling point.

### 4.1 Pump Setting

A bladder pump will he used as the default device for sample collection. If well recovery is so slow that a satisfactory water column height (for normal pump operation) is not reached in a reasonable amount of time, a Teflon@bailer will be used for sample collection. The SIF will show what type of device was used to sample each well. If any device other than the one described above is used, it should-be reported as a protocol exception.

In very slowly recharging wells, the pump intake will be set approximately two feet from the bottom of the well to minimize aeration problems. Alternately, in wells where the entire screen length is saturated, the pump intake will be set in the middle of the screened interval.

The groundwater sampling pump will not be removed between well purging and groundwater sampling. Pumping will be continuous and sampling will immediately follow purging. If pumping is not continuous it will be noted on the SIF. The sample collection pumping rate will be less than or equal to the purging rate. The sampling rate will be between 100 and 250 mL/minute.

### 4.2 Sample Filtration

Sample filtration is not anticipated for this project. If filtration is required, **MPCA** and **USEPA** approval will be obtained prior to sampling.

### 4.3 Filling Sample Containers

Table 1 summarizes the sample container type, filling method, preservation method and holding time for each analytical parameter set. individually prepared bottles will not be opened until they are to be filled with water samples.

1. A clean and dry sheet **of** relatively inert plastic shall be placed on the ground surface in the wellhead area. If materials used in the sampling process must be put down. they will be placed on a clean portion of the plastic sheet instead of the ground surface.
2. A clean pair of nitrile or latex gloves will be put on at the onset of sampling activities at each new sampling point.

3. Sampling personnel will keep their hands as clean as practical and replace gloves if they become soiled while performing sampling activities.

Bottles will be labeled and chain-of-custody sections will be filled out by the field personnel according to procedures described below in Section 5: "Documentation of Sampling Event". To prevent a mix up with sample bottle identification. no sampling-point specific information such as "well name" will be filled out in advance of sampling. Chain of custody information will be completed before leaving the sampling point. Laboratory-prepared bottles will be used to assure quality control.

**The order of filling bottles'withwater to be analyzed will be as follows:**

1. volatile organic compounds
2. methane. ethenc. ethane
3. sample volume for mobile lab analyses
4. nitrate and nitrite
5. total organic carbon
6. bromide

This order will be reversed in very slowly recharging wells and will be noted on the SIF. Replicate samples will be collected sequentially as described in Section 4.4: "Field Blanks, Replicates and Split Samples". Methods for filling sample containers for individual analyses are described in Table 1.

The sample water discharge point at the end of the tube will be held as close as possible to the sample container without allowing the sample tubing to contact the container. At a minimum. sampling personnel will use their body to shield the sampling container from wind and airborne dust while filling. When strong winds, heavy rain, or dusty conditions are present. additional measures will be implemented to guard against background interference.

## 4.4 Field Blanks and Replicates

Sample blanks will be collected to detect background **or** method contamination. Replicate samples will be collected to evaluate variability in analytical methods. QA/QC samples will be collected at sampling points suspected to have relatively higher levels of contamination to provide meaningful information for blank or duplicate sample evaluation. Field duplicate samples will be assigned identification aliases on the sample bottle label and on the chain of custody sheet to avoid alerting laboratories that the sample is a replicate sample. The true identity of the field duplicate samples will be recorded in the field sampling log.

The collection schedule for QA/QC samples will be as follows:

1. one trip blank (composed of three replicate vials) for each cooler of **VOC** samples
2. one field methods (equipment) blank each day by each field sampling crew
3. at least one replicate set for every 10 samples collected

Field ambient air blanks will not be required for this project because the project site is a community park and no VOCs will be emitted from an operating facility during sampling. **Also,** no automobile engines will run during the sampling event. If the pumps use a gas-driven generator. the generator will be located downwind from the sampling point.

For each type of QA/QC sample, containers will be prepared and submitted for the analyses listed in Table **4-7** and Table 5-3 of Ref. 1.

**Field Blank Samples**

Methods that will be used for preparing field blank samples are described below.

Trip blanks for VOCs consist of a set of three pre-filled 40 mL purge and trap vials that will be filled and sealed by the primary VOC analytical laboratory with laboratory-controlled organic-free water. The 40 mL, purge and trap,

blank sample vials will travel with the actual sample vials to and from the field in the cooler, to the well head, etc., so that the blanks are exposed to precisely the same conditions as the actual samples. The bottle blanks will not be opened until they are analyzed in the laboratory along with the actual VOC samples they have accompanied.

Field equipment/methods blanks will be collected in the field for target parameters. Sample containers used for each blank will be the same as for the actual analysis of sample water for these parameter groups. All containers shall be pre-cleaned within the laboratory's QA/QC program in the same manner as primary sample bottles. The sample blank containers will be filled in the field. Laboratory-controlled organic-free water will be used to fill all organic blank samples. Trace metal blanks will be filled with laboratory-prepared. triply distilled water. The same preservatives will he added to both the methods blank and the primary samples.

Collection of field equipment/methods blank samples will be conducted to simulate actual field sampling methods in a manner that would detect the presence of background or cross-contamination of samples from the ambient environment, preservatives or sampling equipment. An effort will be made to have the blank sample water contact all the interfaces and preservatives (where applicable) that the sample water will contact. These may include the sampling mechanism. ambient air. sample container and, when applicable, tubing, filtration membranes and preservatives.

Laboratory-supplied blank water will be pumped through a freshly decontaminated reusable sampling device and directly into the appropriate. laboratory provided, sample containers. Blanks for filtered samples (only if filtered samples are collected) will be collected by passing the blank sample water through the filtration device and the same type of filters used for collecting the primary samples.

**Field Replicate Samples**

Field replicate samples of actual ground water will be collected for the following parameters listed in Table 4-6 and Table 5-2 of Ref. 1. One field replicate sample set will be collected for every ten primary sampling sets. The replicate samples will be collected by sequentially filling all containers as close together in time as practical with a sampling stream that is as steady and continuous as practical. The sequence number (first, second, etc.) and time of sample filling will be listed in the field notebook. The time that each individual container was filled will be listed on the container and on the Sample Identification - field chain of Custody Record (SLFCCR) in the same manner as primary samples. All samples will be sent to the laboratory specified in the QAPP of Ref. 1.

**Field Split Samples**

Field split samples are not anticipated for this project. If split samples are collected in the future, MPCA and USEPA approval of the other laboratory QAPP will be obtained prior to sampling.

## 5.0 DOCUMENTATION OF SAMPLING EVENT

This sampling protocol template includes the use of forms shown in Appendix D of Ref. 1 (Volume I); they are designed for documentation of field activities and collection of field data. They also provide a means to verify whether or not this protocol was followed during a number of key steps in the ground water sampling event. The forms include the following:

1. Sampling Information Form
2. Purging and Stabilization Form
3. Identification - Field Chain of Custody Record (SI-FCCR)

### 5.1 Sample Identification

The Sample Identification - Field Chain of Custody Record (SI-FCCR) in Appendix D of Ref. I (Volume I) will be completed as described above in Section 5.0, "Documentation of Sampling Event".

The SI-FCCR will be at least a two-part (carbonless copy) form.

Each sample container will be labeled with the following information:

- unique container ID #
- sample collection Date and Time
- initials of person collecting sample
- analyses required
- preservation method

Container information will be entered at the sampling point at the time of sample collection. However, for containers receiving preservatives in advance. "analyses required" and "preservation method" will be entered onto labels by laboratory staff. For containers receiving preservatives in the field, "preservation method" will be entered at the time individual containers are tilled.

## 5.2 Chain Of Custody

A chain-of-custody record (SI-FCCR) will be initiated in the field at the time of sampling; a copy will accompany each set of samples (cooler) shipped to any laboratory.

Each time responsibility for custody of the samples changes, the new and previous custodians will sign the record and denote the date and time. A copy of the signed record will be made by the receiving laboratory. The final signed SI-FCCR will be submitted with analytical results in the Remedial Action Report.

### Field Chain of Custody Documentation

All signatures related to sample custody will be made in indelible ink on the SI-FCCR in a timely fashion. One or more signatures will be entered to identify the person or persons who are collecting the samples. Each time the custody of a sample or group of samples is transferred, a signature, date and time will be entered to document the transfer. The signatures, date and time will be entered at the time of transfer. A sample will be considered to be in custody if it is in any one of the following states:

1. in actual physical possession
2. in view, after being in physical possession
3. in physical possession and locked up so that no one can tamper with it
4. in a secured area, restricted to authorized personnel

A secured area such as a locked storage shed or locked vehicle specified in the ''comments'' column may be used for temporary storage. When using such an area, the time, date, and location of the secured area will be recorded in the "relinquished by" space. The time at which an individual regains custody will then be recorded in the "received by" space.

### Chain of Custody During Shipping and Transfer of Samples

When samples are shipped, the person sealing the shipping container will enter the time, date and their signature on the SI-FCCR. The laboratory part of the SI-FCGR will be enclosed in the container; the top page (first part) will be retained for the project manager's file. A post office receipt, bill of lading, or similar document from the shipper will be retained as part of the permanent chain-of-custody documentation.

One or more custody seals will be affixed over the opening of the shipping container in a manner that precludes opening the container without breaking the seal(s). The container seal(s) will be inscribed with the signature of the person sealing the container and the date and time sealed.

The receiving laboratory will be notified in advance of chain-of-custody procedures that must be followed for a group of samples. The laboratory will be instructed to note whether or not the container seal(s) are intact and sign in the appropriate blank on the SI-FCCR at the time of receipt. They will also be instructed to keep a copy and return the original form to their client's quality assurance officer.

## 5.3 Field Sampling Log

A daily field log of sampling activities will be kept by the leader of the field sampling crew. At a minimum, the log will contain a record of the following items:

- list of field personnel present
- field conditions (see Section 5.5)
- description of exceptions to this protocol including specification of which samples may have been impacted by exception(s)
- For each well sampled:
  1) Well Name and unique SI-FCCR # used to identify samples,
  2) equipment used for evacuation and stabilization,
  3) date and time that purging and sampling began and ended,
  4) a list of all samples sent to each laboratory

## 5.4 Exceptions to Sampling Protocol

This protocol defines the procedures to be followed during this sampling event. Exceptions to this protocol will be noted on the SIF.

If there has been any potentially significant impact on sample integrity, then the potential impact for each parameter for each sample affected will be footnoted whenever the results are reported or referred to in the Remedial Action Report.

## 5.5 Field Conditions

Field conditions during the sampling event will be recorded on the SIF. The Remedial Action Report will include a statement regarding the likelihood that any unusual field conditions had a significant impact on the integrity of results. Field conditions reported will include but not be limited to the following:

- air temperature
- wind speed/direction
- precipitation/moisture at the time of the sampling event, and if known, previous days' precipitation
- ambient odors
- airborne dust

# 6.0 SAMPLE PRESERVATION, HANDLING AND TRANSPORT

## 6.1 Sample Preservation

Samples will be preserved as shown in Table I. All chemical preservatives added to containers in the laboratory or field will be produced and controlled within the laboratory's QA/QC program as reflected in the Lab-QAPP (Appendix A of Ref. 1, Volume II). Field supplies of preservatives and sample containers with pre-dosed preservatives will be discarded and replaced with fresh preservatives no later than 14 days after receipt from the laboratory.

All samples will be thermally preserved in the field immediately after sample collection by placing the samples in an insulated ice chest containing ice. The ice chest temperature will be checked by measuring the temperature of the water within the temperature blank container and recorded upon receipt at the laboratory, to verify whether or not samples are kept refrigerated at approximately 4 degrees C.

## 6.2 Sample Handling and Transport

All ice chests shipped will be accompanied by a SI-FCCR form and contain a complete destination and return address on the outside of the cooler. The samples will be kept at approximately 4 degrees C during transport to laboratories. Maintain the chain-of-custody according to procedures described in Section 5.2.

**Table 1: Sample Containers, Filling Method, Preservation and Holding Times**

**Sample Containers, Filling Method, Preservation and Holding Times are provided in Table 4-7 and Table 5-3 of Ref. 1.**

**Figure 1: Location of Sampling Points**

**For Location of wells to be sampled under this project refer to Figure 4-1 in Ref. 1**

## APPENDIX A: SELECTED ANALYTICAL PARAMETERS, METHOD NUMBERS AND REPORTING LIMITS

**Analytical Parameters, Method Numbers, and Practical Quantitation Limits are listed in Table 4-6 and Table 5-2 of Ref. 1.**

# APPENDIX D

# FIELD FORMS

Tetra Tech NUS, Inc.

# EQUIPMENT CALIBRATION LOG

PROJECT NAME : _____ INSTRUMENT NAME/MODEL: _____

SITE NAME: _____ MANUFACTURER: _____

PROJECT No.: _____ SERIAL NUMBER: _____

| Date of Calibration | Instrument I.D. Number | Person Performing Calibration | Instrument Settings | | Instrument Readings | | Calibration Standard (Lot No.) | Remarks and Comments |
|---|---|---|---|---|---|---|---|---|
| | | | Pre-calibration | Post-calibration | Pre-calibration | Post-calibration | | |
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Tetra Tech NUS, Inc

# GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: _____ Project No.: _____

Location: _____ Personnel: _____

Weather Conditions: _____ Measuring Device: _____

Tidally Influenced: Yes ____ No ____ Remarks: _____

| Well or Piezometer Number | Date | Time | Elevation of Reference Point (feet)* | Total Well Depth (feet)* | Water Level Indicator Reading (feet)* | Thickness of Free Product (feet)* | Groundwater Elevation (feet)* | Comments |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
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All measurements lo the nearest 0 01 foot

Tetra Tech NUS, Inc

# GROUNDWATER SAMPLE LOG SHEET-



Project Site Name: _____
Project No.: _____

[] Domestic Well Data
[] Monitoring Well Data
[] Other Well Type: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____
Type of Sample:
[] Low Concentration
[] High Concentration

| ate. | Color | pH | S.C. | Temp. | Turbidity | DO | Salinity | Other |
|---|---|---|---|---|---|---|---|---|
| me. | (Visual) | (S.U.) | (mS/cm) | ($^0$C) | (NTU) | (mg/l) | (%) | |
| ethod: | | | | | | | | |

URGE DATA:

| ate: | Volume | pH | S.C. | Temp. | Turbidity | DO | Salinity | Other |
|---|---|---|---|---|---|---|---|---|
| ethod: | | | | | | | | |
| onitor Reading (ppm): | | | | | | | | |
| 'ell Casing Diameter & Material | | | | | | | | |
| /pe: | | | | | | | | |
| otal Well Depth (TD): | | | | | | | | |
| tatic Water Level (WL): | | | | | | | | |
| ne Casing Volume(gal/L): | | | | | | | | |
| tart Purge (hrs): | | | | | | | | |
| nd Purge (hrs): | | | | | | | | |
| otal Purge Time (min): | | | | | | | | |
| otal Vol. Purged (gal/L): | | | | | | | | |

AMPLE COLLECTION INFORMATION:

| Analvsis | Preservative | Container Reauirements | Collected |
|---|---|---|---|
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BSERVATIONS / NOTES:

ircle if Applicable:

| MS/MSD | Duplicate ID No.: |
|---|---|

Signature(s):

Tetra Tech NUS, Inc.

# PUMPING TEST DATA SHEET

'ROJECT NAME: _____ PUMPING WELL NUMBER: _____

'ROJECT NUMBER: _____ MEASURED WELL NUMBER: _____

] PUMPING TEST [ ] STEPDRAWDOWNTEST

| | |
|---|---|
| 'ATE(s) | MONITORING POINT |
| 'EASUREMENT METHOD | DEPTH CORRECTION (ft) |
| EST NUMBER | PUMP SETTING (Ft below monitoring point) |
| TATIC WATER LEVEL (ft) | DISTANCE FROM PUMPING WELL (ft) |
| 'ERSONNEL. | |
| 'EMARKS: | |

| MILITARY TIME | ELAPSED TIME SINCE PUMP START OR STOP (Min.) | WATER LEVEL (Ft.) | CORRECTION (Ft.) | DRAW DOWN OR RECOVERY (Ft.) | PUMPING RATE (GPM) | FLOW METER READING (Gals.) | REMARKS |
|---|---|---|---|---|---|---|---|
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NOTE All measurements to nearest 0 01 foot measured from top of well riser pipe unless otherwise noted

TECH NUS, INC.

CHAIN OF CUSTODY NUMBER 0804 PAGE — OF —

| PROJECT NO: | FACILITY: | PROJECT MANAGER | PHONE NUMBER | LABORATORY NAME AND CONTACT: |
|---|---|---|---|---|
| | | FIELD OPERATIONS LEADER | PHONE NUMBER | ADDRESS |
| | | CARRIER/WAYBILL NUMBER | | CITY, STATE |

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED

TYPE OF ANALYSIS

| DATE YEAR | TIME | SAMPLE ID | LOCATION ID | TOP DEPTH (FT) | BOTTOM DEPTH (FT) | MATRIX (GW, SO, SW, SD, QC, ETC.) | COLLECTION METHOD GRAP (G) COMP (C) | No. OF CONTAINERS | | | | | | | | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| 2. RELINQUISHED BY | DATE | TIME | 2. RECEIVED BY | DATE / TIME |
| 3. RELINQUISHED BY | DATE | TIME | 3. RECEIVED BY | DATE / TIME |

COMMENTS

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4/02R

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-94-D-0888

Rev. 1
09/05

# Remedial Action Work Plan

## Volume II
## Quality Assurance Project Plan

## Naval Industrial Reserve Ordnance Plant
## Fridley, Minnesota

## Contract Task Order 0330

## September 2005


NAVFAC
Naval Facilities Engineering Command
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406



TETRA TECH NUS, Inc.

**REVISION 1**
**SEPTEMBER 2005**

# REMEDIAL ACTION WORK PLAN

## VOLUME II

## QUALITY ASSURANCE PROJECT PLAN
## FOR
## FIELD ACTIVITIES

NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT
FRIDLEY, MINNESOTA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER *0330*

**SEPTEMBER *2005***

Date 9-19-05
**PROJECT MANAGER**
**TETRA TECH NUS, INC.**

Date 9-19-05
**QUALITY ASSURANCE REVIEWER**
**TETRA TECH NUS INC.**

Date 10/5/05
**PROJECT MANAGER**
**BAY WEST**

Date 9/16/05
**VICE PRESIDENT**
**COLUMBIA ANALYTICAL SERVICES, INC.**

Date 10/05/05
**REMEDIAL PROJECT MANAGER**
**U.S. EPA REGION 5**

N/A Date
**QUALITY ASSURANCE REVIEWER**
**U.S. EPA REGION 5**

Date 10/05/05
**PROJECT MANAGER**
**DEPARTMENT OF THE NAVY**

# Minnesota Pollution Control Agency

**CERTIFIED MAIL**
**RETURN RECEIPT REQUESTED**

October 6, 2005

Commanding Officer
Southern Division
Naval Facilities Engineering Command
Attn.: Dan Owens, Code ES32
P.O. Box 190010
North Charleston, SC 29419-9010

RE: Naval Industrial Reserve Ordnance Plant Superfund Site

Dear Mr. Owens:

The Minnesota Pollution Control Agency (MPCA) staff has reviewed the final change pages to the Remedial Action Work Plan, dated September 2005, submitted by Mr. Mark Sladic of Tetra Tech NUS, Inc. on behalf of the U.S. Navy in his letter of September 23, 2005. The Remedial Action Work Plan is for Operable Unit 1 of the Naval Industrial Reserve Ordnance Plant (NIROP) Superfund Site and was submitted pursuant to the Federal Facility Agreement, dated March 27, 1991, between the MPCA, the U.S. Environmental Protection Agency, and the U.S. Navy (Navy).

The MPCA staff hereby approves the Response Action Work Plan as modified by the final change pages contained in Mr. Sladic's letter cited above.

If you have any questions regarding this letter, please call me at (651) 296-7818.

Sincerely,

David N. Douglas, Project Manager
Superfund Unit 2
Superfund and Emergency Response Section
Remediation Division

DND:csa

cc: Tom Smith, U.S. Environmental Protection Agency
Mark Sladic, Tetra Tech NUS, Inc.
Venky Venkatesh CH2MHILL Constructors, Inc.

# TABLE OF CONTENTS

**SECTION** **PAGE NO.**

**USEPA QAPP WORKSHEET #1** ..... iii

**ACRONYMS** ..... 6

**GROUP A PROJECT MANAGEMENT**

**A4 PROJECT ORGANIZATION** ..... **A4-1**
A4.1 MANAGEMENT ..... A4-1
A4.1.1 USEPA Remedial Project Manager ..... A4-1
A4.1.2 Minnesota Pollution Control Agency Project Manager ..... A4-1
A4.1.3 Navy Project Manager ..... A4-2
A4.1.4 Contractor Project Management ..... A4-2
A4.2 QUALITY ASSURANCE ..... A4-4
A4.2.1 USEPA Region 5 Quality Assurance Coordinator ..... A4-5
A4.2.2 Navy Quality Assurance Manager ..... A4-5
A4.2.3 TtNUS Quality Assurance Manager ..... A4-5
A4.2.4 TtNUS Project Quality Assurance Advisor ..... A4-6
A4.2.5 TtNUS Data Validation Manager ..... A4-6
A4.2.6 Laboratory Responsibilities ..... A4-6
A4.3 FIELD INVESTIGATION ..... A4-8
A4.3.1 Field Operations Leader ..... A4-9
A4.3.2 Site Quality Assurance/Quality Control Advisor ..... A4-10
A4.3.3 Site Safety Officer ..... A4-10
A4.3.4 Field Technical Staff ..... A4-10

**AS PROBLEM DEFINITION / BACKGROUND INFORMATION** ..... **A5-1**
A5.1 FACILITY HISTORY ..... A5-1
A5.1.1 General History ..... A5-1
A5.1.2 Past Data Collection Activities ..... A5-1
A5.2 FACILITY DESCRIPTION ..... A5-1
A5.3 PROJECT STATUS ..... A5-1
A5.4 QUALITY ASSURANCE PROJECT PLAN PREPARATION GUIDELINES ..... A5-2
A5.5 OVERALL PROJECT OBJECTIVES ..... A5-2
A5.6 PROJECT OBJECTIVES ..... A5-2
A5.7 DATA QUALITY OBJECTIVES ..... A5-3

**A6 PROJECT DESCRIPTION AND SCHEDULE** ..... **A6-1**
A6.1 INTRODUCTION ..... A6-1
A6.2 PROJECT TARGET PARAMETERS AND INTENDED DATA USES ..... A6-1
A6.2.1 Field Parameters ..... A6-2
A6.2.2 Laboratory Parameters ..... A6-2
A6.3 DATA VALIDATION ..... A6-2
A6.4 SAMPLE NETWORK DESIGN AND RATIONALE ..... A6-3
A6.5 PROJECT SCHEDULE ..... A6-3

# TABLE OF CONTENTS (Continued)


| SECTION | | | PAGE NO. |
|---|---|---|---|
| **A7** | **QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA** | | **A7-1** |
| | A7.1 | PRECISION | A7-1 |
| | A7.1.1 | Definition | A7-1 |
| | A7.1.2 | Field Precision Objectives | A7-2 |
| | A7.1.3 | Laboratory Precision Objectives | A7-2 |
| | A7.2 | ACCURACY | A7-3 |
| | A7.2.1 | Definition | A7-3 |
| | A7.2.2 | Field Accuracy Objectives | A7-3 |
| | A7.2.3 | Laboratory Accuracy Objectives | A7-4 |
| | A7.3 | COMPLETENESS | A7-4 |
| | A7.3.1 | Definition | A7-4 |
| | A7.3.2 | Field Completeness Objectives | A7-4 |
| | A7.3.3 | Laboratory Completeness Objectives | A7-4 |
| | A7.4 | REPRESENTATIVENESS | A7-5 |
| | A7.4.1 | Definition | A 7-5 |
| | A7.4.2 | Measures to Ensure Representativeness of Field Data | A7-5 |
| | A7.4.3 | Measures to Ensure Representativeness'of Laboratory Data | A7-5 |
| | A7.5 | COMPARABILITY | A7-6 |
| | A7.5.1 | Definition | A7-6 |
| | A7.5.2 | Measures to Ensure Comparability of Field Data | A7-6 |
| | A7.5.3 | Measures to Ensure Comparability of Laboratory Data | A7-6 |
| | A7.6 | LEVEL OF QUALITY CONTROL EFFORT | A7-6 |
| **A8** | **SPECIAL TRAINING REQUIREMENTS** | | **A8-1** |
| | A8.1 | FIELD PERSONNEL | A8-1 |
| | A8.2 | LABORATORY PERSONNEL | A8-1 |
| **A9** | **DOCUMENTATION AND RECORDS** | | **A9-1** |
| | A9.1 | DOCUMENTATION. RECORDS. AND DATA MANAGEMENT | A9-1 |
| | A9.1.1 | Project Documentation and Records | A9-1 |
| | A9.1.2 | Field Analysis Data Package Deliverables | A9-1 |
| | A9.1.3 | Fixed Laboratory Data Package Deliverables | A9-1 |
| | A9.1.4 | Data Reporting Formats | A9-2 |
| | A9.1.5 | Record Retention Time | A9-2 |
| **GROUP B DATA GENERATION AND ACQUISITION** | | | |
| **B1** | **SAMPLING PROCESS DESIGN** | | **B1-1** |
| | 61.1 | SAMPLING DESIGN AND RATIONALE | B1-1 |
| | 61.2 | FIELD MOBILIZATION / DEMOBILIZATION | B1-1 |
| | 61.3 | SAMPLE COLLECTION | 61-2 |
| | B1.4 | SAMPLE IDENTIFICATION SYSTEM | 61-2 |
| | B1.5 | SAMPLE HANDLING, PRESERVATION. AND SHIPPING: | 61-2 |
| | B1.6 | SAMPLE CUSTODY | B1-4 |
| | 61.7 | QUALITY CONTROL SAMPLES | 61-4 |
| | 61.8 | SURVEYING | 61-5 |
| | B1.9 | INVESTIGATION DERIVED WASTE | 61-5 |
| | 61.10 | RECORD KEEPING | B1-5 |

# TABLE OF CONTENTS (Continued)


| SECTION | | | PAGE NO. |
|---|---|---|---|
| **B2** | **SAMPLING METHODS REQUIREMENTS** | | **B2-1** |
| | B2.1 | FIELD MEASUREMENT PROCEDURES | B2-1 |
| **B3** | **SAMPLE HANDLING AND CUSTODY REQUIREMENTS** | | **B3-1** |
| | B3.1 | FIELD CUSTODY PROCEDURES | B3-1 |
| | B3.2 | LABORATORY CUSTODY PROCEDURES | B3-3 |
| | B3.3 | FINAL EVIDENCE FILES | B3-3 |
| **B4** | **ANALYTICAL METHODS REQUIREMENTS** | | **B4-1** |
| | B4.1 | LABORATORY ANALYTICAL AND MEASUREMENT PROCEDURES | B4-1 |
| | B4.1.1 | List of Project Target Compounds and Detection Limits | B4-1 |
| | B4.1.2 | List of Associated Quality Control Samples | B4-1 |
| **B5** | **QUALITY CONTROL REQUIREMENTS** | | **B5-1** |
| | B5.1 | FIELD QUALITY CONTROL CHECKS | B5-1 |
| | B5.1.1 | Field Duplicates | B5-1 |
| | B5.1.2 | Rinsate Blanks | B5-2 |
| | B5.1.3 | Trip Blanks | B5-2 |
| | B5.1.4 | Temperature Blanks | B5-2 |
| | B5.2 | LABORATORY QUALITY CONTROL CHECKS | B5-2 |
| | B5.2.1 | Laboratory Control Samples | B5-3 |
| | B5.2.2 | Laboratory Duplicates (Except VOC) | B5-3 |
| | B5.2.3 | Internal Standards | B5-3 |
| | B5.2.4 | Laboratory Method Blanks | B5-4 |
| | B5.2.5 | Matrix Spikes | B5-4 |
| | B5.2.6 | Matrix Spike Duplicates | B5-5 |
| | B5.2.7 | Surrogates | B5-5 |
| | B5.2.8 | Additional Laboratory Quality Control Checks | B5-5 |
| **B6** | **EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS** | | **B6-1** |
| | B6.1 | FIELD EQUIPMENT PREVENTATIVE MAINTENANCE | B6-1 |
| | B6.2 | LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE | B6-1 |
| | B6.3 | INSPECTION/ ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND 'CONSUMABLES | B6-2 |
| | B6.4 | REFRIGERATORS/OVENS | B6-2 |
| **B7** | **INSTRUMENT CALIBRATION AND FREQUENCY** | | **B7-1** |
| | B7.1 | FIELD INSTRUMENT CALIBRATION | B7-1 |
| | B7.2 | LABORATORY INSTRUMENT CALIBRATION | B7-3 |
| **B8** | **DATA MANAGEMENT** | | **B8-1** |
| | B8.1 | CONTRACT COMPLIANCE SCREENING | B8-1 |
| | B8.2 | DATA VALIDATION | B8-1 |
| | B8.3 | DATA MANAGEMENT PROCEDURES | B8-2 |

# TABLE OF CONTENTS (Continued)

SECTION PAGE NO.

GROUP C ASSESSMENT/ OVERSIGHT

C1 ASSESSMENT AND RESPONSE ACTIONS ..... C1-1
C1.1 FIELD PERFORMANCE AND SYSTEM AUDITS ..... C1-1
C1.1.1 Internal Field Audits ..... C1-1
C1.1.2 External Field Audits ..... C1-3
C1.2 LABORATORY PERFORMANCE AND SYSTEMS AUDITS ..... C1-3
C1.2.1 Internal Laboratory Audits ..... C1-3
C1.2.2 External Laboratory Audits ..... C1-4

C2 REPORTS TO MANAGEMENT ..... C2-1

GROUP D DATA VALIDATION / USABILITY

D1 DATA REVIEW. VALIDATION. AND VERIFICATION REQUIREMENTS ..... D1-1
D1.1 ACCURACY ASSESSMENT ..... D1-1
D1.2 PRECISION ASSESSMENT ..... D1-2
D1.3 COMPLETENESS ASSESSMENT ..... D1-2
D1.4 DATA ASSESSMENT ..... D1-2
D1.4.1 Reconciliation with Data Quality Objectives ..... D1-3

D2 VALIDATION AND VERIFICATION METHODS ..... D2-1
D2.1 DATA REDUCTION ..... D2-1
D2.1.1 Field Data Reduction ..... D2-1
D2.1.2 Laboratory Data Reduction ..... D2-1
D2.2 DATA VALIDATION ..... D2-1
D2.2.1 Procedures Used to Validate Field Data ..... D2-2
D2.2.2 Procedures Used to Validate Laboratory Data ..... D2-2
D2.3 DATA REPORTING ..... D2-3
D2.3.1 Field Data Reporting ..... D2-3
D2.3.2 Laboratory Data Reporting ..... D2-3
D2.4 DATA ACQUISITION REQUIREMENTS AND DATA MANAGEMENT ..... D2-4

D3 CORRECTIVE ACTION ..... D3-1
D3.1 FIELD CORRECTIVE ACTION ..... D3-1
D3.2 LABORATORY CORRECTIVE ACTION ..... D3-1
D3.3 CORRECTIVE ACTION DURING DATA VALIDATION AND .DATA ASSESSMENT ..... D3-2
D3.4 CORRECTIVE ACTION FOR ADMINISTRATIVE ACTIVITIES ..... D3-2

REFERENCES ..... R-1

APPENDICES

A LABORATORY QUALITY ASSURANCE MANUAL. CERTIFICATIONS. AND STANDARD OPERATING PROCEDURES
B FIELD STANDARD OPERATING PROCEDURES
C FRIDLEY DATA VALIDATION SOP

# TABLES

**NUMBER**

A6-1 Field Parameters and Stabilization Criteria for Groundwater Quality Testing
A6-2 Groundwater Remediation System Monitoring Analytical Detection Limits for Surface Discharge Station SD002
A6-3 NPDES/SDS Effluent System Analytical Detection Limits for Surface Discharge Station SD002
A7-1 Groundwater Remediation System and NPDES Quality Control Limits for Surface Discharge Station SD002
A7-2 Non-Calibration QC Sample Usage, Frequencies, Acceptance Limits and Corrective Actions
A9-1 Project Documentation and Records
A9-2 Electronic Data Deliverable Requirements
B4-1 Summary of Aqueous Sample Analytical Procedures for the Groundwater Remediation System
B6-1 Preventive Maintenance For CAS/Kelso Laboratory Analytical and Support Instruments
C2-1 Summary of Reports

# FIGURES

**NUMBER**

A4-1 Project Organization Chart
A6-1 Project Schedule

# ACRONYMS

| | |
|---|---|
| %R | Percent recovery |
| µg/L | Micrograms per liter |
| AES | Atomic Emission Spectrum |
| AMR | Annual Monitoring Report |
| CFR | Code of Federal Regulations |
| CLEAN | Comprehensive Long-Term Environmental Action Navy |
| CLP | Contract Laboratory Program |
| COC | Chain-of-custody |
| CTO | Contract Task Order |
| DoD QSM | Department of Defense Quality Systems Manual |
| DQO | Data quality objective |
| EDLC | Environmental data life cycle |
| FA | Field Activity |
| FFA | Federal Facilities Agreement |
| FOL | Field Operations Leader |
| FS | Feasibility Study |
| FSP | Field Sampling Plan |
| GC/MS | Gas chromatography/mass spectrometer |
| GWTF | Groundwater Treatment Facility |
| HASP | Health and Safety Plan |
| HPLC | High-performance liquid chromatography |
| HSM | Health and Safety Manager |
| ICP | Inductively Coupled Plasma |
| IDW | Investigation derived waste |
| LCD | Laboratory control duplicate |
| LCS | Laboratory control sample |
| MCL | Maximum Contaminant Level |
| MDL | Method Detection Limit |
| MES | Manager of Environmental Services |
| MPCA | Minnesota Pollution Control Agency |
| MS | Matrix spike |
| MSD | Matrix spike duplicate |
| NAVSEA | Naval Sea Systems Command |
| Navy | United States Navy |

| | |
|---|---|
| NFESC | Naval Facilities Engineering Service Center |
| NIROP | Naval Industrial Reserve Ordnance Plant |
| NIST | National Institute of Standards and Technology |
| NPDES | National Pollutant Discharge Elimination System |
| NTU | Nephelometric Turbidity Unit |
| OSHA | Occupational Safety and Health Administration |
| PARCC | Precision, accuracy, representativeness, comparability, and completeness |
| PE | Performance evaluation |
| PM | Project Manager |
| PPE | Personal protective equipment |
| QA | Quality Assurance |
| QAM | Quality Assurance Manager |
| QAPP | Quality Assurance Project Plan |
| QC | Quality control |
| RAMP | Remedial Action Monitoring Plan |
| RAWP | Remedial Action Work Plan |
| RI | Remedial Investigation |
| RL | Reporting Limit |
| ROD | Record of Decision |
| RPD | Relative percent difference |
| RPM | Remedial Project Manager |
| SDG | Sample delivery group |
| SDS | State Disposal System |
| SDWA | Safe Drinking Water Act |
| SOP | Standard Operating Procedure |
| SOUTHNAVFACENGCOM | Southern Division, Naval Facilities Engineering Command |
| SSO | Site Safety Officer |
| TOM | Task Order Manager |
| TtNUS | Tetra Tech NUS, Inc. |
| USEPA | United States Environmental Protection Agency |
| VOC | Volatile organic compound |

# A4 PROJECT ORGANIZATION

This section presents project management and organization information including staffing and coordination requirements for this Field Activity (FA) at Naval Industrial Reserve Ordnance Plant (NIROP) located in Fridley, Minnesota. The authorities and organization relationship of key personnel are depicted in Figure A4-1.

## A4.1 MANAGEMENT

At the direction of the United States Environmental Protection Agency (USEPA) Remedial Project Manager (RPM), Tetra Tech NUS, Inc. (TtNUS), on behalf of the United States Navy (Navy), is responsible for the overall management, implementation of contract FAs, and preparation of the FA plan and report. Personnel from the Navy will be actively involved and will coordinate with TtNUS personnel in a number of areas. Responsibilities for program management, project management, field operations, and laboratory operations are discussed in the following sections. It is intended that the individuals named will perform the designated activities based on personnel availability and project scheduling.

The Navy RPM is in charge overall at the site. Among Navy contractors, responsibility passes from Bay West to TtNUS as the effort passes from field operations to data management. The laboratory is a subcontractor to Bay West and delivers the data packages to Bay West. Bay West transfers this data to TtNUS. Requests or comments to the laboratory from TtNUS are addressed through Bay West.

### A4.1.1 USEPA Remedial Project Manager

The USEPA RPM will oversee the implementation of the FA at NIROP Fridley and have ultimate approval authority for this Quality Assurance Project Plan (QAPP). The USEPA RPM represents the Agency's interests and will provide input from this perspective and lend general historical and technical assistance to NIROP Fridley field activities.

### A4.1.2 Minnesota Pollution Control Agency Project Manager

The Minnesota Pollution Control Agency (MPCA) Project Manager (PM) will oversee the implementation of this FA from MPCA's perspective.

### A4.1.3 Navy Project Manager

The Remedial Project Manager (RPM) acts as the focal representative for the Navy, providing management, technical direction, and oversight for all NIROP Fridley project activities performed by contractors (i.e., TtNUS) and their subcontractors (i.e., Bay West and Columbia Analytical Services [CAS]). Additional responsibilities of the RPM are:

- Definition of project objectives and development of a detailed work plan schedule.
- Establishment of project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.
- Acquisition and application of technical resources (i.e., contractors) as needed to ensure performance within budget and schedule constraints.
- Review of the work performed on each task to ensure its quality, responsiveness, and timeliness.
- Review and analysis of overall task performance with respect to planned requirements and authorizations.
- Approval of all reports (deliverables) before their submission to USEPA Region 5.
- Maintain ultimate responsibility for the preparation and quality of interim and final reports.
- Representation of the project team at meetings and public hearings.

### A4.1.4 Contractor Project Management

**TtNUS Program Manager**

The TtNUS Navy Southern Division Comprehensive Long-Term Environmental Action Navy (CLEAN) Program Manager provides operations, technical, and administrative leadership and oversees and supports quality policies. The Program Manager assigns and oversees the performance of the project Task Order Manager (TOM). The Program Manager also ensures the availability of technical and support resources for program operations and maintains consistency in procedures and projects among Contract Task Order (CTO) assignments. In these matters, the TOM assists the Program Manager.

**TtNUS Task Order Manager**

The TtNUS TOM has the overall responsibility for ensuring that the project meets USEPA and MPCA objectives and Navy and TtNUS quality standards. The TOM is responsible for the preparation and distribution of the QAPP at the direction of the Navy RPM to all parties connected with the project including any subcontractors. The TOM will report to the Navy RPM and is responsible for technical quality control (QC) and project oversight. Additional responsibilities of the TOM are:

- Ensuring timely resolution of project-related technical and quality issues.
- Functioning as primary interface with the Navy RPM, field and office personnel, and subcontractors points-of-contact.
- Monitoring and evaluation of laboratory performance.
- Coordination and oversight of work performed by field and office technical staff (including data validation, statistical evaluations, and report preparation).
- Coordination and oversight of the maintenance of all project records.
- Coordination and oversight of review of project deliverables.
- Preparation and issuing of final deliverables to the Navy.
- Approval of the implementation of corrective action.

**Bay West Manager of Environmental Services**

The Bay West Manager of Environmental Services (MES) provides operations, technical, and administrative leadership and oversees and supports quality policies. The MES assigns PMs and oversees their performance. The MES also ensures the availability of technical and support resources for program operations and maintains consistency in procedures and projects among assignments. In these matters, the MES is assisted by the PM.

**Bay West Project Manager**

The Bay West PM has the overall responsibility for ensuring that the project meets the USEPA and MPCA objectives and Navy and Bay West quality standards. The PM is responsible for the distribution of the laboratory data at the direction of the Navy RPM to parties connected with the project including other Navy contractors. The PM will report to the Navy RPM and is responsible for technical QC and project oversight. Additional responsibilities of the PM are:

- Ensuring timely resolution of project-related technical, quality, safety, or waste management issues.
- Functioning as primary interface with the Navy RPM, field and office personnel, and subcontractor points-of-contact.
- Monitoring and evaluation of laboratory performance.
- Coordination and oversight of work performed by field and office technical staff (including report preparation).
- Coordinating and oversight of maintenance of all project records.
- Approval of the implementation of corrective action.

**Bay West Health and Safety Manager**

The Bay West Health and Safety Manager (HSM) is responsible for the following:

- Oversight of the development and review of the Site Security and Health and Safety Plan (HASP).
- Conducting of Health and Safety audits.
- Preparation of Health and Safety reports for management.

## A4.2 QUALITY ASSURANCE

This section identifies the quality assurance (QA) responsibilities for the NIROP Fridley monitoring program. Responsibilities of the USEPA Region 5, TtNUS, and the analytical laboratory are discussed.

### A4.2.1 USEPA Region 5 Quality Assurance Coordinator

The USEPA Region 5 QA Coordinator has the responsibility to review and approve the QAPP and provide overall QA support and review. Additional responsibilities may include:

- Coordination of external performance and system audits of the contracted laboratory.
- Review and evaluation of analytical field and laboratory procedures.

### A4.2.2 Navy Quality Assurance Manager

The Navy QA Manager will remain independent of direct job involvement and day-to-day operations and will have direct access to resources, as necessary, to resolve any QA issues. The Navy QA Manager is responsible for auditing the implementation of the QA program in conformance with the demands of the specific investigation, TtNUS policies, and USEPA requirements. The Navy QA Manager has sufficient authority to stop work on the investigation as deemed necessary in the event of serious QA/QC issues. Specific functions and duties include:

- Performing QA audits on various phases of the field operations.
- Reviewing and approving QA plans and procedures.
- Providing QA technical assistance to project staff.
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the Navy PM and Executive Vice President for technical operations.

### A4.2.3 TtNUS Quality Assurance Manager

The TtNUS QA Manager (QAM) is responsible for overall QA for the project, and reports directly to the TtNUS Program Manager. The QAM has the responsibility for the following specific activities:

- Developing, maintaining, and monitoring QA policies and procedures.
- Providing training to TtNUS staff in QA/QC policies and procedures.
- Conducting systems and performance audits to monitor compliance with environmental regulations, contractual requirements, QAPP requirements, and corporate policies and procedures.
- Auditing project records.
- Monitoring subcontractor quality controls and records.
- Assisting in the development of corrective action plans.
- Ensuring correction of nonconformances reported in internal or external audits.

- Overseeing and reviewing the development and revision of the QAPP.
- Overseeing the implementation of the QAPP.
- Overseeing the responsibilities of the TtNUS Site QA/QC Advisor.
- Preparing QA reports for management.

### A4.2.4 TtNUS Project Quality Assurance Advisor

The TtNUS Project QA Advisor provides support to the TOM in preparation and review of the QAPP, coordination of work performed by office technical staff, and performance of data assessment. The Project QA Advisor communicates directly with the QAM on matters of QA/QC.

### A4.2.5 TtNUS Data Validation Manager

The TtNUS Data Validation Manager, Joe Samchuck, is responsible for data validation for the project and reports directly to the TtNUS QAM. The Data Validation Manager has the following responsibilities:

- Schedules and assigns data validation tasks.
- Reviews data validation staff work.

### A4.2.6 Laboratory Responsibilities

All samples collected as part of this investigation will be analyzed by Columbia Analytical Services (CAS). Field samples will be received, logged in, and analyzed by the CAS/Kelso facility located at, 1317 South 13th Avenue, Kelso, Washington 98626. The phone number for that location is (360) 577-7222. All work on site is conducted by the Navy's contractors, or subcontractors to these contractors. As such, the Navy RPM (see Figure A4-1) has overall charge of QA on the site.

The subcontracted laboratory is responsible for analyzing all samples in accordance with the analytical methods and additional requirements specified in this QAPP. It also will be the analytical laboratory's responsibility to properly dispose of unused sample aliquots. Responsibilities of key laboratory personnel are outlined in the following paragraphs.

All samples for submittal to the laboratory will be groundwater. All samples will be analyzed only for the following parameters: 1,1-Dichloroethane, 1,1-Dichlorothene, cis-1,2-Dichloroethene, trans-1,2-Dichlorothene, 1,1,1-Trichloroethane, Tetrachloroethene, Trichloroethene, and vinyl chloride.

**Laboratory Project Manager**

The Laboratory PM will report directly to the Bay West PM and will:

- Ensure that method and project-specific requirements are properly communicated and understood by laboratory personnel.
- Ensure that all laboratory resources are available on an as-required basis.
- Monitor analytical and project QA requirements.
- Review data packages for completeness, clarity, and compliance with project requirements.
- Inform the Bay West PM of project status and any sample receipt or analytical problems.

**Laboratory Director**

Responsibilities of the Laboratory Director include the following:

- Support of the QA program within the laboratory.
- Providing management overview of both production and quality-related laboratory activities.
- Maintaining adequate staffing to meet project analytical and quality objectives.
- Approving all laboratory Standard Operating Procedures (SOPs) and QA documents.
- Supervising in-house chain-of-custody (COC) documentation.
- Overseeing the preparation and approval of final analytical reports prior to submittal to TtNUS.

**Laboratory Quality Assurance Officer**

The Laboratory QA Manager (QAM) has the overall responsibility for data after it leaves the laboratory. The Laboratory QAM will be independent of the laboratory but will communicate data issues through the Laboratory PM.

In accordance with the QA Manual found in Appendix A of the QAPP, the laboratory QA Manager shall:

- Oversee laboratory QA
- Oversee QA/QC documentation
- Determine whether to implement laboratory corrective actions
- Reviewing appropriate laboratory QA procedures
- Oversee preparation of laboratory SOPs
- Conduct or oversee annual laboratory audits

- Oversee management of the laboratory quality control limits
- Oversee management of laboratory certifications
- Issue updates to the laboratory QA Manual

Independent QA will be provided by the Laboratory PM and QAM prior to release of all data to TtNUS. The person responsible for the overall QA for the site is the Navy RPM.

**Laboratory Sample Custodian**

The Laboratory Sample Custodian will report to the Laboratory Director. Responsibilities of the Laboratory Sample Custodian include the following:

- Receiving and inspecting the incoming sample containers.
- Recording the condition of the incoming sample containers.
- Signing appropriate documents.
- Verifying COC.
- Notifying laboratory manager and laboratory supervisor of sample receipt and inspection.
- Assigning a unique identification number and customer number, and entering each into the sample receiving log.
- With the help of the laboratory manager, initiating transfer of the samples to appropriate lab sections.
- Controlling and monitoring access/storage of samples and extracts.

**Laboratory Technical Staff**

The Laboratory Technical Staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to the Laboratory Director.

## A4.3 FIELD INVESTIGATION

Bay West will be responsible for all field activities related to this background investigation. The Bay West field team will be organized according to the activities planned. Field team members will be selected based on the type and extent of effort required. All team members will be appropriately skilled and trained for the tasks they are assigned to perform. The team will consist of a combination of the following personnel:

- Field Operations Leader (FOL)
- Site QA/QC Advisor
- Site Safety Officer (SSO)
- Field Technical Staff

### A4.3.1 Field Operations Leader

The FOL is responsible for coordinating all on-site personnel and for providing technical assistance, when required. The FOL, or designee, will coordinate and lead all sampling activities, will identify and document field nonconformances to project requirements, and will ensure the availability and maintenance of all sampling materials/equipment. The FOL is responsible for the completion of all sampling, field and COC documentation, will assume custody of all samples, and will ensure the proper handling and shipping of samples. The FOL will be a highly experienced environmental professional who will report directly to the Bay West PM. Specific FOL responsibilities include the following:

- Functioning as a communications link between field staff members, the Site QA/QC Advisor, SSO, the NIROP Fridley, the Navy, and TtNUS.
- Overseeing the mobilization and demobilization of all field equipment and subcontractors.
- Coordinating and managing the field technical staff.
- Adhering to the work schedules provided by the Navy.
- Bearing responsibility for maintenance of the site logbook, field logbook, and field recordkeeping.
- Initiating field task modification requests when necessary.
- Identifying and resolving problems in the field.
- Resolving difficulties in consultation with the Navy.
- Implementing and documenting corrective action procedures, and providing communication between the field team and upper management.

### A4.3.2 Site Quality Assurance/Quality Control Advisor

The FOL (or their assistant) will act as the Site QA/QC Advisor, who is responsible for ensuring adherence to all QA/QC guidelines as defined in the QAPP. Strict adherence to these procedures is critical to the collection of acceptable and representative data. The following is a summary of the Site QA/QC Advisor's responsibilities:

- Ensuring that field duplicates and field QC blanks are collected with the proper frequency.
- Ensuring that additional volumes of sample are supplied to the analytical laboratory with the proper frequency to accommodate laboratory QA/QC analyses.
- Ensuring that measuring and test equipment are calibrated, used, and maintained in accordance with applicable procedures.
- Acting as liaison between site personnel, laboratory personnel, and the QAM.
- Managing bottleware shipments and overseeing field preservation.

### A4.3.3 Site Safety Officer

The FOL (or designee) will also serve as the SSO. The duties of the SSO are detailed in the HASP. The SSO has stop-work authority, which can be executed upon the determination of an imminent safety hazard.

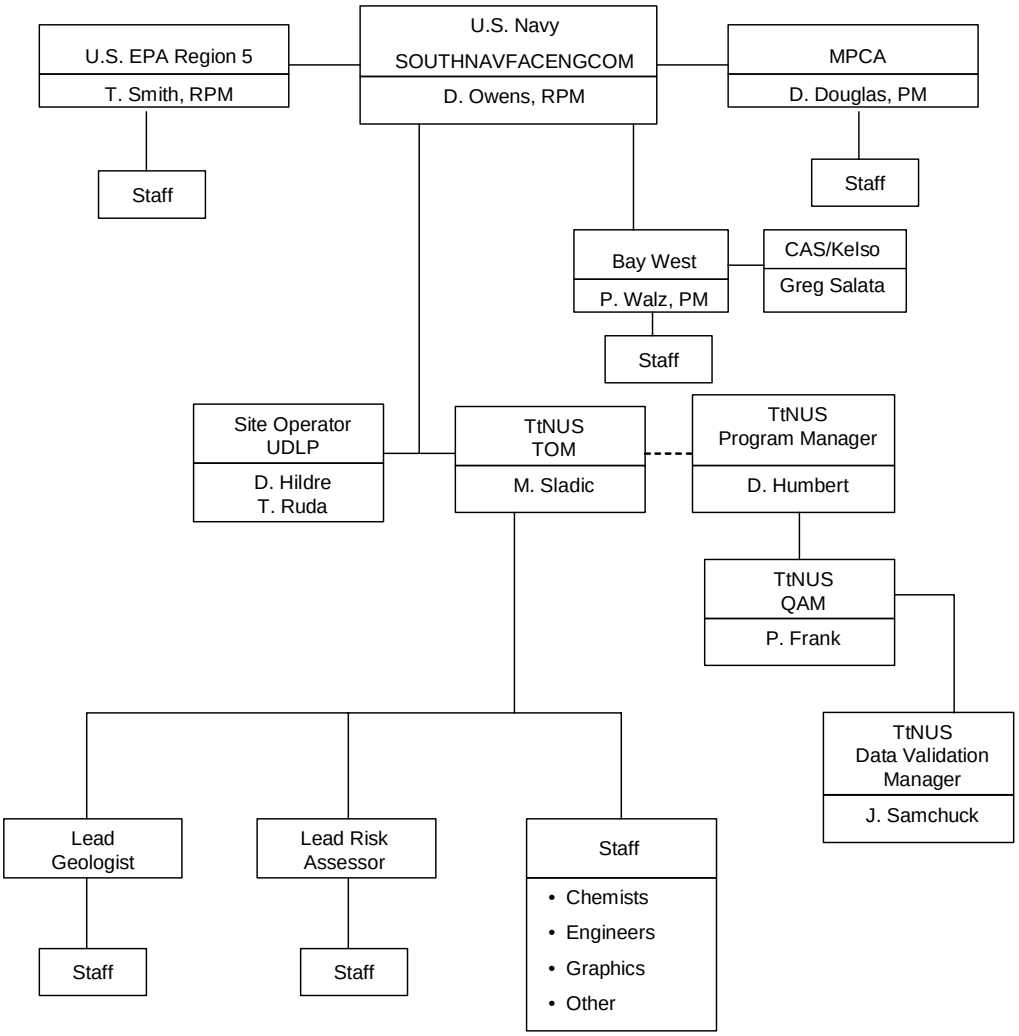
### A4.3.4 Field Technical Staff

The Field Technical Staff for this project will be drawn from Bay West's pool of qualified personnel. All of the designated field team members will be experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

Field staff will be responsible for complying with field-related requirements as presented in the QAPP.

**FIGURE A4-1**

**PROJECT ORGANIZATION CHART**
**ANNUAL MONIOTIRNG REPORT**
**DATA ACQUISITION**
**NIROP FRIDLEY, MINNESOTA**




CAS = Columbia Analytical Services

MPCA = Minnesota Pollution Control Authority
NAVSEA = Naval Sea Systems Command
PM = Project Manger
QAM = Quality Assurance Manager
RPM = Remedial Project Manager

SOUTHNAVFACENGCOM = Southern Division, Naval Facilities Engineering Command
TOM = Task Order Manager
TtNUS = Tetra Tech NUS, Inc.
UDLP = United Defense Limited Partnership
U.S. EPA = Environmental Protection Agency

# A5 PROBLEM DEFINITION / BACKGROUND INFORMATION

## A5.1 FACILITY HISTORY

Detailed discussions of the general history of the NIROP and past data collection activities at the facility are included in Section 1.1 of the Remedial Action Monitoring Plan (RAMP).

### A5.1.1 General History

The NIROP has been in operation since 1940 and is a production facility for Naval ordnance. Items produced at the facility have included gun mounts and advanced missile-launching systems.

### A5.1.2 Past Data Collection Activities

Results of past data collection activities can be found in the Annual Monitoring Reports (AMRs) and the Remedial Investigation (RI) and Feasibility Study (FS) reports.

## A5.2 FACILITY DESCRIPTION

A brief discussion of general site characteristics of the NIROP, including its location, size and borders, regional geology, hydrogeology, topography, etc. is provided in Section 2.0 of the RAMP.

## A5.3 PROJECT STATUS

The groundwater extraction system and pretreatment facilities at NIROP Fridley began operating in September 1992. Monitoring of these facilities and associated monitoring wells has been performed since startup according to the procedures described in the Remedial Action Work Plan for Groundwater Remediation (RMT, 1995) that was approved by USEPA Region 5 and the MPCA. Construction of the Phase II on-site GWTF began in September 1997. Construction was completed and the facility was in operation in December 1998. Treated groundwater from this facility is now discharged to the Mississippi River through Outfall 020 (NPDES/SDS Permit MN0000710) (MPCA, 1996).

A five-year review of the selected remedy for groundwater outlined in the Record of Decision (ROD) (USEPA, 1990) was signed in September 1998. A second five-year review of the selected remedy was signed in October 2003. The five-year reviews recommended the continued operation, maintenance, and upgrade (if necessary) of the groundwater containment and recovery system, with eventual on-site treatment and discharge of treated groundwater in accordance with the NPDES/SDS permit.

## A5.4 QUALITY ASSURANCE PROJECT PLAN PREPARATION GUIDELINES

This QAPP has been prepared in accordance with the general guidance outlined in the USEPA Region 5 Instructions on the Preparation of a Superfund Division Quality Assurance Project Plan (USEPA, 2000). Additional guidance regarding the QAPP contents was obtained from USEPA requirements for Quality Assurance Project Plans, QA/R-5 (USEPA, 1999b).

## A5.5 OVERALL PROJECT OBJECTIVES

The general project objectives for the Fridley groundwater extraction and treatment system are outlined in the Federal Facilities Agreement (FFA) for the NIROP. Attachment B of the FFA outlines the general project objectives as follows:

1. To specify all short- and long-term monitoring of surface water, groundwater, sediment, sludge, and soil necessary to determine the status and effectiveness of the remedial actions implemented at the site, and

2. To develop and implement a monitoring plan that is designed to detect changes/increases in chemical concentrations of contaminated groundwater at and adjacent to the site.

The project purpose and scope are discussed in Section 1.2 of the RAMP. Detailed descriptions of the objectives of the groundwater monitoring and the National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) effluent monitoring are found in Sections 4.1 and 5.1, respectively, in the RAMP.

## A5.6 PROJECT OBJECTIVES

Objectives for the groundwater monitoring are discussed in Section 4.1 of the RAMP. Specific data quality objectives (DQOs) for groundwater chemical analysis were discussed in the March 2002 Well Selection Meeting that resulted in Table 4-4 of the RAMP. The content of this table was approved by all DQO developers including USEPA Region 5, MPCA, the Navy, and TtNUS. Objectives for the NPDES and SDS are discussed in Section 5.1 of the RAMP.

The ultimate objective of groundwater remediation is to restore groundwater quality to Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs). Work conducted under this QAPP will be used to monitor progress toward and attainment of this objective.

## A5.7 DATA QUALITY OBJECTIVES

DQOs for the Fridley FA were developed in accordance with current USEPA guidance through a series of meetings involving the USEPA, MPCA, Navy, and Navy contractors. Refer to the Well Selection Meeting Notes of March 2002 for further information (Appendix B of RAMP).

# A6 PROJECT DESCRIPTION AND SCHEDULE

This project description outlines the overall scope of FAs to be performed for NIROP located in Fridley, Minnesota. This QAPP addresses monitoring requirements associated with the groundwater extraction and treatment (i.e., remediation) system as defined in the ROD for Groundwater Remediation (USEPA, 1990). The QAPP presents the organization, objectives, planned activities, and specific QA/QC procedures associated with the Remedial Action Work Plan (RAWP) for the FA. Specific protocols for sampling, sample handling and storage, COC, and laboratory and field analyses are described. All QA/QC procedures are structured in accordance with applicable technical standards, and USEPA Region 5 and MPCA requirements, regulations, guidance, and technical standards. The groundwater remediation system shares a surface discharge station (sampling point SD002) with the National Pollutant Discharge Elimination System (NPDES) permit No. 0000710. Therefore, some information is provided in this QAPP and the attendant RAMP concerning NPDES requirements. The intent is to avoid any confusion that may arise due to samples being collected from SD002 for two different purposes. Additional details concerning permit requirements (e.g., other NPDES sampling locations and other analysis requirements) can be found in the NPDES permit.

## A6.1 INTRODUCTION

This QAPP has been prepared by TtNUS on behalf of the Navy Southern Division, Naval Facilities Engineering Command (SOUTHNAVFAVENGCOM) and the NIROP, Fridley, Minnesota. This QAPP and other associated documents constitute the project planning documents for the groundwater extraction and treatment system. This QAPP is Volume II of the RAWP, Volume I contains the RAMP.

## A6.2 PROJECT TARGET PARAMETERS AND INTENDED DATA USES

This section discusses the field and laboratory analytical information to be generated during the course of the FA. Field parameters and intended data uses are discussed in Section A6.2.1. Laboratory parameters and intended data uses are discussed in Section A6.2.2. The site history and past investigations identified VOCs in groundwater to be the only contaminants of interest. The following sections identify field and laboratory analyte lists that will support the attainment of project objectives.

### A6.2.1 Field Parameters

Field parameters will include those associated with the completion of purging and stabilization of monitoring wells and groundwater sampling and analysis. Field measurements will include only those completed using simple field instrumentation.

Field parameters including pH, specific conductance, turbidity, and temperature will be completed for aqueous phase samples using a water quality meter as discussed in Section 4.3.2.2 and 5.3.2 of the RAMP. These measurements will be used to support monitoring well development and purging of stagnant water from well casings. Specific conductance and pH will also be used as general indicators of water quality. The ranges of acceptable levels for the field parameters are found in Table A6-1. Details concerning how field measurements will be evaluated relative to those limits are included in the field SOPs (Appendix B).

### A6.2.2 Laboratory Parameters

Laboratory parameters will include a select list of volatile organic compounds (VOCs). Analytical methods are further discussed in Section B4. Table A6-2 provides a summary of all target laboratory analytes and associated Reporting Limits (RLs) and Method Detection Limits (MDLs) for the groundwater remediation system and NPDES analyses to be performed on samples collected from SD002. The list of analytes is different for the groundwater remediation system and the NPDES permit (provided in Section 5 of the RAMP). Seven chlorinated VOCs are common to both programs. The monthly monitoring for NPDES adds methylene chloride to its list of seven VOCs, and the monthly groundwater remediation system monitoring adds vinyl chloride on its list of seven compounds. In addition, NPDES monitoring requires an expanded list of VOCs to be analyzed every six months (See Table A6-2 below and Table 5-2 of the RAMP). EPA Method 624 will be used to analyze the NPDES samples for VOCs; SW-846 Method 8260B will be used to analyze the groundwater samples for VOCs. Details regarding NPDES requirements are provided in the NPDES permit No. 0000710. Quantitation and detection limits are further discussed in Section B4.1.1.

## A6.3 DATA VALIDATION

Data will be verified by comparing the laboratory data deliverables against the laboratory subcontract and QAPP requirements. These requirements address both the deliverable content and format. Further detail is provided in Section D2. Data will be validated in accordance with the National Functional Guidelines for data validation, as described in more detail in Section D2. TtNUS will perform both the verification and validation of data. The quantitative and qualitative measurement performance

assessments of precision, accuracy, representativeness, completeness, and comparability are described in Section D1. Compliance with SOPs will be assessed by the FOL in accordance with Section D1.1.

## A6.4 SAMPLE NETWORK DESIGN AND RATIONALE

The sample network design and rationale are discussed in detail in Section 4.2 of the RAMP. Figures displaying the locations of all proposed borings and monitoring wells are provided in Figure 4-1 of the RAMP.

## A6.5 PROJECT SCHEDULE

The project schedule will be provided each year by the Navy based on each year's:

- Completion of past year AMR/QAPP update team review.
- Availability of the Navy's sample contractor.
- Coordination with UDLP.

Most years, annual sampling of groundwater will be scheduled in mid-October, with a Draft AMR provided by March 31 to discuss the results. Figure A6-1 provides a bar-chart project schedule for 2004 sampling that will be conducted in 2005.

**TABLE A6-1**

**FIELD PARAMETERS AND STABILIZATION CRITERIA**
**FOR GROUNDWATER QUALITY TESTING**
**NIROP FRIDLEY, MINNESOTA**

| Parameter | Method | Stabilization Criteria |
|---|---|---|
| pH | Meter | ± 0.1 Standard units |
| Specific Conductance | Meter | ± 20 mV |
| Turbidity | Meter | ≤ 5 Nephelometric turbidity units (NTU) |
| Temperature | Meter | ± 0.1° Celsius |

**TABLE A6-2**

**GROUNDWATER REMEDIATION SYSTEM MONITORING**
**ANALYTICAL DETECTION LIMITS FOR SURFACE DISCHARGE STATION SD002**
**NIROP FRIDLEY, MINNESOTA**

| Parameter | Daily Maximum (µg/L) | RL (µg/L) | MDL (µg/L) |
|---|---|---|---|
| **VOLATILE ORGANIC COMPOUNDS (SW-846 Method 5030B/8260B)[1]** | | | |
| 1,1-Dichloroethane | NA | 0.5 | 0.1 |
| 1,1-Dichloroethene | NA | 0.5 | 0.2 |
| cis-1,2-Dichloroethene | NA | 0.5 | 0.2 |
| trans-1,2-Dichloroethene | NA | 0.5 | 0.2 |
| Tetrachloroethene | NA | 0.5 | 0.2 |
| 1,1,1-Trichloroethane | NA | 0.5 | 0.2 |
| Trichloroethene | NA | 0.5 | 0.2 |
| Vinyl Chloride | NA | 0.2 | 0.1 |

1 Monitoring frequency is once per month for the groundwater remediation system.

RL = Reporting Limit.
MDL = Method Detection Limit (as provided by CAS/Kelso). Method Detection Limits are subject to change as new MDL studies are completed.
VOCs = Volatile organic compounds

**TABLE A6-3**
**NPDES/SDS EFFLUENT SYSTEM**
**ANALYTICAL DETECTION LIMITS FOR SURFACE DISCHARGE STATION SD002**
**NIROP FRIDLEY, MINNESOTA**


| Parameter | Daily Maximum (µg/L) | RL (µg/L) | MDL (µg/L) |
|---|---|---|---|
| **VOLATILE ORGANIC COMPOUNDS (EPA Method 624)[1]** | | | |
| 1,1,1-Trichloroethane (TCA) | 200 | 5 | 0.45 |
| 1,1,2,2-Tetrachloroethane | Monitor only | 5 | 0.25 |
| 1,1,2-Trichloroethane | Monitor only | 5 | 0.206 |
| 1,1-Dichloroethane | 70 | 5 | 0.34 |
| 1,1-Dichloroethene | 6 | 5 | 0.48 |
| 1,2-Dichlorobenzene | Monitor Only | 5 | 0.186 |
| 1,2-Dichloroethane (EDC) | Monitor Only | 5 | 0.114 |
| 1,2-Dichloropropane | Monitor Only | 5 | 0.183 |
| 1,3-Dichlorobenzene | Monitor Only | 5 | 0.17 |
| 1,4-Dichlorobenzene | Monitor Only | 5 | 0.166 |
| 2-Butanone (MEK) | Monitor Only | 20 | 3.22 |
| 2-Chloroethyl Vinyl Ether | Monitor Only | 10 | 0.62 |
| 2-Hexanone | Monitor Only | 20 | 3.96 |
| 4-Methyl-2-pentanone (MIBK) | Monitor Only | 20 | 2.80 |
| Acetone | Monitor Only | 20 | 3.36 |
| Acetonitrile | Monitor Only | 10 | 1.05 |
| Acrolein | Monitor Only | 50 | 4.24 |
| Acrylonitrile | Monitor Only | 10 | 0.45 |
| Benzene | Monitor Only | 5 | 0.27 |
| Bromodichloromethane | Monitor Only | 5 | 0.17 |
| Bromoform | Monitor Only | 5 | 0.279 |
| Bromomethane | Monitor Only | 5 | 0.81 |
| Carbon Disulfide | Monitor Only | 5 | 0.49 |
| Carbon Tetrachloride | Monitor Only | 5 | 0.38 |
| Chlorobenzene | Monitor Only | 5 | 0.18 |
| Chloroethane | Monitor Only | 5 | 0.456 |
| Chloroform | Monitor Only | 5 | 0.21 |
| Chloromethane | Monitor Only | 5 | 0.31 |
| cis-1,2-Dichloroethene | 70 | 5 | 0.20 |
| cis-1,3-Dichloropropene | Monitor Only | 5 | 0.17 |
| Dibromochloromethane | Monitor Only | 5 | 0.145 |
| Dichlorodifluoromethane | Monitor Only | 5 | 0.61 |
| Ethylbenzene | Monitor Only | 5 | 0.33 |
| m,p-Xylenes | Monitor Only | 5 | 0.27 |

**TABLE A6-3**
**NPDES/SDS EFFLUENT SYSTEM**
**ANALYTICAL DETECTION LIMITS FOR SURFACE DISCHARGE STATION SD002**
**NIROP FRIDLEY, MINNESOTA**

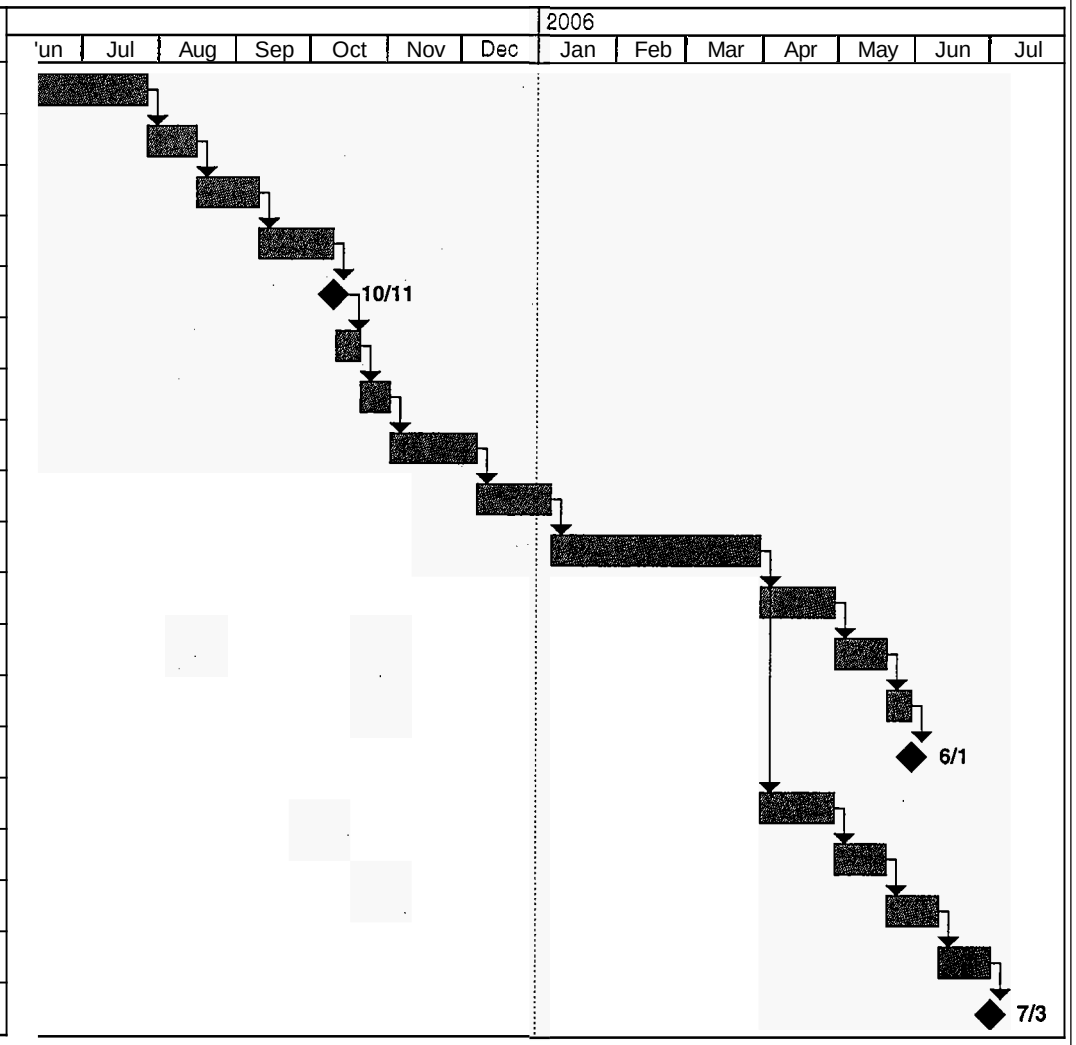

| Parameter | Daily Maximum (µg/L) | RL (µg/L) | MDL (µg/L) |
|---|---|---|---|
| Methyl tert-Butyl Ether | Monitor Only | 0.5 | 0.0734 |
| Methylene Chloride | 5 | 5 | 0.21 |
| o-Xylene | Monitor Only | 5 | 0.2 |
| Pentachloroethane | Monitor Only | 5 | 1.13 |
| Styrene | Monitor Only | 5 | 0.17 |
| Tetrachloroethene (PCE) | 3.8 | 3.8 | 0.43 |
| Toluene | Monitor Only | 5 | 0.25 |
| trans-1,2-Dichloroethene | 100 | 5 | 0.184 |
| trans-1,3-Dichloropropene | Monitor Only | 5 | 0.161 |
| Trichloroethene (TCE) | 5 | 5 | 0.46 |
| Trichlorofluoromethane | Monitor Only | 5 | 0.49 |
| Trichlorotrifluoroethane | Monitor Only | 5 | 0.54 |
| Vinyl Acetate | Monitor Only | 10 | 1.71 |
| Vinyl Chloride | NA | 5 | 0.58 |
| **MISCELLANEOUS PARAMETERS** | | | |
| Chlorine, Total Residual | 100 ug/L | 100 ug/L | 60 ug/L |
| Flow (million gallons per day) | Monitor Only | NA | NA |
| Flow (total volume), MG | Monitor Only | NA | NA |
| pH (daily minimum to maximum range) | 6 to 9 | NA | NA |
| Temperature (degrees Celsius) | 26.5 | NA | NA |

1 Specified in NPDES Permit MN0000710; analyses will be conducted monthly for the short list of VOCs (identified with numerical limits) and every six months for the expanded list of VOCs. Compounds marked as “Monitor Only” do not have daily maximum limits. See NPDES permit for details.

RL = Reporting Limit.
MDL = Method Detection Limit (as provided by CAS/Kelso). Method Detection Limits are subject to change as new MDL studies are completed.
NPDES = National Pollutant Discharge Elimination System.
SDS = State Disposal System.
VOCs = Volatile organic compounds

FIGURE A6-1
PROJECT SCHEDULE
NIROP FRIDLEY, MINNESOTA

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | Team Review RAWP Revision | 45 days | Jun 13 '05 | Jul 27 '05 |
| 2 | RTC/Resolve comments | 20 days | Jul 28 '05 | Aug 16 '05 |
| 3 | Revise RAWP | 25 days | Aug 17 '05 | Sep 10 '05 |
| 4 | Team Review Final RAWP | 30 days | Sep 11 '05 | Oct 10 '05 |
| 5 | Team Approves RAWP | 1 day | Oct 11 '05 | Oct 11 '05 |
| 6 | Mobilize Autumn Sampling Effort | 10 days | Oct 12 '05 | Oct 21 '05 |
| 7 | AMR Field Sampling | 12 days | Oct 22 '05 | Nov 2 '05 |
| 8 | Laboratory Analysis | 35 days | Nov 3 '05 | Dec 7 '05 |
| 9 | Data Validation | 30 days | Dec 8 '05 | Jan 6 '06 |
| 10 | Prepare Draft AMR | 84 days | Jan 7 '06 | Mar 31 '06 |
| 11 | Team Review AMR | 30 days | Apr 1 '06 | Apr 30 '06 |
| 12 | Resolve Team Comments | 21 days | May 1 '06 | May 21 '06 |
| 13 | Finalize AMR Report | 10 days | May 22 '06 | May 31 '06 |
| 14 | Team Approves AMR | 1 day | Jun 1 '06 | Jun 1 '06 |
| 15 | Team Reviews Proposed RAWP Revs | 30 days | Apr 1 '06 | Apr 30 '06 |
| 16 | Resolve RAWP Revs | 21 days | May 1 '06 | May 21 '06 |
| 17 | Update RAWP | 21 days | May 22 '06 | Jun 11 '06 |
| 18 | Team Reviews RAWP Revs. | 21 days | Jun 12 '06 | Jul 2 '06 |
| 19 | Set Schedule for 2006 Sampling | 1 day | Jul 3 '06 | Jul 3 '06 |




Fridley 2005 RAWP
Date: Jun 8 '05

| | | | | | |
|---|---|---|---|---|---|
| Task | | Summary | | Rolled Up Progress | |
| Split | | Rolled Up Task | | External Tasks | |
| Progress | | Rolled Up Split | | Project Summary | |
| Milestone | | Rolled Up Milestone | | | |

# A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, COC, laboratory analysis, and data management and reporting that will provide results sufficient to support attainment of the project objectives specified in Sections A5 through A7. Intended data uses, including the list of project target parameters, are described in the 7-step DQO process included in Appendix B of the RAMP. Data comparisons and the associated decision-making process are described in Section D1.4. Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, internal QC, reporting of data, audits, preventive maintenance of field and laboratory equipment, data management, corrective action, and reporting to management are described in remaining sections of this QAPP. Overall QC level of effort is described in Section A7.6.

The precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters are qualitative and quantitative statements regarding the quality characteristics of the data used to support project objectives and ultimately, environmental decisions. These parameters are presented in the remainder of this section. QC samples used to evaluate performance and their frequencies of use are described in Section B5.1 (field QC samples), and Section B5.2 (laboratory QC samples). Equations used to compute accuracy, precision, and completeness values are provided in Sections D1.1 through D1.3. Data quality objectives developed for NIROP Fridley are presented in the Well Selection Meeting Notes provided in Appendix B of the RAMP.

## A7.1 PRECISION

### A7.1.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement and describes the reproducibility of measurements of the same parameter for samples analyzed under similar conditions. A fundamental tenet of using precision measurements for QC is that precision will be bounded by known limits. Results outside these predetermined limits trigger corrective actions.

By definition, chemical solutions (e.g., VOCs in groundwater) are uniform in composition. Therefore, ignoring any imprecision caused by the sample matrix, the variability of analytical results for water samples should be relatively low unless suspended material or sample handling and storage introduce additional imprecision. Precision acceptance criteria for aqueous duplicate samples have been assigned accordingly in Table A7-1. Results outside of these limits will trigger corrective actions, which are presented in Table A7-2.

### A7.1.2 Field Precision Objectives

Field precision is assessed by collecting and measuring field duplicates at a rate of 1 duplicate per 10 environmental samples. Acceptance limits for field duplicate precision are provided in Table A7-1. This precision estimate encompasses the combined uncertainty associated with sample collection, splitting, handling, laboratory and field storage, digestion, and analysis. In contrast, precision estimates obtained from analyzing duplicate laboratory samples incorporate only subsampling, digestion, laboratory storage, and analysis uncertainties. For VOCs, the act of splitting is actually a rapid resampling rather than physical separation of a single sample into two aliquots. Because the field precision estimates include more sources of potential uncertainty, the field precision estimates [i.e., relative percent difference (RPD) values] should equal or exceed the laboratory precision estimates, on average, for each analyte. If field duplicate precision is significantly different from laboratory duplicate precision, the underlying cause will be investigated to determine whether the observed difference could be an artifact of sampling and analysis. Considerations given to this effort include:

- The scale of subsampling for laboratory precision estimates relative to the scale of field duplicate sample size.
- Analytical measurement precision.
- Precision for repeat analysis of the same laboratory control sample (LCS).

Precision estimates for replicate groundwater samples will be based on the first and last of the replicate samples collected from a randomly selected well. This strategy is designed to provide the greatest potential for identifying problems associated with field sampling and is explained further in Section B1.7.

### A7.1.3 Laboratory Precision Objectives

Laboratory precision QC samples [i.e., matrix spike duplicates (MSDs) for organic chemicals] will be analyzed with a minimum frequency of 5 percent (i.e., 1 QC sample for 20 environmental samples). Laboratory precision is measured by comparing RPD values with precision control limits specified in Table A7-1.

## A7.2 ACCURACY

### A7.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference value. This parameter is assessed by measuring spiked samples [e.g., surrogate spikes or matrix spikes (MSs)] or well-characterized samples of certified analyte concentrations (e.g., LCSs) and by measuring blanks.

Accuracy measurements are designed to detect biases resulting from the sample handling and analysis processes. The equations for determining accuracy of an individual MS and a surrogate spike or LCS for this project are provided in Section D1.1. The equations in Section D1.1 do not apply to blank samples, however, because division by zero (the expected amount or added amount) causes the calculated value to be infinite. Instead, method blank acceptance criteria specified in Table A7-2 are designed to limit the tolerable amount of contamination while recognizing that non-zero results for blanks are likely, if only because of random error in the measurement process. The bias computations for individual MSs, LCSs, and method blanks will be used to control the analysis process by triggering corrective actions as specified in Table A7-2.

### A7.2.2 Field Accuracy Objectives

Accurate field measurements are typically ensured through control over the sample collection and handling and through routine instrument calibration. In addition, after completing field measurements for specific conductance, pH, and turbidity, a check standard is analyzed to verify continued acceptable calibrations. The check standard acceptance criteria are as follows:

- pH: ±0.2 standard units
- Specific conductance: ±10% of the check standard value
- Turbidity: for check standards >5 NTU, ±10% of the check standard value; for all others, no check standard acceptance criteria apply
- Temperature: no check standard acceptance criteria apply

Accuracy is also typically monitored through the use of blanks to detect cross-contamination and by monitoring adherence to procedures that prevent sample contamination or degradation. Equipment rinsate blanks shall be collected for this investigation to assess cross-contamination via sample collection equipment. Trip blanks will be collected to monitor cross-contamination of VOC samples during shipping. Accuracy also shall be assured qualitatively through adherence to all sample handling, preservation, and holding time requirements.

### A7.2.3 Laboratory Accuracy Objectives

Accuracy in the laboratory is measured through the comparison of a spiked sample or LCS result to a known or calculated value and is expressed as a percent recovery (%R). It is also assessed by monitoring the analytical recovery of select surrogate compounds added to samples that are analyzed by organic chromatographic methods. MS and surrogate compound analyses measure the combined accuracy effects of the sample matrix, sample preparation, and sample measurement. LCSs are used to assess the accuracy of laboratory operations with minimal sample matrix effects. Each spiked sample shall be spiked with all project target analytes for the analysis being performed to ensure that accuracy measures are obtained for each target analyte. Spiking concentrations shall equal or approximate the default concentrations detailed in the applicable sample preparation SOPs. LCS and MS analyses are performed at a frequency no less than 1 per 20 associated samples of like matrix. Laboratory accuracy is assessed via comparison of calculated %R values to accuracy control limits specified in Table A7-1.

## A7.3 COMPLETENESS

### A7.3.1 Definition

Completeness is a measure of the amount of usable, valid analytical data obtained compared to the amount expected to be obtained. Completeness is expressed as a percentage.

### A7.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid field measurements obtained from all the field measurements taken in the project. Turbidity is a critical parameter that must be measured prior to sampling to establish attainment of equilibrium, and its completeness criterion is 100 percent. There are no completeness criteria for pH, specific conductance, and temperature, as these are non-critical parameters that are generally determined to verify that appropriate sampling conditions exist prior to sampling. Although there are no completeness criteria for pH, specific conductance and temperature, the field crew should strive to attain 100 percent completeness because the additional data may be useful for other purposes besides the attainment of project objectives described in this QAPP.

### A7.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of usable, valid laboratory measurements per matrix obtained for each of the target analytes. Usable, valid results are those that are judged, after data

assessment, to represent the sampling populations and to have not been disqualified for use through data validation or data assessment. Laboratory completeness objectives are 90 percent for each target analyte in groundwater. Qualifications on the use of data caused by incomplete data sets will be documented in the FA report.

## A7.4 REPRESENTATIVENESS

### A7.4.1 Definition

Representativeness is an expression of the degree to which data accurately and precisely represent a characteristic of a population or environment condition existing at the site. Adherence to procedures described in Section B1 including standardized sample collection, handling, preparation, and analysis, and data reporting requirements ensures that the final data accurately represent the desired populations. An assessment of representativeness will be made during data assessment to determine whether each datum belongs to the observed data distribution. Factors considered during this assessment will include adherence to designated SOPs, relative concentrations of analytes from previous and current sampling rounds, and any other factors that are relevant at the time of assessment. If analyte concentrations appear to deviate from a trend line drawn through the data points (after allowing for data uncertainties), the apparently discordant values will be investigated to determine whether they are erroneous. The choice of linear or non-linear trends for this evaluation will be based on the appearance of the data and may include calculation of best fits to various trend line models. Models used must be reasonable concentration decay models applicable to groundwater monitoring.

### A7.4.2 Measures to Ensure Representativeness of Field Data

Representativeness depends on the proper design of the sampling program and will be satisfied by ensuring that proper sampling techniques are used (see Section B.1.3). Well stabilization parameters (See Table A6-1) will be monitored to ensure that groundwater wells have attained equilibrium prior to sampling.

### A7.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and evaluating field duplicate samples relative to laboratory duplicates. During development of this QAPP, measures to ensure representativeness of the data generated included consideration of past operations, existing analytical data, physical setting, and monitoring well placement. The rationale for the sampling network is presented in detail in Section B1.1.

## A7.5 COMPARABILITY

### A7.5.1 Definition

Comparability is defined as the confidence with which one data set can be compared to another (e.g., between sampling points, between sampling events). Comparability is achieved by using standardized sampling and analysis methods and data reporting formats (including use of consistent units of measure) and by ensuring that reporting and detection limits are sufficiently low to satisfy project detection and quantitation criteria for the duration of the project. The RLs anticipated for this project are presented in Tables A6-2 and A6-3. Additionally, consideration was given to seasonal conditions and other environmental variations that could influence analytical results, but no such influences appear to exist for this investigation that would indicate a need to collect samples at times other than those planned for this investigation.

### A7.5.2 Measures to Ensure Comparability of Field Data

Comparability depends upon the proper design of the sampling program and will be satisfied by ensuring that Section B1 of the QAPP is followed and that proper sampling techniques are used. The rationale behind the sample network design is found in Section B1.

### A7.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented. Results will be reported in units that ensure comparability with previous data. The units used for the laboratory measurements are further explained in Section D2.1.2 of this QAPP.

## A7.6 LEVEL OF QUALITY CONTROL EFFORT

Several QC samples will be analyzed for this project to provide a means to assess field and laboratory performance. Field QC samples consist of field duplicates, equipment rinsate blanks, trip blanks, and temperature blanks. These QC checks are described in Section B5.1. Each type of field QC sample undergoes the same preservation, analysis, and reporting procedures as the related environmental samples. Frequencies of field QC sample collection and analysis are presented in Table A7-2. The types and numbers of QC samples to be collected in the field are presented in Tables 4-11 and 5-4 of the RAMP.

Laboratory QC encompasses other checks performed during sample preparation and analysis, as described in Section B5.2. Frequencies for laboratory QC checks are provided in Table A7-2 and in the method-specific laboratory SOPs appended to this QAPP (Appendix A).

**TABLE A7-1**

**GROUNDWATER REMEDIATON SYSTEM AND NPDES QUALITY CONTROL LIMITS FOR SURFACE DISCHARGE STATION SD002 NIROP FRIDLEY, MINNESOTA**



| Chemical | MS/MSD Samples[1, 2] | | LCS/LCSD Samples[2] | | Field Duplicate RPD[3] |
|---|---|---|---|---|---|
| | %R | RPD | %R | RPD | |
| **SW-846 METHOD 8260B (GROUNDWATER EXTRACTION AND TREATMENT SYSTEM)** | | | | | |
| 1,1-Dichloroethane | 71-128 | 0-30 | 76-117 | 0-30 | 0-30 |
| 1,1-Dichloroethene | 76-143 | 0-30 | 76-129 | 0-30 | 0-30 |
| cis-1,2-Dichloroethene | 70-135 | 0-30 | 83-118 | 0-30 | 0-30 |
| trans-1,2-Dichloroethene | 82-129 | 0-30 | 81-121 | 0-30 | 0-30 |
| 1,1,1-Trichloroethane | 74-141 | 0-30 | 72-132 | 0-30 | 0-30 |
| Tetrachloroethene | 68-134 | 0-30 | 72-124 | 0-30 | 0-30 |
| Trichloroethene | 69-132 | 0-30 | 79-119 | 0-30 | 0-30 |
| Vinyl chloride | 60-145 | 0-30 | 65-135 | 0-30 | 0-30 |
| 4-Bromofluorobenzene (surrogate) | 36-150 | 0-30 | 36-150 | 0-30 | 0-30 |
| Dibromofluoromethane (surrogate) | 46-141 | 0-30 | 46-141 | 0-30 | 0-30 |
| Toluene d-8 (surrogate) | 45-147 | 0-30 | 45-147 | 0-30 | 0-30 |
| **EPA METHOD 624 (NPDES)** | | | | | |
| 1,1,1-Trichloroethane (TCA) | 62-155 | 30 | 68-137 | 30 | 35 |
| 1,1,2,2-Tetrachloroethane | 29-157 | 30 | 58-134 | 30 | 35 |
| 1,1,2-Trichloroethane | 52-140 | 30 | 65-131 | 30 | 35 |
| 1,1-Dichloroethane | 59-146 | 30 | 66-133 | 30 | 35 |
| 1,1-Dichloroethene | 63-163 | 30 | 66-144 | 30 | 35 |
| 1,2-Dichlorobenzene | 61-136 | 30 | 70-128 | 30 | 35 |
| 1,2-Dichloroethane (EDC) | 54-142 | 30 | 64-131 | 30 | 35 |
| 1,2-Dichloropropane | 57-144 | 30 | 66-130 | 30 | 35 |
| 1,3-Dichlorobenzene | 63-140 | 30 | 70-129 | 30 | 35 |
| 1,4-Dichlorobenzene | 61-139 | 30 | 68-130 | 30 | 35 |
| 2-Chloroethyl Vinyl Ether | 10-163 | 30 | 10-190 | 30 | 35 |
| Acrolein | 10-186 | 30 | 24-159 | 30 | 35 |
| Acrylonitrile | 49-143 | 30 | 56-144 | 30 | 35 |
| Benzene | 65-150 | 30 | 71-137 | 30 | 35 |
| Bromodichloromethane | 55-146 | 30 | 72-131 | 30 | 35 |
| Bromoform | 58-145 | 30 | 71-136 | 30 | 35 |
| Bromomethane | 10-173 | 30 | 28-178 | 30 | 35 |
| Carbon Disulfide | 70-130 | 30 | 62-148 | 30 | 35 |
| Carbon Tetrachloride | 61-160 | 30 | 68-141 | 30 | 35 |
| Chlorobenzene | 63-138 | 30 | 69-129 | 30 | 35 |
| Chloroethane | 50-158 | 30 | 58-142 | 30 | 35 |
| Chloroform | 47-152 | 30 | 70-129 | 30 | 35 |

**TABLE A7-1**

**GROUNDWATER REMEDIATON SYSTEM AND NPDES QUALITY CONTROL LIMITS FOR SURFACE DISCHARGE STATION SD002 NIROP FRIDLEY, MINNESOTA**



| Chemical | MS/MSD Samples[1, 2] | | LCS/LCSD Samples[2] | | Field Duplicate RPD[3] |
|---|---|---|---|---|---|
| | %R | RPD | %R | RPD | |
| Chloromethane | 38-167 | 30 | 52-151 | 30 | 35 |
| cis-1,2-Dichloroethene | 70-130 | 30 | 73-129 | 30 | 35 |
| cis-1,3-Dichloropropene | 10-167 | 30 | 66-140 | 30 | 35 |
| Dibromochloromethane | 53-144 | 30 | 69-132 | 30 | 35 |
| Dichlorodifluoromethane | 42-208 | 30 | 22-192 | 30 | 35 |
| Ethylbenzene | 67-153 | 30 | 70-140 | 30 | 35 |
| m,p-Xylenes | 67-159 | 30 | 67-144 | 30 | 35 |
| Methylene Chloride | 50-149 | 30 | 65-136 | 30 | 35 |
| o-Xylene | 65-157 | 30 | 69-139 | 30 | 35 |
| Styrene | 70-130 | 30 | 72-140 | 30 | 35 |
| Tetrachloroethene (PCE) | 59-152 | 30 | 65-137 | 30 | 35 |
| Toluene | 63-150 | 30 | 72-137 | 30 | 35 |
| trans-1,2-Dichloroethene | 61-152 | 30 | 71-135 | 30 | 35 |
| trans-1,3-Dichloropropene | 16-150 | 30 | 57-131 | 30 | 35 |
| Trichloroethene (TCE) | 37-192 | 30 | 70-136 | 30 | 35 |
| Trichlorofluoromethane | 56-156 | 30 | 55-139 | 30 | 35 |
| Trichlorotrifluoroethane | 70-130 | 30 | 64-160 | 30 | 35 |
| Vinyl Acetate | 70-130 | 30 | 43-194 | 30 | 35 |
| Vinyl Chloride | 54-167 | 30 | 55-147 | 30 | 35 |
| Dibromofluoromethane (Surr.) | 59-133 | NA | 59-133 | NA | 35 |
| Toluene-D8 (Surr.) | 71-132 | NA | 71-132 | NA | 35 |
| 4-Bromofluorobenzene (Surr.) | 66-122 | NA | 66-122 | NA | 35 |

1 These acceptance limits apply to spikes that augment the native sample analyte concentration by at least 25 percent.

2 Recoveries less than 50 percent will cause data to be rejected during data validation. Values between 50 and 70 percent will be flagged with a "J" qualifier flag. This 50 percent limit is in conflict with the National Functional Guidelines for Organic Data Review and written MPCA guidance. However, per MPCA request it will be applied for the AMR data set only. The Navy reserves the right to revisit this requirement for all other data uses, in the event that data of otherwise acceptable quality have been routinely rejected.

3 These acceptance limits apply to original and duplicate sample concentrations greater than five times the reporting limit. If one of the results is greater than five times the reporting limit, the acceptance criterion is ±RL. If one or the other results is a non-detect, the reported percent RPD will be 200 percent.

LCS/LCSD = Laboratory control sample/laboratory control duplicate.
MS/MSD = Matrix spike/matrix spike duplicate.
%R = Percent recovery.
RPD = Relative percent difference.

**TABLE A7-2**

**NON-CALIBRATION QC SAMPLE USAGE, FREQUENCIES, ACCEPTANCE LIMITS, AND CORRECTIVE ACTIONS**
**NIROP FRIDLEY, MINNESOTA**


| QC Sample Type | Collection Frequency | Acceptance Limits | Corrective Action |
|---|---|---|---|
| Field Duplicate(1) | 1 per 10 investigative samples collected. | See Table A7-1 | Qualify data according to data validation requirements. |
| Equipment Rinsate Blank | 1 per 10 investigative samples collected, with a minimum of one per day of sampling, per non-disposable sampling device/instrument.<br><br>For pre-cleaned, dedicated, and/or disposable equipment, one rinsate blank will be collected and analyzed at a frequency of one per lot or "batch blank" for a specific equipment type. | < RL | Identify source of contamination, if feasible. Qualify data according to validation criteria. Qualify use of data if contamination appears to have adversely affected its usability. |
| Internal Standard | At least one internal standard per sample for GC/MS analyses. | Retention times stable to ± 30 seconds; area counts stable to within factor of 2. | Laboratory action taken per applicable SOP. TtNUS action taken per validation protocols and Section D1.4. |
| Laboratory Control Sample | 1 per 20 environmental samples per matrix. | See Table A7-1 | Laboratory action taken per applicable SOP. TtNUS action taken per validation protocols and Section D1.4. |
| Laboratory Duplicate (except VOCs) | 1 per 20 environmental samples analyzed for target analytes. | See Table A7-1 | Laboratory action taken per applicable SOP. TtNUS action taken per validation protocols and Section D1.4. |
| Laboratory Method Blank | 1 per 20 environmental samples or per preparation batch, whichever is more frequent. | < RL | Laboratory action taken per applicable SOP. TtNUS action taken per validation protocols and Section D1.4. |
| Matrix Spike(2) | 1 per 20 environmental samples. | See Table A7-1 | Laboratory action taken per applicable SOP. TtNUS action taken per validation protocols and Section D1.4. |
| Matrix Spike Duplicate(2) | 1 per 20 environmental samples analyzed for organic target analytes. | See Table A7-1 | Laboratory action taken per applicable SOP. TtNUS action taken per validation protocols and Section D1.4. |

**TABLE A7-2**

**NON-CALIBRATION QC SAMPLE USAGE, FREQUENCIES, ACCEPTANCE LIMITS, AND CORRECTIVE ACTIONS**
**NIROP FRIDLEY, MINNESOTA**


| QC Sample Type | Collection Frequency | Acceptance Limits | Corrective Action |
|---|---|---|---|
| Surrogate | At least one per sample for organic chromatographic analyses (GC, GC/MS, and HPLC). | See Table A7-1 | Laboratory action taken per applicable SOP. TtNUS action taken per validation protocols and Section D1.4. |
| Temperature Blank | One blank per sample cooler. | 4 ± 2 °C | Laboratory action taken per applicable SOP. TtNUS action taken per validation protocols and Section D1.4. |
| Trip Blank | One blank per sample cooler. | < RL | Laboratory action taken per applicable SOP. TtNUS action taken per validation protocols and Section D1.4. |

1 Refer to Section A7.1.2 for the strategy for obtaining precision estimates for groundwater.
2 Matrix spikes and matrix spike duplicates are not analyzed in the field, but additional sample material must be collected in the field to ensure that the laboratory has enough material for spiking and duplicate analysis.

RL = Reporting Limit.
FOL = Field Operations Leader.
GC/MS = Gas chromatography/mass spectrometer.
HPLC = High-performance liquid chromatography.

# A8 SPECIAL TRAINING REQUIREMENTS

## A8.1 FIELD PERSONNEL

All field personnel will have appropriate training to conduct the field activities to which they are assigned. Additionally, each site worker will be required to have completed a 40-hour course in Health and Safety Training as described under Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(b)(4).

## A8.2 LABORATORY PERSONNEL

Laboratory personnel receive in-field and continuing training as described in Appendix A, Section 17.

# A9 DOCUMENTATION AND RECORDS

## A9.1 DOCUMENTATION, RECORDS, AND DATA MANAGEMENT

This section describes how all project information will be managed, organized, and maintained for efficient use by project personnel. The information management process is outlined from the point of data generation to ultimate storage.

### A9.1.1 Project Documentation and Records

A summary of NIROP records and documentation to be generated and stored in the TtNUS project files is provided in Table A9-1. Information to be maintained in the laboratory files is outlined in Section A9.1.3 of this QAPP.

### A9.1.2 Field Analysis Data Package Deliverables

Field measurements will include those associated with the completion of purging and stabilization of monitoring wells and groundwater sampling and analysis. Field parameters including pH, specific conductance, turbidity, and temperature will be completed for aqueous phase samples using a water quality meter. These readings will be recorded on field sampling sheets, boring logs, or field logbooks.

### A9.1.3 Fixed Laboratory Data Package Deliverables

A turn-around time of 28 days will be requested for all the data. Electronic data deliverables (EDDs), formatted according to the requirements stated in Table A9-2, or similar, will be provided by the laboratory.

The following are required components of the hard copy data deliverables:

- Statement of completeness/accuracy
- Case Narrative
- External chains of custody documents and sample receipt information
- Internal chains of custody
- Summary Data forms (Form Is) showing final results for each sample
- System monitoring compound (surrogate) QC Summaries
- Matrix Spike/Matrix Spike Duplicate results

- Laboratory Control Sample/Laboratory Control Sample Duplicate results
- Method Blank Summaries
- Instrument performance check and internal standard area summaries
- Chromatograms
- Mass spectra
- Calibration data with retention times and responses of calibration standards
- Raw QC data and raw data for calibration and sample analyses
- Sample run log showing the analyses sequences
- Sample calculations
- Sample preparation data

Raw chromatographic data, calibration data, laboratory QC data, and mass spectra are not required to be delivered in electronic format. When manually integrating chromatographic peaks for site samples, the laboratory should provide appropriate documentation (i.e., chromatograms that include data for retention times before and after the manual integration, the reason for each manual integration, and the analyst's initial and date on each manual integration) for every manual integration performed during the analysis of the samples. This should also be done for associated calibration standards and QC samples.

### A9.1.4 Data Reporting Formats

Field data will be recorded in the field logbooks and field forms. All logbook and log sheet entries must be made in indelible ink (black pen is preferred). No erasures or liquid paper or white out are permitted. If an incorrect entry is made, the data will be crossed out with a single strike mark, initialed, and dated. The field personnel will sign and date the logbook pages and field forms. Examples of the forms to be used in the field are presented in Appendix D of the RAMP.

Laboratory data delivered in electronic database files will be formatted according to the requirements of Table A9-2. Hardcopy data will follow standard CLP conventions, with summary data provided on Form Is and supporting data provided on additional applicable forms.

### A9.1.5 Record Retention Time

All reports and records for NIROP Fridley will be retained for 10 years.

**TABLE A9-1**

**PROJECT DOCUMENTATION AND RECORDS**
**NIROP FRIDLEY, MINNESOTA**

| Sample Collection Records | Fixed Laboratory Records | Data Assessment Records | Other |
|---|---|---|---|
| Field Logbooks | Sample receipt, custody and tracking records | Audit report and quality notices | All versions of QAPP |
| Sample Log Sheet-Soil | Standards traceability logs | Data validation report | Health and safety plan |
| Sample Log Sheet-“Low Flow” Groundwater | Equipment calibration logs | | All versions of project reports |
| Boring Logs | Sample prep logs | | |
| Well Construction Logs | Sample analysis logs | | |
| Well Development Logs | Equipment maintenance and testing logs | | |
| Chain-of-Custody Records | Corrective action forms | | |
| Telephone Logs | Data results forms | | |
| Field Modification Records | Reported results for standards, QC checks, and QC samples | | |
| Field Instrument Calibration Logs | Instrument print-outs for samples and standards | | |
| | Sample disposal records | | |
| | Telephone logs | | |

**TABLE A9-2**

**ELECTRONIC DATA DELIVERABLE REQUIREMENTS**
**NIROP FRIDLEY, MINNESOTA**


The analytical data will be delivered electronically in a text file format (filename.txt). The structure of the database is described in the table below. It shall be the responsibility of the laboratory to ensure that all electronic entries are in strict accordance with the information provided on the hard copy Form I.

| DATA FIELD | DATA TYPE | FIELD WIDTH (decimal places) | DATA FIELD DESCRIPTION |
|---|---|---|---|
| LOCATION | C | 15 | Field sample location as listed on the chain-of-custody. The location number indicated in this field should never be truncated. |
| SAMPLE_NO | C | 25 | Field sample ID as listed on the chain-of-custody. The sample number indicated in this field should never be truncated. The only exception for this field not matching the chain-of-custody is for reanalyses and matrix spike results in which a RE or MS suffix will be added to the sample number respectively. |
| TOP_DEPTH | N | 5(1) | Top Depth as listed on the Chain of Custody. |
| BOT_DEPTH | N | 5(1) | Bottom Depth as listed on the Chain of Custody. |
| MATRIX | C | 2 | Matrix as indicated on the Chain of Custody. |
| COLL_METH | C | 2 | “G” (Grab) or “CP” (Composite) as indicated on the Chain of Custody. |
| LAB_ID | C | 15 | Laboratory number for the given sample. |
| LABORATORY | C | 25 | Laboratory name. |
| BATCH_NO | C | 10 | Laboratory code for batch of samples included in a given run. |
| ASSOC_BLNK | C | 15 | Laboratory name of the method blank associated with that particular batch of samples. |
| QC_TYPE | C | 10 | Normal Environmental Sample = “NORMAL”, Laboratory Duplicate = “DUPLICATE”, Matrix Spike = “MS”, Matrix Spike Duplicate = “MSD”, Laboratory Control Sample = “LCS”, Laboratory Control Sample Duplicate = “LCSD”, Method Blank = “M_BLANK”, Preparation Blank = “P_BLANK”. |
| RES_TYPE | C | 5 | Surrogate Recoveries = “SUR”, Target Compound = “TRG”, Internal standards = “IS” |
| SAMP_DATE | D | 8 | Date of sample collection as indicated on the Chain of Custody. Example: 11/07/93. |
| SAMP_TIME | T | 5 | Time of sample collection as indicated on the Chain of Custody. Reported as five character string. |
| REC_DATE | D | 8 | Date sample was received by the laboratory. |
| EXTR_DATE | D | 8 | Date sample was extracted or prepared by the laboratory. |
| ANAL_DATE | D | 8 | Date sample was analyzed by the laboratory. |
| RUN_NUMBER | N | 2 (0) | The number of the analytical run for a given sample in sequence. For example, if a sample is diluted and reanalyzed, the original run number would be 1 and the reanalysis would be 2. |

**TABLE A9-2**

**ELECTRONIC DATA DELIVERABLE REQUIREMENTS**
**NIROP FRIDLEY, MINNESOTA**


| DATA FIELD | DATA TYPE | FIELD WIDTH (decimal places) | DATA FIELD DESCRIPTION |
|---|---|---|---|
| SDG | C | 15 | Sample delivery group identifier assigned by the laboratory. This number should exactly match the SDG designated on the hardcopy data package. |
| PROJECT_NO | C | 10 | Identification of Project Number or Contract Task Order (CTO) number. |
| PROJ_MNGR | C | 25 | The Tetra Tech NUS Project Manager's last name, followed by a comma, followed by the first initial of the Project Manager. Example: HUTSON, D. |
| PARAMETER | C | 45 | Chemical or analyte name exactly as reported on Form I. |
| CAS_NO | C | 10 | Chemical Abstract Service number for the parameter listed. The CAS number should be reported exactly as it is listed in publications such as the Merck Index. This field should be left blank for those parameters not having CAS numbers (e.g. Total Organic Carbon). |
| FRACTION | C | 8 | Metals = 'M', Volatiles = 'OV', Semivolatiles/BNAs = 'OS', Pesticides = 'PEST', Herbicides = 'HERB', Polychlorinated Biphenyls = 'PCB', Explosives = 'EXP', Any petroleum hydrocarbon or fuel = 'TPH', Radionuclide = 'RAD', Miscellaneous = 'MISC', Dioxin/Furans = 'DIOX |
| SORT | C | 5 | Leave this field blank. To be filled in by Tetra Tech NUS, Inc. |
| EXTR_METH | C | 20 | Extraction method used. Example: '5035' for SW-846 Method 5035. |
| ANAL_METH | C | 20 | Analytical method used to quantitate parameter concentrations as listed in the laboratory technical specification. Example: 8270C for SW-846 Method 8270C. |
| LAB_RESULT | C | 20 | Reported value in units specified in the UNITS field containing the proper number of significant digits. The % Recovery for matrix spikes, laboratory control samples, and surrogates shall ALSO be placed in this field. |
| UNITS | C | 5 | The units of measure as reported on the Form I. |
| LAB_QUAL | C | 2 | The laboratory qualifier as reported on the Form I. For example, a 'U' qualifier should be used for all nondetected results. |
| IDL | N | 15 (6) | Instrument detection limit in units specified in the UNITS field. |
| MDL | N | 15 (6) | Method detection limit in units specified in the UNITS field and method specified in the METHOD field. |
| CRDL_CRQL | N | 15 (6) | Contract Required Detection/Quantitation Limit in the units specified in the UNITS field. RDL for non-CLP parameters. |
| DIL_FACTOR | N | 6 (1) | Dilution factor. |
| PCT_MOIST | N | 5 (1) | Percent moisture for soil samples; blank for water samples. |

**TABLE A9-2**

**ELECTRONIC DATA DELIVERABLE REQUIREMENTS**
**NIROP FRIDLEY, MINNESOTA**


| DATA FIELD | DATA TYPE | FIELD WIDTH (decimal places) | DATA FIELD DESCRIPTION |
|---|---|---|---|
| COMMENTS | C | 20 | Analytical result qualifier or comment other than that listed in the LAB_QUAL field. Example: 'Reanalysis'. |

C = Character string (everything shall be reported in capital letters)
N = Numeric string (decimal places are in parentheses in field width column)
D = Date (Ex: 03/25/02)

# B1 SAMPLING PROCESS DESIGN

This section contains a description of the applicable environmental sampling networks as well as the strategies and rationales behind the sampling plan design. The mechanics of sample collection, packaging, shipping, and documentation are also described either explicitly or through citation of the RAMP.

Groundwater samples will be collected during the NIROP Fridley FA.

Site-specific health and safety concerns and processes used to govern the protection of worker health and safety are described in the HASP.

## B1.1 SAMPLING DESIGN AND RATIONALE

Specific details regarding groundwater sampling and analysis and field operation are provided in Sections 4.0 and 5.0 of the RAMP. Laboratory methods are listed in Section B4.

## B1.2 FIELD MOBILIZATION / DEMOBILIZATION

Following approval of the QAPP, Bay West will begin mobilization activities. All field team members will review the QAPP (including the HASP) prior to mobilization to become familiar with the scope of the field activities and the following:

- Identification of the QAPP, including the HASP and applicable field SOPs
- Site-specific safety concerns and requirements
- Project objectives
- Sampling design and strategies for groundwater
- Site-specific particulars of field operations (e.g., locations of utilities, physical access to sampling locations, communication mechanisms, lines of authority and responsibility, scheduling requirements, sample shipping concerns, etc.)

The Bay West FOL will coordinate the mobilization activities for this project.

## B1.3 SAMPLE COLLECTION

The specifics concerning proposed sampling locations, sampling procedures, planned analyses, and field operations that are to be followed as part of sample acquisition are covered in Sections 4.0 and 5.0 of the RAMP. Target analytes for samples collected from surface discharge station SD002 are listed in Table A6-2. The chemical analysis summary, including the number of samples to be collected, is shown in Tables 4-11 and 5-4 of the RAMP. The summary of sample analyses, bottle requirements, preservation requirements, and holding time requirements is listed in Tables 4-7 and 5-3 of the RAMP.

## B1.4 SAMPLE IDENTIFICATION SYSTEM

All samples will be properly labeled with a sample label affixed on the sample container and a sample tag secured around the neck of the sample container. The sample labels and sample tags will include the following information: project name, sample tracking number, sampling date, laboratory analyses requested, matrix type, preservative and sampler's initials.

Each sample collected will be assigned a unique sample tracking number or identification as per Sections 4.3.5 and 5.3.3.1 of the RAMP. The sample tracking number is a multi-segment, alpha-numeric code that identifies the site, type of sample, and sample location. Any other pertinent information regarding sample identification will be recorded in the field logbooks and/or on sample logsheets. Examples of the sample tracking numbers to be used for groundwater sampling are provided in Section 4.3.5.1 of the RAMP.

MS and laboratory duplicate samples will be designated on the field documentation forms and sample labels.

## B1.5 SAMPLE HANDLING, PRESERVATION, AND SHIPPING

Sample handling includes the field-related considerations connected with selecting sample containers, preservatives, allowable holding times, and analyses requested. Samples may be unstable and therefore require preservation to prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Preservation requirements for each of the chemicals of interest are provided in Tables 4-7 and 5-3 of the RAMP.

Samples must be shipped to the CAS/Kelso facility located at:

Greg Salata
Columbia Analytical Services (CAS)
1317 South 13th Avenue
Kelso WA 98626
Tel. No. (360) 577-7222

The following procedures will be followed when shipping samples for laboratory analysis:

- All samples will be promptly chilled with ice to 4° ± 2° Celsius and packaged in an insulated cooler for transport. Each cooler shipped to the laboratory will include a temperature blank. Ice will be sealed in containers to prevent water leakage. Samples will not be frozen. Each sample container will be placed in a Ziplock™ bag to prevent contamination. The Ziplock™ bag will be placed in a bubble-wrap sleeve to protect against breakage. The temperature of the cooler will be measured using the temperature blank and then recorded in the appropriate section of the COC form.

- Only shipping containers that meet all applicable state and federal standards for safe shipment will be used.

- Shipping containers will be sealed with nylon strapping tape in at least two places, and custody seals will be signed, dated, and affixed in a manner that will allow the receiver to quickly identify any tampering that may have occurred during transport to the laboratory.

- The field COC document will be taped to the top inside cover of the shipping container in a sealed plastic envelope.

- Shipment will be made by a public courier at the next scheduled pickup following completion of sample collection.

Sections 4.3.5 and 4.3.6 of the RAMP provide detailed descriptions of sample handling, packaging, and shipping procedures required for this project. The FOL will be responsible for insuring the completion of the following forms:

- Sample labels
- COC forms

- Custody seals for coolers
- Shipping labels for coolers
- Express mail air bills

## B1.6 SAMPLE CUSTODY

Custody of samples must be maintained and documented at all times beginning with the collection of samples in the field. Sample custody procedures are addressed in Section B3.

## B1.7 QUALITY CONTROL SAMPLES

This section focuses on field QC samples that will be collected as part of this environmental investigation. Field QC samples include field duplicates, equipment rinsate blanks, and trip blanks. Tables 4-11 and 5-4 of the RAMP presents the types and numbers of required field QC samples. Section B5.1 provides definitions and details for these and all other QC checks to be used during this investigation. Field QC sample requirements for field duplicates and equipment rinsate blanks required for this project are as follows:

Field Duplicates The field duplicate QC sample requirement for this project will be met as follows:

If monitoring well equilibrium has been attained prior to groundwater sampling, all replicate samples within a well should represent the same analyte concentrations. If the samples are not equally representative, it is reasonable to expect that the first and last samples removed from a well will be the most different in analyte concentration. Therefore, field duplicate groundwater samples for QA/QC purposes will be the first and last sample removed from a randomly-selected well after field monitoring has shown that sampling conditions are stable.

Equipment Rinsate Blanks Equipment rinsate blanks will be obtained under representative field conditions by running analyte-free water through sample collection equipment after decontamination and placing it in the appropriate sample containers for analysis. Equipment rinsate blanks will be collected for non-dedicated equipment for all sampling rounds. Decontamination procedures for non-dedicated equipment will be conducted and are provided in 4.3.1.4 of the RAMP.

Trip Blanks Trip blanks will be supplied by the analytical laboratory. Trip blanks are samples of organic-free water that are prepared by the laboratory and accompany each cooler containing VOC samples.

## B1.8 SURVEYING

Existing survey data will be used to locate the horizontal and vertical locations of all sampling points.

## B1.9 INVESTIGATION DERIVED WASTE

It is anticipated that this investigation will generate three types of potentially contaminated residues or investigation derived waste (IDW):

- Personal protective equipment (PPE)
- Well development and purge fluids
- Equipment decontamination fluids

IDW will be handled as follows:

- PPE All PPE will be double bagged and disposed of appropriately.

- Well Development and Purge Fluids The well development and purge fluids generated during this investigation are not expected to represent a significant risk to human health or the environment if properly managed. All well development and purge water will be disposed by pumping into the GWTF pump-house located on Navy property.

- Equipment Decontamination Fluids All decontamination fluids will be combined with well development and purge fluids when possible and handled in the same manner.

- Tubing Used for Development, Purging, or Sampling All tubing used to develop, purge, or sample a well will be double bagged and disposed of appropriately.

## B1.10 RECORD KEEPING

In addition to the COC record, certain standard forms will be completed for sample description and documentation. These forms shall include sample log sheets, daily activity records, and logbooks. A bound, weatherproof notebook shall be maintained by the FOL. All information related to sampling or field activities will be recorded in the field notebook. This information will include, but is not limited to, sampling times, weather conditions, unusual events, field measurements, and descriptions of

photographs, names of people on-site, visitors, calibration information for field instruments, corrective actions, and sampling points.

A bound, weatherproof logbook shall be maintained by the FOL. This book will contain a summary of each day's activities and will reference the field notebook when applicable. At the completion of field activities, the FOL shall submit to the Navy all field records, data, field notebook, logbook, COC records, sample log sheets, and daily activity logs.

# B2 SAMPLING METHODS REQUIREMENTS

Requirements for the collection of field measurements are presented in this section.

## B2.1 FIELD MEASUREMENT PROCEDURES

Chemical/physical parameters to be measured using field instrumentation include pH, specific conductance, temperature, and turbidity. The field target parameters are presented in Table A6-1. Measurement of field parameters (pH, temperature, turbidity, DO, ORP, and conductivity) will be conducted using a YSI-650MDS;6820 SONDE. For most parameters, the product manual specifies weekly calibration. For some parameters, the manual specifies daily calibration. For the NIROP project, Bay West has historically done daily calibration for all parameters. Calibration is completed in accordance with manufacturer's specifications and the procedures described in Section B7.1. Preventative maintenance of field instrumentation is discussed in Section B6.1.

# B3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Documented sample custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample location and collection, laboratory analysis, and final evidence files. Final evidence files, including all original laboratory reports and purge files, are maintained under document control in a secure area. A sample or evidence file is under custody when any one of the following conditions is satisfied.

- The item is in the actual physical possession of an authorized person.
- The item is in view of the person after being in his or her possession.
- The item was placed in a secure area to prevent tampering.
- The item is in a designated and identified secure area with access restricted to authorized personnel only.

The COC report is a multi-part, standardized form used to summarize and document pertinent sample information such as sample identification and type, sample matrix, date and time of collection, preservation, and requested analyses. Furthermore, through the sequential signature of various sample custodians (e.g., sampler, airbill number, laboratory sample custodian), the COC report documents sample custody and tracking. Laboratory custody procedures will ensure that sample integrity is not compromised from the time of receipt at the laboratory until final data are reported to TtNUS. This requires that the laboratory control all sample handling and storage conditions and circumstances. Custody procedures apply to all environmental and associated field QC samples obtained as part of the data collection system.

## B3.1 FIELD CUSTODY PROCEDURES

The FOL (or designee) is responsible for the care and custody of the samples collected until they are relinquished to the laboratory or entrusted to a commercial courier. COC forms are completed to the fullest extent possible for each sample cooler used for shipment. The forms are legibly completed with waterproof ink and are signed and dated by the sampler. COC forms will include the following information: project name, sample number, time collected, matrix, designated analysis, type of sample, preservative, and name of sampler. Pertinent notes or comments are also indicated on the COC form.

Information similar to that contained on the COC form is provided on the sample label that is securely attached to the sample bottle. In addition, sample tags will be affixed to the sample bottles and returned by the analytical laboratory for inclusion in the final evidence file. Sample labels and tags will include, at a minimum, the following information: sample number, date and time of collection, analysis required for the sample aliquot in the associated sample container, and a space for the laboratory sample number. The procedures for sample numbering are described in Section 4.3.5.1 of the RAMP.

Site conditions during sampling and the care with which samples are handled may factor into the degree to which samples represent the media from which they are collected. This, in turn, could affect the ability of decision makers to make accurate and timely decisions concerning the contamination status of the site. As appropriate, logbooks are assigned to and maintained by key field team personnel. The logbooks are used to record daily conditions/activities such as weather conditions, dates/times of significant events, level of PPE used, actual sample collection locations, photographs taken, problems encountered during field activities and corrective actions taken to overcome problems. In addition, the names of site visitors and the purposes of their visits shall be recorded. Field logbook assignments shall be recorded in the Site Logbook or other central file whose location is known by the FOL. Together, field logbooks and sample documentation including COC forms provide a record that should allow a technically qualified individual to reconstruct significant field activities. The FOL is responsible for the maintenance and security of all field records at the end of each workday during field activities. At the completion of field activities, the FOL will forward all field records to the Navy. All sample records are eventually docketed into the final evidence file.

Section 4.3.6 of the RAMP describes procedures for groundwater sample packaging and shipment. A temperature blank shall be included in each cooler containing groundwater samples for VOC analysis for use by the laboratory upon receipt. A trip blank shall be included in each cooler containing VOC samples. Each cooler shall be taped shut with strapping tape in at least two places to prevent tampering. Custody seals shall be attached so that the seals must be broken to open the cooler. Shipment will be made by a public courier at the next scheduled pickup following completion of the sample collection.

The following procedures will be used when transferring custody of samples. As previously noted, individual custody records will accompany each sample cooler. The methods of shipment, courier name, and other pertinent information will be entered in the remarks section of the custody record. When transferring samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the COC record. The original record (top copy of the multi-part form) will accompany the shipment, and the field sampler will retain a copy. This record documents the sample custody transfer from the sampler to the laboratory, often through another person or agency (common courier). After COC

records have been placed within sealed shipping coolers, the signed courier airbills will serve to document COC. Upon arrival at the laboratory, internal laboratory sample custody procedures will be followed (see Section B3.2). Additional field custody procedures are presented in the SOPs found in Appendix B.

## B3.2 LABORATORY CUSTODY PROCEDURES

When CAS/Kelso receives a shipment of samples, the laboratory's sample custodian will verify that the correct number of coolers has been received. The custodian will examine each cooler's custody seals to verify that they are intact and that the integrity of the environmental samples has been maintained. The custodian will then open each cooler and measure its internal temperature by measuring the temperature of the temperature blank. The temperature reading will be documented in the comments column of the COC form. The sample custodian will then sign the COC form and examine the contents of the cooler. Identification of broken sample containers or discrepancies between the COC form and sample labels will be recorded. The laboratory will retain the original field COC forms, providing copies of the forms with the final data package deliverable. All problems or discrepancies noted during this process will be promptly reported to the Navy. Samples will be logged into the laboratory information management system. Additional information regarding laboratory custody procedures can be found in Section 8.0 of the laboratory QA Manual in Appendix A.

## B3.3 FINAL EVIDENCE FILES

The Administrative Record at NIROP Fridley will be the repository for all documents that constitute evidence relevant to sampling and analysis activities as described in this QAPP. NIROP Fridley will be the custodian of the evidence file and will maintain the contents of these files, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews in a secure, limited access location and under custody of the NIROP Fridley Site Manager. The control file will include at a minimum:

- Field logbooks
- Field data and data deliverables
- Photographs and negatives
- Drawings
- Soil boring logs
- Laboratory data deliverables
- Data validation reports

- Data assessment reports
- Progress reports, QA reports, interim project reports, etc.
- All custody documentation (tags, forms, airbills, etc.)

Upon completion of the contract, all files associated with this investigation will be maintained in the Administrative Record at NIROP Fridley and will be available for inspection by the regulatory agencies for at least 10 years. Prior to disposal of all administrative records, the records will be offered to the USEPA.

# B4 ANALYTICAL METHODS REQUIREMENTS

Analytical procedures are presented in this section.

## B4.1 LABORATORY ANALYTICAL AND MEASUREMENT PROCEDURES

Table B4-1 provides a summary of the laboratory analytical methods and associated laboratory SOPs to be used during this investigation. The laboratory SOPs are included in Appendix A of this QAPP.

### B4.1.1 List of Project Target Compounds and Detection Limits

A list of the laboratory target analytes, project-specific target levels, and laboratory-specific method detection limits (MDLs) and RLs is provided in Table A6-2. The MDLs shown in the table have been determined experimentally using procedures based on the method provided in 40 CFR Part 136 Appendix B (U.S. EPA, 1984). All environmental data will be reported to the analyte's laboratory-specific RL. An analyte's RL is based on the associated MDL with adjustments made to ensure that the precision and accuracy requirements of the method are attainable. RLs will be adjusted on a sample-by-sample basis, as necessary, based on dilutions and sample volume.

### B4.1.2 List of Associated Quality Control Samples

Field and laboratory QC samples to be analyzed in support of this project are identified in Section B5. The analytical SOPs included in Appendix A of the QAPP address minimum QC requirements for each associated analytical method including calibration QC requirements. Details on QC sample usage are provided in Section B5.

**TABLE B4-1**

**SUMMARY OF AQUEOUS SAMPLE ANALYTICAL PROCEDURES FOR THE GROUNDWATER REMEDIATION SYSTEM NIROP FRIDLEY, MINNESOTA**

| Analytical Parameter | Preparation Method | Analytical Method | Preparation/Analytical SOP[1] |
|---|---|---|---|
| VOCs | SW-846[2] 5030B | SW-846 8260B | VOC-5030/VOC-8260 |

1 Laboratory SOPs are included in Appendix A of this QAPP.
2 USEPA, 1997b.

# B5 QUALITY CONTROL REQUIREMENTS

Field and laboratory QC samples will be analyzed routinely to evaluate overall data quality. This section provides information regarding those internal QC checks. Laboratory QC samples are addressed in Section A7 and B5.2 of the QAPP. Section B7 addresses instrument calibrations; Section B5.2 addresses non-calibration analytical QC. Table A7-2 summarizes the routine field and laboratory non-calibration QC sample analysis frequencies and associated corrective actions.

## B5.1 FIELD QUALITY CONTROL CHECKS

TtNUS has established a QC program that is designated to monitor and assess the quality of field work performed during environmental investigations. That program includes the use of various types of QC samples as indicated in Table A7-2. Some of the samples in Table A7-2 are identified as requiring additional sample material to be collected in the field even though the actual field QC check is performed in the laboratory.

The field QC samples consist of field duplicates, equipment rinsate blanks, temperature blanks, and trip blanks. Temperature blanks will be included in each cooler submitted to the laboratory to monitor sample storage conditions prior to arrival at the laboratory. Trip blanks will be included in each sample cooler containing VOC samples. With the exception of temperature blanks, each type of field QC sample undergoes the same preservation, analysis, and reporting procedures as the related environmental samples. The types of field QC samples to be used for this project are described in detail in Sections B5.1.1 through B5.1.4. Target precision and accuracy values, as applicable, for field QC samples are presented in Table A7-2.

### B5.1.1 <u>Field Duplicates</u>

Field duplicates will be collected and analyzed for chemical constituents to measure the cumulative uncertainty (i.e., precision) of the sample collection, splitting, handling, storage, preparation and analysis operations, as well as natural sample heterogeneity. For groundwater sampling, field duplicates may be generated by collecting individual water samples from the same well as the first and last sample removed rather than by rapid succession. Field duplicates are labeled as individual environmental samples and are not identified to the laboratory as duplicate samples.

### B5.1.2 Rinsate Blanks

Equipment rinsate blanks or rinsate blanks are obtained under representative field conditions by collecting the rinse water generated by running analyte-free water through sample collection equipment after sampling and decontamination and prior to use. These blanks will be collected to indicate the potential for sample cross-contamination through the use of improperly cleaned sampling equipment.

### B5.1.3 Trip Blanks

Trip blanks are samples of analyte-free water that measure cross-contamination of VOC samples during transport. The trip blank is prepared by the laboratory and must accompany each sample cooler used to transport VOC samples. The trip blank is not to be opened in the field.

### B5.1.4 Temperature Blanks

Temperature blanks are vials of water inserted into each sample cooler prior to shipment to the field. The temperature of the temperature blank is measured prior to shipment and upon receipt at the laboratory to assess whether samples were properly cooled during transit.

## B5.2 LABORATORY QUALITY CONTROL CHECKS

CAS/Kelso operates a QC program that ensures the reliability and validity of the analyses performed at the laboratory. The laboratory's QA Plan describes the policies, organization, objectives, QC activities, and specific QA functions employed by the laboratory. All analytical procedures are documented in writing as SOPs. Each analytical SOP specifies minimum QC requirements for the procedure. As previously noted, SOPs for all analyses to be performed during this investigation are included in Appendix A of this QAPP. Table B4-1 provides a list of the SOPs associated with each analytical procedure. In addition, the laboratory maintains SOPs regarding general laboratory QA operations. Several of these SOPs, as applicable, are also included in Appendix A. The Table of Contents included in Appendix A provides a list of laboratory SOP titles and associated SOP numbers for all SOPs contained in the appendix.

Internal laboratory analytical QC requirements beyond those used for instrument calibration QC are highlighted in the remainder of this section. Additional QC requirements, which are specific to the Department of Defense Quality Systems Manual for Environmental Laboratories (DoD, 2002) (hereafter DoD QSM) and are therefore requirements for this project, are also specified, as applicable, for each of

the QC checks. Target precision and accuracy values (control limits) are presented in Table A7-1. The applicable analytical SOPs include a discussion of calibration QC measures.

### B5.2.1 Laboratory Control Samples

LCSs provide a means to monitor the overall performance of each step during the analysis, including the sample preparation. These are blank spikes (water analyses) that contain concentrations of analytes that are known with a specified degree of certainty.

Based on the requirements of the DoD QSM, LCSs for multiple-analyte organic methods must contain at least two targeted analytes from each major class of compounds subject to analysis. For this project, the laboratory will spike as many target analytes that is reasonable based on the laboratory's past experience with chromatographic co-elution and interference from surrogate compounds and internal standard compounds in groundwater. Performance requirements for target analytes other than those listed in Table A7-1 shall comply with internal laboratory control requirements.

Based on DoD QSM requirements, if recovery of a LCS falls outside the control limits (See Table A7-1), the laboratory will reject the data for the analytical batch and take corrective action. The associated samples, extracts, or digestates may be reanalyzed a single time, and if the LCS recoveries meet acceptance criteria, the data will be reported. If LCS analyte recovery is still outside the acceptance limits, the associated samples in the preparation batch will be reprocessed if sufficient sample is available and holding times have not lapsed. If re-preparation or re-analysis is not possible, the data will be flagged and the sample delivery group (SDG) narrative will include details of the failed LCS.

### B5.2.2 Laboratory Duplicates (Except VOC)

Laboratory duplicates are two subsamples obtained by the laboratory analyst after mixing the sample. If RPD values exceed QC limits for laboratory duplicates (Table A7-1), the analytical process will be investigated to assess whether the observed RPD value is an indication of a deficient analytical system or an indication of excess sample heterogeneity.

### B5.2.3 Internal Standards

Internal standards are added to each sample analyzed by gas chromatography/mass spectrometer (GC/MS) to ensure that the analysis sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (-50 percent to +100 percent) from the associated 12-hour calibration standard.

### B5.2.4 Laboratory Method Blanks

Laboratory method blanks or preparation blanks are an analyte-free matrix prepared and analyzed in accordance with the analytical method employed to determine whether contaminants originating from laboratory sources have been introduced and have affected environmental sample analyses. Analyte-free water is used as a blank for water analyses.

Laboratory method blanks acceptance criteria and corrective actions for non-compliant results are described in detail in the applicable analytical SOP included in Appendix A. Under no circumstances are laboratory method blank contaminant values subtracted from environmental sample analysis results.

### B5.2.5 Matrix Spikes

Matrix spikes are environmental samples to which known quantities of analytes are added prior to sample digestion. These samples provide information about the heterogeneity of the samples as well as the effect of the sample matrix on the sample digestion and measurement methodology.

Matrix spikes, to conform with DoD QSM requirements, will contain all targeted analytes of interest. If the MS recovery in not within applicable control limits, the laboratory will assess the batch to determine whether the spike results are attributable to a matrix effect or are the result of other problems in the analytical process. Based on DoD QSM requirements, if all the batch QC elements that are not affected by the sample matrix are in control (e.g., method blank, LCS, calibration checks) and if there is no evidence that spiking was not properly performed, the poor spike recovery may be attributed to matrix effects. In this case, the associated data will be flagged, but re-preparation and re-analysis will not be required. In such cases, the laboratory is encouraged to contact Bay West to offer them an opportunity for alternate corrective action (re-collection of samples) that could prevent the loss of valuable data. If any of the batch QC elements that are not affected by the sample matrix are out of control, or if there is any evidence that spiking may have been improperly performed, the MS sample will be re-processed through the entire analytical sequence. If there is insufficient sample available, or if holding times have passed, the laboratory will flag the associated data. In such cases, the laboratory is encouraged to contact Bay West to offer them an opportunity for alternate corrective action (re-collection of samples) that could prevent the loss of valuable data. Details of noncompliant and laboratory duplicate results will be included in the SDG narrative.

### B5.2.6 Matrix Spike Duplicates

MSDs are duplicates of matrix spikes and are used for estimating the precision of organic target analyte analyses. They are used in lieu of simple duplicate samples because native environmental samples frequently do not exhibit detectable levels of organic target analytes, which otherwise prevents the calculation of RPD values.

### B5.2.7 Surrogates

Surrogates are organic compounds (typically brominated, fluorinated, or isotopically labeled) that are similar in nature to the compounds of concern and are not likely to be present in environmental media. They are spiked into each sample, standard, and method blank before analysis and are used in organic chromatographic analysis procedures as a check of method effectiveness. Corrective actions for noncompliant surrogate recoveries are presented in the relevant determinative SOPs included in Appendix A of this QAPP. Details of noncompliant surrogate recoveries will be included in the SDG narrative.

### B5.2.8 Additional Laboratory Quality Control Checks

An additional internal laboratory QC check is mass tuning for GC/MS analysis and other analysis-specific QC measures. Specific requirements for this QC check are provided in the applicable SOPs included in Appendix A of this QAPP.

# B6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Equipment used to collect samples will be maintained in accordance with the manufacturers' operation and maintenance manuals. Equipment and instruments will be calibrated in accordance with the procedures and at the frequency presented in Section B7 (Instrument Calibration and Frequency). Preventative maintenance for field and laboratory equipment is addressed in the remainder of this section.

## B6.1 FIELD EQUIPMENT PREVENTATIVE MAINTENANCE

The equipment manager and the equipment operator will be responsible for ensuring that equipment is operating prior to use and that routine maintenance is performed and documented. Field measurements of pH, specific conductance, temperature, and turbidity in groundwater will be taken using an electronic instrument. Maintenance procedures to be performed on the instrument are in accordance with the manufacturer's instructions on preventative maintenance. Any problems encountered while operating the instrument will be recorded in the field logbook, including a description of the symptoms and corrective actions taken. If problems with the equipment are detected and service is required, the equipment will be logged, tagged, and segregated from equipment in proper working order. Use of the equipment will not resume until the problem is corrected.

## B6.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

Proper maintenance of laboratory instruments and equipment is essential. Depending on manufacturers' recommendations, maintenance intervals are established for each instrument. All instruments will be labeled with a model number and serial number, and a maintenance logbook will be maintained for each instrument. Personnel must be alert to the maintenance status of the equipment they are using at all times. Table B6-1 provides a summary of preventive maintenance procedures performed by CAS/Kelso for key analytical instruments and equipment associated with this project. Additional information regarding laboratory instrument preventative maintenance can be found in Section 14.0 of the laboratory QA Manual in Appendix A.

The use of manufacturer-recommended grades or better of supporting supplies and reagents is also a form of preventive maintenance. For example, gases used in the gas chromotographs/mass spectrometers are of sufficient grade to minimize fouling of the instruments. The routine use of other supporting supplies from a reputable manufacturer will assist in averting unnecessary periods of

instrument downtime. An inventory of critical spare parts will also be maintained by the laboratory to minimize instrument downtime.

## B6.3 INSPECTION / ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

All field equipment shall be inspected prior to use to ensure that necessary parts are available. Most equipment planned for use in this project is simple with few to no moving parts. Therefore, a visual inspection prior to use shall be sufficient to ensure that the equipment is suitable for use. This visual inspection shall occur during mobilization and during each use by the person using the equipment. Chemical standards used in the field shall be inspected prior to use to ensure that they are of acceptable quality. The standards shall be of reagent grade or, if purity is specified in the applicable SOP, they shall meet the purity specified in the SOP.

Laboratory inspection and acceptance requirements include:

- Following of individual SOP specifications for grades of chemicals necessary to achieve acceptable analytical performance. SOPs are required to detail the necessary grade of chemicals, including compressed gases.

- Obtaining primary chemical standards from reliable sources that use calibrated glassware in the preparation of the standards and maintaining all certificates supplied with the standards. Emphasis is on obtaining National Institute of Standards and Technology (NIST)-traceable standards where possible.

- Storage of chemical standards in accordance with applicable SOPs and in a manner that preserves their integrity.

- Routine monitoring of de-ionized water and other solvents to ensure that analytical systems, samples, and standards are not contaminated.

- Recording of the date received and the date opened for each container of chemical used for analysis.

## B6.4 REFRIGERATORS/OVENS

The temperatures of refrigerators used for sample storage will be monitored once daily. The acceptable range for refrigerator temperatures is 4°Celsius ±2°Celsius. The temperatures will be recorded on a

Temperature Log. Maintenance of the log will be the responsibility of the sample custodian. The log will contain the following information:

- Date
- Time
- Temperature
- Initials of the person performing the check

Assignment of responsibilities for temperature monitoring to specific personnel does not preclude the participation of other laboratory personnel. If unusual temperature fluctuations are noted, it is the responsibility of the observer to immediately notify the person in charge of the discrepancy before the condition of the samples is compromised.

Unstable or fluctuating temperatures may be indicative of malfunctions in the cooling system. On the other hand, the instability may be due to frequent opening of the door. Regardless of the cause, such an observation must be investigated, and modifications must be made to access procedures, or repairs to equipment must be made, to prevent jeopardizing the integrity of the samples.

Oven temperatures are checked prior to use. The required temperature is dependent on the method to be performed. The oven temperature is recorded with the associated analytical results in a logbook designated for the analytical method.

**TABLE B6-1**

**PREVENTIVE MAINTENANCE FOR CAS/KELSO LABORATORY ANALYTICAL AND SUPPORT INSTRUMENTS NIROP FRIDLEY, MINNESOTA**

| Instrument | Preventive Maintenance | Maintenance Frequency |
|---|---|---|
| GC/MS | Check gas supplies. | Daily; replace when pressure = 50 psig |
| | Change in-line filters | Annually or as needed. |
| | Change septum. | Daily |
| | Clip first foot of capillary column. | As needed |
| | Change guard column. | As needed |
| | Change analytical column. | As needed when peak resolution fails. |
| | Clean jet separator. | As needed |
| | Clean Mass spectrometer source. | As needed (e.g., when tuning fails) |
| | Change vacuum pump oil. | Per service specifications. |
| Refrigerators | Monitor temperature. | Daily |
| Ovens | Monitor temperature. | Daily |
| Balances | Check alignment<br>Check calibration<br>Clean pans and compartment | Before every use<br>Daily<br>After every use. |
| Thermometers | Calibrate against NIST thermometer. | Annually |

GC/MS = Gas chromatography/mass spectrometer.

# B7 INSTRUMENT CALIBRATION AND FREQUENCY

All instrumentation used to perform chemical measurements must be properly calibrated prior to use in order to obtain valid and usable results. Instruments used in the field and in the laboratory will be calibrated according to the procedures governing the use of the instruments. Laboratory SOPs are included in Appendix A. For this investigation, field instrument calibration is described in Section B7.1 and laboratory instrument calibration is outlined in Section B7.2.

## B7.1 FIELD INSTRUMENT CALIBRATION

Several monitoring instruments will be used during field activities, including the following:

- Electronic water level meter
- Water quality meter (combination temperature probe, specific conductance meter, pH meter, and turbidity meter)

The electronic water level meters (M-scopes or equivalent) will be calibrated prior to field use and periodically at the discretion of the FOL. They will be calibrated by comparison of M-scope markings with a steel tape measure.

Calibration of the water quality meter (YSI-650MDS; 6820 SONDE) will be performed according to manufacturer's instructions. Except for temperature, all of the water quality parameters to be tested at NIROP require calibration. Listed below are calibration steps for each parameter.

**<u>Conductivity</u>**

1. From the 2-Calibrate menu off of the Main menu, select number 1-Conductivity.

2. Choose calibration by specific conductance (calibration by conductivity or salinity is also offered but specific conductance is recommended).

3. Enter the value of the standard used during calibration and press Enter.

4. Follow the stabilization of readings and confirm the calibration when the readings are stable by pressing Enter.

5. As instructed, press Enter again to return to Calibrate menu.

**Dissolved Oxygen**

1. From the 2-Calibrate menu off of the Main menu, select number 2-Dissovled Oxy.

2. Choose calibration by percent saturation or mg/L (calibration by percent saturation in water-saturated air in normally recommended).

3. For the percent saturation calibration mode, be certain that the sensor has been thermally equilibrated in water-saturated air, the sensor has been stabilized, and the pressure in the cup has been relieved. Enter the local barometric pressure in mm Hg and press Enter. Monitor the DO readings and press Enter when no changes have occurred for approximately 30 seconds. Go to Step 5.

4. For the mg/L mode, calibration is carried out in a water sample which has a known concentration of dissolved oxygen. Immerse sensor in water. After thermal equilibrium, enter the known mg/L value and press Enter. Monitor the DO readings and press Enter when no changes have occurred for approximately 30 seconds.

5. As instructed, press Enter again to return to the Calibrate menu.

**pH**

1. From the 2-Calibrate menu off of the Main menu, select number 4-ISE1-pH.
2. Choose 1-point, 2-point, or 3-point calibrations.
3. Immerse in one of the buffers and enter the actual pH value and press Enter.
4. Follow the stabilization of readings and confirm the calibration when the readings are stable by pressing Enter.
5. Repeat Steps 3-4 based on the number of buffer solutions chosen (2 or 3).
6. As instructed, press Enter again to return to Calibrate menu.

**Turbidity**

1. From the 2-Calibrate menu off of the Main menu, select number 9-Turbidity.

2. Choose 1-point, 2-point, or 3-point calibrations.

3. Place the instrument in clear water with no suspended solids and input 0 NTU at the screen prompt and press Enter.

4. Follow the stabilization of readings and confirm the calibration when the readings are stable by pressing Enter.

5. Repeat Steps 3-4 based on the number of solutions chosen (2 or 3).

6. As instructed, press Enter again to return to Calibrate menu.

All calibrations will be documented on an Equipment Calibration Log. During calibration, an appropriate maintenance check will be performed on each piece of equipment. If damaged or defective parts are identified during the maintenance check and it is determined that the damage could have an impact on the instrument's performance, the instrument will be removed from service until the defective parts are repaired or replaced.

## B7.2 LABORATORY INSTRUMENT CALIBRATION

Organic chemical analyses begin with an initial calibration of the GC/MS system with an initial calibration curve that establishes the instrument responses as functions of analyte concentration. Calibration standards include target analytes and any applicable internal standards or surrogate compounds. On a routine basis, a continuing calibration is performed in which the validity of the calibration curve is checked with a known chemical standard of a source independent of the initial calibration standards. This continuing calibration standard contains the target analytes of interest and applicable internal standards and surrogate compounds. The internal standards compensate for variations in analytical response that may occur in individual chromatographic analyses. The surrogate compounds provide a means to assess the efficiency of analyte extraction and analysis for each sample.

All standards used to calibrate analytical instruments must be obtained from the NIST or through a reliable commercial supplier with a proven record for quality standards. All commercially supplied

standards will be traceable to NIST reference standards, where possible, and appropriate pedigree documentation will be obtained from the supplier. In cases where documentation is not available, the laboratory will analyze the standard and compare the results to a USEPA-known or previous NIST-traceable standard.

Calibrations and associated documentation are required for all laboratory instruments. The documentation for calibrations performed in-house shall identify the person performing the calibration, the instrument being calibrated, the standards used for calibration and their concentration values or other pertinent calibration values, the source of the calibration standards, and the date of calibration. Certain instruments (e.g., balances) may be calibrated by a third party. In those cases, the details of calibration as described above and a certification of acceptable performance shall be obtained from the third party. The period during which the calibration is valid may appear in the calibration record or may be governed by a SOP.

Calibration procedures, frequency requirements, acceptance criteria, and conditions that require recalibration are described for each analytical procedure in the applicable laboratory SOPs included in Appendix A. The laboratory must maintain calibration data with data packages so that recovery of calibrations and verification of analyte concentrations can be made.

# B8 DATA MANAGEMENT

The data review process is performed in two phases. The initial phase, contract compliance screening, consists of inspecting the laboratory data deliverables to determine if the contract requirements were met. The second phase, data validation, includes a review of data results to assess data usability and application of data qualifiers to the analytical results based on adherence to method protocols and laboratory-specific QA/QC limits. Method SW8260B data will undergo validation.

## B8.1 CONTRACT COMPLIANCE SCREENING

Contract compliance screening, performed by TtNUS, is the review of sample data deliverables for completeness and compliance with project requirements. Completeness is evaluated by ensuring that all required data deliverables are received in a legible format with all required information. The contract compliance screening process also includes a review of the COC forms, case narratives, and project reporting limits. Sample resubmission requests, documentation of nonconformances with respect to data deliverable completeness, and corrective actions often are initiated during the contract compliance screening review. The outputs from this process will be combined with the data validation outputs in a summary of compliances and non-compliances with laboratory subcontracts and validation criteria. Data validation is described in Section B8.2 and Section D2.

## B8.2 DATA VALIDATION

Following completion of the contract compliance screening process, TtNUS will subject 100 percent of the laboratory data to full validation as described in Section D2.2.2. The validation process includes a review of summary information to determine adherence to analytical holding times, to evaluate results from analysis of field duplicates, method blanks, field blanks, surrogate spikes, MS/MSDs, LCSs, and to verify adherence to shipping and storage temperature requirements. The results of the contract compliance screening process are incorporated into the data validation process. Data qualifiers are applied to analytical results during the data validation process based on adherence to method protocols and laboratory-specific QA/QC limits.

Secondary data (i.e., data obtained from independent sources or data that is not used directly in decision making) will be used for this project. Some of the secondary data will be generated in the field (e.g., measurements used to establish the stabilization of sampling conditions prior to groundwater sample collection). The secondary data also include sources such as historical data, land survey data, and well installation data. If not previously reviewed for quality, these data will be reviewed to ensure that they are

suitable for their intended purpose. This typically means that historical data are compared to more recent data and any apparent anomalies or inconsistencies are investigated to ascertain whether the historical or more recent data could be in error. It also means that data generated in the field such as survey data or chemical measurements are reviewed independently by someone other than the surveyor or sampler who generated the data. The nature of the data comparisons and reviews varies with the data. The FOL is responsible for reviewing chemical measurement data generated in the field. Survey data are reviewed for accuracy by comparing the surveyed coordinates to the proposed sample collection coordinates. Any other anomalies that are detected will be handled on a case by case basis.

The validation guidelines found in Appendix C were developed in accordance with the most recent version of the National Functional Guidelines for Organic Data Review and the National Functional Guidelines for Inorganic Data Review as modified for the specific analytical method. Expanded criteria for the validation guidelines were developed where professional judgment is recommended within the EPA guidelines. QC guidelines are those specified in the analytical method protocols.

Data qualified as rejected will be assessed as to their critical importance. If required, the samples will be recollected and reanalyzed.

## B8.3 DATA MANAGEMENT PROCEDURES

Laboratory data recording, transformation, and reduction of analytical results are performed in accordance with applicable SOPs that govern sample check-in, tracking, handling, preparation for analysis, analysis, calculation of final results, and quality control. Field SOPs contain similar information. Laboratory and field SOPs, which include analysis flow charts, example forms (where appropriate), and the equations used to compute final results, are provided in Appendix A and are referenced throughout the QAPP, where appropriate. Personnel responsible for identifying and correcting errors are identified in Section A4 with descriptions of their duties. The following software and hardware will be used for data reduction and manipulation:

**Software**

- Microsoft Excel
- StatSoft Statistica
- ArcView for GIS
- Microsoft SQL Server for data management

**Hardware**

- IBM-compatible personal computers

Validated laboratory data are used as is. Aside from simple statistical data summaries such as frequencies of detection, means, and standard deviations, the numbers and types of data manipulations of laboratory data that will be required for generating the AMR report are unknown. This is so because the data themselves will determine how many and what type of computations/manipulations are necessary. However, example calculations will be provided in the AMR report for all critical computations such as statistical calculations. For the more esoteric calculations such as kriging, a requirement exists to inspect the results for reasonableness.

A project-specific repository has been established in the TtNUS SQL Server database so that environmental data for this project are separable from other project data. This separability provides data security. To further enhance data security, the project database is password protected to prevent unauthorized access. Unless specifically granted “write” privileges, all project personnel will possess ”read only” access to the database. The project manager and the database manager must concur concerning access privileges before a person is granted “write” privileges. This concurrence is usually informal and is not generally documented because the number of people with any level of access to the database is limited.

A database manager attends key internal project meetings to ensure that information that is essential to the smooth operation of the project database is gathered at the appropriate points in a project. Database system requirements are continually communicated through this person to other project team members. This person also provides oversight of the environmental data throughout the data life cycle. The TtNUS environmental data life cycle (EDLC) is as follows:

1. Database Setup
2. Project Planning
3. Data Collection
4. Data Receipt From Field or Laboratory
5. Data Review/Validation/Verification
6. Data Loading
7. Report Generation
8. Archiving

All steps of the EDLC are essential to assure data users of a high level of data integrity.

Upon receipt, the electronic data deliverables are checked for completeness and compliance under the supervision and direction of the Data Validation Manager. These checks are made against the laboratory subcontract which delineates the format and content of the data deliverable.

The hard copy data (or equivalent .pdf file) is used as the basis for data validation. The calibration data, quality control data, example calculations, and other pertinent data are evaluated relative to the data validation criteria, as described in Section D2. Data that are perceived to be deficient in quality are reviewed and, if found to be deficient relative to the validation criteria, are flagged with the appropriate data validation qualifier flags. The validation output is a series of computer screens that summarizes the validation findings. The data are stored temporarily in the “validation database” pending Data Validation Manager review.

Electronic forms and reports are implemented in Oracle Developer. Data setup and loading modules utilize MS Access User Interface forms (VBA) and are coded with ODBC connection strings for SQL. There are no hard copy forms for these processes, although some requests for database services may be made in writing at the discretion of the requestor.

At this point, the validation output is reviewed by the Data Validation Manager and corrections are made, as necessary. The data validation process culminates in the generation of a hard copy data validation letter which summarizes the detected data deficiencies. These letters are typically provided as an appendix to the project AMR.

Upon approval by the Data Validation Manager, the validated data are uploaded electronically to the TtNUS Microsoft SQL server database. The data are subjected to a series of logic checks to ensure that there are no significant incompatibilities with the database requirements. Any incompatibilities detected at this stage of data transfer are resolved by the project database coordinator and project team members, as necessary.

During the data validation period or shortly thereafter, data collected in the field such as well coordinates, well screen depths are transferred manually to the SQL data system. The standard practice for manual data entry into the SQL Server database is for two individuals to independently enter the data. Any discrepancies between corresponding data values are resolved at that point, typically by checking the hard copy data.

Upon entry of the validated data into the SQL Serve database, the data are officially available to the project team. At this point, the data are used in various ways that are largely dictated by the data themselves. The level of effort anticipated for this project is to:

- Generate descriptive statistics.
- Generate isoconcentration plots for select groundwater VOCs .
- Generate tag maps for detected groundwater VOCs.
- Compare current groundwater VOC data to historical data.
- Compare VOC data to risk-based screening levels.
- Compare observed detection limits to anticipated detection limits and risk-based screening levels.

The software used for the data manipulations is commercial software that varies from Microsoft Excel and StatSoft Statistica for summary statistics and tables to C-Tech EVS and ESRI ArcView for data visualization. Data tables and plots are produced from the Microsoft and StatSoft software, and hard copy maps and related figures are produced from the visualization software. In addition, certain figures such as geological cross-sections may be produced using computer aided design software. Where reasonable, e.g., for statistical calculations, sample calculations are provided in the AMR. Each output is checked for accuracy and reasonableness by the generator of the output and by the project manager. Many times example calculations can not be provided (e.g., when generating maps). In those cases, the outputs are inspected by a knowledgeable project team member to ensure that the results are accurate within expectations.

At the discretion of the TOM, project data may be transferred to TtNUS's environmental geographical information system. This system, which is written in the ArcView 3.2 (Avenue) scripting language, provides end users with real-time reporting capability and the ability to prepare simple data posting plots at their discretion.

Typically, after several different data presentations are generated, the project team, with TOM oversight, selects those outputs that will become part of the AMR. The selected outputs will be chosen to illustrate or demonstrate certain characteristics of the data that as accurately as possible represent the physical nature of site contaminants. These characteristics will form the basis of decision making and evaluating whether project objectives have been attained. Much of the evaluations will necessarily involve best professional judgments on the part of the data users and will take into account various aspects of the investigation such as:

- Statistical outlier tests, as necessary.
- Observed spatial and temporal chemical concentration trends.
- Relative magnitudes of observed concentrations and risk-based levels.
- Geology, hydrogeology, and topography of the site.
- Spatial relationships among site features and elevated or non-elevated chemical concentrations and potential contaminant sources.
- Chemical relationships of chemicals (e.g., whether they have a parent-daughter relationship).

# C1 ASSESSMENT AND RESPONSE ACTIONS

Performance and system audits will be conducted periodically to ensure that work is being implemented in accordance with the approved QAPP and in an overall satisfactory manner. Some examples of pertinent audits are as follows:

- The FOL will supervise and check daily that the field observations are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and fieldwork is documented accurately and neatly.

- The TOM will maintain contact with the FOL and Data Validation Manager to ensure that management of the acquired data proceeds in an organized and expeditious manner.

Details regarding additional audit responsibilities, frequencies, and procedures are provided in the remainder of this section. Field performance and system audits are addressed in Section C1.1. Laboratory performance and system audits are discussed in Section C1.2.

## C1.1 FIELD PERFORMANCE AND SYSTEM AUDITS

This section presents the responsibilities, frequencies, and procedures associated with internal and external field performance and system audits.

### C1.1.1 Internal Field Audits

#### C1.1.1.1 Internal Field Audit Responsibilities

In addition to the daily checks performed by the FOL, the Navy or designee may conduct an independent performance and system audit of field activities. Such audits may be scheduled by the Navy without involvement of the Navy RPM, TtNUS, TOM, or Bay West PM. If a formal field audit is conducted for this study, the QAM (or designee) will be responsible for ensuring that sample collection, handling, and shipping protocols, as well as equipment decontamination and field documentation procedures, are being performed in accordance with the approved QAPP and SOPs.

#### C1.1.1.2 Internal Field Audit Frequency

As explained in Section C1.1.1.1, internal field audits may be scheduled by the Navy without the involvement of the Navy RPM, TtNUS TOM, or Bay West PM. The Navy will report to the MPCA all major findings of internal audits to include a description of problems identified, corrective actions taken, and ultimate resolution of the problems. Any corrective actions taken in the field to mitigate conditions adverse to quality will be summarized. A description of corrective actions taken on site, if any, will be included in the AMR. In addition, key field personnel changes will also be documented in the AMR. These changes will represent changes to decision makers rather than individual personnel such as sample collectors.

#### C1.1.1.3 Internal Field Audit Procedures

Internal field audits will be conducted in accordance with the following procedures:

- Prior to the audit, the auditor will prepare a detailed checklist to be used as an auditing guide.
- Upon arrival at the audit location, the auditor shall conduct a pre-audit meeting with the responsible management of the organization or project to be reviewed.
- Field audits will include a review of required project documentation (logbooks, sample log sheets, etc.) and field operations (sample COC, sample handling, etc.) to evaluate completeness and compliance with applicable SOPs.
- The audit checklist will be used to record observations including any noted nonconformances.
- A formal post-audit debriefing will be conducted, and potential immediate corrective actions will be discussed.
- The auditor will generate a formal audit report that will address corrective actions; the auditor will provide this report to the Navy.
- The Navy or designee will ensure that all corrective actions are addressed and will provide written verification of corrective action implementation to the auditor.
- The auditor will manage corrective action verification and audit closure.

- The following audit records will be maintained by the QAM:

  - Audit checklists
  - Audit reports
  - Response evaluations
  - Verification of corrective actions
  - Follow-up checklists and audit reports

### C1.1.2 External Field Audits

#### C1.1.2.1 External Field Audit Responsibilities

The MPCA, the USEPA Region 5, or both may conduct external field audits.

#### C1.1.2.2 External Field Audit Frequency

External field audits may be conducted at any time during field activities at the discretion of the MPCA and USEPA Region 5. If an audit is to be conducted, scheduling should be coordinated through the TtNUS QAM to ensure that personnel and equipment are available as necessary. Personnel being audited may or may not be informed of the impending audit at the discretion and request of the auditing body.

#### C1.1.2.3 External Field Audit Procedures

External audit procedures are at the discretion of the MPCA and USEPA Region 5.

## C1.2 LABORATORY PERFORMANCE AND SYSTEMS AUDITS

This section presents the responsibilities, frequencies, and procedures associated with internal and external laboratory performance and systems audits.

### C1.2.1 Internal Laboratory Audits

Guidance on the Navy audit process, including the Navy's audit checklist, can be found in the Department of Defense Quality Systems Manual for Environmental Laboratories at the following web address: http://www.navylabs.navy.mil/ManualsDocs.htm.

#### C1.2.1.1 Internal Laboratory Audit Responsibilities

The QAM or appropriate designee of the subcontracted laboratory performs routine internal audits of the laboratory. The Navy, through the Naval Field Engineering Service Center (NFESC), also conducts internal laboratory audits. TtNUS and Bay West hold no responsibility for such audits. Performance and system audits of laboratories are coordinated through the NFESC by an independent QA contractor. It is the responsibility of the NFESC and its contractor to ensure that the subcontracted laboratory complies with good laboratory practices and general requirements of all analytical services provided by the laboratory.

#### C1.2.1.2 Internal Laboratory Audit Frequency

In accordance with Section 13.0 of Appendix A, internal laboratory audits are performed periodically. In addition, each laboratory department at CAS/Kelso analyzes blind performance evaluation (PE) samples. The CAS/Kelso QAM or designee also performs data audits at least once per year for each analytical area.

The Navy completes internal laboratory performance and system audits for each contracted laboratory on an 18-month schedule.

#### C1.2.1.3 Internal Laboratory Audit Procedures

Internal systems audits are conducted to detect any problems in sample flow, analytical procedures, or documentation to ensure adherence to laboratory SOPs.

Internal Navy laboratory audit procedures, as performed by a Navy contractor, include a pre-screening process that requires review of the laboratory's QA Plan, analysis of PE samples, generation of data deliverables for those samples, an on-site technical systems audit of the laboratory, and satisfactory resolution of all deficiencies and findings.

### C1.2.2 <u>External Laboratory Audits</u>

#### C1.2.2.1 External Laboratory Audit Responsibilities

The MPCA and USEPA Region 5 may perform external audits at their discretion. CAS/Kelso is also involved in various other external audits and performance evaluation studies throughout the year, as required, to maintain certifications and/or approvals by other regulatory agencies or programs.

#### C1.2.2.2 External Laboratory Audit Frequency

USEPA Region 5 or MPCA may conduct an external laboratory audit prior to or during sampling and analysis activities.

#### C1.2.2.3 External Laboratory Audit Procedures

External audit procedures are at the discretion of USEPA Region 5 and the MPCA. External laboratory audits may include (but are not limited to) review of laboratory analytical procedures, laboratory on-site audits, and/or submission of PE samples to the laboratory for analysis.

# C2 REPORTS TO MANAGEMENT

QA reports to management will be provided in four primary formats during the course of this investigation: data validation reports, reports summarizing accomplishments and QA/QC issues during the field investigation, project-wide progress reports, and laboratory QA reports. The frequencies of report generation, report content, report preparer, and report recipient(s) are summarized in Table C2-1.

Data validation reports will address all major and minor laboratory noncompliances as well as noted sample matrix effects. In the event that major problems occur with the analytical laboratory (e.g., repeated or extreme holding time exceedances or calibration noncompliances, etc.), the Data Validation Manager will notify the Navy, Bay West PM, TOM, QAM, and Laboratory Services Coordinator. Such notifications (if necessary) are typically provided via internet memoranda and are placed in the project file. These reports contain a summary of the noncompliance, a synopsis of the impact on individual projects, and recommendations regarding corrective action and compensation adjustments. Corrective actions for major noncompliances are initiated at the program level.

The FOL will provide the Bay West PM with daily oral field progress reports during the course of the sampling event. These reports will explain accomplishments, deviations from the QAPP, and upcoming activities, and will contain a QA summary. Bay West provides a monthly progress report to the Navy that addresses the project budget, schedule, accomplishments, planned activities, and QA/QC issues and intended corrective actions.

The subcontracted analytical laboratories will provide a QA report to Bay West if QC limits, MDLs, and RLs are updated or if other significant plan deviations result from unanticipated circumstances.

**TABLE C2-1**

**SUMMARY OF REPORTS**
**NIROP FRIDLEY, MINNESOTA**

| Report | Content | Preparer | Frequency of Submittal | Recipient |
|---|---|---|---|---|
| Data Validation Report | All major and minor laboratory noncompliances as well as noted sample matrix effects. | Data Validation Manager or designee | Per SDG | TOM, Project file |
| Major Analysis Problem Identification Report (internal memorandum) | Notification of persistent or major problems with analytical laboratory performance. Summary of the noncompliance(s), a synopsis of the impact on the project, and recommendations regarding corrective action and compensation adjustments. | Data Validation Manager or designee | When persistent analysis problems are detected | Bay West PM, TOM, QAM, Laboratory Services Coordinator, Project file, Navy, USEPA |
| Project Monthly Progress Report | Summary of the project budget, schedule, accomplishments, planned activities, and QA/QC issues and intended corrective actions. | Bay West PM | Monthly for duration of project | Navy, Project file |
| Field Progress Reports | Explain accomplishments, deviations from the FSP, and upcoming activities and will include a QA summary. | FOL | Daily, oral, during the course of sampling | Bay West PM |
| Laboratory QA Report | Summary of updated QC limits or significant deviations from planned activities/performance. | CAS, Inc. (Kelso Facility) | When QC limits are updated or when other significant plan deviations result from unanticipated circumstances | Bay West (TtNUS, Project file; USEPA Region 5, if QAPP deviations impact DQOs) |

CAS = Columbia Analytical Services
DQO = Data quality objective.
FOL = Field Operations Leader.
FSP = Field Sampling Plan.
PM = Project Manager.
QAM = Quality Assurance Manager.
RL= Reporting Limit.
SDG = Sample delivery group.
TOM = Task Order Manager.

# D1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Compliance with quantitative QC objectives for laboratory accuracy and precision as outlined in Tables A7-1 and A7-2 will be evaluated during data validation (Section D2). Compliance with completeness objectives for field and laboratory data will be computed. Sections D1.1 and D1.2 present equations to be used for computing accuracy and precision values, respectively. Section D1.3 describes the means and presents the equation for determining completeness. Section D1.4 addresses the overall data assessment process.

In general, data validation requires that data quality be evaluated batch-by-batch based on the results of quality indicators for the respective batches. Section D1.4 presents additional data quality considerations to be evaluated after data validation. These considerations are designed to incorporate data quality factors that extend beyond evaluation of the simple quantitative estimators for precision, accuracy, and completeness.

## D1.1 ACCURACY ASSESSMENT

Sample collection accuracy cannot be evaluated because there is no standard by which to judge such accuracy. Instead of a quantitative evaluation of sample collection accuracy, compliance with field SOPs will be the metric to assess sample collection accuracy. Background comparisons of the data generated by identical sampling and analysis methods incorporate similar biases and are expected to be directly comparable without any adjustments or compensations.

Sample analysis accuracy will be assessed through the use of surrogate spikes, MSs, calibration check standards, internal standards and blanks. Blanks will be used to infer the potential for positive biases because of contamination. To assure the accuracy of the analytical procedures, prior to preparation for analysis, at least 1 of every 20 environmental samples will be spiked with known amounts of target analytes (i.e., MSs). The spiked samples will be analyzed and the concentrations of each target analyte observed in the spiked sample compared to the reported value of the analyte in the unspiked sample to determine the %R of the analyte. The %R for a spiked sample will be calculated using the following formula:

$$\%R = \frac{\text{Amount in Spiked Sample - Amount in Sample}}{\text{Known Amount Added}} \times 100\%$$

## D1.2 PRECISION ASSESSMENT

As presented in Section A7.1.3, MSD samples (for organic analyses) will be prepared and analyzed at a minimum frequency of 1 per every 20 environmental samples per matrix. As described in Section A7.1.2, field duplicate samples will be collected a minimum frequency of 1 per 10 environmental samples per matrix. The RPD between a sample or MS (Sample 1) and its duplicate or MSD (Sample 2) is calculated using the following formula:

$$\text{RPD} = \frac{|\text{Amount in Sample 1} - \text{Amount in Sample 2}|}{0.5\,(\text{Amount in Sample 1} + \text{Amount in Sample 2})} \times 100\%$$

## D1.3 COMPLETENESS ASSESSMENT

Completeness for this project will be determined based on the number of sample results for each target analyte and each sample type that are usable as determined through data validations and data assessment. Data values rejected during data validation (indicated by an “R” flag) will be considered unusable unless additional review and documentation by one or more technical team members demonstrates that the rejection is erroneous. To monitor completeness, the number of usable, valid results (i.e., non R-qualified results) for each matrix type and analyte will be counted and compared to the completeness objectives in Section A7.3.2 and A7.3.3.

Percent completeness will be calculated using the following equation:

$$\%\,\text{Completeness} = \frac{\text{Number of Valid Measurements}}{\text{Number of Measurements Planned}} \times 100\%$$

## D1.4 DATA ASSESSMENT

The assessment of data obtained from this investigation is a critical part of determining what the next step in data collection and decision making should be. It must be determined if the data are of appropriate type, quality, quantity, and representativeness to support the project objectives. The effect of the loss of data deemed unacceptable for use, for whatever reason, will be evaluated.

### D1.4.1 Reconciliation with Data Quality Objectives

Field data will be examined immediately after generation for errors. Laboratory data will be examined upon receipt from the laboratory in a cascading series of evaluations. The first step will be a data verification and validation as described in Section D2.

After data validation, the data will be reconciled with DQOs to determine whether sufficient data of acceptable quality are available for decision making. DQOs are provided in Appendix B of the RAMP. In addition to the evaluation described in Section D1.1 through D1.3, a series of inspections will be performed to estimate several of the data set characteristics. These inspections will be designed to:

- Identify deviations, if any, from field sampling SOPs.
- Identify deviations, if any, from laboratory analytical SOPs.
- Identify deviations, if any, from the QAPP.
- Identify deviations, if any, from the data validation process.
- Identify and explain the impacts of elevated RLs.
- Identify unusable data (i.e., data qualified as “R”).
- Evaluate adherence to investigation objectives and decision rules.
- Ensure completion of corrective actions.
- Evaluate effects of deviations from planned procedures and processes on the interpretation and utility of the data.

The TOM shall bear ultimate responsibility to ensure that data are evaluated in a manner consistent with project objectives. In addition to the above, a review of the data will be conducted to determine the extent to which data precision, accuracy, completeness, comparability, representativeness, and sensitivity objectives were met. This review will be summarized in the conclusions of the AMR. All data will be retained as part of the final record even though they may not be used in decision making.

# D2 VALIDATION AND VERIFICATION METHODS

This section describes the procedures to be used for data reduction, validation, and reporting. Data generated during the course of the field investigations will be maintained in hard copy form in the Administrative Record at NIROP Fridley.

## D2.1 DATA REDUCTION

### D2.1.1 Field Data Reduction

All field logs containing observations will be inspected and approved by the FOL. All field observations will be recorded in the logs immediately after observations are made.

If errors are made in recording or transcribing observations, erroneous observations will be legibly crossed out using a single line, initiated, dated by the field member, and corrected in a space adjacent to the crossed-out entry. The FOL has responsibility to assure that errors are identified and assessed relative to the intent of the QAPP.

Errors judged to affect the utility of the sample results within the context of this investigation shall be brought to the immediate attention of the Navy.

### D2.1.2 Laboratory Data Reduction

Data reduction will be completed by CAS/Kelso in accordance with the method-specific laboratory SOPs included in Appendix A.

Laboratory analytical data will be reported using standard concentration units to ensure comparability with previous analytical results. Groundwater sample results will be reported in units of micrograms per liter (µg/L).

## D2.2 DATA VALIDATION

Validation of field measurements and laboratory analytical data are discussed in this section.

### D2.2.1 Procedures Used to Validate Field Data

Field measurements will not be subjected to a formal data validation process. Validation of field data will be limited to real time inspection by the FOL of observations relative to actual site conditions and activities. In addition, field technicians will ensure that the equipment used for sample collections is performing adequately via compliance with the applicable SOPs.

### D2.2.2 Procedures Used to Validate Laboratory Data

One hundred percent of the laboratory analytical data will be subjected to validation to ensure that the data are of evidentiary quality. Validation of analytical data will be completed by the TtNUS Environmental Chemistry/Toxicology Department located in TtNUS's Pittsburgh office. Final review and approval of validation deliverables will be completed by the Department's Data Validation Manager.

Analytical results will be validated versus the applicable analytical methods, the SOPs included in Appendix A, and the requirements of this QAPP. Validation of these data will conform to the National Functional Guidelines for Organic Data Review (USEPA, 1999a) to the greatest extent practicable. Data validators will review the chemical analytical data packages submitted by the laboratory. The data validators will check that the data were obtained using approved methodology, that the appropriate level of QC and reporting was conducted, and that the results are in conformance with QC criteria.

On the basis of the data validation results, the data validator will generate a report describing detected data limitations. The report will be reviewed internally by the Data Validation Manager prior to submittal to the TOM. Data review will be extended beyond this routine validation by involving the project chemist to examine the data for anomalies (See Section D1.4). This additional review may result in more detailed inspection of the data to determine the cause of, and to rectify, individual anomalies. The impact of data qualifiers on data usability will also be assessed and any qualifications that are indicated during use of the data shall be documented in the FA report.

The data validation process will provide an estimate of the number of usable data points. This completeness check will be effected by computing the number of data points that are rejected relative to the total number of data points for a given analyte in a given environmental medium.

## D2.3 DATA REPORTING

This section discusses data reporting requirements for field and laboratory analytical data. Section D2.3.1 discusses field measurement data handling and reporting. Section D2.3.2 discusses laboratory data handling and reporting.

### D2.3.1 Field Data Reporting

Field data will be transferred manually from the site logbook or sample logsheets to the electronic database and will be reviewed for accuracy by an independent reviewer.

All records regarding field measurements (i.e., field logbooks, sampling logbooks, and sample logsheets) will be placed in the TtNUS central files upon completion of the field effort. Entry of these results in the database will require removal of these records from the files. Outcards (including date, person, and subject matter information) will be used to document the removal of any such documentation from the files. After database entry is complete, all records will be copied for placement in TtNUS central files. All original records will be sent to NIROP Fridley for inclusion in the final evidence files as described in Section B3.3.

### D2.3.2 Laboratory Data Reporting

To achieve the investigation objectives, a confirmational level of analytical quality is needed. This provides the highest level of data quality necessary to address potential risks. These analyses require full documentation of the chosen USEPA SW-846 and other analytical methods and sample preparation steps, data packages, and data validation sufficient to provide defensible data. QC must be sufficient to define the overall precision and accuracy of these procedures. Therefore, data reported by CAS/Kelso for all analytical fractions will be in a CLP-like reporting format. Hard copy data deliverables shall be generated at the time of analysis. All pertinent QC data including raw data and summary forms for blank, standard analysis, calibration information, etc., will be provided for all analyses. Case narratives will be provided for each SDG.

Validation will be completed using the hard copy data. Upon completion of validation of a SDG and review by the Data Validation Manager, the validation qualifiers will be entered into the electronic database and will be subjected to independent review for accuracy. During this review process, the electronic database printout will be compared with the hard copy data to ensure that the hard copy data and electronic data are consistent.

## D2.4 DATA ACQUISITION REQUIREMENTS AND DATA MANAGEMENT

Data acquisition and management begins with the identification and collection of past data and newly acquired project samples. The samples are labeled and tagged, packaged for shipment, and shipped to the analytical laboratory in accordance with Section 4.3.5 of the RAMP. The samples are received at the laboratory and analyzed, the analytical results are reported by the analyst along with QC check data, and the data are reviewed within the laboratory according to laboratory SOPs as provided in Appendix A. Data are then transmitted from the laboratory in both hardcopy and electronic formats according to laboratory SOPs as provided in Appendix A. Upon receipt by TtNUS, the data are validated, analyzed, assessed, and ultimately archived.

The electronic database will include pertinent sampling information such as sample number, sampling date, sample point location, and analytical information. Sample-specific RLs will be reported for nondetected analytes. Units will be clearly summarized in the database and will conform to those identified in Section D2.1.2. The original electronic diskettes and data validation reports for this investigation will be maintained in the Administrative Record at NIROP Fridley, and copies will be maintained in TtNUS central files.

# D3 CORRECTIVE ACTION

Under the TtNUS QA/QC program, it is required that any and all personnel noting conditions adverse to quality should report these conditions immediately to the TOM and QAM. These parties, in turn, are charged with performing root-cause analyses and implementing appropriate corrective actions in a timely manner. It is ultimately the responsibility of the QAM to document all findings and corrective actions taken and to monitor the effectiveness of the corrective measures performed. A brief summary of corrective actions for some specific field and laboratory QC check samples is presented in Section A7, Table A7-2.

## D3.1 FIELD CORRECTIVE ACTION

Field nonconformances or conditions adverse to quality must be identified and corrected as quickly as possible so that work integrity or product quality is not compromised. The need for corrective action may arise based on deviations from project plans and procedures, adverse field conditions, or other unforeseen circumstances. Corrective action needs may become apparent during the performance of daily work tasks or as a consequence of the internal or external field audits.

Corrective action may include resampling and may involve amending previously approved field procedures. Minor modifications to field activities, such as the collection of additional samples, will be initiated at the discretion of the FOL, subject to on-site approval by NIROP Fridley personnel. Major modifications, such as the elimination of a sampling point or other situations that affect compliance with or achievement of DQOs, must be approved and documented. Approval of the corrective action will be obtained by the Navy (in conjunction with USEPA Region 5). The FOL is responsible for initiating modification requests for all deviations from the project plan documents, as applicable. Documentation of all modification requests will be maintained with the on-site project planning documents and will be placed in the final evidence file.

## D3.2 LABORATORY CORRECTIVE ACTION

In general, laboratory corrective actions are warranted whenever an out-of-control event or potential out-of-control event is noted. The specific corrective action taken depends on the specific analysis and the nature of the event. Generally, the following occurrences alert laboratory personnel that corrective action may be necessary:

- QC data are outside established warning or control limits
- Method blank analyses yield concentrations of target analytes above acceptable levels
- Undesirable trends are detected in spike %Rs or in duplicate RPDs
- There is an unexplained change in compound detection capability
- Inquiries concerning data quality are received
- Deficiencies are detected by laboratory QA staff during audits or from PE sample test results

Any corrective action taken above the analyst level that cannot be performed immediately at the instrument will be documented. Corrective actions typically are documented for out-of-control situations on a Nonconformity and Corrective Action Report form (Appendix A Section 15.0).

Laboratory corrective actions must be documented and included as part of the Final Evidence File. Major corrective actions that do not bring DQO-related nonconformances into conformance with project DQOs shall be identified to the Bay West PM and the TtNUS TOM who will advise all levels of project management, including the USEPA, in accordance with Section C2 of this QAPP.

## D3.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

The need for corrective action may become apparent during data validation, interpretation, or presentation activities. The performance of rework (i.e., resampling or reanalysis), the institution of a change in work procedures, or the provision of additional/refresher training are possible corrective actions relevant to data evaluation activities. The TOM will be responsible for approving the implementation of a corrective action and ensuring that it is documented appropriately. The USEPA will be directly notified of any corrective actions taken. Analytical data may be qualified during data validation to alert data users to the potential that particular analysis results are potentially deficient relative to expected performance standards. Such validation practices are described in Section D2.2. When conducting data assessment for project decision making, a number of situation-dependent qualifications on data or decisions are possible. The number of possible situations or conditions precludes enumeration of all possible corrective actions; however, the approach used to identify and impose such qualifications is described in Section D1.4

## D3.4 CORRECTIVE ACTION FOR ADMINISTRATIVE ACTIVITIES

Findings identified through office procedures and file audits may also necessitate the performance of corrective actions. Corrective actions involving file management and office procedures usually consist of

correction of an isolated nonconformance or the performance of activities necessary to conform to clarified guidance.

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# APPENDIX A

## LABORATORY QUALITY ASSURANCE MANUAL, CERTIFICATIONS, AND STANDARD OPERATING PROCEDURES

# QUALITY ASSURANCE MANUAL

**Columbia Analytical Services, Inc.**

1317 South 13th Avenue

Kelso, Washington 98626

(360) 577-7222

January 7, 2005

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**Approved by:**

**Laboratory Director/Technical Director:** _____
Jeff Christian

**Quality Assurance Manager/Technical Director:** _____
Lee Wolf

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**Technical Director - Metals:** _____
Jeff Coronado

**Technical Director - Inorganics:** _____
Todd Poyfair

**Technical Director - Organics:** _____
Jeff Grindstaff

**Technical Director - Microbiology:** _____
Paula Wiest

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## 2.0 TABLE OF CONTENTS

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| Section | Heading | Page |
|---|---|---|
| 1.0 | Title Page with Provision Signatures | 1 |
| 2.0 | Table of Contents | 2 |
| 3.0 | Introduction and Company Quality Assurance Policy | 4 |
| 4.0 | Program Description | 5 |
| 5.0 | Professional Conduct and Ethical Practices | 10 |
| 6.0 | Project Organization and Responsibilities | 11 |
| 7.0 | Information Management | 14 |
| 8.0 | Sample Management | 16 |
| 9.0 | Analytical Procedures | 29 |
| 10.0 | Calibration Procedures and Frequency | 32 |
| 11.0 | Quality Control | 37 |
| 12.0 | Data Reduction, Validation, and Reporting | 44 |
| 13.0 | Performance and System Audits | 59 |
| 14.0 | Preventive Maintenance | 63 |
| 15.0 | Corrective Action | 65 |
| 16.0 | Quality Assurance Reports | 67 |
| 17.0 | Personnel Training | 68 |
| 18.0 | References for Analytical Procedures | 72 |

| Tables | | Page |
|---|---|---|
| Table 6-1 | Summary of Technical Experience and Qualifications | 13 |
| Table 8-1 | Sample Preservation and Holding Times | 20 |
| Table 12-1 | Descriptions of CAS Data Deliverables | 58 |
| Table 13-1 | Current CAS Performance and System Audit Programs | 61 |

Figures Page

Figure 4-1 CAS/Kelso Laboratory Floor Plan ..... 9
Figure 8-1 Chain of Custody Form ..... 26
Figure 8-2 Cooler Receipt and Preservation Check Form ..... 27
Figure 8-3 Tier V Project Specification Form ..... 28
Figure 12-1 Evaluation of Method Calibration ..... 49
Figure 12-2 Evaluation of Continuing Calibration ..... 50
Figure 12-3 Evaluation of Method Blank and Instrument Blank Results ..... 51
Figure 12-4 Evaluation of Sample Results for Inorganic Analyses ..... 52
Figure 12-5 Evaluation of Sample Results for Organic Analyses ..... 53
Figure 12-6 Evaluation of Surrogate Compound Recoveries ..... 54
Figure 12-7 Evaluation of Duplicate Sample and/or Duplicate Matrix Spike Results.. 55
Figure 12-8 Evaluation of Matrix Spike Recoveries ..... 56
Figure 12-9 Evaluation of Laboratory Control Sample (LCS) Results ..... 57
Figure 15-1 Nonconformity and Corrective Action Report ..... 66
Figure 17-1 Initial Demonstration of Proficiency Requirements ..... 71

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Appendices Pase

Appendix A List of QA Program Documents ..... A1
Appendix B Organizational Chart and Resumes of Key Personnel ..... B l
Appendix C Major Analytical Equipment ..... Cl
Appendix D Preventive Maintenance Procedures ..... D1
Appendix E SOP List and List of NELAC Accredited Methods ..... E l

# 3.0 INTRODUCTION AND COMPANY QUALITY ASSURANCE POLICY

Columbia Analytical Services, Inc. (CAS) is an employee-owned professional analytical services laboratory which performs chemical and microbiological analyses' on a wide variety of sample matrices, including drinking water, groundwater, surface water, wastewater, soil, sludge, sediment, tissue, industrial and hazardous waste, and other material.

It is a policy at CAS that there will be sufficient Quality Assurance (QA) activities conducted in the laboratory to ensure that all analytical data generated and processed will be scientifically sound, legally defensible, of known and documented quality, and will accurately reflect the material being tested. This goal is achieved by ensuring that adequate Quality Control (QC) procedures are used throughout the monitoring process, and by establishing a means to assess performance of these Quality Control and other QA activities. Policies and procedures are established in order to meet the quality objectives **of** clients, accrediting authorities, and certifying organizations. The Quality System is established to meet the requirements of the National Environmental Laboratory Accreditation Conference (NELAC).

CAS maintains control of analytical results by adhering to written standard operating procedures (SOPs) and by observing sample custody requirements. All analytical results are calculated and reported in units consistent with project specifications to allow comparability of data.

We recognize that quality assurance requires a commitment to quality by everyone in the organization - individually, within each operating unit, and throughout the entire laboratory.

CAS is a network of laboratories. In addition to the Kelso, WA facility, to which this manual is applicable, CAS also operates laboratories in California, Florida, New York, Arizona, and Texas.

The information in this document has been organized according to the format described in *EPA Requirements for Quality Management Plans, EPA QA/R-2,* USEPA, 2001; and *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5,* USEPA, 2001.

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# 4.0 PROGRAM DESCRIPTION

The purpose of the QA program at CAS is to ensure that our clients are provided with analytical data that is scientifically sound, legally defensible, and of known and documented quality. The concept of Quality Assurance can be extended, and is expressed in the mission statement of CAS:

> "The mission of Columbia Analytical Services, Inc., is to provide high quality, cost-effective, and timely professional testing services to our customers. We recognize that our success as a company is based on our ability to maintain customer satisfaction. To do this requires constant attention to customer needs, maintenance of state-of-the-art testing capabilities and successful management of our most important asset - our people - in a way that encourages professional growth, personal development and company commitment."

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In support of this mission, our QA program addresses all aspects of laboratory operations, including laboratory organization and personnel, standard operating procedures, sample management, sample and quality control data, calibration practices, standards traceability data, equipment maintenance records, method proficiency data (such as method detection limit studies and control charts), document control/storage and staff training records.

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## 4.1 Facilities and Equipment

CAS features over 25,000 square feet of laboratory and administrative workspace. The laboratory has been designed and constructed to provide safeguards against cross-contamination of samples and is arranged according to work function, which enhances the efficiency of analytical operations. The ventilation system has been specially designed to meet the needs of the analyses performed in each work space. Also, CAS minimizes laboratory contamination sources by employing janitorial and maintenance staff to ensure that good housekeeping and facilities maintenance are performed. In addition, the segregated laboratory areas are designed for safe and efficient handling of a variety of sample types. These specialized areas (and access restrictions) include:

- Shipping and Receiving/Purchasing
- Sample Management Office, including controlled-access sample storage areas
- Inorganic/Metals Sample Preparation Laboratories (2)
- Inorganic/Metals "clean room" sample preparation laboratory
- ICP-AES Laboratory
- ICP-MS Laboratory
- AA Laboratory
- Water Chemistry & General Chemistry Laboratories
- Semi-volatile Organics Sample Preparation Laboratories (3)
- Gas Chromatography/High Performance Liquid Chromatography Laboratory

- Gas Chromatography/Mass Spectrometry Laboratory
- Petroleum Hydrocarbon Laboratory
- Semi-volatile Organics Drinking Water Laboratory
- Volatile Organics Laboratory
  - Separate sample preparation laboratory
  - Access by semi-volatile sample preparation staff only after removing lab coat and solvent-contaminated gloves, etc.
- Microbiology Laboratory
- Laboratory Deionized Water System
- Laboratory Management, Client Service, Report Generation and Administration
- Data Archival, Data Review and support functions areas
- Information Technology (IT) and LIMS

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In addition, the designated areas for sample receiving, refrigerated sample storage, dedicated sample container preparation and shipping provide for the efficient and safe handling of a variety of sample types. Figure 4-1 shows the facility floor plan. The laboratory is equipped with state-of-the-art analytical and administrative support equipment. The equipment and instrumentation are appropriate for the procedures in use. Appendix C lists the major equipment, illustrating the laboratory's overall capabilities and depth.

## 4.2 Technical Elements of the Quality Assurance Program

The Quality Assurance Program provides a platform on which technical operations are based. The program provides laboratory organization, procedures, and policies by which the laboratory operates. The necessary certifications and approvals administered by external agencies are maintained. This includes method approvals and audit administration. In addition, internal audits are performed to assess compliance with policies and procedures. Standard Operating Procedures (SOPs) are maintained for technical and administrative functions. A document control system is used for SOPs, as well as laboratory notebooks, and this QA Manual. A list of QA Program documents is provided in Appendix A,

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Acceptable calibration procedures are defined in the SOP for each test procedure. Calibration procedures for other laboratory equipment (balances, thermometers, etc.) are also defined. Quality Control (QC) procedures are used to monitor the testing performed. Each analytical procedure has associated QC requirements to be achieved in order to demonstrate data quality. The use of method detection limit studies, control charting, and preventative maintenance procedures further ensure the quality of data produced. Proficiency Testing (PT) samples are used as an external means of monitoring the quality and proficiency of the laboratory. PT samples are obtained from qualified vendors and are performed on a regular basis. In addition to method proficiency, documentation **of** analyst training is performed to ensure proficiency and competency of laboratory analysts and technicians. Sample handling and custody procedures are defined in SOPs. Procedures are also in place to monitor the sample storage areas. The technical elements of the QA program are discussed in further detail in later sections of this QA manual.

## 4.3 Operational Assessments

There are a number of methods used to assess the laboratory and its daily operations. In addition to the routine quality control (QC) measurements to measure quality, the senior laboratory management examines a number of other indicators to assess the overall ability of the laboratory to successfully perform analyses for its clients. On-time performance, report quality, training, and Quality Assurance are a few of the items that are used to assess performance from an external perspective. A frequent, routine assessment must also be made of the laboratory's facilities and resources in anticipation of accepting an additional or increased workload.

CAS utilizes a number of different methods to ensure that adequate resources are available in anticipation of the demand for service. Regularly scheduled senior staff meetings, tracking of outstanding proposals and an accurate, current synopsis of incoming work all assist the senior staff in properly allocating resources to achieve the required results. All Requests for Proposal (RFP) documents are reviewed by the Project Chemist and appropriate managerial staff to identify any project specific requirements that differ from the standard practices of the laboratory. Any requirements that cannot be met are noted and communicated to the client, as well as requesting the client to provide any project specific Quality Assurance Plans (QAPPs) if available. A weekly status meeting is also conducted with the laboratory staff by the Client Services Manager to inform the staff of the status of incoming work, future projects, or project requirements.

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## 4.4 Document Control

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Procedures for control and maintenance of documents are described in the *SOP for Document Control (ADM-DOC–CTRL).* The procedures described in the SOP include distribution, tracking, filing, and copyrighting of CAS controlled documents. The requirements of the SOP apply to all standards preparation logbooks, instrument maintenance logbooks, run logbooks, standard operating procedures (SOPs), quality assurance manuals (QAMs), quality assurance project plans (QAPPs), Environmental Health & Safety (EHS) manuals, and other controlled CAS documents.

Each controlled copy of a controlled document will be released only after a document control number is assigned and the recipient is recorded on a document distribution list. Filing and distribution is performed by the Quality Assurance Manager, or designee, and ensure that only the most current version of the document is distributed and in use. A document control number is assigned to logbooks. Completed logbooks that are no longer in use are archived in a master logbook file.

CAS maintains a records system that ensures all laboratory records (including raw data, reports, and supporting records) are retained and available. The archiving system is described in the *SOP for Data Archiving (ADM-ARCH).*

## 4.5 Subcontracting

Analytical services are subcontracted when CAS/Kelso needs to balance workload or when the requested analyses are not performed by CAS/Kelso. Subcontracting is only done with the knowledge and approval of the client. Subcontracting to another CAS laboratory is preferred over external-laboratory subcontracting. Further, sub-contracting is done using capable and qualified laboratories. Established procedures are used to qualify external subcontract laboratories. These procedures are described in the *SOP for Qualification of Subcontract Laboratories (ADM-SUBLAB).* The Quality Assurance Director is responsible for qualifying and oversight of subcontract laboratories.

## 4.6 Procurement

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The quality level of reagents and materials (grade, traceability, etc.) required is specified in analytical SOPs. Department supervisors ensure that the proper materials are purchased. Inspection and verification of material ordered is performed at the time of receipt by receiving personnel. The receiving staff labels the material with the date received. Expiration dates are assigned (by the laboratory user) as appropriate for the material. Storage conditions and expiration dates are specified in the analytical SOP. The procedures for purchasing and procurement are described in the *SOP for Purchasing through CAS Purchasing Agent (SOP ADM-PUR).* Also, refer to section 10.4 for a discussion of reference materials.

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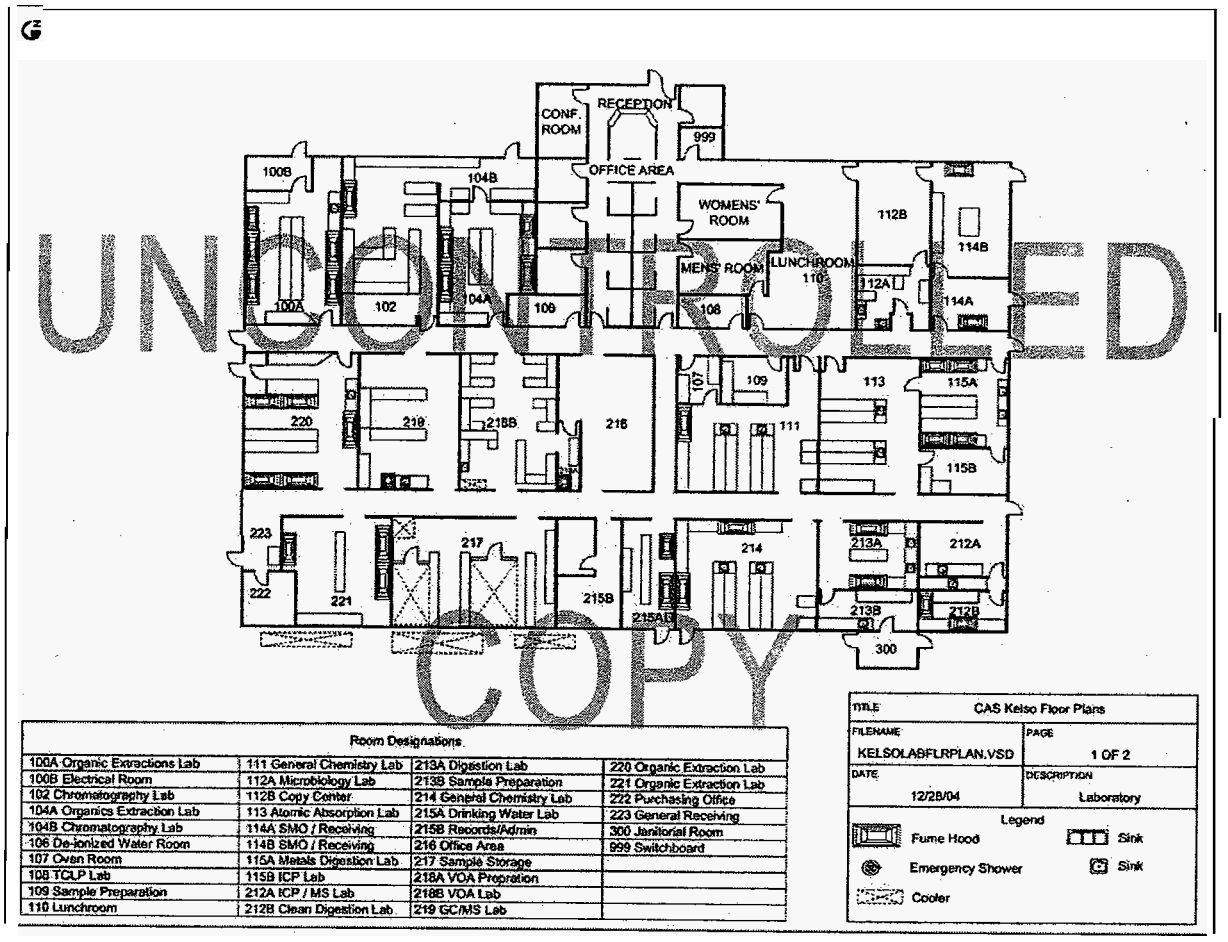
# Figure 4-1
# CAS/Kelso Laboratory Floor Plan




| Room Designations | | | |
|---|---|---|---|
| 100A Organic Extractions Lab | 111 General Chemistry Lab | 213A Digestion Lab | 220 Organic Extraction Lab |
| 100B Electrical Room | 112A Microbiology Lab | 213B Sample Preparation | 221 Organic Extraction Lab |
| 102 Chromatography Lab | 112B Copy Center | 214 General Chemistry Lab | 222 Purchasing Office |
| 104A Organics Extraction Lab | 113 Atomic Absorption Lab | 215A Drinking Water Lab | 223 General Receiving |
| 104B Chromatography Lab | 114A SMO / Receiving | 215B Records/Admin | 300 Janitorial Room |
| 106 De-ionized Water Room | 114B SMO / Receiving | 216 Office Area | 999 Switchboard |
| 107 Oven Room | 115A Metals Digestion Lab | 217 Sample Storage | |
| 108 TCLP Lab | 115B ICP Lab | 218A VOA Prepration | |
| 109 Sample Preparation | 212A ICP / MS Lab | 218B VOA Lab | |
| 110 Lunchroom | 212B Clean Digestion Lab | 219 GC/MS Lab | |

## *5.0* PROFESSIONAL CONDUCT AND ETHICAL PRACTICES

One of the most important aspects of the success of CAS is the emphasis placed on the integrity of the data provided and services performed. To promote product quality, employees are required to comply with certain standards of conduct and ethical practices. The following examples of CAS policy are representative of these standards, and are not intended to be limiting or all-inclusive:

- Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to senior management for appropriate corrective action. Unless specifically required in writing by a client, alteration, deviation or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.

- Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible. Employee discipline is progressive in its severity and each situation is handled individually in that the discipline is designed to fit the circumstances. Potential disciplinary actions may include a verbal warning, written warning, a second written notice (more severe and more strongly worded than a warning), suspension without pay, demotion, or termination.

- It is the responsibility of all CAS employees to safeguard sensitive company and client information. The nature of our business and the well being of our company and of our clients is dependent upon protecting and maintaining proprietary company/client information. All information, data, and reports (except that in the public domain) collected or assembled on behalf of a client is treated as confidential. Information may not be given to third parties without the consent of the client. Unauthorized release of Confidential information about the company or its clients is taken seriously and is subject to formal disciplinary action.

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All employees are required to sign and adhere to the requirements set forth in the CAS *Confidentiality and Conflicts of Interest Employee Agreement* and the CAS *Commitment to Excellence in Data Quality Policy.* All employees receive in-house ethics training and are periodically reminded of their data quality and ethical conduct responsibilities.

CAS makes every attempt to ensure that employees are free from any commercial, financial, or other undue pressures that might affect their quality of work. Related policies are described in the CAS Employee Handbook. This includes the CAS Ombudsman Program, the *CAS* Open Door Policy, and the use of flexible work hours. Operational assessments are regularly made to ensure that project planning is performed and that adequate resources are available during anticipated periods of increased workloads (Section **4.3).** Procedures for subcontracting work are established, and within the **CAS** laboratory network additional capacity is typically available for subcontracting, if necessary.

# 6.0 ORGANIZATION AND RESPONSIBILITIES

The CAS/Kelso staff, consisting of approximately 110 employees, includes chemists, technicians and support personnel. They represent diverse educational backgrounds and experience, and provide the comprehensive skills that the laboratory requires. During seasonal workload increases, additional temporary employees may be hired to perform specific tasks.

CAS is committed to providing an environment that encourages excellence. Everyone within CAS shares responsibility for maintaining and improving the quality of our analytical services. The responsibilities of key personnel within the laboratory are described below. Table 6-1 lists the CAS/Kelso personnel assigned to these key positions. Managerial staff members are provided the authority and resources needed to perform their duties. An organizational chart of the laboratory, as well as the resumes of these key personnel, can be found in Appendix **B.**

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- The role of the **Laboratory Director** is to provide technical, operational, and administrative leadership through planning, allocation and management of personnel and equipment resources. The Laboratory Director provides leadership and support for the QA program and is responsible for overall laboratory efficiency and the financial performance of the Kelso facility. The Laboratory Director has the authority to stop work in response to quality problems. The Laboratory Director also provides resources for implementation of the QA program, reviews and approves this QA Manual, reviews and approves standard operating procedures (SOPs), and provides support for business development by identifying and developing new markets through continuing support of the management of existing client activities.

- The responsibility of the **Quality Assurance Manager** (QAM) is to oversee implementation of the quality program and to coordinate QA activities within the laboratory. The QAM works with laboratory production units to establish effective quality control and assessment plans. The QAN has the authority to stop work in response to quality problems. The QAM is responsible for maintaining the QA Manual and performing an annual review of it; reviewing and approving SOPs and coordinating the annual review of each SOP; maintaining QA records such as metrological records, archived logbooks, PT sample results, etc.; document control; conducting PT sample studies; approving nonconformity and corrective action reports; maintaining the laboratory's certifications and approvals; performing internal QA audits; preparing QA activity reports; etc. The QAM reports directly to the Laboratory Director. The QAM also interacts with the CAS Quality Assurance Director. It is important to note that when evaluating data, the QAM does so in an objective manner and free of outside, or managerial, influence.

  The Quality Assurance Director is responsible for the overall QA program at all the US laboratories. The QA Director is responsible for performing an annual on-site audit at each CAS laboratory and preparing a written report; maintaining a data base of information about state certifications and accreditation programs; writing laboratory-wide SOPs; maintaining a data base of US-approved subcontract laboratories; providing assistance to the laboratory QA staff and laboratory managers; preparing a quarterly QA activity report; etc.

- In the case of absence of the Laboratory Director or QA Manager, deputies are assigned to act in that role. Default deputies for these positions are the Client Services Manager or Organics Department Manager (for the Laboratory Director) and the QA Director or Laboratory Director (for the QA manager).
- The **Environmental Health and Safety Officer** (EH&S) is responsible for the administration of the laboratory health and safety policies. This includes the formulation and implementation of safety policies, the supervision of new-employee safety training, the review of accidents, incidents and prevention plans, the monitoring of hazardous waste disposal and the conducting of departmental safety inspections. The EH&S officer is also designated as the Chemical Hygiene Officer. The EH&S Officer has a dotted-line reporting responsibility to CAS' EH&S Director.
- The **Client Services and Sample Management Office Manager** is responsible for the Client Services Department (customer services/project chemists, and Electronic Data Deliverables group) and the sample management office/bottle preparation sections. The Client Services Department provides a complete interface with clients from initial project specification to final deliverables. The sample management office handles all the activities associated with receiving, storage, and disposal of samples. The Client Services Manager has the authority to stop subcontractor work in response to quality problems.
- The **Project Chemist** is a senior-level scientist assigned to each client to act as a technical liaison between the client and the laboratory. The project chemist is responsible for ensuring that the analyses performed by the laboratory meet all project, contract, and regulatory-specific requirements. This entails coordinating with the CAS laboratory and administrative staff to ensure that client-specific needs are understood, and that the services CAS provides are properly executed and satisfy the requirements of the client.
- The Analytical Laboratory is divided into operational units based upon specific disciplines. Each department is responsible for establishing, maintaining and documenting a quality control program based upon the unique requirements within the department.. Each **Department Manager and Supervisor** has the responsibility to ensure that quality control functions are carried out as planned, and to guarantee the production of high quality data. Department managers and bench-level supervisors have the responsibility to monitor the day-to-day operations to ensure that productivity and data quality objectives are met. Each department manager has the authority to stop work in response to quality problems in their area. Analysts have the responsibility to carry out testing according to prescribed methods, SOPs, and quality control guidelines particular to the laboratory in which he/she is working.
- The **Sample Management Office** plays a key role in the laboratory QA program by maintaining documentation for all samples received by the laboratory, and by assisting in the archival of all laboratory results. The sample management office staff is also responsible for the proper disposal of samples after analysis.
- **Information Technology** (IT) staff are responsible for the administration of the Laboratory Information Management System **(UMS)** and other necessary support services. Other functions of the IT staff include laboratory network maintenance, IT systems development and implementation, education of analytical staff in the use of scientific software, Electronic Data Deliverable (EDD) generation, and data back-up, archival and integrity operations.

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**Table 6-1**
**Summary of Technical Experience and Qualifications**

| Personnel | Years of Experience | Project Role |
|---|---|---|
| Jeff Christian, B.S. | 26 | Laboratory Director |
| Lee Wolf, B.S. | 19 | Quality Assurance Manager |
| Lynda Huckestein, B.S. | 16 | Client Services Manager<br>Sample Management Office Manager |
| Jeff Coronado, B.S. | 15 | Inorganics Department Manager |
| Todd Poyfair, B.S. | 13 | Gas Chromatography and Petroleum Hydrocarbons Department Manager |
| Jeff Grindstaff, B.S. | 16 | Volatiles and Semivolatiles GC/MS Department Manager |
| Jim Smith, B.S. | 17 | Organics Drinking Water Department Manager |
| Eileen Arnold, B.A. | 23 | Environmental Health and Safety Officer |
| Paul Gowan, B.A. | 18 | Technical Information Specialist |
| Lawrence Jacoby, Ph.D. | 32 | CAS Quality Assurance Director |
| Gary Ward, M.S. | 29 | CAS Information Technology Director<br>CAS Chief Quality Officer |
| Steve Vincent, B.S. | 29 | CAS President |

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# 7.0 INFORMATION MANAGEMENT

The generation, compilation, reporting, and archiving of electronic data is a critical component of laboratory operations. In order to generate data of known and acceptable quality, the quality assurance systems and quality control practices for electronic data systems must be complete and comprehensive and in keeping with the overall quality assurance objectives of the organization. CAS management provides the tools and resources to implement electronic data systems and establishes information technology standards and policies. Appendix C lists major automated data processing equipment.

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## 7.1 Software Quality Assurance Plan

CAS has defined practices for assuring the quality of the computer software used throughout all laboratory operations to generate, compile, report, and store electronic data. These practices are described in the CAS Software Quality Assurance Plan (SQAP). The purpose of the SQAP is to describe the policies and practices for the procurement, configuration management, development, validation and verification, data security, maintenance, and use of computer software. The policies and practices described in the plan apply to purchased computer software as well as to internally developed computer software. Key components of configuration management plan are policies for controlling the software version that is in use in the laboratory.

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## 7.2 IT Support

The local CAS Information Technology (IT) department is established to provide technical support for all computing systems. The IT department staff continually monitors the performance and output of operating systems. The IT department oversees routine system maintenance and data backups to ensure the integrity of all electronic data. A software inventory is maintained. Additional IT responsibilities are described in the SQAP.

In addition to the local IT department, CAS corporate IT provides support for network-wide systems. CAS-Kelso also has personnel assigned to information management duties such as development and implementation of reporting systems; data acquisition, and Electronic Data Deliverable generation.

## 7.3 Information Management Systems

CAS has various systems in place to address specific data management needs. The CAS Laboratory Information Management System (UMS) is used to manage sample information and invoicing. Access is controlled by password. This is a Unix-based network system, operating in an Oracle@database environment. This system is used to establish and define sample identification, analysis specifications, and provide a means of sample tracking. This system is used during sample login to generate the internal Service Request. The Service

Request provides a summary of client information, sample information, required analyses, work instructions, deliverable requirements and other necessary information provided on the chain of custody. The LIMS also is the basis for valuable sample tracking mechanisms used throughout the laboratory. Laboratory analysts generate worklists from the LIMS and the barcoding system used for internal chain of custody (Section ***8)*** interfaces with this system.

Where possible, instrument data acquired locally is immediately moved to a server (Microsoft Windows2000® local area network) dedicated to this function. This provides a reliable, easily maintained, high-volume acquisition and storage system for electronic data files. With password entry, users may access the system from many available computer stations, improving efficiency and flexibility. Another server is dedicated to data reporting, EDD generation, and administrative functions. Access to these systems is controlled by password. A standardized EDI (electronic data interchange) format is used as a reporting platform, providing functionality and flexibility for end users. With a common standardized communication platform, the EDI provides data reporting in a variety of hardcopy and electronic deliverable formats.

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## 7.4 Backup and Security

CAS laboratory data is either acquired directly to the centralized acquisition server or acquired locally and then transferred to the server. All data is eventually moved to the centralized data acquisition server for reporting and archiving. Differential backups are performed on all file server information once per day, Sunday through Thursday. Full backups are performed on Friday and Saturday nights. Tapes are physically stored in a locked media cabinet within a locked, temperature controlled computer room.

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Access to sample information and data is on a need-to-know basis. Access is restricted to the person's areas of responsibility. Passwords are required on all systems. No direct external, non-CAS access is allowed to any of our network systems.

The external e-mail system and Internet access is established via a single gateway to discourage unauthorized entry. CAS uses a closed system for company e-mail. Files, such as electronic deliverables, are sent through the external e-mail system only via a trusted agent. The external messaging system operates through a single secure gateway. Email attachments sent in and out of the gateway are subject to a virus scan. Because the Internet is not regulated, we use a limited access approach to provide a firewall for added security. Virus screening is performed every week on all network systems.

# 8.0 SAMPLE MANAGEMENT

## 8.1 Sampling and Sample Preservation

The quality of analytical results is highly dependent upon the quality of the procedures used to collect, preserve and store samples. CAS recommends that clients follow sampling guidelines described in 40 CFR 136, 40 CFR 141, USEPA SW-846, and state-specific sampling guidelines, if applicable. Sampling factors that must be taken into account to insure accurate, defensible analytical results include:

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- Amount of sample taken
- Type of container used
- Type of sample preservation
- Sample storage time
- Proper custodial documentation

CAS uses the sample preservation, container, and holding-time recommendations published in a number of documents. The primary documents of reference are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III for hazardous waste samples, and USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, and Supplements; and *Standard Methods for the Examination of Water and Wastewater* for water and wastewater samples. The complete citation for each of these references can be found in Section 18.0 of this document. The container, preservation and holding time information for these references is summarized in Table 8-1 for soil, water, and drinking water. The current EPA CLP Statement of Work should be referred to for container, preservation and holding time information for CLP procedures. Where allowed by the project sampling and analytical protocols (such as Puget Sound Protocols) the holding time for sediment, soil, and tissue samples may be extended for a defined period when stored frozen at -20°C.

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CAS routinely provides sample containers with appropriate preservatives for our clients. The containers are purchased as precleaned to a level 1 status, and conform to the requirements for analytical samples established by the USEPA. Certificates of analysis for the sampling containers are available to clients if requested. Reagent water used for sampling blanks (trip blanks, etc.) and chemical preservation reagents are tested by the laboratory to ensure that they are free of interferences and documented. Our sample kits typically consist of foam-lined, precleaned shipping coolers, (cleaned inside and out with appropriate cleaner, rinsed thoroughly and air-dried), specially prepared and labeled sampte containers individually wrapped in protective material, (VOC vials are placed in a specially made, foam holder), chain-of-custody (COC) forms, and custody seals. Container labels and custody seals are provided for each container. Figure 8-1 shows the chain-of-custody form routinely used at CAS and included with sample kits. For large sample container shipments, the containers may be

shipped in their original boxes. Such shipments will consist of several boxes of labeled sample containers and sufficient materials (bubble wrap, COC forms, custody seals, shipping coolers, etc.) to allow the sampling personnel to process the sample containers and return them to CAS. The proper preservative is added to the sample containers prior to shipment, unless otherwise instructed by the client.

If any returning shipping cooler exhibits an odor or other abnormality after receipt and subsequent decontamination by laboratory personnel, a second, more vigorous decontamination process is employed. Containers exhibiting an odor or abnormality after the second decontamination process are promptly and properly discarded. CAS keeps client-specific shipping requirements on file and utilizes major transportation carriers to guarantee that sample shipping requirements (same-day, overnight, etc.) are met. CAS also provides courier service that makes regularly scheduled trips to the Greater Portland, Oregon Metropolitan area.

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When CAS ships environmental samples to other laboratories for analysis each sample bottle is wrapped in protective'material and placed in a plastic bag (preferably Ziploc®) to avoid any possible cross-contamination of samples during shipping. The sample management office (SMO) follows formalized procedures for maintaining the chain of custody of the sample(s) (SOP *for Chain of* ***Custody*** *for Sample Transfer between Laboratories* [SOP ADM-COC]), proper packaging and Shipment, specification of proper methodology, etc. Blue or gel ice is the only temperature preservative used by CAS, unless otherwise specified by the client or receiving laboratory.

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## 8.2 Sample Receipt and Handling

Standard Operating Procedures are established for the receiving of samples into the 'laboratory. These procedures ensure that samples are received and properly logged into the laboratory, and that all associated documentation, including chain of custody forms, is complete and consistent with the samples received. Complete documentation of all sample storage is maintained in order to preserve the integrity of the samples.

Once samples are delivered to the CAS sample management office (SMO), a Cooler Receipt and Preservation Check Form (CRF - See Figure 8-2 for an example) is used to assess the shipping cooler and its contents as received by the laboratory personnel. Verification of sample integrity includes the following activities:

- Assessment of custody seal presence/absence, location and signature;
- Temperature of sample containers upon receipt;
- Chain of custody documents properly used (entries in ink, signature present, etc.);
- Sample containers checked for integrity (broken, leaking, etc.);
- Sample is clearly marked and dated (bottle labels complete with required information);
- Appropriate containers (size, type) are received for the requested analyses;
- The minimum amount of sample material is provided for the analysis.

- Sample container labels and/or tags agree with chain of custody entries (identification, required analyses, etc.);
- Assessment of proper sample preservation (if inadequate, corrective action is employed); and
- VOC containers are inspected for the presence/absence of bubbles. (Assessment of proper preservation of VOC containers is performed by lab personnel).

Samples are logged into a Laboratory Information Management System (LIMS). Any anomalies or discrepancies observed during the initial assessment are recorded on the CRF and COC documents. Potential problems with a sample shipment are addressed by contacting the client and discussing the pertinent issues. When the Project Chemist and client have reached a satisfactory resolution, the login process may continue and analysis may begin. During the login process, each sample is given a unique laboratory code and a service request form is generated. The LIMS generates a Service Request that contains client information, sample descriptions, sample matrix information, required analyses, sample collection dates, analysis due dates and other pertinent information. The service request is reviewed by the appropriate Project Chemist for accuracy, completeness, and consistency of requested analyses and for client project objectives.

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Samples are kept refrigerated until they undergo analysis, unless otherwise specified. CAS stores samples in various refrigerators or freezers, depending on the type of analysis and the matrix of the sample. CAS has five walk-in refrigerators which house the majority of sample containers received at the laboratory. In addition to the walk-in refrigerators, there are four additional refrigerators, including dedicated refrigerated storage of VOC samples. These refrigerators are segregated by matrix type (soil or water) and method of analysis. The dedicated storage areas for VOC samples are monitored using storage blanks, as described in the *SOP for VOA Storage Blanks (VOC-BLAN)*. CAS also has six sub-zero freezers capable of storing samples at -20° C; these are primarily used for tissue and sediment samples requiring specialized storage conditions. The temperature of each sample storage unit used at CAS is monitored daily and the data recorded in a bound logbook. Continuous-graph temperature recorders have also been placed in the walk-in refrigerators to provide a permanent record of the storage conditions to which samples are exposed.

CAS adheres to the method-prescribed or project-specified holding times for all analyses. In order to comply with holding time requirements, the sampling date and time are entered into the LIMS system at the time of sample receipt and login. Each analyst then monitors holding times by obtaining analysis-specific worklists from the LIMS. These worklists provide holding time information on all samples for the analysis, calculated from the sampling date and the holding time requirement. In order to report adherence to holding time requirements, the date analyzed is printed or written on the analytical raw data. For analyses with holding time prescribed in hours, the time analyzed is also recorded.

Unless other arrangements have been made in advance, upon completion of all analyses and submittal of the final report, aqueous samples and sample extracts are retained at ambient temperature for 30 days, soil samples are retained at ambient temperature for 60 days, and tissue samples are retained frozen for 3 months. Upon expiration of these time limits, the samples are either returned to the client or disposed of according to approved disposal

practices. All samples are characterized according to hazardous/non-hazardous waste criteria and are segregated accordingly. All hazardous waste samples are disposed of according to formal procedures outlined in the *CAS Environmental Health and Safety Manual.* All waste produced at the laboratory, including the laboratory's own various hazardous waste streams, is treated in accordance with applicable local and Federal laws. Documentation is maintained for each sample from initial receipt through final disposal. This ensures that an accurate history of the sample from "cradle to grave" is generated.

## 8.3 Sample Custody

Sample custody transfer at the time of sample receipt is documented using chain-of-custody (COC) forms accompanying the samples. During sample receipt, it is also noted if custody seals were present. This is described in the *SOP for Sample Receiving (SMO-GEN).* Figure 8-1 is a copy of the chain-of-custody form routinely used at CAS.

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Facility security and access is important in maintaining the integrity of samples received at CAS/Kelso. Access to the laboratory facility is limited by use of locked exterior doors with a coded entry, except for the reception area and sample receiving doors, which are manned during business hours and locked at all other times. In addition, the sample storage area within the laboratory is a controlled access area with locked doors with a coded entry. The CAS facility is equipped with an alarm system and CAS employs a private security firm to provide nighttime and weekend security.

A barcoding system is used to document internal sample custody. Each person removing or returning samples from/to sample storage while performing analysis is required to document this custody transfer. The system uniquely identifies the sample container and provides an electronic record of the custody of each sample. For sample extracts and digestates the analyst documents custody of the sample extract or digestate by signing on the benchsheet, or custody record, that they have accepted custody. The procedures are described in the *SOP for Sample Tracking and Internal Chain of Custody (SMO-SCOC).*

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## 8.4 Project Setup

The analytical method(s) to be used for sample analysis are chosen based on the COC information and project requirements. Unless specified otherwise, the most recent versions of reference methods are used. LIMS codes are chosen to identify the analysis method used for analysis. The Project Chemist ensures that the correct methods are selected for analysis, deliverable requirements are identified, and due dates are specified on the UMS generated Service Request. To communicate and specify project-specific requirements, a Tier V form (Figure 8-3) is used and accompanies the service request form.

# Table 8-1
## Sample Preservation and Holding Times

| DETERMINATION | MATRIX[b] | CONTAINER[c] | PRESERVATION | MAXIMUM HOLDING TIME |
|---|---|---|---|---|
| | | | | |
| Coliform, Colilert | W, DW | P, Bottle or Bag | Cool, 4°C, 0.008% $Na_2S_2O_3$[d] | 6-24 hours' |
| Coliform, Fecal and Total | W, DW | P,G | Cool, 4°C, 0.008% $Na_2S_2O_3$[d] | 6-24 hours[e] |
| Fecal Streptococci | W | P,G | Cool, 4°C, 0.008% $Na_2S_2O_3$[d] | 6-24 hours[e] |
| **Inorganic Tests** | | | | |
| Acidity | W | P,G | Cool, 4°C | 14 days |
| Alkalinity | W, DW | P,G | Cool, 4°C | 14 days |
| Ammonia | W, DW | P,G | Cool, 4°C, $H_2SO_4$ to pH<2 | 28 days |
| Biochemical Oxygen Demand (BOD) | W | P,G | Cool, 4°C | 48 hours |
| Bromate | W, DW | P,G | 50mg/L EDA, cool to 4°C | 28 days |
| Bromide | W, DW | P,G | None Required | 28 days |
| Chemical Oxygen Demand (COD) | W | P,G | Cool, 4°C, $H_2SO_4$ to pH<2 | 28 days |
| Chloride | W, DW | P,G | None Required | 28 days |
| Chlorine, Total Residual | W, DW | P,G | None Required | 24 hours |
| Chlorite | W, DW | P,G | 50mg/L EDA, cool to 4°C | 14 days |
| Chlorophyll-A | W | G Amber | Cool, 4°C | Analyze immediately |
| Color | W, DW | P,G | Cool, 4°C | 48 hours |
| Cyanide, Total and Amenable to Chlorination | W, DW | P,G | Cool, 4°C, NaOH to pH>12, plus 0.6 g Ascorbic Acid | 14 days |
| Cyanide, Weak Acid Dissociable | W | P,G | Cool, 4°C, NaOH to pH >12 | 14 days |
| Ferrous Iron | W, DW | G Amber | Cool, 4°C | 24 hours |
| (Fluoride | W, DW | P,G | None Required | 28 days |
| Hardness | W, DW | P,G | $HNO_3$ to pH<2 | 6 months |
| Hydroqen Ion (pH) | W, DW | P,G | None Required | 24 hours |
| Kjeldahl and Organic Nitrogen | W | P,G | Cool, 4°C, $H_2SO_4$ to pH<2 | 28 days |
| Nitrate | W, DW | P,G | Cool, 4°C | 48 hours |
| Nitrate | W, DW | P,G | Cool, 4°C | 14 days |
| Nitrate-Nitrite | W, DW | P,G | Cool, 4°C, $H_2SO_4$ to pH<2 | 28 davs |
| Nitrite | W, DW | P,G | Cool, 4°C | 48 hours |
| Orthophosphate | W, DW | P,G | Filter Immediately, Cool, 4°C | 48 hours |
| Oxygen, Dissolved (Probe) | W, DW | G, Bottle and Top | None Required | Analyze immediately |
| Oxygen, Dissolved (Winkler) | W, DW | G, Bottle and Top | Fix on Site and Store in Dark | 8 hours |
| Perchlorate | W, DW | P,G | Protect from temp. extremes | 28 days |

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| DETERMINATION | MATRIX[b] | CONTAINER[c] | PRESERVATION | MAXIMUM HOLDING TIME |
|---|---|---|---|---|
| Phenolics, Total | W | G Onlv | Cool, 4°C, $H_2SO_4$ to pH<2 | 28 days |

| DETERMINATION | MATRIX[b] | CONTAINER[c] | PRESERVATION | MAXIMUM HOLDING TIME |
|---|---|---|---|---|
| Phosphorus, Elemental | W | G Only | Cool, 4°C | 48 hours |
| Phosphorus, Total | W | P,G | Cool, 4°C, $H_2SO_4$ to pH<2 | 28 days |
| Residue, Total | W | P,G | Cool, 4°C | 7 days |
| Residue, Filterable (TDS) | W | P,G | Cool, 4°C | 7 days |
| Residue, Nonfilterable (TSS) | W | P,G | Cool, 4°C | 7 days |
| Residue. Settleable | W | P.G | Cool. 4°C | 48 hours |
| Residue, Volatile | W | P,G | Cool, 4°C | 7 days |
| Silica | W | P Onlv | Cool. 4°C | 28 davs |
| Specific Conductance | W, DW | P,G | Cool, 4°C | 28 days |
| Sulfate | W, DW | P,G | Cool, 4°C | 28 days |
| Sulfide | W | P,G | Cool, 4°C, Add Zinc Acetate plus Sodium Hydroxide to pH>9 | 7 days |
| Sulfite | W | P,G | None Required | 24 hours |
| Surfactants (MBAS) | W | P,G | Cool, 4°C | 48 hours |
| Tannin and Lignin | W | P,G | Cool, 4°C | 28 days |
| Temperature | W | P,G | None Required | Analyze immediately |
| Turbidity | W, DW | P,G | Cool, 4°C | 48 hours |
| **Metals** | | | | |
| Metals, except CrVI and Mercury | W, DW | P,G | $HNO_3$ to pH<2 | 6 months |
| | S | G, Teflon-Lined Cap | Cool, 4°C | 6 months |
| Chromium VI | W | P,G | Cool, 4°C | 24 hours |
| Mercury | W | P,G | $HNO_3$ to pH<2 | 28 days |
| | S | P,G | Cool, 4°C | 28 days |
| Oil and Grease, Hexane Extractable Material (EPA 1664) | W | G, Teflon-Lined Cap | Cool, 4°C, $H_2SO_4$ to pH<2 | 28 days |
| Organic Carbon, Total (TOC) | W | P,G | Cool, 4°C, $H_2SO_4$ to pH<2 | 28 days |
| Organic Halogens, Total (TOX) | W | G, Teflon-Lined Cap | Cool, 4°C, $H_2SO_4$ to pH<2, No headspace | 28 days |
| Organic Halogens, Adsorbable (AOX) | W | G, Teflon-Lined Cap | Cool, 4°C, $HNO_3$ to pH<2 | 6 months |

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| | | | | |
|---|---|---|---|---|
| Petroleum Hydrocarbons, Total | W | G, Teflon-Lined Cap | Cool, 4°C, HCl or $H_2SO_4$ to pH<2 | 7 days until extraction; 40 days after extraction |
| | S | G, Teflon-Lined Cap | Cool, 4°C | 14 days until extraction; 40 days after extraction |

## Table 8-1 (continued)
## Sample Preservation and Holding Times

| DETERMINATION | MATRIX[b] | CONTAINER[c] | PRESERVATION | MAXIMUM HOLDING TIME |
|---|---|---|---|---|
| | | **Volatile Organics** | | |
| Petroleum Hydrocarbons, Volatile (Gasoline-Range Organics) | W | G, Teflon-Lined Septum Cap | Cool, 4°C, HCl to pH<2 No Headspace | 14 days |
| | S | G, Teflon-Lined Cap | Cool, 4°C Minimize Headspace | 14 days |
| urgeable Halocarbons | W | G, Teflon-Lined Septum Cap, No Headspace | **No Residual Chlorine Present:** HCl to pH<2, Cool, 4°C, No Headspace **Residual Chlorine Present:** 10% $Na_2S_2O_3$, HCl to pH<2, Cool, 4°C | 14 days |
| | S | G, Teflon-Lined Cap | Cool, 4°C, Minimize Headspace | 14 days |
| | S | Method 5035 | Encore, Freeze at -20°C Methanol, Cool, 4°C<br>Sodium Bisulfate Cool, 4°C | 7 days 48 hrs to prepare from Encore, 14 days after preparation. 48 hrs to prepare from Encore, 14 days after preparation. |
| Jrgeable Aromatic Hydrocarbons (including BTEX and MTBE) | | G, Teflon-Lined Septum Cap, No | **No Residual Chlorine Present:** HCl to pH<2, Cool, 4°C, No Headspace **Residual Chlorine Present:** 10% $Na_2S_2O_3$, HCl to pH<2, Cool 4°C | 14 days |
| | S | G, Teflon-Lined Cap | Cool, 4°C, Minimize Headspace | 14 days |
| | S | Method 5035 | Encore, Freeze at -20°C Methanol, Cool, 4°C<br>Sodium Bisulfate Cool, 4°C | 7 days 48 hrs to prepare from Encore, 14 days after preparation. 48 hrs to prepare from Encore, 14 days after preparation. |

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| | | | | |
|---|---|---|---|---|
| Acrolein, Acrylonitrile, Acetonitrile | W | G, Teflon-Lined Septum Cap | Adjust pH to 4-5, Cool, 4°C, No Headspace | 14 days |
| EDB and DBCP | W,S | G, Teflon-Lined Cap | Cool, 4°C, 3 mg $Na_2S_2O_3$, No Headspace | 28 days |

## Table 8-1 (continued)
## Sample Preservation and Holding Times

| DETERMINATION | MATRIX[b] | CONTAINER[c] | PRESERVATION | MAXIMUM HOLDING TIME |
|---|---|---|---|---|
| **Semivolatile Organics** | | | | |
| Petroleum Hydrocarbons, Extractable (Diesel-Range Organics) | W,S | G, Teflon-Lined Cap | Cool, 4°C | 7 days until extraction;[f] 40 days after extraction |
| Alcohols and Glycols | W,S | G, Teflon-Lined Cap | Cool, 4°C[g] | 7 days until extraction;[f] 40 days after extraction |
| Phenols | W,S | G, Teflon-Lined Cap | Cool, 4°C[g] | 7 days until extraction;[f] 40 days after extraction |
| | W,S | G, Teflon-Lined Cap | Cool, 4°C[g] | 7 days until extraction;[f] 40 days after extraction |
| Nitrosamines | W,S | G, Teflon-Lined Cap | Cool, 4°C, Store in Dark[g] | 7 days until extraction;[f] 40 days after extraction |
| Organochlorine Pesticides and PCBs | W,S | G, Teflon-Lined Cap | Cool, 4°C | 7 days until extraction;[f] 40 days after extraction |
| Nitroaromatics and Cyclic Ketones | W,S | G, Teflon-Lined Cap | Cool, 4°C, Store in Dark[g] | 7 days until extraction! 40 days after extraction |
| Polynuclear Aromatic Hydrocarbons | W,S | G, Teflon-Lined Cap | Cool, 4°C, Store in Dark[g] | 7 days until extraction;[f] 40 days after extraction |
| Haloethers | W,S | G, Teflon-Lined Cap | Cool, 4°C[g] | 7 days until extraction;[f] 40 days after extraction |
| Chlorinated Hydrocarbons | W,S | G, Teflon-Lined Cap | Cool, 4°C[g] | 7 days until extraction;[f] 40 days after extraction |
| Organophosphorus Pesticides | W,S | G, Teflon-Lined | Cool, 4°C[g] | 7 days until |

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| | | | | |
|---|---|---|---|---|
| | | Cap | | extraction;' 40 days after extraction |
| Nitrogen- and Phosphorus-Containing Pesticides | W,S | G, Teflon-Lined Cap | Cool, 4°C[g] | 7 days until extraction;[f] 40 days after extraction |

| DETERMINATION | MATRIX[b] | CONTAINER[c] | PRESERVATION | MAXIMUM HOLDING TIME |
|---|---|---|---|---|
| Chlorinated Herbicides | W,S | G, Teflon-Lined Cap | Cool, 4°C[g] | 7 days until extraction; 40 days after extraction |
| Chlorinated Phenolics | W | G, Teflon-Lined Cap | $H_2SO_4$ to pH<2, Cool, 4°C[g] | 30 days until extraction; 30 days after extraction |
| Resin and Fatty Acids | W | G, Teflon-Lined Cap | NaOH to pH ≥10, Cool, 4°C[g] | 30 days until extraction; 30 days after extraction |
| **Drinking Water Organics** | | | | |
| Purgeable Organics | DW | G, Teflon-Lined Septum Cap | Ascorbic Acid, HCl to pH≤2, Cool, 4°C, No Headspace | 14 days |
| EDB, DBCP, and TCP | DW | G, Teflon-Lined Septum Cap | Cool, 4°C, 3 mg $Na_2S_2O_3$, No Headspace | 14 days |
| Carbamates, Carbamoyloximes | DW | G, Amber, Teflon-Lined Cap | 1.8 mL monochloroacetic acid to pH<3; 80 mg/L $Na_2S_2O_3$ if Res.Cl.; Cool, 4°C | 28 days |
| Chlorianted Herbicides | DW | G, Amber, Teflon-Lined Cap | If Res.Cl, 2mg/4omL NaS; Cool, <6°C | 14 days until lextraction; 21 days after extraction- |
| Chlorinated Pesticides | DW | G, Amber, Teflon-Lined Cap | 50 mg/L NaS, HCl to pH≤ 2; Cool, 4°C | 14 davs until lextraction; 30 days after extraction |
| Diquat and Paraquat | DW | G, Amber, Teflon-Lined Cap | 100 mg/L $Na_2S_2O_3$ if Res.Cl., Cool, 4°C, | 7days until extraction; 21 days after extraction |
| Endothall | DW | G, Amber, Teflon-Lined Cap | Cool, 4°C | 7 days until extraction; 14 days after extraction |
| Glyphosate | DW | G, Amber, Teflon-Lined Cap | 100 mg/L $Na_2S_2O_3$, Cool, 4°C | 14 days |
| Haloacetic Acids | DW | G, Amber, Teflon-Lined Cap | 100 mg/L $NH_4Cl$, Cool, 4°C | 14 days until extraction; 7 days after extraction |
| Semivolatile Organics | DW | G, Amber, Teflon-Lined Cap | 50 mg/L NaS, HCl to pH≤ 2; Cool, 4°C | 14 days until lextraction; 30 days after extraction |

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## Table 8-1 (continued)
## Sample Preservation and Holding Times

| DETERMINATION | MATRIX[b] | CONTAINER[c] | PRESERVATION | MAXIMUM HOLDING TIME |
|---|---|---|---|---|
| **Toxicity Characteristic Leaching Procedure (TCLP)** | | | | |
| Mercury | HW | P,G | Sample: Cool, 4°C<br>TCLP extract: $HNO_3$ to pH<2 | 28 days until extraction; 28 days after extraction |
| Metals, except Mercury | HW | P,G | Sample: Cool, 4°C<br>TCLP extract: $HNO_3$ to pH<2 | 180 days until extraction; 180 days after extraction |
| Volatile Organics | HW | G, Teflon-Lined Cap | Sample: Cool, 4°C<br>Minimize Headspace<br>TCLP extract: Cool, 4°C, HCl to pH<2, No Headspace | 14 days until extraction; 14 days after extraction |
| Semivolatile Organics | HW | G, Teflon-Lined Cap | Sample: Cool, 4°C, Store in Dark[g]<br>TCLP extract: Cool, 4°C, Store in Dark[g] | 14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction |
| Organochlorine Pesticides | HW | G, Teflon-Lined Cap | Sample: Cool, 4°C<br>TCLP extract: Cool, 4°C | 14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction |
| Chlorinated Herbicides | HW | G, Teflon-Lined Cap | Sample: Cool, 4°C<br>TCLP extract: Cool, 4°C | 14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction |

a See Section 18.0 for sources of holding time information.
b DW = Drinking Water, W = Water; S = Soil or Sediment; HW = Hazardous Waste
c P = Polyethylene; G = Glass
d For chlorinated water samples
e The recommended maximum holding time is variable, and is dependent upon the geographical proximity of sample source to the laboratory.
f Fourteen days until extraction for soil, sediment, and sludge samples.
g If the water sample contains residual chlorine, 10% sodium thiosulfate is used to dechlorinate.

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**Figure 8-1**
**Chain of Custody Form**

Columbia Analytical Services inc.
An Employee-Owned Company

# CHAIN OF CUSTODY

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222x07 • FAX (360) 636-1068

SR#: _____

PAGE _____ OF _____ COC # _____

PROJECT NAME
PROJECT NUMBER
PROJECT MANAGER
COMPANY/ADDRESS
PHONE # | FAX #
SAMPLER'S SIGNATURE

| SAMPLE I.D. | DATE | TIME | LAB I.D. | MATRIX | NUMBER OF CONTAINERS | Semivolatile Organics by GC/MS 625☐ 8270☐ 8270LL☐ | Volatile Organics 624☐ 8260☐ | Hydrocarbons (*see below) Gas☐ 8021☐ BTEX☐ Diesel☐ Oil☐ ☐ Fuel Fingerprint (FFO) ☐ NW-HCID Screen | Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐ | PCB's Aroclors☐ Congeners☐ | Pesticides/Herbicides 608☐ 8081A☐ 8141A☐ 8151A☐ | Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐ | PAHS 8310☐ SIM☐ | Metals, Total or Dissolved (See list below) | Cyanide☐ | pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS (circle) | NH3N, COD, Total P, TKN, TOC DOC (circle) NO2+NO3 | TOX/Halogens☐ AOX 1650☐ 506☐ | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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**REPORT REQUIREMENTS**

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. Data Validation Report (includes all raw data)
___ IV. CLP Deliverable Report
___ V. EDD

**INVOICE INFORMATION**

P.O. # _____
Bill To: _____

**TURNAROUND REQUIREMENTS**

____ 24 hr. ____ 48 hr.
____ 5 Day
____ Standard (10-15 working days)
____ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: _____ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| Signature / Date/Time | Signature / Date/Time | Signature / Date/Time | Signature / Date/Time |
| Printed Name / Firm | Printed Name / Firm | Printed Name / Firm | Printed Name / Firm |

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# Figure 8-2

**Columbia Analytical Services Inc.**
**Cooler Receipt And Preservation Form**

Project/Client_____ Work Order K23_____

Cooler received on_____ and opened on _____ by_____

| | | | |
|---|---|---|---|
| 1. | Were custody seals on outside of cooler?<br>If yes, how many and where?_____ | Y | N |
| 2. | Were seals intact and signature & date correct? | Y | N |
| 3. | Is the shipper's airbill available and filed? If no, record airbill number:_____ | Y | N |
| 4. | COC # _____ _____ _____ _____<br>Temperature of cooler(s) upon receipt: _____ _____ _____ _____<br>Temperature Blank: _____ _____ _____ _____ | | |
| 5. | Were custody papers properly filled out (ink, signed, etc.)? | Y | N |
| 6. | Type of packing material present _____ | | |
| 7. | Did all bottles arrive in good condition (unbroken)? | Y | N |
| 8. | Were all bottle labels complete (*i.e.* analysis, preservation, etc.)? | Y | N |
| 9. | Did all bottle labels and tags agree with custody papers? | Y | N |
| 10. | Were the correct types of bottles used for the tests indicated? | Y | N |
| 11. | Were all of the preserved bottles received at the lab with the appropriate pH? | Y | N |
| 12. | Were VOA vials checked for absence of air bubbles, and if present, noted below? | Y | N |
| 13. | Did the bottles originate from CAS/K or a branch laboratory? | Y | N |
| 14. | Are CWA Microbiology samples received with > ½ the 24 hr. hold time remaining from collection? | Y | N |
| 15. | Was Cl2/Res negative? | Y | N |

Explain any discrepancies:_____

_____

_____

_____

RESOLUTION:_____

Samples that required preservation or received out of temperature:

| Sample ID | Reagent | Volume | Lot Number | Bottle Type | Rec'd out of Temperature | Initials |
|---|---|---|---|---|---|---|
| | | | | | | |
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# Figure 8-3
# Tier V Form

Client :

Project Chemist:

ProjectName:

Service Request :

Project Number :

SMO LimsTemplate ID :

Project Description :

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**QAPP/SOW Information :**

**Reporting**

Tier Level :

PDF:

Report to :

In result field use :

EDD :

Flagging Requirements :

Other Requirements :

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**Sample Considerations**

Sample Limitations :

Sample Prep/Analysis :

Non-Standard Holdtimes :

Historical Data :

Comments :

# *9.0* ANALYTICAL PROCEDURES

CAS employs methods and analytical procedures from a variety of sources. The primary method references are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III for hazardous waste samples, and USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, and Supplements; and *Standard Methods for the Examination of Water and Wastewater* for water and wastewater samples. The complete citation for each of these references can be found in Section 18.0 of this document. Other published procedures, such as state-specific methods, program-specific methods (such as Puget Sound Protocols), or in-house methods may be used. The implementation of methods by CAS is described in SOPs specific to each method. A list of SOPs and NELAC-accredited methods are given in Appendix E. Futher details are described below.

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## 9.1 Standard Operating Procedures (SOPs) and Laboratory Notebooks.

CAS maintains **SOPs** for use in both technical and administrative functions. SOPs are written following the format and content requirements described in the *SUP for Preparation of Standard Operating Procedures* (SOP No. ADM-SOP). Each SOP is reviewed and approved by a minimum of two managers (the Laboratory Director and/or Department Manager and the Quality Assurance Manager). All SOPs undergo a documented annual review to make sure current practices are described. The QA Manager maintains a comprehensive list of current SOPs. The document control process ensures that only the most currently prepared version of an SOP is being used. The QA Manual, QAPPs, SOPs, standards preparation logbooks, maintenance logbooks, etc., are controlled documents. The procedures for document control are described in the *SUP for Document Control* (ADM-DOC_CTRL). In addition to **SOPs,** each laboratory department maintains a current file, accessible to all laboratory staff, of the current methodology used to perform analyses. Laboratory notebook entries are standardized following the guidelines in the *Making Entries into Logbooks and onto Benchsheets* SOP (ADM-DATANTRY). Entries made into laboratory notebooks are reviewed and approved by the appropriate supervisor at a regular interval.

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## *9.2* Deviation from Standard Operating Procedures

When a customer requests a modification to an **SOP** (such as a change in reporting limit, addition or deletion of target analyte(s), etc.), the project chemist handling that project must discuss the proposed deviation with the department manager in charge of the analysis and obtain their approval to accept the project. The project chemist is responsible for documenting the approved or allowed deviation from the standard operating procedure by placing a detailed description of the deviation attached to the quotation or in the project file and also providing an appropriate comment on the service request when the samples are received.

For circumstances when a deviation or departure from company policies or procedures involving any non-technical function is found necessary, approval must be obtained from the appropriate supervisor, manager, the laboratory director, or other level of authority. Frequent

departure from policy is not encouraged. However, if frequent departure from any policy is noted, the laboratory director will address the possible need for a change in policy.

## 9.3 Modified Procedures

CAS strives to perform published methods as described in the referenced documents. If there is a material deviation from the published method, the method is cited as a "Modified" method in the analytical report. Modifications to the published methods are listed in the standard operating procedure. Standard operating procedures are available to analysts and are also available to our clients for review, especially those for "Modified" methods. Client approval **is** obtained for the use of "Modified" methods prior to the performance of the analysis.

## 9.4 Analytical Batch

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The basic unit for analytical quality control is the analytical batch. The definition that CAS has adopted for the analytical batch is listed below. The overriding principle for describing an analytical batch is that all the samples in a batch, both field samples and quality control samples, are to be handled exactly the same way, and all of the data from each analysis is to be manipulated in exactly the same manner.

The minimum requirements of an analytical batch are:

1) The number of (field) samples in a batch is not to exceed 20.

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2) All (field) samples in a batch are of the same matrix.

3) The QC samples to be processed with the (field) samples include:

   a) Method Blank (a.k.a. Laboratory Reagent Blank)

      Function: Determination of laboratory contamination.

   b) Laboratory Control Sample (a.k.a. Laboratory Fortified Blank)

      Function: Assessment of method performance

   c) Matrix Spiked (field) Sample (a.k.a. Laboratory Fortified Sample Matrix)

      Function: Assessment of matrix problems

      NOTE: A sample identified as a field blank, an equipment blank, or a trip blank is not to be matrix spiked.

   d) Duplicate Matrix Spiked (field) Sample or Duplicate (field) Sample (a.k.a. Laboratory Duplicate)

      Function: Assessment of batch precision

      NOTE: A sample identified as a field blank, an equipment blank, or a trip blank is not to be duplicated.

4) A single lot of reagents is used to process the batch of samples.

5) Each operation within the analysis is performed by a single analyst, technician, chemist, or by a team of analysts/technicians/chemists.

6) The time frame is not to exceed a 24-hour period. "Open batches" extending over more than one 24 hour period are not allowed.

7) (Field) samples are assigned to batches commencing at the time that sample processing begins. For example: for analysis of metals, sample processing begins when the samples are digested. For analysis of organic constituents, it begins when the samples are extracted.

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8) The QC samples are to be analyzed in conjunction with the associated field samples prepared with them. However, for tests which have a separate sample preparation step that defines a batch (digestion, extraction, etc.), the QC samples in the batch do not require analysis each time a field sample within the preparation batch is analyzed (multiple instrument sequences to analyze all field samples in the batch need not include re-analyses of the QC samples).

9) The batch is is to be assigned a unique identification number that can be used to correlate the QC samples with the field samples.

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10) Batch QC refers to the QC samples that are analyzed in a batch of (field) samples.

11) Specific project, program, or method SOP requirements may be exceptions. If project, program, or method SOP requirements are more stringent than these laboratory minimum requirements, then the project, program, or method SOP requirements will take precedence. However, if the project, program, or method SOP requirements are less stringent than these laboratory minimum requirements, these laboratory minimum requirements will take precedence.

# 10.0 CALIBRATION PROCEDURES AND FREQUENCY

All equipment and instruments used at CAS are operated, maintained and calibrated according to the manufacturer's guidelines and recommendations, as well as to criteria set forth in the applicable analytical methodology. Operation and calibration are performed by personnel who have been properly trained in these procedures. Documentation of calibration information is maintained in appropriate reference files. Brief descriptions of the calibration procedures for our major laboratory equipment and instruments are described below. Records are maintained to provide traceability of reference materials.

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Any item of the equipment which has been subjected to overloading or mishandling, or has been shown by verification or otherwise to be defective, is taken out of service until it has been repaired. The equipment is placed back in service only after verifying by calibration that the equipment performs satisfactorily. An evaluation of the effect of this defect on previous calibrations or tests is made and documented appropriately.

Calibration verification is performed according to in the applicable analytical methodology. Calibration verification procedures and criteria are listed in laboratory Standard Operating Procedures. Documentation of calibration verification is maintained in appropriate reference files. For NELAP accredited methods, the concentration of calibration verification standards are varied within the calibration range periodically.

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## 10.1 Temperature Control Devices

Temperatures are monitored and recorded **for** all of the temperature-regulating support equipment such as sample refrigerators, freezers, and standards refrigerators. Bound record books are kept which contain daily-recorded temperatures, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks. The procedure for performing these measurements is provided in the *SOP for Support Equipment Monitoring and Calibration (SOP ADM-SEMC).* The SOP also includes the use of acceptance criteria and correction factors.

Where the operating temperature is specified as a test condition (such as ovens, incubators, evaporators) the temperature is recorded on the raw data. All thermometers are identified according to serial number, and the calibration of these thermometers is checked annualty against a National Institute of Standards and Technology (NIST) certified thermometer. The NIST thermometer is recertified by a professional metrology organization on an annual basis.

## 10.2 Analytical Balances

Analytical balances are serviced on a semi-annual basis by a professional metrology organization. New certificates of calibration for each balance are issued to the laboratory on a semi-annual basis. The calibration of each analytical balance is checked daily with three class S or S-1 weights, which assess the accuracy of the balance at low, mid-level and high levels

within the working range. The weights are recertified using NIST traceable standards by a professional metrology organization on an annual basis.

As needed, the balances are recalibrated using the manufacturers recommended operating procedures. Bound record books are kept which contain the recorded measurements, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks. The procedure for performing these measurements and use of acceptance criteria is described in the SOP ADM-SEMC.

## 10.3 Water Purification System

The water purification system is designed to produce deionized water of 18 megohms resistivity or better, meeting specifications for Type I water, as described in *Standard Methods for the Examination of Water and Wastewater (SM1080)*. The system is monitored continuously with an on-line meter, which is recorded daily in a bound record book. Deionizers are rotated and replaced when the first unit in the series produces water of 0.5 megohms, which is monitored by a light on the unit. The status of the deionizers is also checked (resistivity reading and light status) and recorded daily in a bound record book. Activated carbon filters are also in series with the demineralizers to produce "organic-free" water. Conductivity is checked at a point downstream of the purification system at a spigot in one of the laboratories. This information is also recorded each week day.

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## 10.4 Source and Preparation of Standard Reference Materials

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All analytical measurements generated at CAS are performed using materials and/or processes that are traceable to a reference material. Metrology equipment (analytical balances, thermometers, etc.) is calibrated using reference materials traceable to the National Institute of Standards and Technology (NIST). These primary reference materials are themselves recertified on an annual basis. All sampling containers provided to the client by the laboratory are purchased as precleaned (Level 1) containers, with certificates of analysis available for each bottle type. This information is provided to the client when requested.

Consumable reference materials routinely purchased by the laboratories (e.g., analytical standards) are purchased from nationally recognized, reputable vendors. All vendors have fulfilled the requirements for ISO 9001 certification and/or are accredited by $A_2LA$. CAS relies on a primary vendor for the majority of its analytical supplies. Consumable primary stock standards are obtained from certified commercial sources or from sources referenced in a specific method. Supelco, Ultra Scientific, AccuStandard, Chem Services, Inc., Aldrich Chemical Co., Baker, Spex, etc. are examples of the vendors used. Reference material information is recorded in the appropriate logbook(s) and materials are stored under conditions that provide maximum protection against deterioration and contamination. The logbook entry includes such information as an assigned logbook identification code, the source of the material (i.e. vendor identification), solvent (if applicable) and concentration of analyte(s), reference to the certificate of analysis and an assigned expiration date. The date that the standard is received in the laboratory is marked on the container. When the reference material is used for the first time, the date of usage and the initials of the analyst are also recorded on the container.

Stock solutions and calibration standard solutions are prepared fresh as often as necessary according to their stability. All standard solutions are properly labeled as to analyte concentration, solvent, date, preparer, and expiration date; these entries are also recorded in the appropriate notebook(s) following the *SOP for Making Entries into Logbooks and onto Benchsheets* (SOP No. ADM-DATANTRY). Prior to sample analysis, all calibration reference materials are verified with a second, independent source of the material (see section 11.3.5).

## 10.5 Inductively Coupled Plasma-Atomic Emission Spectrograph (ICP-AES)

Each emission line on the ICP is calibrated daily against a blank and against standards. Analyses of calibration standards, initial and continuing calibration verification standards, and inter-element interference check samples are carried out as specified in the EPA CLP Statement of Work for Inorganic Analysis, SOW No ILM04.0.

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## 10.6 Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)

Each element *of* interest is calibrated for using a blank and a single standard. Prior to calibration, a short-term stability check is performed on the system. Following calibration, an independent check standard is analyzed, and a continuing calibration verification standard (CCV) is analyzed with every ten samples.

## 10.7 Atomic Absorption Spectrophotometers (AAS)

These instruments are calibrated daily using a minimum of four standards and a blank. Calibration is validated using reference standards and is verified at a minimum frequency of once every ten samples. Initial calibration points cannot be "dropped" from the resulting calibration curve.

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## 10.8 GC/MS Systems

All GC/MS instruments are calibrated at a minimum of five different concentration levels for the analytes of interest (unless specified otherwise) using procedures outlined in Standard Operating Procedures and/or appropriate USEPA method citations. All reference materials used for this function are vendor-certified standards. Calibration verification is performed at method-specified intervals following the procedures in the SOP and reference method. Compounds selected as system performance check compounds (SPCCs) must show a method-specified response factor in order for the calibration to be considered valid. Calibration check compounds (CCCs) must also meet method specifications for percent difference from the multipoint calibration. For isotope dilution procedures, the internal standard response(s) and labeled compound recovery must meet method criteria. Method-specific instrument tuning is regularly checked using bromofluorobenzene (BFB) for volatile organic chemical (VOC) analysis, or decafluorotriphenylphosphine (DFTPP) for semi-volatile analysis. Mass spectral peaks for the tuning compounds must conform both in mass numbers and in relative intensity criteria before analyses can proceed. Calibration policies for organics chormatographic analyses are described in the *SOP for Calibration of Instruments for Organics Chromatographic Analyses (SOP SOC-CAL).*

## 10.9 Gas Chromatographs and High Performance Liquid Chromatographs

Calibration and standardization follow SOP guidelines and/or appropriate USEPA method citations. All GC and HPLC instruments are calibrated at a minimum of five different concentration levels for the analytes of interest (unless specified otherwise). The lowest standard is equivalent to the method reporting limit; additional standards define the working range of the GC or LC detector. Results are used to establish response factors (or calibration curves) and retention-time windows for each analyte. Calibration is verified at a minimum frequency of once every ten samples, unless otherwise specified by the reference method. *SOP for Calibration of Instruments for Organics Chromatographic Analyses (SOP SOC-CAL).*

## 10.10 UV-Visible Spectrophotometer (manual colorimetric analyses)

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Routine calibrations for colorimetric and turbidimetric analyses involve generating a 5-point calibration curve including a blank. Initial calibration points cannot be "dropped" from the resulting calibration curve. Correlation coefficients must meet method or SOP specifications before analysis can proceed. Independent calibration verification standards (ICVs) are analyzed with each batch of samples. Continuing calibration is verified at a minimum frequency of once every ten samples. Typical UV-Visible spectrophotometric methods at CAS include total phenolics, phosphates, surfactants and tannin-lignin.

## 10.11 Flow Injection Analyzer (automated colorimetric analysis)

A minimum of three standards and a blank are used to calibrate the instrument for cyanide analysis. A blank and (minimum of) five standards are used to calibrate the instrument for all other automated chemistries. Initial calibration points cannot be "dropped" from the resulting calibration curve. Standard CAS acceptance limits are used to evaluate the calibration curve prior to sample analysis.

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## 10.12 Ion Chromatographs

Calibration of the ion chromatograph (IC) involves generating a 5-point calibration curve. Initial calibration points cannot be 'dropped" from the resulting calibration curve. A correlation coefficient of $\geq$ 0.995 for the curve is required before analysis can proceed. Quality Control (QC) samples that are routinely analyzed include blanks and laboratory control samples. The target analytes typically determined by the IC include nitrate, nitrite, chloride, fluoride, sulfate and bromide. Calibration verification is performed at method-specified intervals following the procedures in the SOP and reference method.

## 10.13 Turbidimeter

Calibration of the turbidimeter requires analysis of three Nephelometric Turbidity Unit (NTU) formazin standards. Quality Control samples that are routinely analyzed include blanks, Analytical Products Group® QC samples (or equivalent) and duplicates.

## 10.14 Ion-selective electrode

Two standards are used to calibrate the electrodes before analysis. The slope of the curve must be within acceptance limits before analysis can proceed. Quality Control samples that are routinely analyzed include blanks, LCSs and duplicates.

## 10.15 Pipets

The calibration of pipets and autopipettors used to make critical-volume measurements is verified following the *SOP for Checking Pipet Calibration,* Both accuracy and precision verifications are performed, at intervals applicable to the pipet and use. The results of all calibration verifications are recorded in bound logbooks.

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## 10.16 Other Instruments

Calibration for the total organic carbon (TOC), total organic halogen (TOX), and other instruments is performed following manufacturer's recommendations and applicable SOPs.

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# 11.0 QUALITY CONTROL

A primary focus of Columbia Analytical Services Quality Assurance (QA) Program is to ensure the accuracy, precision and comparability of all analytical results. Prior to using a procedure for the analysis of field samples, acceptable method performance is established by performing demonstration of capability analyses and performance characteristics are established by performing method detection limit studies and assessing accuracy and precision according to the reference method. CAS has established Quality Control (QC) objectives for precision and accuracy that are used to determine the acceptability of the data that is generated in its laboratories. These QC limits are either specified in the methodology or are statistically derived based on the laboratory's actual historical data obtained from the various QC measurements for each analytical method. The Quality Control objectives are defined below.

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## 11.1 Quality Control Objectives

**11.1.2 Demonstration of Capability** - Where required by mandatory test method, regulation, or accreditation protocols, a demonstration of capability (DOC) is made prior to using any test method. This demonstration is made following regulatory, accreditation, or method specified procedures. In general, this demonstration does not test the performance of the method in real world samples, but in the applicable clean matrix free of target analytes and interferences.

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A quality control reference material or quality control sample is obtained. The analyte(s) is (are) diluted in a volume of clean matrix (for analytes which do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples). Where specified, the method-required concentration levels are used. Four aliquots are prepared and analyzed according to the test procedure. The mean recovery and standard deviations are calculated and compared to the corresponding acceptance criteria for precision and accuracy in the test method or laboratory-generated acceptance criteria (if there are not established mandatory criteria). All parameters must meet the acceptance criteria. Where spike levels are not specified, actual Laboratory Control Sample results or MDL study results may be used to meet this requirement, provided acceptance criteria is met.

**11.1.3 Accuracy** - Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory-fortified blanks, standard reference materials, and standard solutions. In addition, laboratory-fortified (i.e. matrix-spiked) samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery (% REC.) of the measured value, relative to the true or expected value. If a measurement process produces results whose mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). CAS utilizes several quality control

measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement

**11.1.4 Precision** - Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling and in laboratory analysis. The American Society of Testing and Materials (ASTM) recognizes two levels of precision: repeatability - the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions, and reproducibility - the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material.

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"Within-batch" precision is measured using replicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

**11.1.5 Control Limits** - The acceptance limits for accuracy and precision originate from two different sources: For analyses having enough QC data, control limits are calculated at the 99% confidence limits. For analyses not having enough QC data, or where the method is prescriptive, control limits are taken from the method on which the procedure is based. If the method does not have control limits stated in it, then control limits are assigned method-default or reasonable values. New control limits are generated periodically. After review of the data by the Quality Assurance Manager, the new acceptance criteria replace the previous criteria and data is assessed using the new values.

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These control limits are updated when new statistical limits are generated for the appropriate surrogate, laboratory control sample, and matrix spike compounds (typically once a year) or when method prescribed limits change. The current acceptance limits for accuracy and precision are available from the labaoratory and on the accompanying CD-ROM. For inorganics, the precision limit values listed are for laboratory duplicates. For organics, the precision limit values listed are for duplicate laboratory control samples or duplicate matrix spike analyses.

**11.1.6 Representativeness** - Representativeness is the degree to which the field sample represents the overall sample site or material. This can be extended to the sample itself, in that representativeness is the degree to which the subsample that is analyzed represents the entire field sample submitted for analysis. CAS has sample handling procedures to ensure that the sample used for analysis is representative of the entire sample. These include the SOP for Sample Preparation, Compositing, and Subsampling, the *SOP for Solid Sample Preparation,* and the *SOP for Tissue Sample Preparation.* Further, analytical SOPs specify appropriate sample handling and sample sizes to further ensure the sample aliquot that is analyzed is representative in entire sample.

**11.1.7 Completeness** - Completeness is a measure of the amount of valid data that is obtained, compared to the amount that is expected. For the purposes of this plan, completeness is calculated by dividing the number of samples having valid data by the total number of samples in the project, expressed as a percentage. The CAS objective for completeness is 100%.

**11.1.8 Comparability** - Comparability expresses the confidence with which one data set can be compared to another. **To** ensure comparability, standard operating procedures are used for the preservation, handling, and analysis of all samples. Data is reported in units specified by the customer.

## 11.2 Method Detection Limits and Method Reporting Limits

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Method Detection Limits (MDL) for analytical methods routinely performed at CAS/Kelso are determined annually, thus may change slightly from year to year. The MDLs are determined by following the *SOP for the Determination of Method Detection Limits,* which is based on the procedure in 40 CFR Part 136, Appendix **B.** The Method Reporting Limits (MRLs) used at CAS are the routinely reported lower limits of quantitation. These MRLs are the levels to which CAS routinely reports results in order to minimize false positive or false negative results. The MRLs take into account day-to-day fluctuations in instrument sensitivity as well as other factors. Analyses are calibrated to the MRL, or lower. The MRL is typically two to ten times the MDL. Current laboratory MDLs and MRLs are available from the laboratory.

## 11.3 Quality Control Procedures

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The specific types, frequencies, and processes for quality control sample analysis are described in detail in method-specific standard operating procedures and listed below. These sample types and frequencies have been adopted for each method and a definition of each type of QC sample is provided below. In addition, a number of other quality control processes that may impact analytical results are also described below.

### 11.3.1 Method Blank (a.k.a. Laboratory Reagent Blank)

The method blank is either analyte-free water or analyte-free soil (when available), subjected to the entire analytical process. When analyte-free soil is not available, anhydrous sodium sulfate, organic-free sand, or an acceptable substitute may be used instead. The method blank is analyzed to demonstrate that the analytical system itself is not contaminated with the analyte(s) being measured. The method blank results should be below the Method Reporting Limit (MRL) or, if required for DoD projects, below half of the MRL for the analyte(s) being tested. Otherwise, corrective action must be taken. A method blank is included with the analysis of every sample preparation batch, every 20 samples, or as stated in the method, whichever is more frequent.

### 11.3.2 Calibration Blanks

For some methods, calibration blanks are prepared along with calibration standards in order to create a calibration curve. Calibration blanks are free of the analyte of interest and, where applicable, provide the zero point of the calibration curve.

### 11.3.3 Continuing Calibration Blanks

Continuing calibration blanks (CCBs) are solutions of either analyte-free water, reagent, or solvent that are analyzed in order to verify the system is contamination-free when CCV standards are analyzed. The frequency of CCB analysis is either once every ten samples or as indicated in the method, whichever is greater.

### 11.3.4 Calibration Standards

Calibration standards are solutions of known concentration prepared from primary standard solutions that are, in turn, prepared from stock standard materials. Calibration standards are used to calibrate the instrument response with respect to analyte concentration. Standards are analyzed in accordance with the requirements stated in the particular method being used.

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### 11.3.5 Initial (or Independent) Calibration Verification Standards

Initial (or independent) calibration verification standards (ICVs) are standards that are analyzed *after* calibration with newly prepared standard(s) but *prior to* sample analysis, in order to verify the validity and accuracy *of* the standards used in the calibration. Once it is determined that there is no reference material defect or systematic error in preparation **of** the calibration standard(s), standards are considered valid and may be used for subsequent calibrations and quantitative determinations (as expiration dates and methods allow). The ICV standards are prepared from materials obtained from a source independent of that used for preparing the calibration standards ("second-source"). ICVs are also analyzed in accordance with method-specific requirements

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### 11.3.6 Continuing Calibration Verification Standards

Continuing calibration verification standards (CCVs) are midrange standards that are analyzed in order to verify that the calibration of the analytical system is still acceptable. The frequency ***of*** CCV analysis is either once every ten samples, or as indicated in the method.

### 11.3.7 Internal Standards

Internal standards are known amounts of specific compounds that are added to each sample following sample preparation or extraction. Internal standards are generally used for GC/MS and **ICP-MS** procedures to correct sample results that have been affected by changes in instrument conditions or changes caused by certain matrix effects. The requirements for evaluation ***of*** internal standards are specified in each method and SOP.

### 11.3.8 Surrogates

Surrogates are organic compounds which are similar in chemical composition and chromatographic behavior to the analytes ***of*** interest, but which are not normally found in environmental samples. Depending on the analytical method, one or more ***of*** these

compounds is added to method blanks, calibration and check standards, and samples (including duplicates, matrix spike samples, duplicate matrix spike samples and laboratory control samples) prior to extraction and analysis in order to monitor the method performance on each sample. The percent recovery is calculated for each surrogate, and the recovery is a measurement of the overall method performance.

### 11.3.9 Laboratory Control Samples (a.k.a. Laboratory Fortified Blanks)

The laboratory control sample (LCS) is an aliquot of analyte-free water or analyte-free soil (or anhydrous sodium sulfate or equivalent) to which known amounts of the method analyte(s) is(are) added. A reference material of known matrix type, containing certified amounts of target analytes, may also be used as an LCS. The LCS sample is prepared and analyzed in the same analytical batch, and in exactly the same manner, as the other routine samples. The percent recovery (% REC.) of the target analytes in the LCS assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit. Comparison of batch-to-batch LCS analyses enables the laboratory to evaluate batch-to-batch precision and accuracy. Acceptance criteria for LCS analyses are obtained through the use of control charts. An LCS is prepared and analyzed at a minimum frequency of one LCS per 20 samples, with every analytical batch or as stated in the method, whichever is more frequent.

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### 11.3.10 Matrix Spikes (a.k.a. Laboratory Fortified Sample Matrix)

Matrix spiked samples are aliquots of samples to which a known amount of the target analyte (or analytes) has been added. The samples are then prepared and analyzed in the same analytical batch, and in exactly the same manner as are routine samples. The stock solutions used for spiking the sample(s) are purchased and prepared independently of calibration standards. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Spike recoveries are calculated as follows:

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$$\text{Recovery (\%)} = (S - A) \times 100 \div T$$

Where: S = The observed concentration of analyte in the spiked sample,
A = The analyte concentration in the original sample, and
T = The theoretical concentration of analyte added to the spiked sample.

For the appropriate methods, matrix spiked samples are prepared and analyzed at a minimum frequency of one spiked sample (and one duplicate spiked sample, if appropriate) per twenty samples.

### 11.3.11 Laboratory Duplicates and Duplicate Matrix Spikes

Duplicates are additional replicates **of** samples that are subjected to the same preparation and analytical scheme as the original sample. Depending on the method of analysis, either a duplicate analysis (and/or a matrix spiked sample) or a matrix spiked sample and duplicate matrix spiked sample (MS/DMS) are analyzed. The relative percent difference between duplicate analyses or between an MS and DMS is a measure of the precision for a given method and analytical batch. The relative percent difference **(RPD)** for these analyses is calculated as follows:

$$\text{Relative Percent Difference (RPD)} = (S1 - S2) \times 100 \div S_{ave}$$

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Where S1 and S2 = The observed concentrations of analyte in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike, and

$S_{ave}$ = The average of observed analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

Depending on the method of analysis, either duplicates (and/or matrix spikes) or MS/DMS analyses are performed at a minimum frequency of one set per 20 samples. If an insufficient quantity of sample is available to perform a laboratory duplicate or duplicate matrix spikes, duplicate LCSs will be prepared and analyzed.

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### 11.3.12 Interference Check Samples

An interference check sample (ICS) is a solution containing both interfering and analyte elements of known concentration that can be analyzed to verify background and interelement correction factors in metals analyses. The ICS is prepared to contain known concentrations of interfering elements that will provide an adequate test of the correction factors. The ICS is spiked with the elements of interest at concentrations of approximately ten times the instrument detection limits. The ICS is analyzed at the beginning and end of an analytical run or every eight hours, whichever is more frequent, and the results must be within ± 20% of the true values.

### 11.3.13 Post Digestion Spikes

**Post** digestion spikes are samples prepared for metals analyses that have an analyte spike added to determine if matrix effects may be a factor in the results. The spike addition should produce a method-specified minimum concentration above the instrument detection limit. **A post** digestion spike is analyzed with each batch of samples and recovery criteria are specified for each method.

### 11.3.13 Control Charting

The generation of control charts is routinely performed at CAS. Surrogate, Matrix Spike and LCS recoveries are all monitored and charted. In addition, the laboratory also monitors the Relative Percent Difference **(RPD)** measurement of precision. Control charts are available to each individual laboratory unit to monitor the data generated in its facility using control charts that have been programmed to identify various trends in the analytical results. If trends in the data are perceived, various means of corrective action may then be employed in order to prevent future problems with the analytical system(s). Finally, data quality reports using control charts are generated for specific clients and projects pursuant to contract requirements. The control charting procedure is described in the SOP for *Control Charting Quality Control Data* (ADM-CHRT).

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### 11.3.14 Glassware Washing

Glassware washing and maintenance play a crucial role in the daily operation of a laboratory. The glassware used at CAS undergoes a rigorous cleansing procedure prior to every usage. A number of SOPs have been generated that outline the various procedures used at CAS; each is specific to the end-use of the equipment as well as to the overall analytical requirements of the project. In addition, other equipment that may be routinely used at the laboratory is also cleaned following instructions in the appropriate SOP.

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# 12.0 DATA REDUCTION, VALIDATION, AND REPORTING

CAS reports the analytical data produced in its laboratories to the client via the certified analytical report (CAR). This report includes a transmittal letter, a case narrative, client project information, specific test results, quality control data, chain of custody information, and any other project-specific support documentation. The following procedures describe our data reduction, validation and reporting procedures.

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## 12.1 Data Reduction and Review

Results are generated by the analyst who performs the analysis and works up the data. All data is initially reviewed and processed by analysts using appropriate methods (e.g., chromatographic software, instrument printouts, hand calculation, etc.). Equations used for calculation of results are found in the applicable analytical SOPs. The resulting data set is either manually entered (e.g., titrimetric or microbiological data) into an electronic report form or is electronically transferred into the report from the software used to process the original data set (e.g., chromatographic software). Once the complete data set has been transferred into the proper electronic report form(s), it is then printed. The resulting hardcopy version of the electronic report is then reviewed by the analyst for accuracy. Once the primary analyst has checked the data for accuracy and acceptability, the hardcopy is forwarded to the supervisor or second qualified analyst, who reviews the data for errors. Where calculations are not performed a validated software system, the reviewer rechecks a minimum of 10% of the calculations. When the entire data set has been found to be acceptable, a final copy of the report is printed and signed by the laboratory supervisor, departmental manager or designated laboratory staff. The entire data package is then placed into the appropriate service request file, and an electronic copy of the final data package is forwarded to the appropriate personnel for archival. Data review procedures are described in the *SOP for Laboratory Data Review Process*.

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Policies and procedures for manual editing of data are established. The analyst making the change must initial and date the edited data entry, without obliteration of the original entry. The policies and procedures are described in the *SOP for Making Entries into Logbooks and onto Benchsheets* (SOP ADM-DATANTRY).

Policies and procedures for electronic manual integration of chromatographic data are established. The analyst performing the integration must document the integration change by printing both the "before" and "after" integrations and including them in the raw data records. The policies and procedures are described in the *SOP for Manual Integration of Chromatographic Peaks* (SOP ADM-INT).

## 12.2 Confirmation Analysis

12.2.1 Gas Chromatographic and Liquid Chromatographic Analyses

For gas chromatographic (GC) and liquid chromatographic (LC) analyses, all positive results are confirmed by a second column, a second detector, a second wavelength (HPLC/UV), or by GC/MS analysis, unless exempted by one of the following situations:

- The analyte of interest produces a chromatogram containing multiple peaks exhibiting a characteristic pattern, which matches appropriate standards. This includes polychlorinated biphenyls and hydrocarbon fuels (e.g., gasoline and diesel).

- The sample is analyzed for benzene, toluene, ethylbenzene, xylenes, and naphthalene (BTMN), and the sample is found, by a separate analysis, to contain gasoline. In a sample containing no gasoline, the presence of BTEXN compounds will be confirmed.

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- The sample meets all of the following requirements:

  1. All samples (liquid or solid) come from the same source (e.g., groundwater samples from the same well) for continuous monitoring. Samples of the same matrix from the same site, but from different sources (e.g., different sampling locations) are not exempt.

  2. All analytes have been previously analyzed in sample(s) from the same source (within the last year), identified and confirmed by a second column or by GC/MS. The chromatogram is largely unchanged from the one for which confirmation was carried out. The documents indicating previous confirmation must be available for review.

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12.2.2 Confirmation Data

Confirmation data will be provided as specified in the method. Identification criteria for GC, LC or GC/MS methods are summarized below:

- GC and LC Methods

  1. The analyte must fall within plus or minus three times the standard deviation (established for the analyte/column) of the retention time of the daily midpoint standard in order to be qualitatively identified. The retention-time windows will be established and documented, as specified in the appropriate Standard Operating Procedure (SOP).

  2. When sample results are confirmed by two dissimilar columns or detectors, the agreement between quantitative results must be evaluated. The relative percent difference between the two results is calculated and evaluated against SOP and/or method criteria.

- GC/MS Methods - Two criteria are used to verify identification:

1. Elution of the analyte in the sample will occur at the same relative retention time (RRT) as that of the analyte in the standard.

2. The mass spectrum of the analyte in the sample must, in the opinion of a qualified analyst or the department manager, correspond to the spectrum of the analyte in the standard or the current GC/MS reference library.

## 12.3 Data Review and Validation

The integrity of the data generated in the laboratory is assessed through the evaluation of the results of the analysis of method blanks, laboratory control samples, sample duplicates, matrix spiked samples, QC samples, trip blanks, et al. The numerical criteria for evaluation of these QC samples are listed within each method-specific Standard Operating Procedure. These various QC sample analyses are evaluated using the flow diagrams found in Figures 12-1 through 12-9. Other validation measures of the data include a check of the linearity of the calibration curve, an accuracy check of the QC standards and a check of the system sensitivity. Data transcriptions and calculations are also reviewed.

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## 12.4 Data Reporting

When an analyst determines that a data package has met the data quality objectives (and/or any client-specific data quality objectives) of the method and has qualified any anomalies in a clear, acceptable fashion, the data package is reviewed by a trained chemist. Prior to release of the report to the client, the project chemist reviews and approves the entire report for completeness and to ensure that any and all client-specified objectives were successfully achieved. The original raw data, along with a copy of the final report, is filed in project files by service request number for archiving. CAS maintains control of analytical results by adhering to standard operating procedures and by observing sample custody requirements. All data are calculated and reported in units consistent with project specifications, to enable easy comparison of data from report to report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). The *SOP for Data Reporting and Report Generation* addresses the flagging and qualification, of data. The CAS-defined data qualifiers, state-specific data qualifiers, or project-defined data qualifiers are used depending on project requirements. A case narrative may be written by the project chemist to explain any unusual problems with a specific analysis or sample, etc.

For subcontracted analyses, the Project Chemist verifies that the report received from the subcontractor is complete. Verification includes checking that the correct analyses were performed, the analyses were performed for each sample as requested, a report is provided for each analysis, and the report is signed. The Project Chemist accepts the report if all verification items are complete. Acceptance is demonstrated by forwarding the report to the CAS client.

## 12.5 Documentation

CAS maintains a records system which ensures that all laboratory records of analysis data retained and available. Analysis data is retained for 5 years from the report date unless contractual terms specify a longer retention time. The archiving system is described in the ***SOP*** *for Data Archiving.*

### 12.5.1 Documentation and Archiving of Sample Analysis Data

The archiving system includes all of the following items for each set of analyses performed:

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- Benchsheets describing sample preparation (if appropriate) and analysis;
- Instrument parameters (or reference to the data acquisition method);
- Sample analysis sequence;
- Instrument printouts, including chromatograms and peak integration reports for all samples, standards, blanks, spikes and reruns;
- Logbook ID number for the appropriate standards;
- Copies of report sheets submitted to the work request file; and
- Copies of Nonconformity and Corrective Action Reports, if necessary.

Individual sets of analyses are identified by analysis date and service request number. Since many analyses are performed with computer-based data systems, the final sample concentrations can be automatically calculated. If additional calculations are needed, they are written on the integration report or securely stapled to the chromatogram, if done on a separate sheet.

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### 12.5.2 Documentation of Batch-related QC and Calibration Data

For organics analysis, data applicable to all analyses within the batch, such as GCMS tunes, CCVs, batch QC, and analysis sequences; are kept using a separate documentation system. This system is used to archive data on a batch-specific basis and is segregated according to the date of analysis. This system also includes results for the most recent calibration curves, as well as method validation results.

## 12.6 Deliverables

In order to meet individual project needs, CAS provides several levels of analytical reports. Basic specifications for each level of deliverable are described in Table 12-1. Variations may be provided based on client or project specifications. This includes (but is not limited to) to following specialized deliverables:

- ADEC – Alaska Department of Conservation specified data package
- ACOE/HTRW – Army Corps of Engineers HTRW specified data package and reporting requirements
- AFCEE – Air Force Center for Environmental Excellence project-specific reporting

When requested, CAS provides Electronic Data Deliverables (EDDs) in the format specified by client need or project specification. The EDD is prepared by report production staff using the electronic version of the laboratory report to minimize transcription errors. User guides and EDD specification outlines are used in preparing the EDD. The EDD is reviewed and compared to the hard-copy report for accuracy.

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**Figure 12-1**
**Evaluation of Method Calibration**

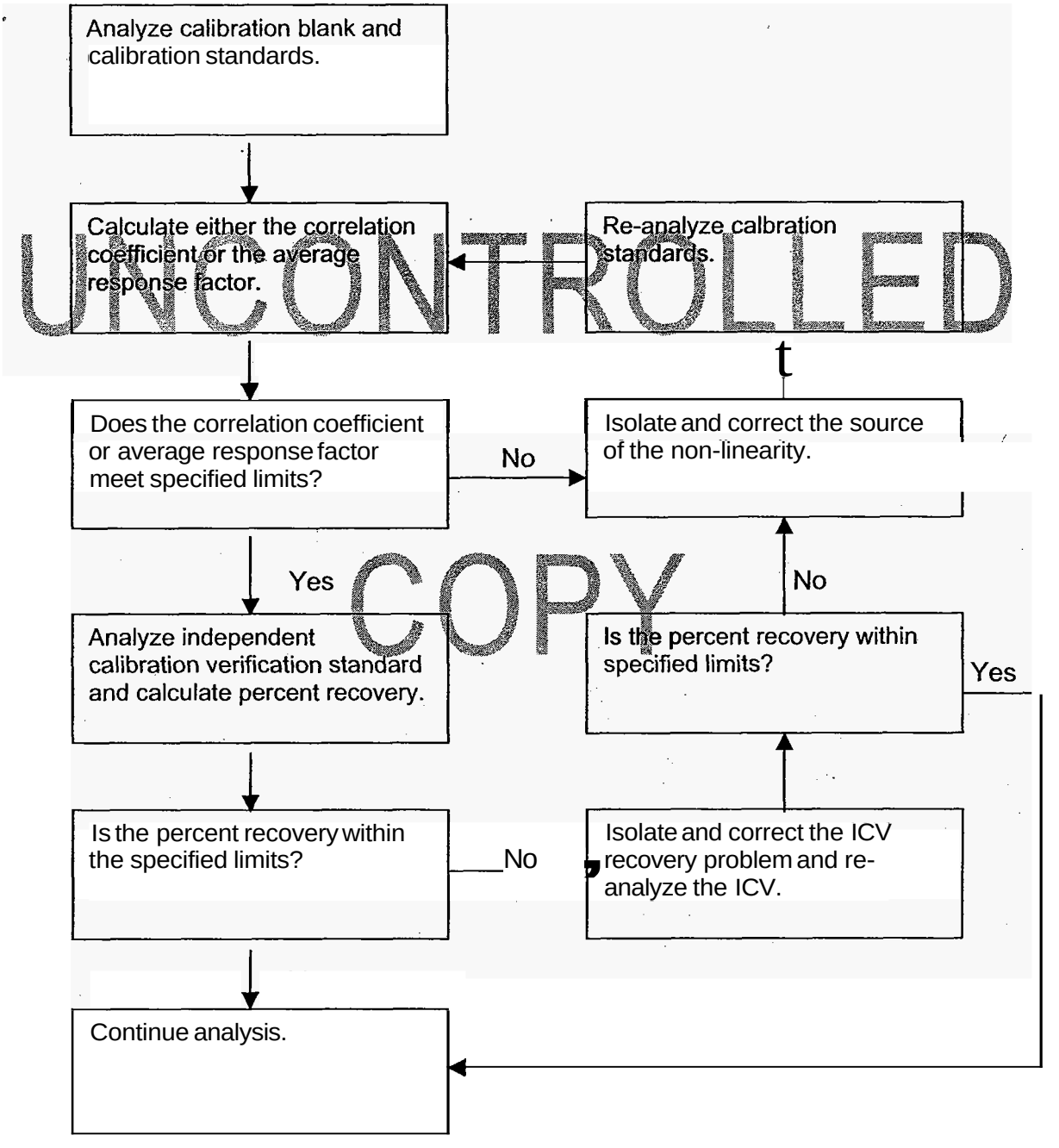


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**Figure 12-2**
**Evaluation of Continuing Calibration**

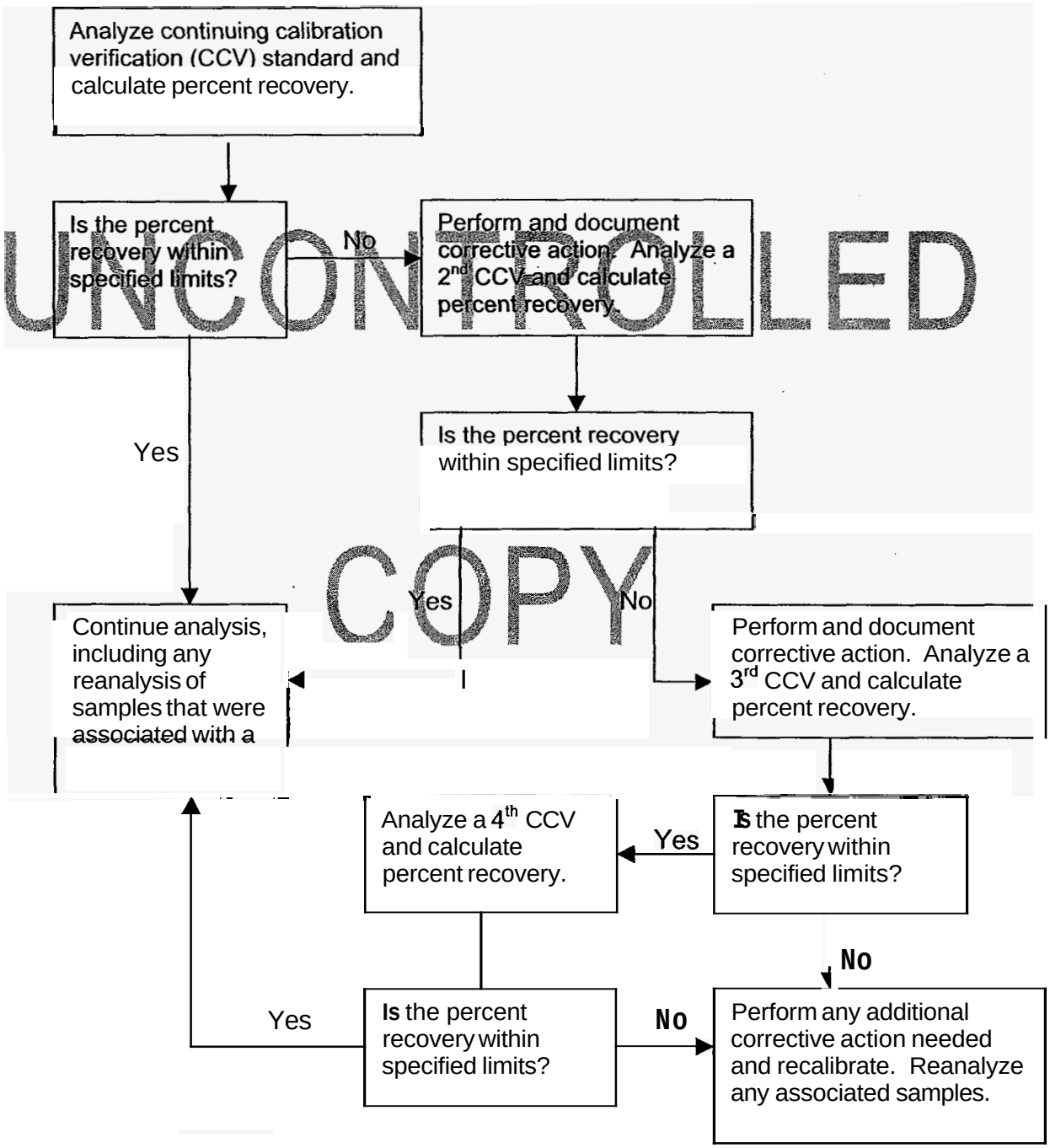


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**Figure 12-3**
**Evaluation of Method Blank and Instrument Blank Results**

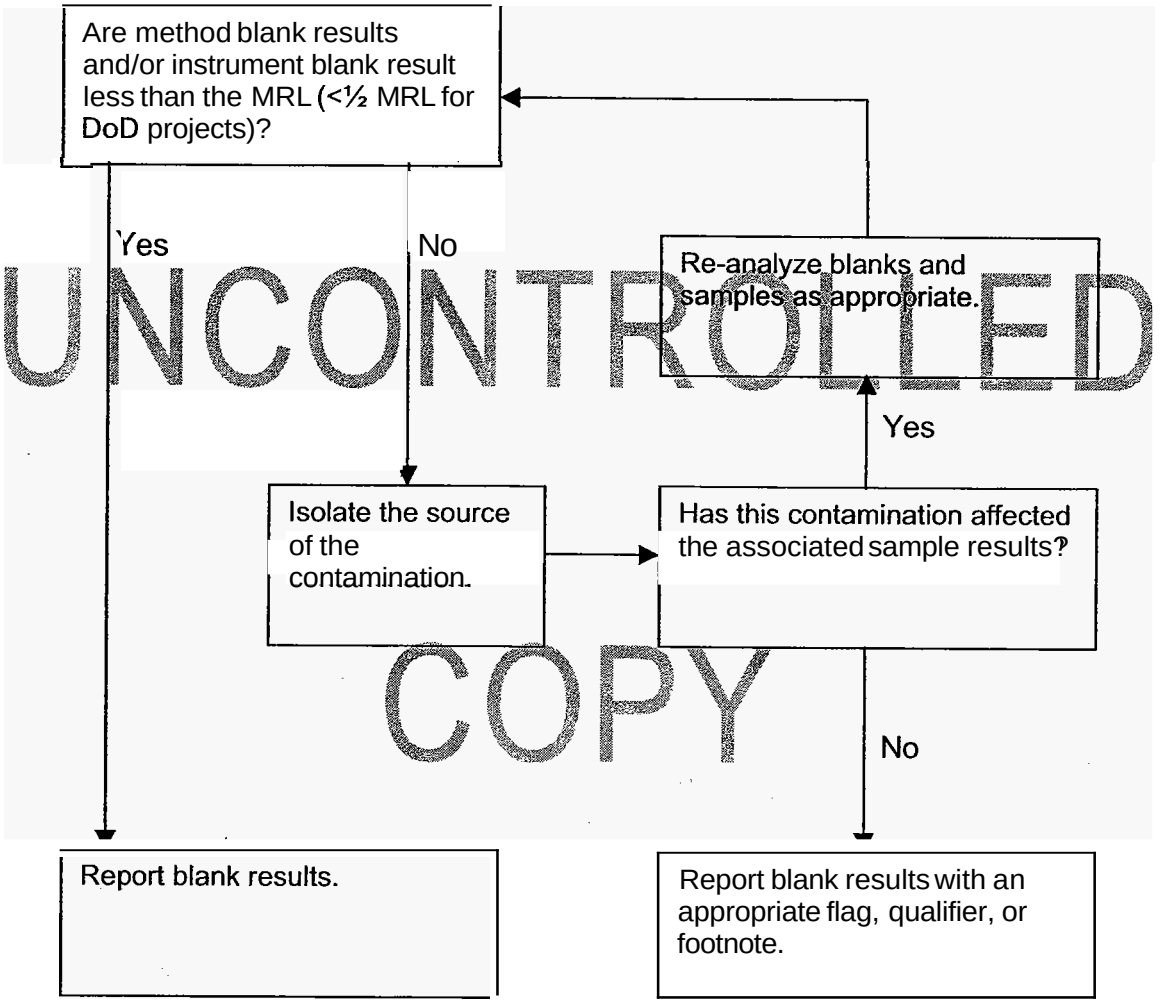


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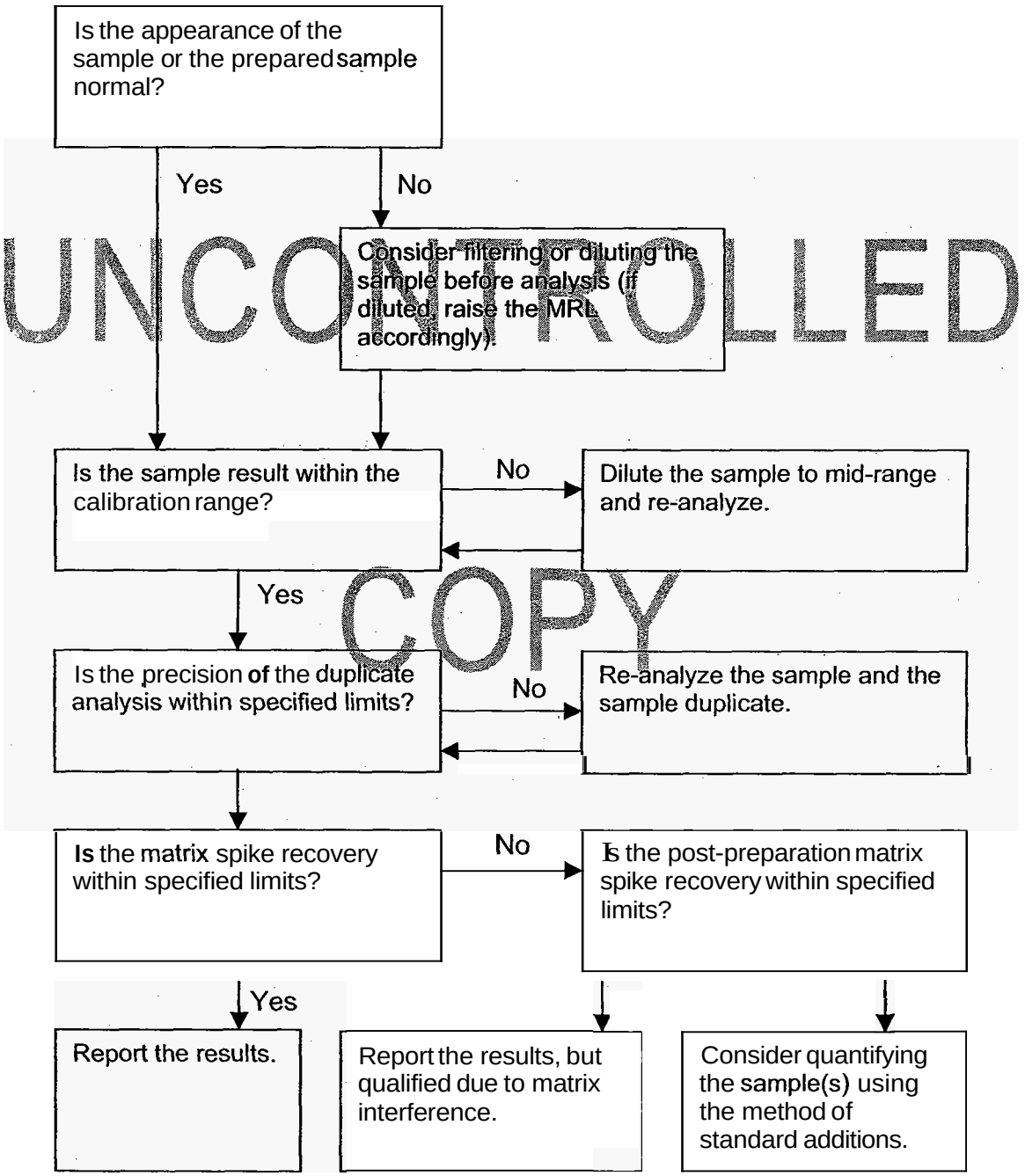
**Figure 12-4**
**Evaluation of Sample Results for Inorganic Analyses**

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## Figure 12-5
## Evaluation of Sample Results for Organic Analyses

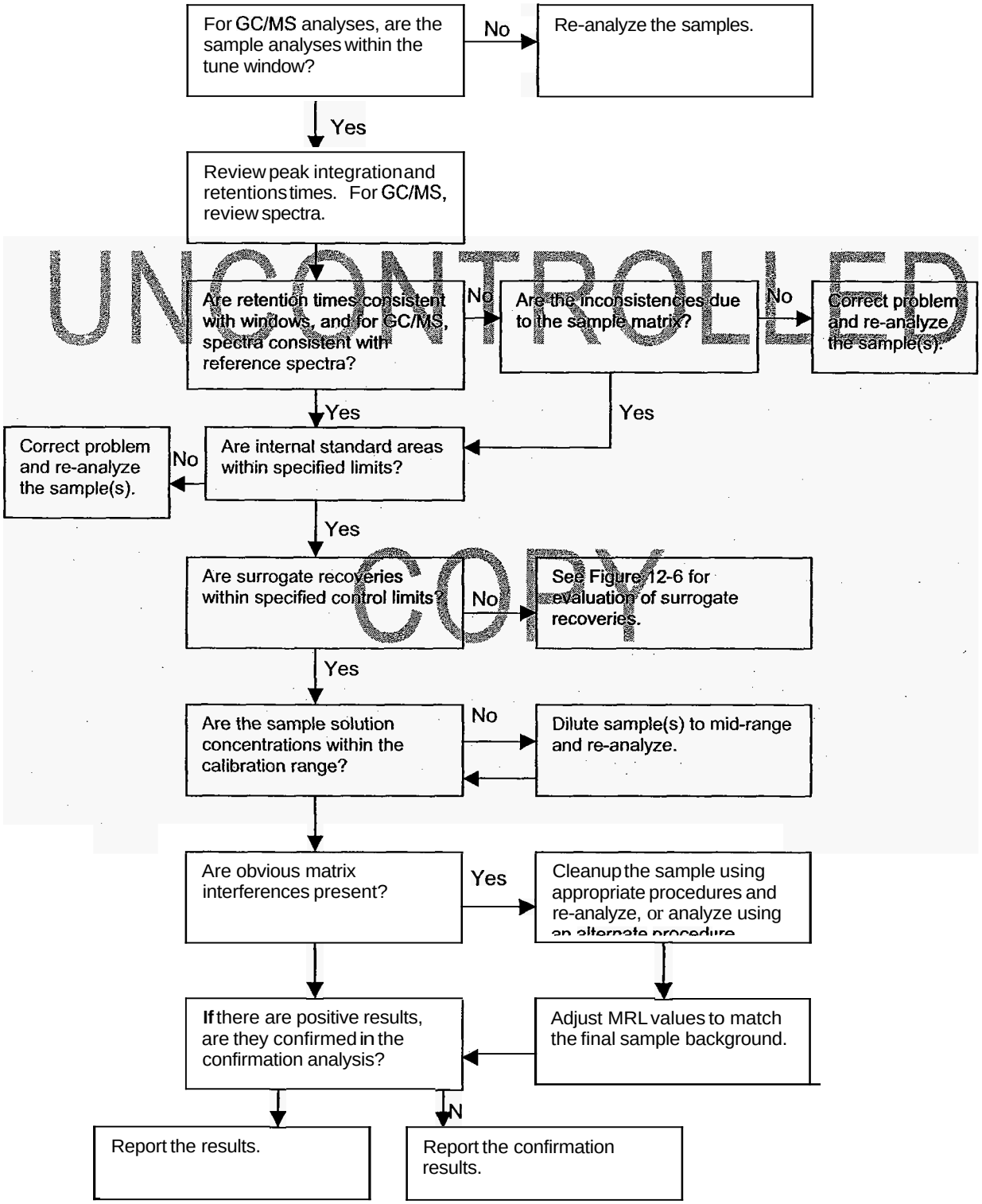


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**Figure 12-6**
**Evaluation of Surrogate Compound Recoveries**

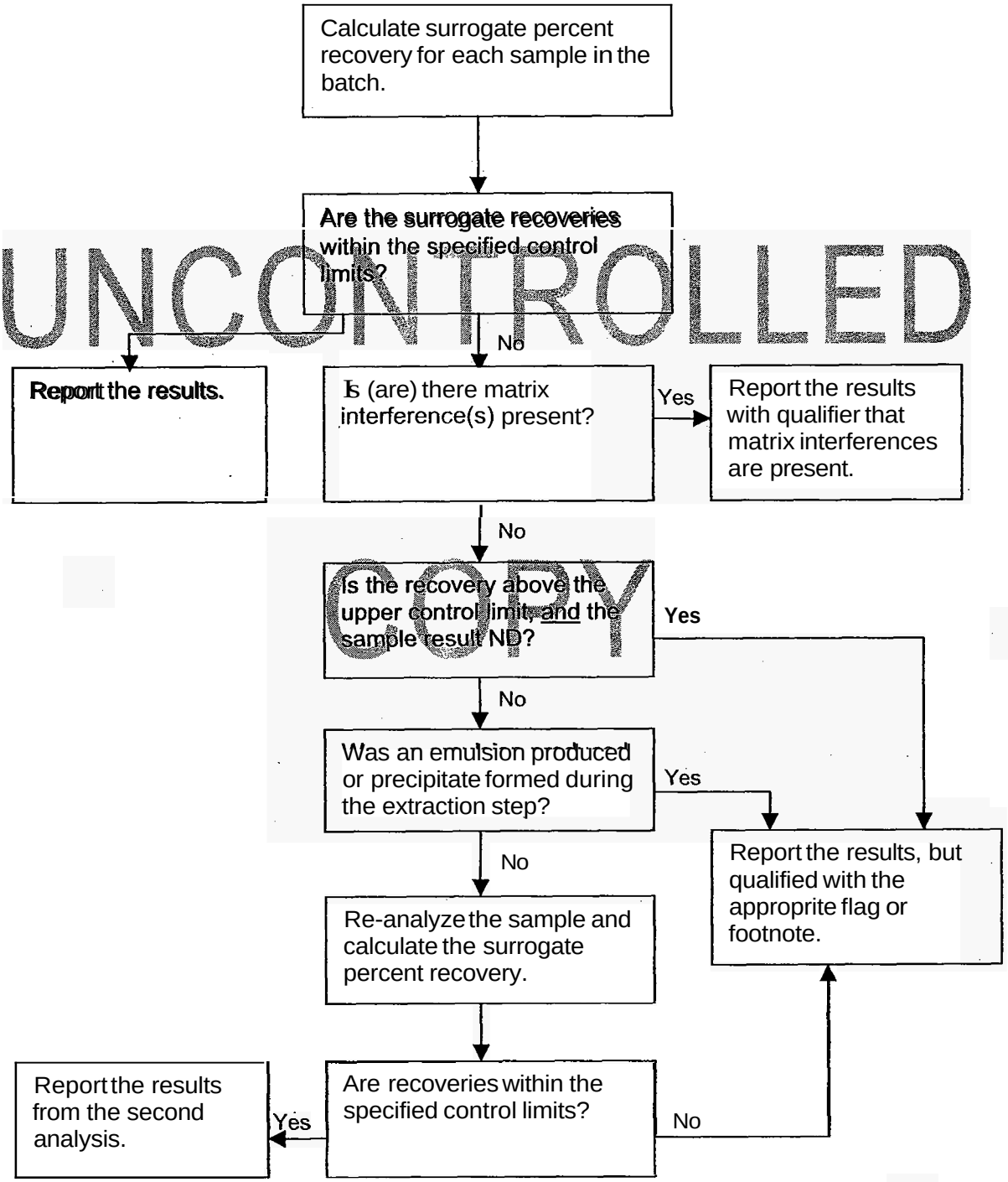


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**Figure 12-7**
**Evaluation of Duplicate Sample and/or Duplicate Matrix Spike Results**

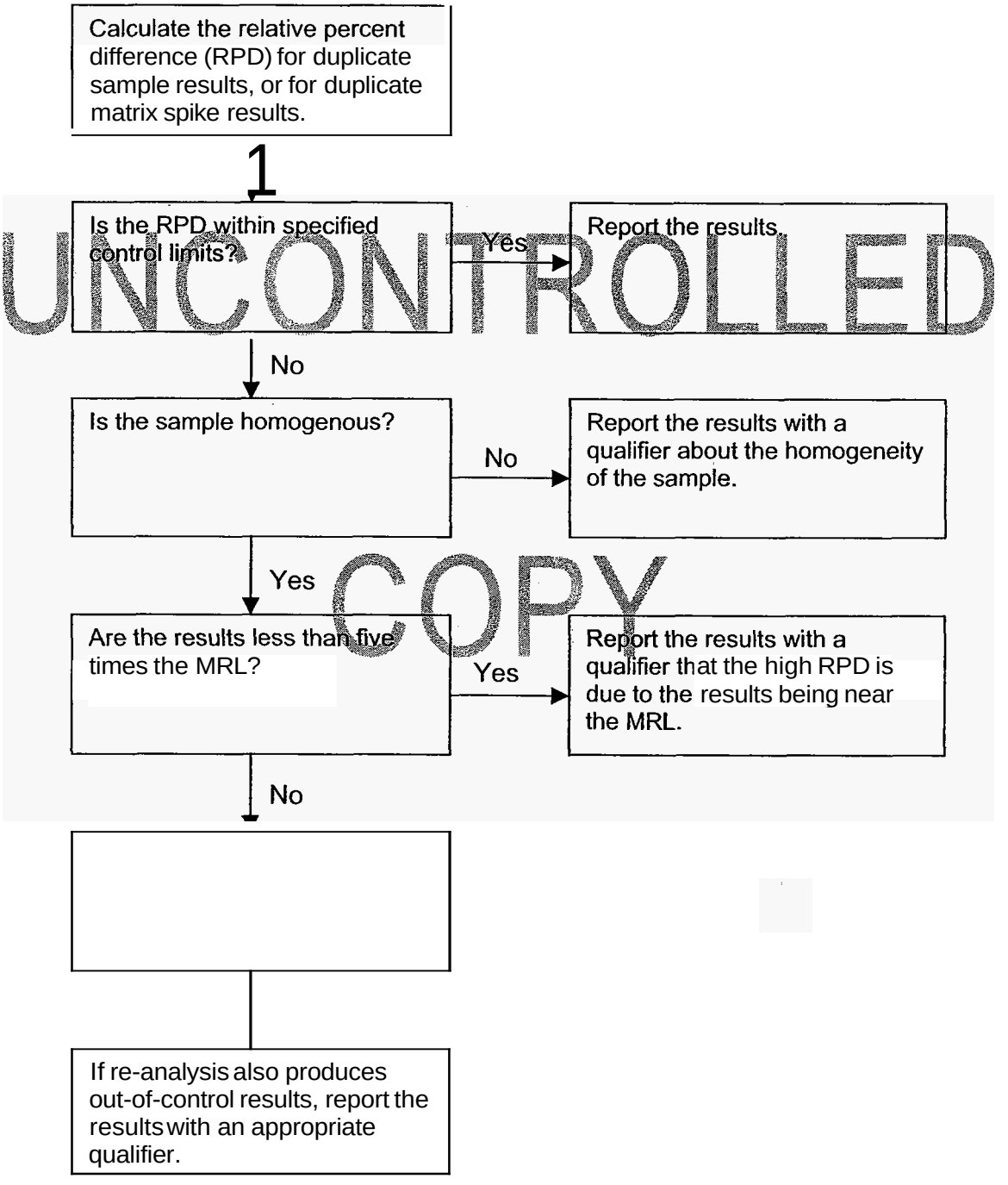


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**Figure 12-8**
**Evaluation of Matrix Spike Recoveries**

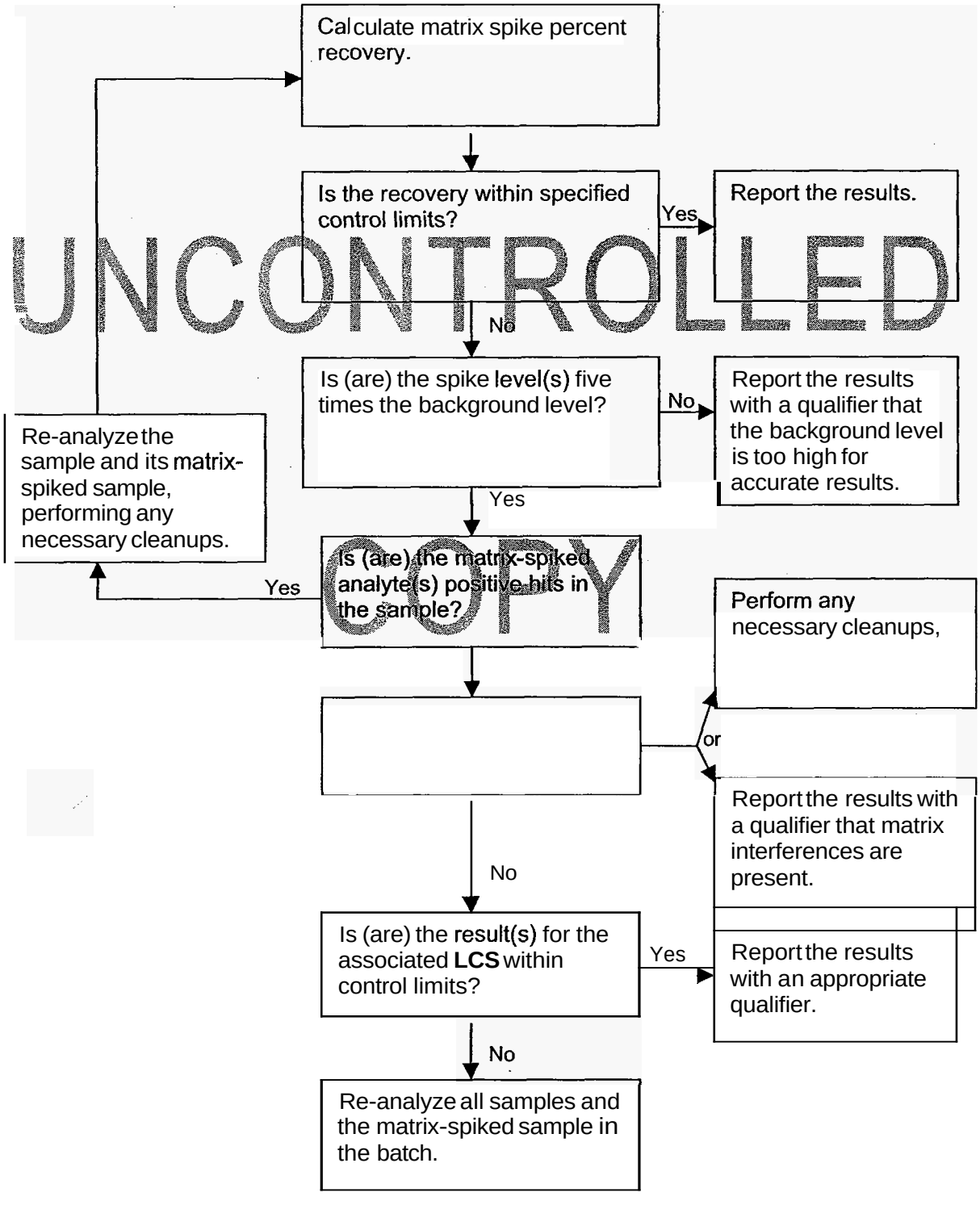


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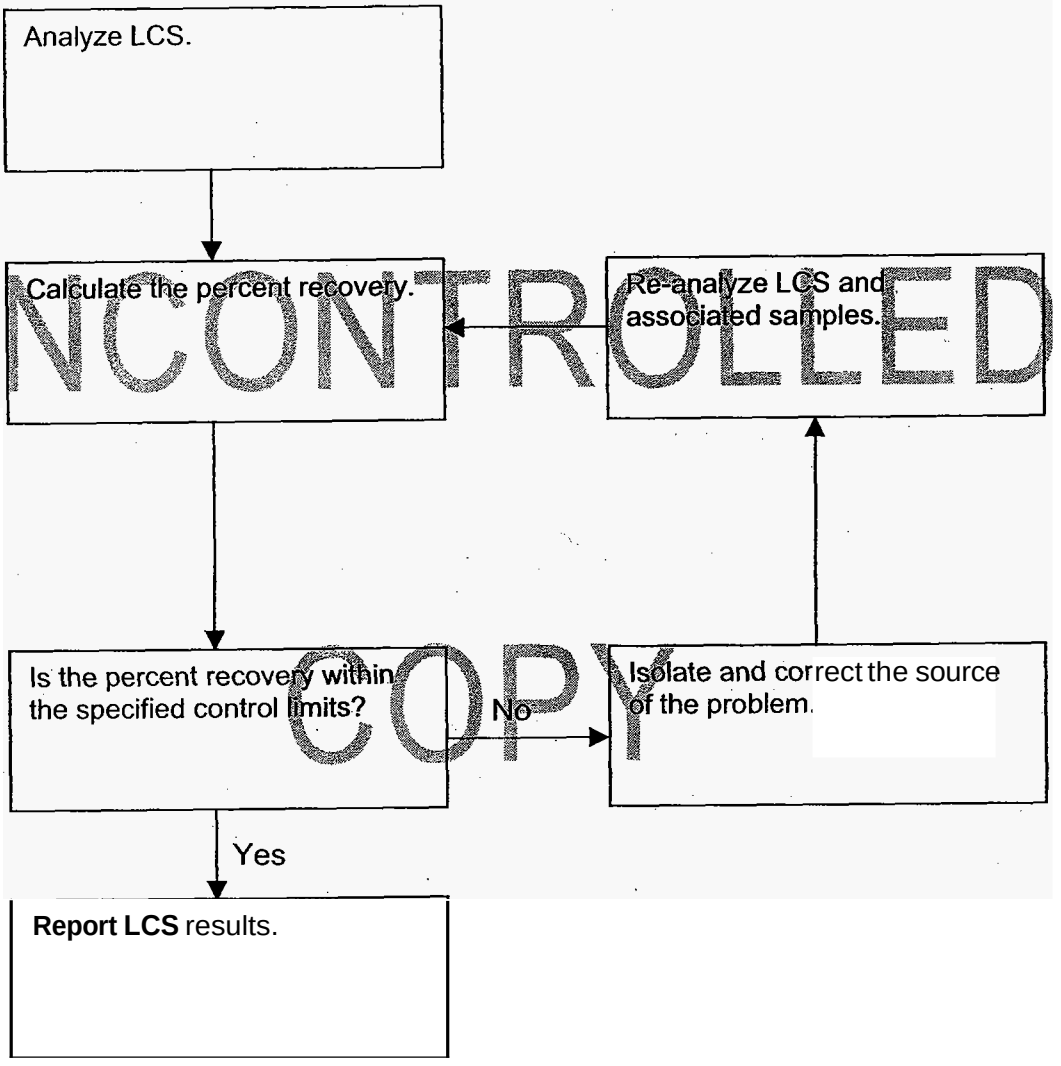
**Figure 12-9**
**Evaluation of Laboratory Control Sample (LCS) Results**

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## Table 12-1
## Descriptions of CAS Data Deliverables

**Tier I. Routine Certified Analytical Report (CAR) includes the following:**

1. Transmittal letter
2. Sample analytical results
3. Method blank results
4. Surrogate recovery results and acceptance criteria for applicable organic methods
5. Chain of custody documents
6. Dates of sample preparation and analysis for all tests

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**Tier II and IIA. In addition to the Tier I Deliverables, this CAR includes the following:**

1. Matrix spike result(s) with calculated recovery and including associated acceptance criteria
2. Duplicate or duplicate matrix spike result(s) (as appropriate to method), with calculated relative percent difference
3. Tier IIA also includes Laboratory Control Sample (LCS) result(s) with calculated recovery and including associated acceptance criteria

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**Tier 111. Data Validation Package. In addition to the Tier II Deliverables, this CAR includes the following:**

1. Case narrative
2. Calibration records and results of initial and continuing calibration verification standards, with calculated recoveries
3. Results of laboratory control sample (LCS) or Quality Control check sample, with calculated recovery and/or associated acceptance limit criteria
4. Results of calibration blanks or solvent blanks (as appropriate to method)
5. Summary forms for associated QC and calibration parameters
6. Copies of all raw data, including extraction/preparation bench sheets, chromatograms, and instrument printouts. For GC/MS, this includes tuning criteria and mass spectra of all positive hits. Results and spectra of TIC compounds will be included upon request.

**Tier IV. CLP-Level Data Validation Package.**

A complete Data Validation Package containing all sample results, quality control and calibration results, and raw data necessary to fulfill all deliverable requirements of an EPA Contract Laboratory Program (CLP) data package.

# 13.0 PERFORMANCE AND SYSTEM AUDITS

Quality audits are an essential part of CAS/Kelso's quality assurance program. There are two types of audits used at the facility: System Audits are conducted to qualitatively evaluate the operational details of the QA program, while Performance Audits are conducted by analyzing performance evaluation samples in order to quantitatively evaluate the outputs of the various measurement systems.

## 13.1 System Audits

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The system audit examines the presence and appropriateness of laboratory systems. External system audits of CAS/Kelso are conducted regularly by various regulatory agencies and clients. Table 13-1 summarizes some of the major programs in which CAS/Kelso participates. Programs and certifications are added as required. Additionally, internal system audits of CAS/Kelso are conducted regularly by the Quality Assurance Manager and by the CAS Quality Assurance Director. The internal audit procedures are described in the *SOP fur Internal Audits*. The internal audits are performed as follows:

- Comprehensive lab-wide system audit – performed annually by the QA Director.
- Focused systems audits – performed twice quarterly by the QA Department.
- Hardcopy data audits – minimum of 3 per quarter.
- Electronic data audits – minimum of 3 per quarter.

COPY

The results of each audit are reported to the Laboratory Director for review and comment. Any deficiencies noted by the auditor are summarized in the audit report and corrective action is identified to correct each deficiency within a .specified time period. All audit and review findings, and corrective actions are documented. Should problems impacting data quality be found during an internal audit, any client whose data is adversely impacted will be given written notification if not already provided.

Electronic data audits may be performed in conjunction with hardcopy data audits. The electronic audits focus on organic chromatographic data and include an examination of audit trails, peak integrations, calibration practices and files, GCMS tuning data, peak response data, use of appropriate files, and other components of the analysis. The audit also verifies that the electronic data supports the hardcopy reported data.

## 13.2 Performance Audits

CAS/Kelso also participates in the analysis of interlaboratory proficiency testing (PT) samples. Participation in PT studies is performed on a regular basis and is designed to evaluate all analytical areas of the laboratory. CAS routinely participates in the following studies:

- Water Pollution (WP) and additional water parameters, 2 per year.
- Water Supply **(WS)** PT studies, 2 per year.
- Hazardous Waste/Soil PT studies, 2 per year.
- Underground Storage Tank **PT** studies, 2 per year.
- Microbiology **(WS** and WP) PT studies, 2 per year.
- Other studies as required for specific certifications, accreditations, or validations.

PT samples are processed by entering them into the UMS system as samples (assigned Service Request, due date, testing requirements, etc.) and are processed the same as field samples. The laboratory sections handle samples the same as field samples, performing the analyses following method requirements and performing data review. The laboratory sections submit results to the QA Manager for subsequent reporting to the appropriate agencies or study provider. Results of the performance evaluation samples and audits are reviewed by the Quality Assurance Manager, Laboratory Director, the laboratory staff, and the CAS Quality Assurance Director. For any results outside acceptance criteria, the analysis data is reviewed to identify a possible cause for the deficiency, and corrective **action** is taken and documented.

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## Table 13-1
## Current CAS Performance and System Audit Programs

### Federal and National Programs

- Naval Facilities Engineering Service Center
  Validated Laboratory for NFESC Parameters
- U.S. Air Force, Air Force Center for Environmental Excellence (AFCEE)
  Approved Laboratory for AFCEE Projects
- U.S. Army Corps of Engineers - MRD, HTRW Center of Expertise
  Validated Laboratory for HTRW parameters
- National Environmental Laboratory Accreditation Conference (NELAC) Accredited

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### State and Local Programs

- State of Alaska, Department of Environmental Conservation
  UST Laboratory, Lab I.D. UST040
- State of Arizona, Department of Health Services
  License No. AZ0339
- State of Arkansas, Department of Environmental Quality
  Certified Environmental Laboratory
- State of California, Department of Health Services, Environmental Laboratory Accreditation Program
  Certification No. 2286
- State of Colorado, Department of Public Health and Environment
  Certified Drinking Water Laboratory
- State of Florida, Department of Health
  Primary NELAC Accreditation No. E87412
- State of Hawaii, Department of Health
  Certified Drinking Water Laboratory
- State of Idaho, Department of Health and Welfare
  Certified Drinking Water Laboratory
- State of Indiana, Department of Health
  Certified Drinking Water Laboratory, Lab I.D. C-WA-01
- State of Kansas, Department of Health and Environment
  Certified Drinking Water Laboratory, Lab I.D. E-10357
- State of Louisiana, Department of Environmental Quality
  Accredited Environmental Laboratory, Lab I.D. 3016
- State of Louisiana, Department of Health and Hospitals
  Accredited Drinking Water Laboratory, Lab I.D. LA050001
- State of Maine, Department of Human Services
  Certified Environmental Laboratory, Lab I.D. WA901
- State of Michigan, Department of Environmental Quality
  Certified Drinking Water Laboratory, Lab I.D. 9949
- State of Minnesota, Department of Health
  Certified Environmental Laboratory, Lab I.D. 053-999-368
- State of Montana, Department of Health and Environmental Sciences
  Certified Drinking Water Laboratory, Lab I.D. 0047
- State of Nebraska, Health and Human Services System
  Certified Drinking Water Laboratory
- State of Nevada, Division of Environmental Protection
  Certified Drinking Water Laboratory, Lab I.D. WA35

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# Table 13-1 (continued)

## State and Local Programs (continued)

- State of New Jersey, Department of Environmental Protection
  Accredited Environmental Laboratory, Lab I.D. WA005
- State of New Mexico, Environment Department
  Certified Drinking Water Laboratory
- State of New York, Department of Health
  Accredited Environmental Laboratory, Lab I.D. 11775
- State of North Carolina, Department of Environment and Natural Resources
  Certified Environmental Laboratory, Lab I.D. 605
- State of North Dakota, Department of Health
  Certified Drinking Water Laboratory, Lab I.D. R-174
- State of Oklahoma, Department of Environmental Quality
  General Water Quality/Sludge Testing, Lab I.D. 9801
- State of Oregon, ORELAP Laboratory Accreditation Program
  Accredited Environmental Laboratory, Lab I.D. WA200001
- State of Pennsylvania, Department of Environmental Protection
  Accredited Drinking Water Laboratory, Lab I.D. 68-659
- State of Pennsylvania Department of Environmental Protection
  Registered Environmental Laboratory
- State of South Carolina, Department of Health and Environmental Control
  Certified Environmental Laboratory, Lab I.D. 61002
- State of Tennessee, Department of Health
  Certified Drinking Water Laboratory, Lab I.D. 2868
- State of Utah, Department of Health, Division of Laboratory Services
  Accredited Environmental Laboratory
- State of Washington, Department of Ecology, Environmental Laboratory Accreditation Program
  Accreditation No. C001
- State of Wisconsin, Department of Natural Resources
  Accredited Environmental Laboratory, Lab I.D. 998386840

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# 14.0 PREVENTIVE MAINTENANCE

Preventive maintenance is a crucial element of the Quality Assurance program. Instruments at CAS (e.g., ICP/MS and ICP systems, GC/MS systems, atomic absorption spectrometers, analytical balances, gas and liquid chromatographs, etc.) are maintained under commercial service contracts or by qualified, in-house personnel. All instruments are operated and maintained according to the instrument operating manuals. All routine and special maintenance activities pertaining to the instruments are recorded in instrument maintenance logbooks. The maintenance logbooks used at CAS contain extensive information about the instruments used at the laboratory.

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An initial demonstration of analytical control is required on every instrument used at CAS before it maybe used for sample analysis. If an instrument is modified or repaired, a return to analytical control is required before subsequent sample analyses can occur. When an instrument is acquired at the laboratory, the following information is noted in a bound maintenance notebook specifically associated with the new equipment:

- The equipment's serial number;
- Date the equipment was received;
- Date the equipment was placed into service;
- Condition of equipment when received (new, used, reconditioned, etc.); and
- Prior history of damage, malfunction, modification or repair (if known).

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Equipment records also include a copy of the manufacturer's manual(s) and dates and results of calibrations.

Preventive maintenance procedures, frequencies, etc. are available for each instrument used at CAS. They may be found in the various SOPs for routine methods performed on an instrument and may also be found in the operating or maintenance manuals provided with the equipment at the time of purchase.

Responsibility for ensuring that routine maintenance is performed lies with the section supervisor. The supervisor may perform the maintenance or assign the maintenance task to a qualified bench level analyst who routinely operates the equipment. In the case of non-routine repair of capital equipment, the section supervisor is responsible for providing the repair, either by performing the repair themselves with manufacturer guidance or by acquiring on-site manufacturer repair. Each laboratory section maintains a critical parts inventory. The parts inventories include the items needed to perform the preventive maintenance procedures listed in Appendix D.

This inventory or "parts list" also includes the items needed to perform any other routine maintenance and certain in-house non-routine repairs such as gas chromatography/mass spectrometry jet separators and electron multipliers and ICP/MS nebulizer. When performing maintenance on an instrument (whether preventive or corrective), additional information about the problem, attempted repairs, etc. is also recorded in the notebook. Typical logbook entries include the following information:

- Details and symptoms of the problem;
- Repairs and/or maintenance performed;
- Description and/or part number of replaced parts;
- Source(s) of the replaced parts;
- Analyst's signature and date; and
- Demonstration of return to analytical control.

See the table in Appendix **D** for a list of preventive maintenance activities and frequency for each instrument.

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# 15.0 CORRECTIVE ACTION

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). Failure to meet established analytical controls, such as the quality control objectives outlined in Section 11, prompts corrective action. In general, corrective action may take several forms and may involve a review of the calculations, a check of the instrument maintenance and operation, a review of analytical technique and methodology, and reanalysis of quality control and field samples. If a potential problem develops that cannot be solved directly by the responsible analyst, the supervisor, team leader, the department manager, and/or the Quality Assurance Manager may examine and pursue alternative solutions. In addition, the appropriate project chemist may be notified in order to ascertain if contact with the client is necessary.

Problems with analysis, as well as the corresponding corrective actions taken, are documented on Nonconformity and Corrective Action Reports *(See* Figure 15-1) following the requirements in the *SOP for Nonconformity* ***and*** *Corrective Action Documentation* **(SOP** No. **ADM - NCAR).** This form is utilized to document corrective actions in response to out-of-control situations. The Quality Assurance Manager reviews each problem, ensuring that appropriate corrective action has been taken by the appropriate personnel. The Nonconformity and Corrective Action Report (NCAR) is filed in the associated service request file and a copy is kept by the Quality Assurance Manager. The Quality Assurance Manager periodically reviews all NCARs looking for chronic, systematic problems that need more in-depth investigation and alternative corrective action consideration. In addition, the appropriate project chemist is promptly notified **of** any problems in order to inform the client and proceed with any action the client may want to initiate.

Corrective action due to a performance audit or a check sample problem is initiated by the Quality Assurance Manager; the affected laboratory laboratory supervisors and managers are promptly informed of performance audit results requiring corrective action.

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# Figure 15-1

## Nonconformity and Corrective Action Report

NONCONFORMITY N&CA Report Nu. _____

PROCEDURE (SOP or METHOD): EVENT DATE: _____

EVENT: ☐ Missed Holding Time ☐ QC Failure ☐ Lab Error (spilled sample, spiking error, etc.)
☐ Method Blank Contamination ☐ Login Error ☐ Project Management Error
☐ Equipment Failure ☐ Unacceptable PT Sample Result ☐ Other (describe):

SAMPLES / PROJECTS / CUSTOMERS / SYSTEMS AFFECTED

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DETAILED DESCRIPTION:

ORIGINATOR: _____ DATE: _____

PROJECT CHEMIST(s): _____ NOTIFIED BY: _____ DATE: _____

CORRECTIVE ACTION AND OUTCOME

Re-establishment of conformity must be demonstrated and documented. Describe the steps that were taken, or are planned to be taken, to correct the particular Nonconformity and prevent its reoccurrence. Include Project Chemist instructions here.

COPY

Is the data to be flagged in the Analytical Report with an appropriate qualifier? ☐ No ☐ Yes

APPROVAL AND NOTIFICATION

Supervisor Verification and Approval of Corrective Action _____ Date: _____
Comments:

QA PM Verification and Approval of Corrective Action _____ Date: _____
Comments:

Customer Notified by ☐ Telephone ☐ Fax ☐ E-mail ☐ Narrative ☐ Not notified
Project Chemist Verification and Approval of Corrective Action _____ Date: _____
Comments: (Retain record)

Page 1 of 1
Original: Customer File Photocopies: Supervisor and QA PM N&CA Report 2004.doc 3/26/2004

# 16.0 QUALIN ASSURANCE REPORTS

Quality assurance requires an active, ongoing commitment by CAS personnel at all levels of the organization. Information flow and feedback mechanisms are designed so that analysts, supervisors and managers are aware of quality assurance issues in the laboratory. Analysts performing routine testing are responsible for generating a Data Quality Report (DQR), or similar form, with every analytical batch they process. This report contains explicit documentation of the various controls that must be met during the analysis. This report also allows the analyst to provide appropriate notes and/or a case narrative if problems were encountered with the analyses. A Non-Conformity and Corrective Action Report (NCAR) (see Section 15.0) may also be attached to the data prior to review. Supervisors or qualified analysts review all of the completed analytical batches to ensure that all QC criteria have been examined and any deficiencies noted and corrected if possible.

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It is the responsibility of each laboratory unit to provide the project chemist with a final report of the data, accompanied by signature approval. Footnotes and/or narrative notes must accompany any data package if problems were encountered that require further explanation to the client. Each data package is submitted to the appropriate project chemist, who in turn reviews the entire collection of analytical data for completeness. The project chemist must also review the entire body of data to ensure that any and all client-specified objectives were successfully achieved. A case narrative may be written by the project chemist to explain any unusual problems with a specific analysis or sample, etc.

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The Quality Assurance Manager (QAM) provides overview support to the project chemists as required (e.g., contractually specified, etc.). The QAM is also responsible for the oversight of all internal and external audits, for all proficiency testing sample and analysis programs, and for all laboratory certification/accreditation responsibilities. The QAM provides the Laboratory Director with quarterly reports that summarize the various QA/QC activities that occurred during the previous quarter. The report addresses such topics as the following:

- Status, schedule, and results of internal and external audits;
- Status, schedule, and results of internal and external proficiency testing studies;
- Status of certifications, accreditations, and approvals;
- Status of QA Manual and SOP review and revision;
- Status of MDLs studies;
- Discussion of QC problems in the laboratory;
- Discussion of corrective action program issues;
- Status of staff training and qualification; and
- Other topics as appropriate.

Any operational or quality assurance problems noted by the Laboratory Director are then addressed during the senior staff operations meetings with all appropriate department managers. The Laboratory Director also performs an annual documented review of the laboratory quality system to identify any necessary changes or improvements to the quality system or quality assurance policies.

# 17.0 PERSONNEL TRAINING

Technical position descriptions are available for all employees, regardless of position or level of seniority. These documents are maintained by the Human Resources personnel and are available for review. In order to assess the technical capabilities and qualifications of a potential employee, all candidates for employment at CAS are evaluated, in part, against the appropriate technical description.

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Training begins the first day of employment at CAS when the company policies are presented and discussed. Safety and QA/QC requirements are integral parts of all technical SOPs and, consequently, are integral parts of all training processes at CAS. Safety training begins with the reading of the *Environmental Health and Safely Manual.* Employees are also required to attend periodic safety meetings where additional safety training may be performed by the Environmental, Health and Safety Officer. Employees are responsible for complying with the requirements of the QA Manual and QA/QC requirements associated with their function(s).

Each employee participates in Ethics training, which is part of the CAS Improper Practices Prevention Program. CAS also encourages its personnel to continue to learn and develop new skills that will enhance their performance and value to the Company. Ongoing training occurs for all employees through a variety of mechanisms. The "CAS University" education system, external and internal technical seminars and training courses, and laboratory-specific training exercises are all used to provide employees with professional growth opportunities.

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A training plan is developed for each Standard Operating Procedure. The training plan includes a description of the step-by-step process for training an employee and for initial demonstration of proficiency. Where the analyst performs the entire procedure, a generic training plan may be used. In cases where work cells are used, a training plan specific to the work cell is established.

## 17.1 Initial Demonstration of Capability

Training in analytical procedures typically begins with the reading of the Standard Operating Procedure (SOP) for the method. Hands-on training begins with the observation of an experienced analyst performing the method, followed by the trainee performing the method under close supervision, and culminating with independent performance of the method on quality control samples. Successful completion of the applicable Demonstration of Capability analysis qualifies the analyst to perform the method independently. Demonstration of Capability is performed by one of the following:

- Successful completion of a Initial Precision and Recovery (IPR) study (required where mandated by the method).

- Analysis of 4 consecutive Laboratory Control Samples, with acceptable accuracy and precision. (For use of this option, LCSs must be from "second-source" standard materials independent of the calibration standards materials.).

- Where spiking is not possible but QC standards are used ("non-spiked" Laboratory Control Samples), analysis of **4** consecutive Laboratory Control Samples with acceptable accuracy and precision.

- Where one of the three above is not possible, special requirements are as follows:

  - Total Settleable Solids: Successful single-blind PT sample analysis and duplicate results with RPD<10%.
  - Color: Four consecutive prepared LCSs with acceptable accuracy and precision of <10% RSD.
  - Physical Tests (Grain size, Corrosivity to Steel, etc.): Supervisor acknowledgement of training and approval.

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A flowchart identifying the Demonstration of Proficiency requirements is given in Figure 17-1. The flowchart identifies allowed approaches to assessing Demonstration of Capability when a 4-replicate study is not mandated by the method, when spiking is not an option, or when QC samples are not readily available.

## 17.2 Continuing Demonstration of Proficiency

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A periodic demonstration of proficiency is required to maintain continuing qualification. Continuing Demonstration of Proficiency is required each year, and may be performed one of the following ways:

- Successful performance on external (independent) single-blind PT sample analyses using the test method, or a similar test method using the same technology.

- Performing Initial Demonstration of Capability as described above, with acceptable levels of precision and accuracy.

- Analysis of at least **4** consecutive **LCSs** with acceptable levels of accuracy and precision from in-control analytical batches.

- For methods for which PT samples are not available and a spiked analysis (LFB, **MDL,** etc.) is not possible, analysis of field samples that have been analyzed by another analyst with statistically indistinguishable results.

## 17.3 Documentation of Training

Records are maintained to indicate the employee has the necessary training, education, and experience to perform their functions. Information of previously acquired skills and abilities for a new employee is maintained in Human Resources personnel files and CAS resumes. A

database is used to record the various technical skills and training acquired while employed by CAS. Information includes the employee's name, a description of the skill including the appropriate method and **SOP** reference, the mechanism used to document proficiency, and the date the training was completed. General procedures for documenting technical training are described in the *SOP for Documentation of Training (SOP No. ADM-TRANDOC).*

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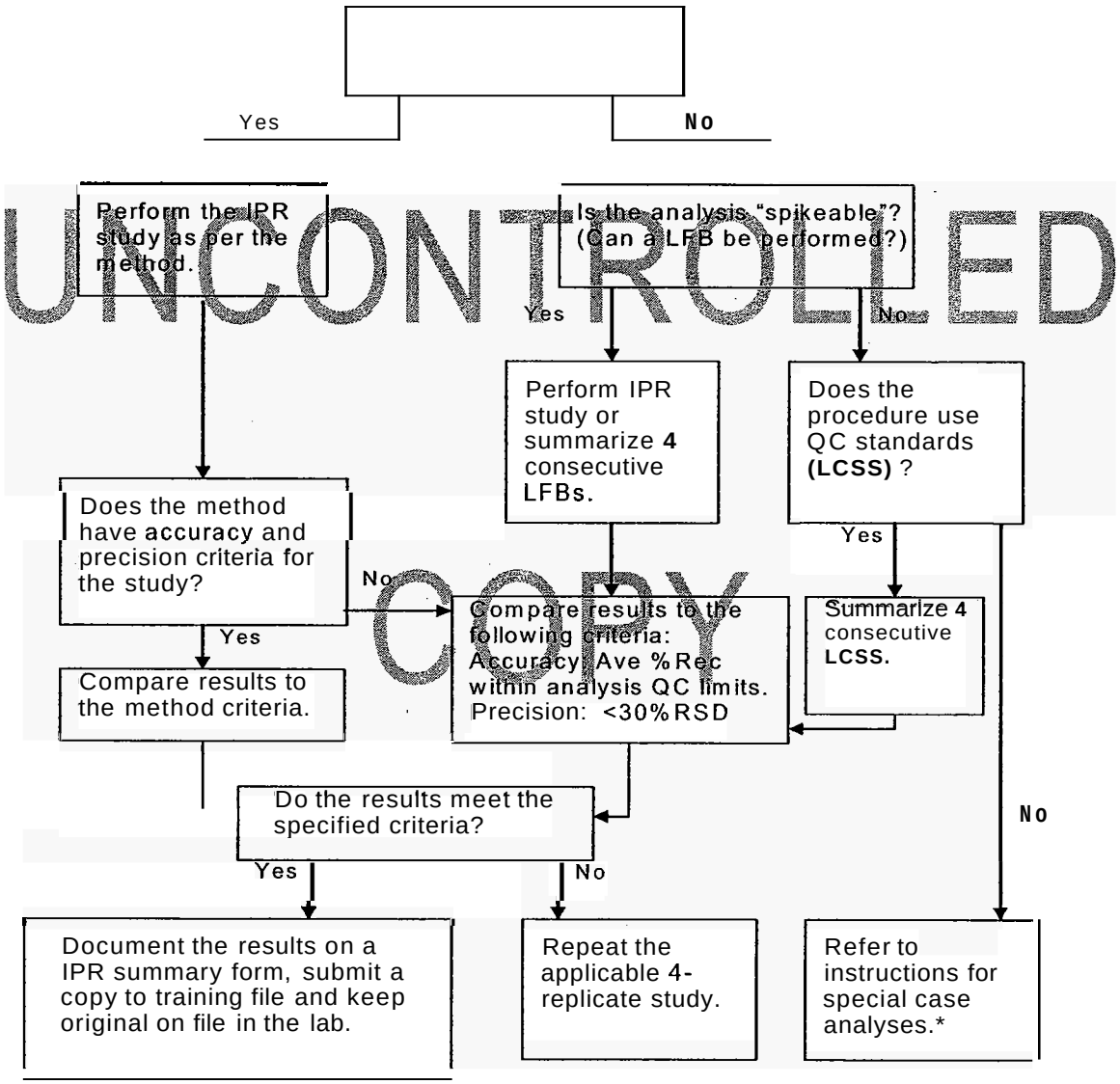
## Figure 17-1
## Initial Demonstration of Capability Requirements[a]

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[a] For IDOC IPR or LFB studies, "second-source" reference materials are used, as per NELAC requirements
*Total Settleable Solids: Successful **PT** sample analysis and duplicate results with **RPD<10%.**
*Color: Four consecutive prepared LCSs with acceptable accuracy and precision **of <10%** RSD.
* Physical Tests (Grain size, **Corrosivity** to Steel, etc.): Supervisor acknowledgement of training and approval.

## 18.0 REFERENCES FOR ANALYTICAL PROCEDURES

The analytical methods used at CAS generally depend upon the end-use of the data. Since most of our work involves the analysis of environmental samples for regulatory purposes, specified federal and/or state testing methodologies are used and followed closely. Several factors are involved with the selection of analytical methods to be used in the laboratory. These include the method detection limit, the concentration of the analyte being measured, method selectivity, accuracy and precision of the method, the type of sample being analyzed, and the regulatory compliance objectives. Typical methods used at CAS are taken from the following references:

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- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, (September 1986) and Updates I (July 1992), II (September 1994), IIA (August 1993), IIB (January 1995), III (December 1996), and Proposed Update IVA (January 1998). ***See*** Chapters 1, 2, 3, and 4. Unless otherwise specified, the most current promulgated version is used.

- *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, (Revised March 1983).

- *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100 (August 1993).

COPY

- *Methods for the Determination of Metals in Environmental Samples* EPA/600/4-91/010 (June 1991) and Supplements.

- *Methods for Organic Chemical Analyst3 of Municipal and Industrial Wastewater*, EPA 600/4-82-057 (July 1982) and 40 CFR Part 136, Appendix A.

- *Methods for the Determination of Organic Compounds in Drinking Water*, EPA/600/4-88/039 (December 1988) and Supplements.

- *Standard Methods for the Examination of Water and Wastewater*, 16th Edition (1985); 17th Edition (1989); 18th Edition (1992); 19th Edition (1995). ***See*** Introduction in Part 1000.

- 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act.

- 40 CFR Part 141, National Primary Drinking Water Regulations.

- *Analytical Methods for Petroleum Hydrocarbons*, ECY 97-602, Washington State Department of Ecology, June 1997.

- State-specific total petroleum hydrocarbon methods for the analysis of samples for gasoline, diesel, and other petroleum hydrocarbon products (Alaska, Arizona, California, Oregon, Washington, Wisconsin, etc.).

- Annual Book of ASTM Standards, Part 31, Water.

- EPA Contract Laboratory Program, Statement of Work for Organic Analysis, SOW Nos. OLM01.8, OLM02.0, OLM03.1, OLM03.2, OLM04.2, and OLM04.3.

- EPA Contract Laboratory Program, Statement of Work for Inorganic Analysis, SOW No. ILM04.0, ILM04.1, and ILM05.2.

- *U. S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-94/012 (February 1993).

- *U. S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA-540/R-94/013 (February 1994).

- National Institute for Occupational Safety and Health (NIOSH) *Manual of Analytical Methods*, Third Edition (August 1987); Fourth Edition (August 1994).

- *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, for USEPA and USACE (March 1986), with revisions through April 1997.

- WDOE 83-13, *Chemical Testing Methods for Complying with the State of Washington Dangerous Waste Regulations* (March 1982) and as Revised (July 1983 and April 1991).

- *Identification and Listing of Hazardous Waste,* California Code of Regulations, Title 22, Division 4.5, Chapter 11.

- *Analytical Methods for the Determination of Pollutants in Pulp and Paper Industry Wastewater*, EPA 821-R-93-017 (October 1993).

- *Analytical Methods for the Determination of Pollutants in Pharmaceutical Manufacturing Industry Wastewaters*, EPA 821-B-98-016 (July 1998).

- National Council of the Pulp and Paper Industry for Air and Stream Improvement (NCASI).

- *Good Automated Laboratory Practices, Principles and Guidance to Regulations For Ensuring Data Integrity In Automated Laboratory Operations*, EPA 2185 (August 1995).

- *Manual for the Certification of Laboratories Analyzing Drinking Water*, 4th Edition, EPA 815-B-97-001 (March 1997).

- National Environmental Laboratory Accreditation Conference (NELAC), 2002 Quality Standards.

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# APPENDIX A

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## LIST of QA PROGRAM DOCUMENTS

COPY

| | |
|---|---|
| Quality Assurance Manual | 1/7/05 |
| Software Quality Assurance Plan | 8/7/01 |
| CAS-Kelso Certifications/Accreditations | Cert_kel.xls |
| Columbia Analytical Services MDL Tracking Spreadsheet | Mdl list.xls |
| Technical Training Summary Database | TrainDat.mdb |
| Approved Signatories List | QA Dept. Files |
| Personnel resumes/qualifications | (all staff) |
| Personnel Job Descriptions | HR Department |
| Quality Control Acceptance Criteria | Qclimits.xls |
| Master Logbook of Laboratory Logbooks | Masterlog-001 |
| **TECHNICAL STANDARD OPERATING PROCEDURES** | |
| SOP TABLE OF CONTENTS | SOPLIST.DOC |
| **ADMINISTRATIVE STANDARD OPERATING PROCEDURES** | |
| **ADMINISTRATIVE - CORPORATE{PRIVATE }** | **FILE NAME** |
| CHAIN OF CUSTODY FOR SAMPLE TRANSFER BETWEEN LABORATORIES | ADM-COC |
| CHECKING NEW LOTS OF CHEMICALS FOR CONTAMINATION | ADM-CTMN |
| CONTROL LIMITS | ADM-CTRL_LIM |
| DEALING WITH COMPLAINTS | ADM-CMPLT |
| DOCUMENT CONTROL | ADM-DOCCTRL |
| DOCUMENTATIONOF TRAINING | ADM-TRANDOC |
| ELECTRONIC DATA AUDITING | ADM-E_DATAUDIT |
| MAKING ENTRIES INTO LOGBOOKS AND ONTO BENCHSHEETS | ADM-DATANTRY |
| MANUAL INTEGRATION OF CHROMATOGRAPHIC PEAKS | ADM-INT |
| NONCONFORMITY AND CORRECTIVE ACTION | ADM-NCAR |
| PREPARATION OF STANDARD OPERATING PROCEDURES | ADM-SOP |
| PURCHASING THROUGH CAS PURCHASING AGENT | ADM-PUR |
| QUALIFICATION OF SUBCONTRACT LABORATORIES | ADM-SUBLAB |
| SAMPLE BATCHES | ADM-BATCH |
| SIGNIFICANT FIGURES | ADM-SIG.FIG |
| THE DETERMINATION OF METHOD DETECTION LIMITS | ADM-MDL |

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| **ADMINISTRATIVE – LOCAL LABORATORY{PRIVATE }** | **FILE NAME** |
|---|---|
| **ARMY CORPS OF ENGINEERS HTRW PROJECT MANAGEMENT** | ADM-HTRW |
| **CHECKING PIPET CALIBRATION** | ADM-CPIP |
| CONTINGENCY PLAN FOR LABORATORY EQUIPMENT FAILURE | ADM-ECP |
| CONTROL CHARTING QUALITY CONTROL DATA | ADM-CHRT |
| DATA ARCHIVING | ADM-ARCH |
| DATA REPORTING AND REPORT GENERATION | ADM-RG |
| ELECTRONIC DATA BACKUP AND ARCHIVING | ADM-EBACKUP |
| INTERNAL QUALITY ASSURANCE AUDITS | ADM-IAUD |
| LABORATORY DATA REVIEW PROCESS | ADM-DREV |
| METHOD DETECTION LIMIT DOCUMENTATION AND CONTROL | ADM-MDLC |
| PROJECT MANAGEMENT | ADM-PCM |
| REAGENT LOGIN AND TRACKING | ADM-RLT |
| SUPPORT EQUIPMENT MONITORING AND CALIBRATION | ADM-SEMC |
| THERMOMETER CALIBRATION | ADM-TCAL |
| **SAMPLE MANAGEMENT SOPS{PRIVATE }** | **FILE NAME** |
| BOTTLE ORDER PREPARATION AND SHIPPING | SMO-BORD |
| FOREIGN SOILS HANDLING TREATMENT | SMO-FSHT |
| SAMPLE DISPOSAL | SMO-SDIS |
| SAMPLE RECEIVING | SMO-GEN |
| SAMPLE TRACKING AND LABORATORY CHAIN OF CUSTODY | SMO-SCOC |

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# APPENDIX B

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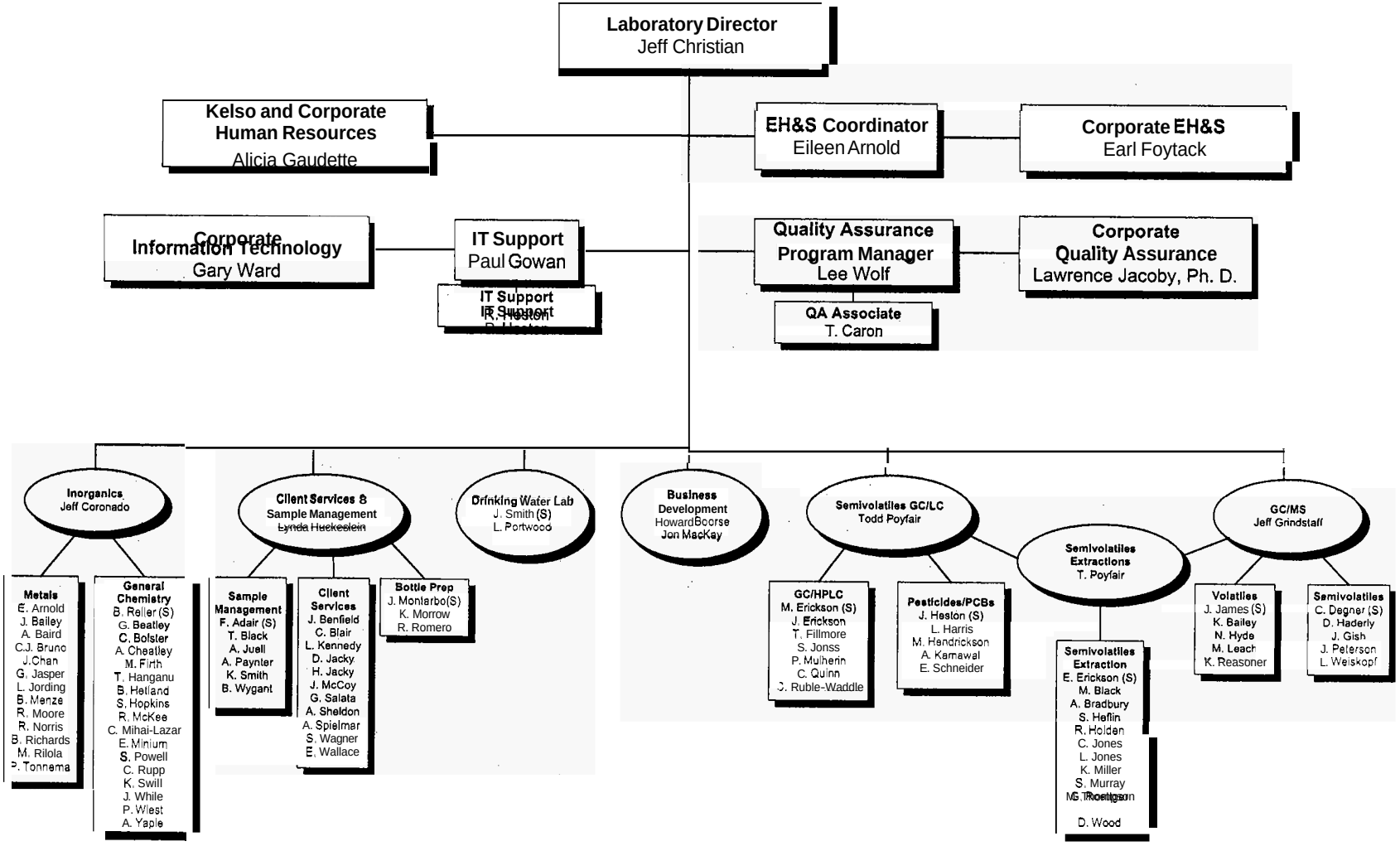
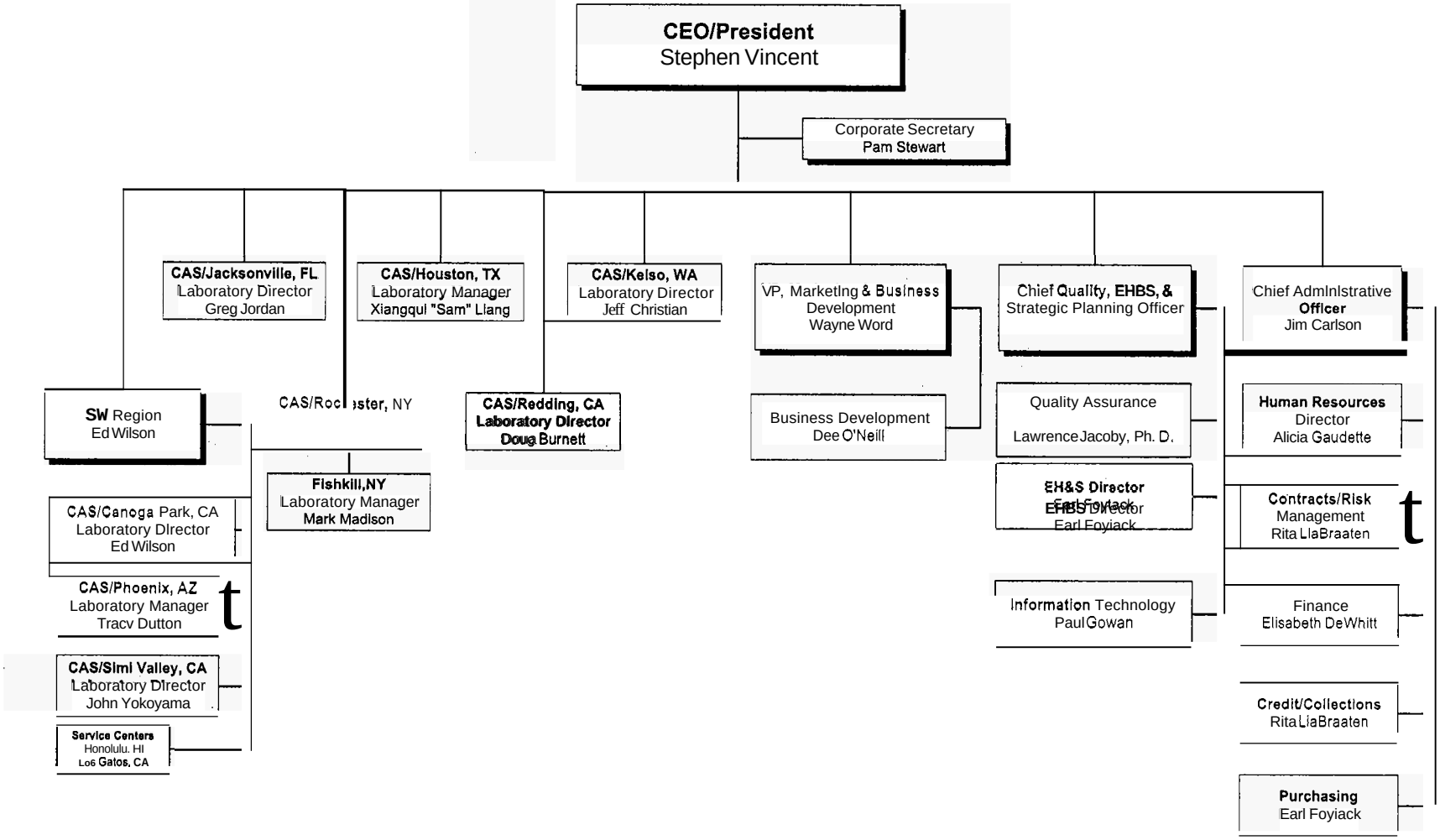
## ORGANIZATIONAL CHARTS and RESUMES OF KEY PERSONNEL

COPY

# Columbia Analytical Services, Inc.
# Kelso, Washington Laboratory Organization



# Columbia Analytical Services, Inc.
# Laboratory Division Organization




Revised 1/10/05

# JEFFREY D. CHRISTIAN

**7989 TO PRESENT**

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**VICE PRESIDENT/NW REGIONAL DIRECTOR** – 1996 to Present

***Responsibilities***

Responsible for all phases of laboratory operations at the Kelso (WA) and Redding (CA) facilities, including project planning, budgeting, and quality assurance. Primary duties include the direct management of the Kelso laboratory (i.e. serves as the Kelso Laboratory Director, 1993-present). Also responsible for additional duties acquired as a member of the Columbia Analytical Services Holdings, Inc., Board of Directors.

***Experience***

**Laboratory Director, Kelso Laboratory,** ***Columbia Analytical Services, Inc., Kelso, Washington,*** 1993-1995. Responsible for all phases of laboratory operations, including project planning, budgeting, and quality assurance.

**Operations Manager, Kelso Laboratory,** ***Columbia Analytical Services, Inc., Kelso, Washington,*** 1992-1993. Responsibilities included directing the daily operation of the Kelso laboratory. Other responsibilities and duties included functioning as a technical consultant to clients, providing assistance in developing and planning analytical schemes to match client objectives, and writing and developing analytical procedures/methods. Also, served as Project Manager for State of Alaska Department of Environmental Conservation contract and Coordinator for EPA Special Analytical Services (SAS) contracts.

**Project Chemist and Manager, Metals Analysis Laboratory,** ***Columbia Analytical Services, Kelso, Washington,*** 1989-1992. Responsible for directing the daily operation of the Metals Laboratory, including the sample preparation, AAS, ICP-OES, and ICP-MS Laboratories.

**Scientist,** ***Weyerhaeuser Technology Center, Federal Way, Washington,*** 1986-1989. Responsibilities included supervising atomic spectroscopy laboratory which included flame and furnace **AAS,** ICP-OES, and sample preparation capabilities to handle a wide variety of sample types. Interfaced with internal and external clients to provide technical support. Wrote and developed analytical procedures/methods.

**Lead Technician, Metals Lab,** ***Weyerhaeuser Technology Center, Federal Way, Washington,*** 1981-1986. Responsibilities included primary ICP and **AAS** analyst for EPA-CLP contract work. Extensive experience in wide variety of environmental and product-related testing.

**Research Assistant,** ***ITT Rayonier, Olympic Research Division, Shelton, Washington,*** 1978-1981. Responsibilities included performing water quality tests, product-related analytical tests, corrosion tests (i.e., potentiometric polarization techniques), and operated pilot equipment specific to the pulp and paper industry.

***Education***

**B.S., Chemistry,** ***Evergreen State College, Olympia, Washington,*** 1993.
**ICP/MS Training Course,** ***VG-Elemental,*** 1992.
**Coursework,** ***Pacific Lutheran University, Tacoma, Washington.*** 1988-1989.
**Coursework,** ***Tacoma Community College, Tacoma, Washington.*** 1970-1971, 1988-1989.
**Perkin-Elmer Advanced Furnace,** ***Norwalk, Connecticut,*** 1986.
**CERTIFICATION, Chemistry,** ***L.H. Bates Technical, Tacoma, Washington,*** 1978.
**Coursework,** ***Central Washington University, Ellensburg, Washington.*** 1969-1970.

***Publications/ Presentations***

*On* ***request.***

# LEEE. WOLF

**1988 TO PRESENT**

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**TECHNICAL MANAGER IV, KELSO QUALITY ASSURANCE MANAGER** – 2002 to Present

***Responsibilities***

Responsible for the overall coordination of the laboratory QA program, and for ensuring that established quality objectives are met. Responsible for Quality Assurance function, including the Quality Assurance Manual, certifications, documenting SOPs, and maintaining performance evaluation records. Oversee balance calibration and sample storage temperature control. Maintain certifications/accreditations for regulatory agencies and client certifications or approval programs. Act as primary point **of** contact during laboratory audits. Provides audit responses and initiates any changes in procedures resulting from an audit. Coordinate the analysis of performance evaluation samples required for certification/accreditation programs. Report and review results for these analyses. Conduct internal audits and make recommendations for corrective action.

***Experience***

**Scientist IV, Kelso Quality Assurance Manager,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1996-2002. Duties primarily as listed above.

**Project Chemist/Principal Organic Scientist,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1994-1996. Responsibilities included GC and GC/MS method development and special projects coordination. Acts **as** technical advisor to the GC and GC/MS laboratories and GC/MS interpretation specialist and CLP organics specialist. Also responsible for Project Chemist functions, including management and coordination of projects for clients, identifying client needs, and preparation of data reports.

**Semi-VOA Department Manager,** *Columbia Analytical Services,* 1988-1994. Responsibilities included overall management of the Semi-VOA department. Oversee the operation of Semi-VOA GC/MS, data review and reporting and related QA/QC function. *Also* responsible for supervision of staff, including training, scheduling, and other personnel issues. Beginning in 1992, increased responsibilities to include Project Chemist functions for organics EPA-SAS and other clients. This involved scheduling projects for clients, identifying client needs, and preparing data reports.

**GC/MS Chemist, *U.S.*** *Testing Co., Richland, Washington,* 1985-1988. Responsibilities included GC and GC/MS analysis of water and soil samples for volatiles and Semi-VOA by EPA protocol, including Methods 8240, 8270 and CLP. Coordinated extraction and GC-GC/MS areas to manage sample/data flow through the lab. Experience also with pesticide/PCB analysis by EPA Methods **8080** and CLP. Responsible for development of analysis methods for non-routine pesticides and herbicides and performed HPLC analysis.

**Laboratory Assistant,** *Eastern Washington University, Cheney, Washington,* 1985. Responsibilities included supervision and instruction of organic chemistry labs. Experience **with** GC and IR operation. Responsible for lab safety.

**Chemist Assistant,** *Spokane County Air Pollution Control Authority, Spokane, Washington,* 1984. Responsibilities included gathering and analyzing air samples for ***CO*** content using IR equipment.

***Education***

**Documenting Your Quality System,** *A2LA Short Course, Las Vegas, Nevada,* 1998.
**Internal Laboratory Audits,** *A2LA Short Course, Las Vegas, Nevada,* 1998.
**Mass Spectra Interpretation,** *ACS Short Course, Denver, Colorado,* 1992.
**BS, Chemistry, Minor in Geology,** *Eastern Washington University, Cheney, Washington,* 1985.

***Publications/ Presentations***

*On Request.*

*Affiliations*

American Chemical Society.

# *LYNDA A. HUCKESTEIN*

***1989 TO PRESENT***

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**CLIENT SERVICES MANAGER IV** – 1998 to Present

***Responsibilities***

Management of the Client Services Departments: Project Management, Electronic Data Deliverables and Report Generation, and Sample Management. Personally responsible for approximately 1.5 million dollars of client work annually performing technical project management and client service. Provides technical and regulatory interpretation assistance as-well-as project organization to work received by the laboratory.

**Documentation of Demonstration of Capabilities is available for review.**

***Experience***

**Project Chemist,** *Columbia Analytical Service, Inc., Kelso, Washington,* 1992-1998. Primary responsibilities included technical project management and client service in areas of pulp & paper, marine services, mining, and DOD. Also responsible for providing technical and regulatory interpretation assistance as-well-as project organization to work received by the laboratory

**Project Chemist and Department Manager, General Chemistry Laboratory,** *Columbia Analytical Services, Inc.,* 1989-1992. Responsible for management of the General Chemistry laboratory for routine wastewater, bioassay, and microbiological analyses. Also responsible for supervision of staff, data review, and reporting.

**Analyst III,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1989. Primary responsibilities included coliform testing, total recoverable petroleum hydrocarbon extractions and analysis, BODs, ammonias, and TKN, in addition to miscellaneous wet chemistry analyses.

**Microbiologist/Chemist**, *Coffey Laboratories, Portland, Oregon,* 1983. Coliform analysis; water chemistry.

**Laboratory Assistant,** *Oregon State University, Corvallis, Oregon,* 1983. Wheat spike dissection and tissue culture.

***Education***

**BS, Microbiology,** *Oregon State University, Cowallis, Oregon,* 1983.

# *JEFFREY A. CORONADO*

***1989 TO PRESENT***

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**TECHNICAL MANAGER IV, INORGANICS DEPARTMENT MANAGER** – 2001 to Present

***Responsibilities***

Oversee the operation of the inorganic groups, which consists of two separate laboratories: Metals and General Chemistry. Responsible for the quality and timeliness of the inorganic laboratories analytical reports, departmental budgets, workload coordination, method development efforts, cost-effectiveness, and resource allocation.

**Documentation of Demonstration of Capabilities is available for review.**

***Experience***

**Metals Department Manager,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1992-2001. Responsibilities included management of all aspects of the metal laboratory operation, including personnel training and evaluation, review of all metals data, and report generation. Also responsible for client service on a number of ongoing CAS accounts. Technical duties include primary analytical responsibility for trace level metals analysis by ICP/MS. Analyses range from routine water and soil analysis, to marine tissues, as well as industrial applications such as ultra-trace QA/QC work for various semiconductor clients. Also responsible for a number of specialized sample preparation techniques including trace metals in seawater by reductive precipitation, and arsenic and selenium speciation by ion-exchange chromatography. Developed methodology for performing mercury analysis at low part per trillion levels by cold vapor atomic fluorescence..

**Supervisor, GFAA Laboratory,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1989-1992. Responsibilities included supervision of metals analysis by graphite furnace atomic absorption following SW-846 and EPA CLP methodologies. Duties include workload scheduling, data review, instrument maintenance, personnel training and evaluation.

***Education***

**Field Immunoassay Training Course,** *EnSys Inc.*, 1995.
**Winter Conference on Plasma Spectrochemistry,** *San Diego, California,* 1994.
**ICP-MS Training Course,** *VG-Elemental,* 1992.
**BS, Chemistry,** *Western Washington University, Bellingham, Washington,* 1988.
**BA, Business Administration,** *Western Washington University, Bellingham, Washington,* 1985.

# JEFFREY A. GRINDSTAFF

**1991 TO PRESENT**

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**TECHNICAL MANAGER III, GC/MS VOA AND SEMI-VOA LABORATORIES –** 1997 to Present

***Responsibilities***

Primary responsibilities include supervision of GC/MS VOA and Semi-VOA staff, method development, training, data review, tracking department workload, scheduling analyses, and general maintenance and troubleshooting of GC/MS systems.

**Documentation of Demonstration of Capabilities is available for review.**

***Experience***

**Manager, GC/MS VOA Laboratory,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1994-1997. Responsible for supervision of GC/MS VOA staff, method development, training, data review, tracking department workload, scheduling analyses, and general maintenance and troubleshooting of GC/MS systems.

**Scientist III, GC/MS VOA Laboratory,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1991-1994. Responsibilities included scheduling workload, data review, instrument maintenance and troubleshooting, and personnel training and evaluation. Also responsible for supervision of extraction personnel and instrument analysts. Additional supervisory duties included report generation and data review for GC analyses. Responsibilities also included project management and customer service.

**Chemist,** *Enseco-CRL, Ventura, California,* 1990-1991. Established GC/MS department including inventory maintenance, preparation of state certification data packages, method development, SOPs, and extended data programs. Performed daily maintenance and troubleshooting of GC and GC/MS instrumentation. Scheduled and performed routine and non-routine VOA analyses.

**GC/MS Chemist, VOA Laboratory** *Coast-to-Coast Analytical Service, San Luis Obispo, California,* 1990-1991. Responsible for standard preparation for VOA analyses and instrument calibration, tuning, and maintenance. Also implemented and further developed EPA methods for quantitative analysis of pesticides and priority pollutants..

***Education***

**Mass Selective Detector Maintenance,** *Hewlett-Packard Education Center,* 1993.
**Interpretation of Mass Spectra I,** *Hewlett-Packard Analytical Education Center,* 1992.
**B.S., Chemistry,** *California Polytechnic State University, San Luis Obispo, California,* 1989.
**A.A., Liberal Arts,** *Allan Hancock College, Santa Maria, California.* 1986

***Publications/ Presentations***

*Alternate Method to Lower Detection Limits to Satisfy Regulatory Action Levels for Volatiles in Groundwater,* with David Edelman, Kairas Parvez, and Paul Laymon. TAPPI National Meeting, Orlando, Florida. 1996

***Affiliations***

American Chemical Society. 1989

# TODD N. POYFAIR

**1991 TO PRESENT**

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**TECHNICAL MANAGER III, SVG LABORATORIES – 2001** to Present

***Responsibilities***

Primary responsibilities include supervision of GC, HPLC, and fuels Semi-VOA laboratory staff. Also responsible for training oversight, data review, tracking department workload, and scheduling and performance of GC and HPLC analyses.

**Documentation of Demonstration of Capabilities is available for review.**

***Experience***

**Supervisor/Manager, General Chemistry Department,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1995-2001. Responsibilities included supervision, management, and training of General Chemistry staff. Also responsible for workload coordination, data review, reporting, and instrument maintenance within the General Chemistry department.

**Project Chemist, Client Services Group,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1993-1995. Responsibilities included technical project management and customer service. Responsible for meeting the clients' needs of timely and appropriate analyses, and to acted as liaison for all client-related activities within CAS.

**Scientist II, General Chemistry Laboratory,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1992-1993. Responsibilities included the review and summarization of pH, alkalinity, conductivity, turbidity, hardness, and CODs.

**Scientist I, General Chemistry Laboratory,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1992. Responsibilities included analysis of Total Organic Halogens, Chemical Oxygen Demand, Sulfides, Ammonia, TKN, Nitrate/Nitrite by Lachat, and Cyanide.

**Analyst III, General Chemistry Laboratory,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1991-1992. Responsibilities included analysis **of** pH, Conductivity, Alkalinity, Turbidity, and Oil and Grease.

***Education***

**BS, Chemistry,** *Portland State University, Portland, Oregon,* 1991.
**BA, German,** *Portland State University, Portland, Oregon,* 1990.
**COURSEWORK,** *Brigham Young University, Provo, Utah.* 1982-1983 & 1985-1986.

# JAMES R. "JIM" SMITH

**2001 TO PRESENT**

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**TECHNICAL MANAGER I, DRINKING WATER LABORATORY SUPERVISOR** – 2002 to Present

***Responsibilities***

Overall implementation of Organic Drinking Water Methods and method development. Project management of Drinking water accounts. Development of Standard Operating Procedures for Drinking Water methods. Operation of Varian GC/MS, Agilant GC/ECD and Agilant HPLC.

**Documentation of Demonstration of Capabilities is available for review.**

***Experience***

**Project Manager III,** *Columbia Analytical Services, Inc., Kelso, Washington,* 2001-2002. Responsible for technical project management, ensuring overall data quality and compliance with customer requirements, and providing technical support to clients regarding laboratory application to projects. Extensive technical experience with the various GC and G C N S method allow for detailed technical review of organics projects. Also has extensive experience coordinating drinking water and sediment projects. Currently responsible for coordination of approximately $200,000 of analyses in the laboratory on a monthly basis. Current large clients include Bechtel (Navy work), which involves numerous groundwater-monitoring projects, the Port of Seattle and URS. Also responsible for various storm water studies for Bremerton Naval Shipyard.

**Director, Trace Organics and Project Manager,** *Amtest, Inc., Redmond, Washington,* 1987-2001. Responsible for project management, client contact, data review, and writing reports. Additional responsibilities pertained to supervision of the trace organics department and running the G C N S system. Performed various methods by G C N S for volatiles, semi-volatiles and by GC for pesticides, PCBs, herbicides, and fuels (LUST). Also performed hazardous waste characterization including completion of waste profile forms.

***Education***

**BS, Chemistry,** *Rochester Institute of Technology, Rochester, New York,* 1985.

# EILEEN M. ARNOLD

**1987 TO PRESENT**

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**SCIENTIST IV, METALS LABORATORY, KELSO HEALTH AND SAFTEY OFFICER –** 1994 to Present

***Responsibilities***

Duties include the operation and maintenance of the Inductively Coupled Argon Plasma (ICAP) Emission Spectrometer. This involves digestion, instrumental analysis, and report generation for environmental samples using approved EPA techniques. Health and Safety Officer responsibilities included development and implementation of the Kelso Health and Safety program, including accident investigation and incident review, maintenance of all safety related equipment and documents, and performance of monthly safety audits.

**Documentation of Demonstration of Capabilities is available for review.**

***Experience***

**Project Chemist, Client Services Group, Kelso Health and Safety Officer,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1992-1994. Duties included technical project management and customer service. Responsible **for** meeting the clients' needs of timely and appropriate analyses, and to act as liaison for all client-related activities within Columbia Analytical Services, Inc. Health and Safety Officer responsibilities included development and implementation of the Kelso Health and Safety program, including accident investigation and incident review, maintenance of all safety related equipment and documents, and performance of monthly safety audits.

**Scientist IV, Metals Laboratory, Health and Safety Officer,** *Columbia Analytical Services, Inc., Kelso, Washington, 1987-1992.* Duties include the operation and maintenance of the Inductively Coupled Argon Plasma (ICAP) Emission Spectrometer. This involves digestion, instrumental analysis, and report generation for environmental samples using approved EPA techniques. Health and Safety Officer responsibilities included development and implementation of the Kelso Health and Safety program, including accident investigation and incident review, maintenance of all safety related equipment and documents, and performance of monthly safety audits.

**Chemist,** *Dow Coming Corporation, Springfield, Oregon,* 1986-1987. Responsibilities included ICP and atomic absorption work in silicon manufacturing. Methods development for ICP analysis of minor impurities found in silicon.

**Chemist,** *Ametek, Inc., Harleysville, Pennsylvania,* 1982-1985. Responsibilities included product research and development chemist involved in production of thin-film semiconductors for use as solar cells. Work involved AA and **SEM** techniques.

**Chemist,** *Janbridge, Inc., Philadelphia, Pennsylvania,* 1978-1982. Responsibilities included maintaining electroplating process lines through wet chemical analysis techniques, and performed Quality Assurance testing on printed circuit boards.

***Education***

**BA, Chemistry,** *Immaculata College, Immaculata, Pennsylvania,* 1977.

***Affiliations***

American Chemical Society, Member since 1987.

# PAUL GOWAN

**1994 TO PRESENT**

*CAS Holdings Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

**Current Position**

**IT MANAGER** 11,2002 to Present

**Responsibilities**

Identify and plan IT requirements by interacting with management personnel to identify current and long-term user objectives. Assist in developing and tracking the IT computer capital budget. Provide electronic data deliverable (EDD) and **LIMS** system guidance to management personnel throughout the company. Ensure the effective utilization of computer systems. Train users **as** required. Establish IT policies, standards, practices, and specifications. Participate in the LIMS planning group.

Plan and supervise IT department staffing, organization, hardware and software acquisitions to meet requirements. Acquire, develop, and maintain a professional, skilled, and motivated staff through effective performance review and career development programs. Develop and maintain relationships with local and national vendors of computer hardware, software, and telephone equipment.

**Experience**

**KELSO IT MANAGER,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1999-2002. Responsible for all IT efforts related to the CAS laboratory in Kelso, WA, including, but not excluded to computing equipment specification, purchasing and maintenance; network infrastructure; software development; strategic planning for future IT initiatives; budget preparation performance reviews, and career growth planning for IT staff.

**TECHNICAL INFORMATION SPECIALIST,** *CAS Holdings, Inc., Kelso, Washington,* 1994-1999. Primary responsibilities included support automation of HP chemstation and Enviroquant; support continued development of unified organic laboratories; support and development of project-specific data deliverables, technical assistance in Information Technology at Kelso to meet CAS IT objectives as related to **LIMS.**

**Organics Section Manager,** *Anametrix, Inc., San Jose, California,* 1992-1994. Responsibilities included managing the GC/MS and GC/Pesticide Departments, following protocols of the Department of Defense NEESA contracts (demanding stringent QA/QC and "Level D" data package submittals). Primary responsibilities included supervisor training and development, budget preparation and maintenance, performance reviews, data review, continuing research on environmental trends, SOP generation and updates, method development, capital equipment evaluation for laboratories, and project management.

**GCMS Program Manager,** *Anametrix, Inc., San Jose, California,* 1988-1992. Responsibilities included supervision **of** five chemists, two Finnigan 4000 GC/MS Systems, and three HP 5971 GC/MS Systems. Primary responsibilities were to maintain high productivity and insure that the GC/MS department generated legally defensible data. Also responsible for sample scheduling and tracking, instrument maintenance and troubleshooting, analyst training and review, client interfacing, and purchasing.

**GCMS Analyst,** *Anametrix, Inc., San Jose, California,* 1986-1988. Responsibilities included analyzing for VOA and **Semi-VOA** priority pollutants using EPA Methods 6241625 and 824018370.

**Education**

**BA, Biochemistry,** *San Jose State University, San Jose, California,* 1986.

# LAWRENCE J. "LAWRY" JACOBY

**1990 TO PRESENT**

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**VICE PRESIDENT, QUALITY ASSURANCE DIRECTOR** – 1992 to Present

***Responsibilities***

Responsible for the conduct **of** the quality assurance (QA) program and activities for CAS; for conducting systems and data audits at each CAS laboratory to ensure that the QA objectives established by management and by the various certifications, accreditations, project plans, and regulations under which CAS operates are satisfactorily met, to ensure that the QA programs are functioning as stated in QA Manuals, and to make appropriate recommendations for corrective actions and improvements; for management of performance evaluation and round-robin samples analyses programs; for evaluating data quality; for maintaining CAS-wide standard operating procedures; for preparing quarterly QA reports to management; for preparing, facilitating, and presenting quarterly ethics training; and for providing technical assistance and training to QA program managers at each CAS laboratory.

***Experience***

**Quality Assurance Coordinator,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1990-1992. Responsible for CAS/Kelso's quality assurance program and projects, and for evaluating data quality.

**Client Services Manager,** *$CH_2M$ Hill Laboratory, Redding, California,* 1989-1990. Management of client services and sample custody groups; customer service and maintenance; project management; proposal and quotation preparation; project-engineer/laboratory liaison.

**Inorganic Division Manager,** *$CH_2M$ Hill Laboratory, Redding, California,* 1988-1989. Responsible for managing the operation of the inorganic analyses section including wet chemical, soil, and metals analyses; project management; customer service; proposal and quotation preparation.

**Laboratory Manager,** *$CH_2M$ Hill Laboratory, Cowallis, Oregon,* 1986-1988. Responsible for managing the operation of the laboratory and coordinating the activities of project support staff; project management; quality assurance; proposal and quotation preparation; laboratory safety; engineering project consulting.

**Analytical Chemist,** *Teledyne Wah Chang, Albany, Oregon,* 1976-1986. Responsibilities included methods development; instrument maintenance; non-routine analyses; workload scheduling and coordination; and task force assignments.

**Instructor,** *Chemeketa Community College, Salem, Oregon,* 1971-1976. Taught college courses in general, organic and analytical chemistry.

**Assistant Professor,** *Portland State University, Portland, Oregon,* 1969-1971. Taught college courses in general and organic chemistry.

***Education***

**PhD, Organic Chemistry,** *Colorado State University, Ft. Collins, Colorado,* 1969.
**BS, Chemistry,** *Oregon State University, Cowallis, Oregon,* 1965.

***Affiliations***

American Society for Quality.
American Chemical Society.
AOAC International.

# GARY K. WARD

**2001 TO PRESENT**

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**VICE PRESIDENT, CHIEF QUALITY, SAFETY, AND ETHICS OFFICER –** 2001 to Present

***Responsibilities***

Responsibilities include directing and managing the overall corporate-wide quality systems, ethics and safety programs for all CAS facilities, as well as strategic planning, marketing, business development, and information technology. Responsible for all interaction and liaison with government entities involving quality, technical and operational issues.

***Experience***

**Deputy Director, Laboratory Standards,** *Intertek Testing Services, Houston, Texas,* 1998-2001. Responsibilities included professional standards/quality assurance for 240 laboratories in 93 countries, involving laboratory tests ranging fiom petroleum products and environmental samples to toys, textiles, and building products. Resolution of issues with a variety of governments, agiences, and companies with particular focus on interactions with the **US EPA.** Was previously responsible for all operations of over 100 labs in the Americas, ranging fiom Canada to South America, including duties to improve quality, raise profits and revenues, and implement a **LIMS.**

**Director, Technical Operations,** *Environmental Health Laboratories, South Bend, Indiana,* 1995-1998. Responsibilities included operations and quality assurance of the laboratory. Directed, administered and coordinated activities of the lab in accordance with goals and objectives of the company. Responsible for the R&D program, laboratory throughput and financial performance, and implementation of the new LIMS system.

**Executive Scientist,** *Quanterra (Enseco), Arvada, Colorado,* 1987-1995. Responsibilities included providing expertise and experience in laboratory analysis and operations to the entire laboratory system. Duties included implementation of network-wide LIMS as well as coordination of the Technology, QA, **IS,** and Operations groups. As Director of Technology and Quality Assurance was responsible for management of the R&D program, Quality Assurance program, and Environment, Health and Safety program throughout the Enseco lab system. Direct reports were all QA managers, safety managers, and chief scientists fiom each of the 13 laboratories.

**Deputy Branch Chief,** *U.S. Environmental Protection Agency,* 1983-1987. Responsibilities included providing expertise to entire Superfund program ranging fiom lab analytical services to sampling. Duties involved managing the CLP program as well as the Superfund R&D program. **As** CLP National Program Manager was responsible for development and implementation of CLP analytical protocols, administration of contracts for over 100 laboratories throughout the country, and liasion with contract divisions, other EPA programs, and enforcement. Responsible for development and implementation of disk deliverables, automated contract screening, as well as writing new protocols for specific methods such as ICP/MS and for EPA methods such as included in SW846, 3rd Edition. Duties also included coordination of the annual CLP conferences.

***Education***

**MS, Chemical Oceanography,** *RSMAS, University of Miami, Miami, Florida,* 1973.
**BS, Chemistry,** *Loyola University, Los Angeles, California,* 1970.

***Publications, Presentations. And Affiliations***

*Mr. Ward has a number of publications and presentations, and is affiliated with several professional organizations.* ***For*** *a list of these, please contact CAS.*

# STEPHEN W. VINCENT

**1986 TO PRESENT**

*Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222*

***Current Position***

**PRESIDENT, CAS HOLDINGS INC.** – 1986 to Present

***Responsibilities***

Responsible for the overall growth and profitability of the CAS laboratory network. This includes establishing and implementing long-range objectives, plans, and policies, and representing the company with its major customers, technical community, and the public.

***Experience***

**Laboratory Manager,** ***Weyerhaeuser Company, Federal Way, Washington,*** 1979-1986. Responsibilities involved all phases of technical and administrative management. This included management of organic, inorganic, and microbiological analyses and management of capital; an annual operating budget of approximately $2 million; management of thirty staff members; contract procurement, and project management. Projects included an EPA Inorganic **CLP** contract; an EPA acid rain deposition contract; **a** contract with the Fish and Wildlife Service to measure trace organic contaminants in animal tissues; and others.

**Analytical Chemist,** ***Weyerhaeuser Company, Longview, Washington,*** 1975-1979. Responsibilities: Method development, routine analysis and supervision for the Weyerhaeuser Multi-Region Support Lab. Responsible for setting **up** a company-wide laboratory audit, round robin, and quality assurance program.

***Education***

**Market Strategy for Technology Based Companies,** ***Executives Program, Stanford University.*** 1994.

**Advanced Technical Management Program,** ***University of California at Los Angeles, Department of Business, Engineering and Management,*** 1991.

**Completion of Coursework for MS, Pulp and Paper Technology,** ***University of Washington, Seattle, Washington,*** **1984.**

**Post Graduate Coursework, Engineering and Management,** ***University of California at Los Angeles, Graduate School of Engineering and Applied Science, Los Angeles, California,*** 1981.

***BS,*** **Oceanography,** ***University of Washington, Seattle, Washington,*** 1974.

*Publications/ Presentations*

*Mr.* ***Vincent has a number of publications*** *and presentations.* ***For a list of these publications and presentations, please contact CAS.***

***Affiliations***

American Chemical Society.
Technical Association **of** the Pulp and Paper Industry.

# APPENDIX C

UNCONTROLLED

## MAJOR ANALYTICAL EQUIPMENT

COPY

| GENERAL CHEMISTRY/WATER CHEMISTRY LABORATORY | | | |
|---|---|---|---|
| **Equipment Description** | **Year Acquired** | **Manufacturer or Laboratory Maintained (MM/LM)** | **# of Trained Operators** |
| Analytical Balances (9): | | | |
| Precisa and Mettler models | 1988-2000 | MM | 15 |
| Autoclave - Market Forge Sterilmatic | 1988 | LM | 5 |
| Calorimeter - Parr 1241 EA Adiabatic | 1987 | LM | 5 |
| Centrifuge - Damon/IEC Model K | 1992 | LM | 15 |
| Colony Counter - Quebec Darkfield | 1988 | LM | 4 |
| Conductivity Meters (2): | | | |
| YSI Model 3200 | 2004 | LM | 4 |
| VWR | 2001 | LM | 4 |
| Digestion Systems (5): | | | |
| COD (4) | 1987, 1989 | LM | 3 |
| Kjeldahl, Lachat 46-place (1) | 1999 | LM | 3 |
| Dissolved Oxygen Meter - YSI Model 58 (3) | 1987,1988,1991 | LM | 5 |
| Distillation apparatus (Midi) - Easy Still (2) | 1996,2000 | LM | 7 |
| Drying Ovens (11): | | | |
| Shel-Lab and VWR models | 1988 - 2003 | LM | 15 |
| Flash Point Testers: | | | |
| ERDCO Setaflash Tester (2) | 1988,1991 | LM | 5 |
| Flow-Injection Analyzers (2): | | | |
| Lachat Quik-Chem AE | 1990 | LM | 5 |
| Bran-Leubbe | 2002 | LM | 3 |
| Ion Chromatographs (3) | | | |
| Dionex 2000i with Peaknet Data Systems | 1988 | LM | 2 |
| Dionex DX-120 with Peaknet Data System | 1998 | LM | 3 |
| Dionex ICS-2500 with Chromchem Data System | 2002 | LM | 3 |
| Ion Selective Electrode Meters (5) | | | |
| Fisher Scientific Accument Model 50 | 1997 | LM | 6 |
| Fisher Scientific Accument Model 25 | 1993 | LM | 6 |
| Fisher Scientific Accument Model 20 | 2000 | LM | 6 |
| Orion Model 920A | 1990 | LM | 6 |
| Coming pH/ion Meter Model 135 | 1992 | LM | 6 |
| Microscopes (2): | | | |
| Bausch & Lomb | 1988 | LM | 1 |
| Swift | 1988 | LM | 1 |
| Muffle Furnace-Sybron Thermolyne Model F-A1730 | 1991 | LM | 15 |
| pH Meters (3): | | | |
| Beckman 34 (2) | 1989 | LM | 6 |
| Fisher Scientific Accument Model 20 | 1993 | LM | 6 |
| Shatter Box - GP 1000 | 1989 | LM | 5 |

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| GENERAL CHEMISTRY/WATER CHEMISTRY LABORATORY (continued) | | | |
|---|---|---|---|
| **Equipment Description** | **Year Acquired** | **Manufacturer or Laboratory Maintained (MM/LM)** | **# of Trained Operators** |
| Sieve Shakers (2): | | | |
| CE Tyler - Portable RX 24 | 1990 | LM | 5 |
| WS Tyler - RX 86 | 1991 | LM | 5 |
| Thomas-Wiley Laboratory Mill, Model 4 | 1989 | LM | 7 |
| Total Organic Carbon (TOC) Analyzers (2) | | | |
| Coulemetrics Model 5012 | 1997 | LM | 3 |
| O-I Corporation Model 1010 | 2002 | LM | 3 |
| Total Organic Halogen (TOX) Analyzers (3): | | | |
| Mitsubishi TOX-Sigma | 1995 | LM | 4 |
| Mitsubishi TOX-100 (2) | 2001 | LM | 4 |
| Turbidimeter - Hach Model 2100N | 1996 | LM | 8 |
| UV-Visible Spectrophotometers (2): | | | |
| Hitachi 100-40 Single Beam | 1986 | LM | 10 |
| Milton Roy 1001 Plus | 1991 | LM | 10 |
| Vacuum Pumps (2): | | | |
| Welch Duo-Seal Model 1376 | 1990 | LM | 13 |
| Busch R-5 Series Single Stage | 1991 | LM | 13 |
| Water Baths/Incubators (6): | | | |
| Hach Model 15320 Incubator | 1986 | LM | 15 |
| Precision Model L-6 (2) | 1989, 1990 | LM | 15 |
| VWR 1540 | 1991 | LM | 15 |
| Fisher 11-680-626M Incubator | 1992 | LM | 15 |
| Fisher Isotemp Incubator | 2001 | LM | 15 |

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| METALS LABORATORY | | | |
|---|---|---|---|
| **Equipment Description** | **Year Acquired** | **Manufacturer or Laboratory Maintained (MM/LM)** | **# of Trained Operators** |
| Analytical Balance (6) | | | |
| Various Mettler AE 200 analytical balance | 1990 | MM | 12 |
| Various Mettler models *(5)* | 1988 | MM | 12 |
| Atomic Absorption Spectrophotometers (6): | | | |
| Varian SpectrAA 300 Zeeman AA and IBM Data Systems (2) | 1989 | LM | 3 |
| Varian SpectrAA Zeeman/220 AA w/Data Systems (2) | 2000 | LM | 3 |
| Varian SpectrAA 20 with Flame, Cold Vapor, and Hydride Systems | 1988 | LM | 3 |
| CETAC Mercury Analyzer | 2000 | LM | 2 |
| Atomic Fluorescence Spectrophotometer Brooks-Rand Model III | 1996 | LM | 4 |
| Centrifuge - IEC Model Clinical Centrifuge | 1990 | LM | 12 |
| Drying Oven - VWR Model 1370F | 1990 | LM | 12 |
| Freeze Dryers (2) - Labconco | 1988,1992 | LM | 5 |
| Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES) - Thermo Jarrell Ash Model 61E | 1988 | LM | 4 |
| Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES): Thermo Jarrell Ash, Model IRIS | 2000 | MM | 4 |
| Inductively Coupled Plasma Mass Spectrometer (ICP-MS): VG PQ-S | 1997 | MM | 3 |
| Inductively Coupled Plasma Mass Spectrometer (ICP-MS): VG Excell | 2001 | MM | 3 |
| Muffle Furnace - Thermolyne Furnatrol Model 53600 | 1991 | LM | 5 |
| Shaker - Burrell Wrist Action Model 75 | 1990 | LM | 12 |
| TCLP Extractors (3) | 1989,2002 | LM | 5 |

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| SEMIVOLATILE ORGANICS SAMPLE PREPARATION LABORATORY | | | |
|---|---|---|---|
| **Equipment Description** | **Year Acquired** | **Manufacturer or Laboratory Maintained (MM/LM)** | **# of Trained Operators** |
| Accelerated Solvent Extractor - Dionex ASE 200 | 1996 | LM | 5 |
| Analytical Balance (3) | | | |
| Mettler BB240 | 1987 | MM | 12 |
| Satorious B610 (2) | 1999,2000 | MM | 12 |
| Aspirator pumps - Labconco Cole Parmer (1) | 1994 | LM | 7 |
| Centrifuges (2): | | | |
| Adams Model DYNAC | 1986 | LM | 7 |
| Sorvall Model GLC-1 | 1988 | LM | 7 |
| Drying Oven - Fisher Model 655 G | 1991 | LM | 7 |
| Evaporators (10): | | | |
| Organomation N-Evap (5) | 1989-90,1998-2001 | LM | 12 |
| Organomation S-Evap (5) | 1989-1991 | LM | 12 |
| Extractors: Lab-Line Multi-Unit Extraction Heaters (60) | 1987-1992 | LM | 12 |
| Extractors ***(64):*** | | | |
| Continuous Liquid/Liquid Extractors (24) | 1991 | LM | 10 |
| Branson Model 450 Sonifier (2) | 1991 | LM | 4 |
| Tekmar Sonifier (2) | 1994 | LM | 4 |
| Soxhtherm (36) | 2000 | LM | 5 |
| Gas Chromatograph: Hewlett-Packard 5890 with HP 7673 autosampler and FID Detector | 1994 | LM | 5 |
| Gel Permeation Chromatography (GPC) (3): | | | |
| ABC single column (2) | 1998, 1999 | LM | 4 |
| ABC Autoprep 1000 | 1995 | LM | 4 |
| Muffle Furnace - Parflow MIC 6000 | 1994 | LM | 12 |
| Solid Phase Extractors (4) – Dionex SPE-Dex 4790 | 2003 | LM | 6 |
| Sonic Water Bath - Branson Model 8200 | 1991 | LM | 12 |
| Vacuum Pump - Edwards | 1992 | LM | 8 |

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| GC SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY | | | |
|---|---|---|---|
| **Equipment Description** | **Year Acquired** | **Manufacturer or Laboratory Maintained (MM/LM)** | **# of Trained Operators** |
| Analytical Balance - Mettler AT 250 | 1989 | MM | 6 |
| Chromatography Data Systems (12) | | | |
| HP Enviroquant (8) | 1994-2002 | LM | 4 |
| Thruput Target (4) | 1998-2000 | LM | 3 |
| Gas Chromatographs (11): | | | |
| Hewlett-Packard 5890 GC with HP 7673 Autosampler and Dual ECD Detectors (7) | 1990 – 1995 | LM | 5 |
| Hewlett-Packard 5890 GC with HP 7673 Autosampler and Dual FPD Detectors | 1991 | LM | 4 |
| Agilent 6890 GC with Agilent 7683 Autosampler and Dual ECD Detectors (2) | 2001 | LM | 4 |
| Agilent 6890 GC with Agilent 7683 Autosampler and Dual FPD Detectors | 2003 | MM | 4 |

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| GC/MS SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY | | | |
|---|---|---|---|
| **Equipment Description** | **Year Acquired** | **Manufacturer or Laboratory Maintained (MM/LM)** | **# of Trained Operators** |
| HP Enviroquant Chromatography Data Systems (9) | 1994-2002 | LM | 6 |
| Semivolatile GC/MS Systems (8): | | | |
| Agilent 6890/5973 with ATAS Optic2 LVI and HP 7673 Autosampler (2) | 1997, 2001 | MM | 4 |
| Agilent 5890/5970 with ATAS Optic2 LVI and HP 7673 Autosampler (2) | 1990,1994 | MM | 4 |
| Agilent 589015972 with ATAS Optic2 LVI and HP 7673 Autosampler (3) | 1993,1994,1998 | MM | 4 |
| Agilent 6890/5973 with ATAS Optic3 LVI and 7683 Autosampler (1) | 2004 | MM | 4 |

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| PETROLEUM HYDROCARBONS GC/HPLC LABORATORY | | | |
|---|---|---|---|
| **Equipment Description** | **Year Acquired** | **Manufacturer or Laboratory Maintained (MM/LM)** | **# of Trained Operators** |
| **SAMPLE PREPARATION** | | | |
| Analytical Balance (3) | | | |
| Mettler BB300 | 1991 | MM | 6 |
| Mettler BB240 | 1994 | MM | 6 |
| Mettler AE166 | 1994 | MM | 6 |
| Aspirator pumps – GAST (2) | 2002, 2004 | LM | 6 |
| Drying Oven - Fisher Model 630F | 1991 | LM | 6 |
| Evaporators (2): | | | |
| Organomation N-Evap | 1990 | LM | 6 |
| Organomation S-Evap | 1991 | LM | 6 |
| Extractors (4): | | | |
| Sonic Horns (3): Branson, Ultrasonics, Fisher Models | 1991-1994 | LM | 6 |
| **INSTRUMENTATION** | | | |
| HP Enviroquant Chromatography Data Systems (10) | 1994-2002 | LM | 6 |
| Gas Chromatographs(8): | | | |
| Varian 3300 with PID/FID detectors | 1989 | LM | 3 |
| O-I 4460A Purge and Trap Concentrator and | 1989 | LM | 3 |
| Dynatech PTA-30 Autosampler | 1996 | LM | 3 |
| Hewlett-Packard 5890 Series II with PID/FID detector, | 1991 | LM | 3 |
| Tekmar LSC-2000 Purge and Trap Concentrator | 1991 | LM | 3 |
| Dynatech Archon 5100 Autosampler | 1992 | LM | 3 |
| Hewlett-Packard 5890 Series II with TCD/FID detector | 1988 | LM | 3 |
| and ComBi-Pal Headspace Autosampler | 1999 | LM | 3 |
| Hewlett-Packard 5890 Series II with PID/PID/FID det. | 1999 | MM | 3 |
| O-I 4560A Purge and Trap Concentrator | 1999 | LM | 3 |
| Dynatech Archon 5100 Autosampler | 1999 | LM | 3 |
| Hewlett-Packard 5890 GC with HP 7673 Autosampler and Dual FID Detectors (3) | 1990- 1995 | LM | 3 |
| Agilent 6890 with Dual FID Detectors and Agilent 7873 Autosampler | 2001 | LM | 4 |
| High-Performance Liquid Chromatographs (2): | | | |
| HP 1090M Series II with Diode Array UV Detector | 1999 | LM | 3 |
| HP 1050/1100 Series with Fluorescence & Diode Array UV Detectors | 2004 | LM | 3 |
| High-Performance Liquid Chromatograph/Mass Spectrometer - Thermo Electron TSQ Quantum LC/MS/MS with Thermo Surveyor HPLC and Autosampler | 2005 | MM | 2 |

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| VOLATILE ORGANICS LABORATORY | | | |
|---|---|---|---|
| **Equipment Description** | **Year Acquired** | **Manufacturer or Laboratory Maintained (MM/LM)** | **# of Trained Operators** |
| Analytical Balance | | | |
| Mettler PE 160 | 1989 | MM | 6 |
| Baxter Vortex Mixer | 1989 | LM | 6 |
| Extractors (10): | | | |
| Millipore TCLP Zero Headspace Extractors (10) | 1987-1992 | LM | 2 |
| TCLP Extractor - Tumbler (12 position) | 1989 | LM | 2 |
| HP Enviroquant Chromatography Data Systems (10) | 1994-2002 | LM | 6 |
| Drying Ovens (2): | | | |
| Narco 420 | 1989 | LM | 6 |
| VWR 1305 U | 1991 | LM | 6 |
| Sonic Water Bath - Branson Model 2200 | 1989 | LM | 6 |
| Volatile GC/MS Systems (6): | | | |
| Agilent 589015970 (2) | 1989 | MM | 4 |
| Tekmar 3000 Purge and Trap Concentrator | 1995 | LM | 4 |
| Dynatech ARCHON 5100 Autosampler | 1996 | LM | 4 |
| Agilent 5890/5970 | 1999 | MM | 4 |
| EST Encon Purge and Trap Concentrator | 2002 | LM | 4 |
| Dynatech ARCHON 5100 Autosampler | 1999 | LM | 4 |
| Agilent 5890/5971 | 1991 | MM | 4 |
| Tekmar 3000 Purge and Trap Concentrator | 2001 | LM | 4 |
| Dynatech ARCHON 5100 Autosampler | 1995 | LM | 4 |
| Agilent 5890/5972A | 1993 | MM | 4 |
| Tekmar 3000 Purge and Trap Concentrator | 1995 | LM | 4 |
| Dynatech ARCHON 5100 Autosampler | 1996 | LM | 4 |
| Agilent 689015973 | 2001 | MM | 4 |
| Tekmar 3100 Purge and Trap Concentrator | 2001 | LM | 4 |
| Varian Archon Autosampler | 2001 | LM | 4 |

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| DRINKING WATER ORGANICS LABORATORY | | | |
|---|---|---|---|
| Equipment Description | Year Acquired | Manufacturer or Laboratory Maintained (MM/LM) | # of Trained Operators |
| Analytical Balance - Mettler BB300 | 1991 | MM | 2 |
| Extractors (5) – Horizon SPE-DEX Solid Phase Extractor | 2003 | LM | 2 |
| Aglinet Enviroquant Chromatography Data Systems (2) | 2003 | LM | 2 |
| Varian Saturn Chromatography Data System | 2003 | LM | 2 |
| Evaporator - Organomation N-Evap | 2003 | LM | 2 |
| Agilent 1 100HPLC w/post-column derivitization: | 2003 | LM | 2 |
| UV/Fluoescence detectors | 2003 | LM | 2 |
| Pickering PCX-5200 Post-column derivitization unit | 2003 | LM | 2 |
| Agilent 6890N GC/ECD system: | 2003 | LM | 2 |
| Dual micro-ECD detectors | 2003 | LM | 2 |
| Agilent autosampler | 2003 | LM | 2 |
| Varian Ion trap GC/MS: | 2003 | LM | 2 |
| Varian 3900 GC w/CP8400 autosampler | 2003 | LM | 2 |
| Varian Saturn 2100T mass spectrometer | 2003 | LM | 2 |

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| PHARMACEUTICAL TESTING LABORATORY | | | |
|---|---|---|---|
| Equipment Description | Year Acquired | Manufacturer or Laboratory Maintained (MM/LM) | # of Trained Operators |
| Analytical Balance - Mettler AB104-5 (2) | 2004 | MM | 6 |
| Incubator – VWR 1510E | 2004 | LM | 2 |
| Karl Fisher Titrators (2) – Mettler DL38 and DL39 | 2004 | MM | 3 |
| Melting point apparatus – Optimelt | 2004 | LM | 3 |
| Refractometer – Reichert Abbe Mark II | 2004 | LM | 2 |
| Rotary evaporator – Labonco/Cole-Parmer aspirator pump | 2004 | LM | 3 |
| Rotary shakers – Thermolyne Rotomix (2) | 2004 | LM | 2 |
| Vacuum oven – Precision Model 19 w/GAST aspirator | 2004 | LM | 3 |
| Water baths (3) – VWR Models 1212, 1235 and Labline 18002 | 2004 | LM | 2 |

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| AUTOMATED DATA PROCESSING EQUIPMENT | | | |
|---|---|---|---|
| Equipment Description | Year Acquired | Manufacturer or Laboratory Maintained (MM/LM) | # of Trained Operators |
| I-WAN: LIMS Sample Manager using Oracle 10g DBMS running on Redhat Advanced Server 3.0 (Linux) platform connected/linked on a frame relay WAN environment | 1994-2004 | LM | NA |
| 2 - Network Servers Pentium III class. 1 for Reporting and Data Acquisition running Windows 2003 Advanced Server. 1 for Applications running Windows 2000 Advanced Server. Data acquisition capacity at 65GB with redundant tape and disk arrarys. | 1994 - 2004 | LM | NA |
| Approximately 50+ HP and Dell Laserjet printers (various types including IIIs, 4s, 5s, 8150s, 4000s, 4050s, 4250, 8150s, W5300s) | 1991 - 2004 | LM | NA |
| Approximately 126 Gateway/Dell PC/Workstations running Windows 2000/XP on LAN connected via 10BT/100BT and TCP/IP for LIMs Terminal Emulation | 1993 - 2004 | LM | NA |
| Microsoft Office 2003 Professional as the base application for all PC/Workstations. Some systems still using Office 2000197. | 1996 - 2004 | LM | NA |
| E-Mail with link to SMTP for internal/external messaging. Web mail via Cobalt Qube interface. Microsoft Outlook 2003. | 1994 - 2004 | LM | NA |
| Standard Excel (R) reporting platform application linked to LAN/WAN for data connectivity and EDD generation. | 1996 - 2004 | LM | NA |
| Standard Excel (R) reporting platform application linked to LAN/WAN for data connectivity and EDD generation. | 1996 - 2004 | LM | NA |
| Facsimile Machines 9600 - 33600 Baud, (2) Brother 4750e, 15 ppm; (1) Brother MFC 1970MC, 2ppm; (1) Canon CFX-L4000 | 1991 - 2004 | LM | NA |
| Copiers/Scanners (2) Konica 7085, 85ppm, 20GB; (2) Konica 7155; (1) Toshiba eStudio 80. The 7085s and one 7155 are accessible via LAN for network scanning. | 2000 - 2004 | LM | NA |
| Dot Matrix Epson FX-880, LQ-1050, LX-300 | 1991 - 2004 | LM | NA |
| Thruput, MARRS, Stealth, Harold, Blackbird, StarLIMS reporting software systems. | 1998 - 2004 | LM | NA |

NA: Not applicable. This equipment administered by IT staff but may be used by all staff.

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# APPENDIX D

# PREVENTIVE MAINTENANCE PROCEDURES

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| Instrument | Activity | Frequency |
|---|---|---|
| Refrigerators and Coolers | Record temperatures | Daily |
| | Clean coils | Annually |
| | Check coolant | Annually or if temperature outside limits |
| Vacuum Pumps | Clean and change pump oil | Every month or as needed |
| Fume Hoods | Face velocity measured | Quarterly |
| | Sash operation | As needed |
| | Change filters | Annually |
| | Inspect fan belts | Annually |
| Ovens | Clean | As needed or if temperature outside lim. |
| | Record temperatures | Daily, when in use |
| Incubators | Record temperatures | Daily, morning and evening |
| Water Baths | Record temperatures | Daily, morning and evening |
| | Wash with disinfectant solution | When water is murky, dirty, or growth appears |
| Autoclave | Check sterility | Every month |
| | Check temperature | Every month |
| | Clean | When mold or growth appears |
| Analytical Balances | Check alignment | Before every use |
| | Check calibration | Daily |
| | Clean pans and compartment | After every use |
| Dissolved Oxygen Meter | Change membrane | When fluctuations occur |
| pH probes | Condition probe | When fluctuations occur |
| Fluoride ISE | Store in storage solution | Between uses |
| Ammonia ISE | Store in storage solution | Between uses |
| UV-visible Spectrophotometer | Wavelength check | Annually |
| Total Organic Carbon Analyzers | Check IR zero | Weekly |
| | Check digestion/condensation vessels | Each use |
| | Clean digestion chamber | Every 2000 hours, or as needed |
| | Clean permeation tube | Every 2000 hours, or as needed |
| | Clean six-port valves | Every 200 - 2000 hours, or as needed |
| | Clean sample pump | Every 200 - 2000 hours, or as needed |
| | Clean carbon scrubber | Every 200 - 2000 hours, or as needed |
| | Clean IR cell | Every 2000 - 4000 hours, or as needed |

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| Instrument | Activity | Frequency |
|---|---|---|
| Total Organic Halogen Analyzers | Change cell electrolyte | Daily |
| | Change electrode fluids | Daily |
| | Change pyrolysis tube | As needed |
| | Change inlet and outlet tubes | As needed |
| | Change electrodes | As needed |
| Flow Injection Analyzer | Check valve flares | Each use |
| | Check valve ports | Each use |
| | Check pump tubing | Each use |
| | Check light counts | Each use |
| | Check flow cell flares | Quarterly |
| | Change bulb | As needed |
| | Check manifold tubing | Each use |
| | Check T's and connectors | Each use |
| Ion Chromatographs | Change column | Every six months or as needed |
| | Change valve port face & hex nut | Every six months or as needed |
| | Clean valve slider | Every six months or as needed |
| | Change tubing | Annually or as needed |
| | Eluent pump | Annually |
| Atomic Absorption Spectro-photometers - FAA and CVAA | Check gases | Daily |
| | Clean burner head | Daily |
| | Check aspiration tubing | Daily |
| | Clean optics | Every three months |
| | Empty waste container | Weekly |
| Atomic Absorption Spectro-photometers - GFAA | Check gases | Daily |
| | Check argon dewar | Daily |
| | Change graphite tube | Daily, as needed |
| | Clean furnace windows | Monthly |
| ICP - AES | Check argon dewar | Daily |
| | Replace peristaltic pump tubing | Daily |
| | Empty waste container | Weekly |
| | Clean nebulizer, spray chamber, and torch | Every two weeks |
| | Replace water filter | Quarterly |
| | Replace vacuum air filters | Monthly |

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| Instrument | Activity | Frequency |
|---|---|---|
| ICP - MS | Check argon dewar | Daily |
| | Check water level in chiller | Daily |
| | Complete instrument log | Daily |
| | Replace peristaltic pump tubing | Daily |
| | Clean sample and skimmer cones | As needed |
| | Clean RF contact strip | As needed |
| | Inspect nebulizer, spray chamber, and torch | Clean as needed |
| | Clean lens stack/extraction lens | As needed |
| | Check rotary pump oil | Monthly |
| | Change rotary pump oil | Every six months |
| Gel-Permeation Chromatographs | Clean and repack column | As needed |
| | Backflush valves | As needed |
| High Pressure Liquid Chromatographs | Backflush guard column | As needed |
| | Backflush column | As needed |
| | Change guard column | As needed when back pressure to high |
| | Change column | Annually or **as** needed |
| | Change in-line filters | As needed |
| | Leak check | After column maintenance |
| | Change pump seals | As needed |
| | Change pump diaphragm | Annually |
| | Clean flow cell | As needed |
| | Fluorescence detector check | Daily |
| | Diode array absorbance check | Daily |
| Gas Chromatographs, Semivolatiles | Check gas supplies | Daily, replace when pressure reaches 50 psi |
| | Change in-line filters | Quarterly or after **30** tanks of gas |
| | Change septum | Daily |
| | Change injection port liner | Weekly or as needed |
| | Clip first **6-12**" of capillary column | As needed |
| | Change guard column | As needed |
| | Replace analytical column | As needed when peak resolution fails |
| | Check system for gas leaks | After changing columns and after any power failure |
| | Clean FID | Weekly or as needed |
| | Clean ECD | Quarterly or as needed |
| | Leak test ECD | Annually |

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| Instrument | Activity | Frequency |
|---|---|---|
| Gas Chromatograph/Mass Spectrometers, Semivolatiles | Check gas supplies | Daily, replace when pressure reaches 50 psi |
| | Change in-line filters | Annually or as needed |
| | Change septum | Daily, when in use |
| | Change injection port liner | Weekly or as needed |
| | Clip first 6-12" of capillary column | As needed |
| | Change guard column | As needed |
| | Replace analytical column | As needed when peak resolution fails |
| | Clean source | As needed when tuning problems |
| | Change pump oil | As specified by service specifications |
| Purge and Trap Concentrators | Change trap | Every four months or as needed |
| | Change transfer lines | Every six months or as needed |
| | Clean purge vessel | Daily |
| Gas Chromatographs, Volatiles | Check gas supplies | Daily, replace when pressure reaches 50 psi |
| | Change in-line filters | Quarterly or after 30 tanks of gas |
| | Change septum | Daily |
| | Clip first 6-12" of capillary column | As needed |
| | Change guard column | As needed |
| | Replace analytical column | As needed when peak resolution fails |
| | Check system for gas leaks | After changing columns and after any power failure |
| | Clean PID lamp | As needed |
| | Clean FID | As needed |
| | Change ion exchange resin | {Every60 days |
| | Replace nickel tubing | Quarterly or as needed |
| Gas Chromatograph/Mass Spectrometers, Volatiles | Check gas supplies | Daily, replace when pressure reaches 50 psi |
| | Change in-line filters | Annually or as needed |
| | Change septum | Daily |
| | Clip first foot of capillary column | As needed |
| | Change guard column | As needed |
| | Replace analytical column | As needed when peak resolution fails |
| | Clean jet separator | As needed |
| | Clean source | As needed when tuning problems |
| | Change pump oil | As specified by service specifications |

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# APPENDIX E

## SOP LIST AND LIST OF NELAC ACCREDITED METHODS

COPY

COLUMBIA ANALYTICAL SERVICES, INC. ,KELSO, WA.
STANDARD OPERATING PROCEDURES TABLE OF CONTENTS
January 7, 2005

| SOP NAME | FILE NAME | REV # |
|---|---|---|
| ARMY CORPS OF ENGINEERS HTRW PROJECT MANAGEMENT | ADM-HTRW | 1 |
| CHECKING PIPETTE CALIBRATION | ADM-CPIP | 4 |
| CONTINGENCY PLAN FOR LABORATORY EQUIPMENT FAILURE | ADM-ECP | 0 |
| CONTROL CHARTING QUALITY CONTROL DATA | ADM-CHRT | 1 |
| DATA ARCHIVING | ADM-ARCH | 2 |
| DATA REPORTING AND REPORT GENERATION | ADM-RG | 4 |
| ELECTRONIC DATA BACKUP AND ARCHIVING | ADM-EBACKUP | 0 |
| | | 4 |
| LABORATORY DATA REVIEW PROCESS | ADM-DREV | 4 |
| METHOD DETECTION LIMIT DOCUMENTATION AND CONTROL | ADM-MDLC | 0 |
| PROJECT MANAGEMENT | ADM-PCM | 4 |
| REAGENT LOGIN AND TRACKING | ADM-RLT | 2 |
| SUPPORT EQUIPMENT MONITORING AND CALIBRATION | ADM-SEMC | 4 |
| THERMOMETER CALIBRATION | ADM-TCAL | 3 |
| | | |
| COLIFORM, FECAL | BIO-9221FC | 5 |
| COLIFORM, FECAL (MEMBRANE FILTER PROCEDURE) | BIO-9222D | 0 |
| COLIFORM, TOTAL | BIO-9221TC | 3 |
| COLIFORM, TOTAL (DRINKING WATER) | BIO-9221DW | 2 |
| COLILERT COMPLETED TEST VERIFICATION OF E. COLI IN MUG CULTURES | BIO-CCT | 0 |
| COLILERT P/A | BIO-COLI | 2 |
| ENTEROLERT | BIO-ENT | 0 |
| FECAL STREPTOCOCCUS/ENTEROCOCCUS | BIO-9230B | 4 |
| HEPTEROTROPHIC PLATE COUNT | BIO-HPC | 1 |
| MICROBIOLOGY QUALITY ASSURANCE AND QUALITY CONTROL | BIO-QAQC | 8 |
| | | |
| EPA CLP ORGANICS ANALYSES | CLP_ORGA | 1 |
| | | |
| ADDITION OF SPIKES AND SURROGATES | EXT-SAS | 5 |
| AUTOMATED SOXHLET EXTRACTION | EXT-3541 | 2 |
| CONTINUOUS LIQUID - LIQUID EXTRACTION | EXT-3520 | 10 |
| DIAZOMETHANE PREPARATION | EXT-DIAZ | 4 |
| FLORISIL CLEANUP | EXT-FLOR | 1 |
| MEASURING SAMPLE WEIGHTS AND VOLUMES FOR ORGANICS ANALYSIS | EXT-WVOL | 1 |
| ORGANIC EXTRACTIONS GLASSWARE CLEANING | MT-GC | 2 |
| PREPARATION OF ANHYDROUS SODIUM SULFATE, MARTIX SAND. SODIUM CHLORIDE. AND POTASSIUM CARBONATE | MT-SULF | 2 |
| PRESSURIZED FLUID EXTRACTION | EXT-3545 | 5 |

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| | | |
|---|---|---|
| SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION | EXT-3510 | 7 |
| SOLID PHASE EXTRACTION | EXT-3535 | 2 |
| SOXHLET EXTRACTION | EXT-3540 | 7 |
| ULTRASONIC EXTRACTION | EXT-3550 | 7 |
| WASTE DILUTION EXTRACTION | EXT-3580 | 1 |
| | | |
| ACIDITY | GEN-305.2 | 1 |
| ALKALINITY TOTAL | GEN-310.1 | 5 |
| | | 3 |
| AMMONIA BY FLOW INJECTION ANALYSIS | GEN-350.1 | 3 |
| AMMONIA, NITROGEN - DISTILLATION PROCEDURE | GEN-350.2 | 1 |
| BIOCHEMICAL OXYGEN DEMAND | GEN-405.1 | 8 |
| BULK DENSITY OF SOLID WASTE. FRACTIONS | GEN-E1109 | 0 |
| CARBON, TOTAL ORGANIC DETERMINATION (WALKELY BLACK METHOD) | GEN-OSU | 1 |
| CARBON, TOTAL ORGANIC IN SOIL | GEN-ASTM | 2 |
| CARBONATE ($CO_3$) BY EVOLUTION AND COLUMETRIC TITRATION | GEN-D513-82M | 0 |
| CHEMICAL OXYGEN DEMAND | GEN-COD | 4 |
| CHLORIDE (TITRIMETRIC, MERCURIC NITRATE) | GEN-325.3 | 3 |
| CHLORINE, TOTAL/FREE RESIDUAL | GEN-330-4 | 1 |
| COLOR | GEN-110.2 | 1 |
| COLOR, NCASI | GEN-NCAS | 0 |
| CONDUCTIVITY IN WATER AND WASTES | GEN-COND | 5 |
| CORROSIVITY TOWARDS STEEL | GEN-CORR | 1 |
| CYANIDE EXTRACTION OF SOLIDS AND OILS | GEN-9013 | 0 |
| CYANIDE, WEAK ACID DISSOCIABLE | GEN-CNWAD | 0 |
| DETERMINATION OF INORGANIC ANIONS IN DRINKING WATER BY ION CHROMATOGRAPHY | GEN-300_1 | 1 |
| FERROUS IRON IN WATER | GEN-FeII | 1 |
| FLASHPOINT DETERMINATION - SETAFLASH | GEN-1020 | 4 |
| FLUORIDE | GEN-FISE | 3 |
| FORMALDMYDE COLORIMETRIC DETERMINATION | GEN-FORM | 0 |
| GLASSWASHING FOR INORGANIC ANALYSES | GEN-WASH | 3 |
| HALIDES. ADSORBABLE ORGANIC (AOX) | GEN-1650 | 0 |
| HALIDES, ADSORBABLE ORGANIC (AOX) | GEN-506 | 2 |
| HALIDES, EXTRACTABLE ORGANIC (EOX) | GEN-9020M | 1 |
| HALIDES, TOTAL ORGANIC (TOX) | GEN-9020 | 7 |
| HALOGENS TOTAL AS CHLORIDE BY BOMB COMBUSTION | GEN-5050 | 2 |
| HARDNESS, TOTAL | GEN-130.2 | 4 |
| HEAT OF COMBUSTION | GEN-BTU | 2 |
| HEXAVALENT CHROMIUM - COLORIMETRIC | GEN- CR6 | 5 |
| HYDROGEN HALIDES BY ION CHROMATOGRAPHY (METHOD 26) | GEN-HA26 | 1 |
| ION CHROMATOGRAPHY | GEN-IONC | 8 |

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| | | |
|---|---|---|
| MBAS | GEN-425.1 | 1 |
| MERCURY IN COAL SAMPLE PREPARATION BY PARR BOMB COMBUSTION | GEN-HGPREP | 0 |
| NITRATE/NITRITE, NITRITE BY FLOW INJECTION ANALYSIS | GEN-353.2 | 4 |
| NITRITE BY COLORIMETRIC PROCEDURE | GEN-354.1 | 0 |
| NITROGEN, EXTRACTION OF NITRATE/NITRITE AND AMMONIA IN SOIL/SLUDGE | GEN-NNA | 2 |
| NITROGEN, TOTAL AND SOLUBLE KJELDAHL | GEN-TKN | 7 |
| PARTICLE SIZE DETERMINATION | GEN-PSP | 4 |
| PARTICLE SIZE DETERMINATION - ASTM PROCEDURE | GEN-PSASTM | 0 |
| PERCHLORATE BY ION CHROMATOGRAPHY | GEN-314-0 | 9 |
| Ph IN SOIL AND SOLIDS | GEN-Phs | 7 |
| Ph IN WATER | GEN-Phw | 7 |
| PHENOLICS, TOTAL | GEN-420.1 | 9 |
| PHOSPHORUS DETERMINATION USING COLORMETRIC PROCEDURE | GEN-365.3 | 7 |
| POST DIGESTION DETERMINATION OF TOTAL KJELDAHL NITROGEN BY SEMIAUTOMATED COLORIMETRY | GEN-TKNAA | 0 |
| REACTIVE CYANIDE | GEN-RCN | 1 |
| SETTEABLE SOLIDS | GEN-160.5 | 2 |
| SOLIDS, TOTAL DISSOLVED (TDS) | GEN-160.1 | 6 |
| SOLIDS, TOTAL SUSPENDED (TSS) | GEN-160.2 | 6 |
| SOLIDS, TOTAL VOLATILE AND PERCENT ASH IN SOIL AND SOLID SAMPLES | GEN-160.4 | 3 |
| SULFIDE. SOLUBLE DETERMINATION OF SOLUBLE SULFIDE IN SEDIMENT | GEN-DIS.S2 | 1 |
| SULFIDE, TITRIMETRIC (IODINE) | GEN-376-1 | 0 |
| SULFIDES, ACIDS VOLATILE | GEN-AVS | 4 |
| SULFIDE, METHYLENE BLUE | GEN-376-2 | 0 |
| SULFIDES, REACTIVE | GEN-RS | 4 |
| SULFITE | GEN-SO3 | 1 |
| TANNIN AND LIGNIN | GEN-5550 | 4 |
| THIOCYANATE | GEN-THIOCN | 0 |
| TISSUE SAMPLE PREPARATION | GEN-TISP | 3 |
| TOTAL CYANIDES AND CYANIDES AMENABLE TO CHLORINATION | GEN-335 | 10 |
| TOTAL ORGANIC CARBON IN WATER | GEN-TOC | 6 |
| TOTAL SOLIDS | GEN-160.3 | 9 |
| TOTAL SULFIDE BY PSEP | GEN-S2PS | 0 |
| TOTAL SULFIDES BY METHYLENE BLUE DETERMINATION | GEN-9030M | 7 |
| TOTAL SULFUR FOR ION CHROMATOGRAPHY | GEN-ICS | 1 |
| TURBIDITY MEASUREMENT | GEN-TURB | 3 |
| ULTIMATE BOD | GEN-UBOD | 0 |
| | | |
| CATION-EXCHANGE CAPACITY OF SOILS (SODIUM ACETATE) - METHOD 9081 | MET-9081 | 1 |
| CLOSED VESSEL OIL DIGESTION | MET-3051M | 0 |
| DETERMINATION OF LEAD BY FLAME ATOMIC ABSORPTION (FAA) | MET-7420 | 0 |
| DETERMINATION OF METALS & TRACE ELEMENTS BY INDUCTIVELY COUPLED | MET-6020 | 8 |

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|---|---|---|
| PLASMA-MS (METHOD 6020) | | |
| DETERMINATION OF METALS & TRACE ELEMENTS BY INDUCTIVELY COUPLED PLASMA-MS (METHOD 200.8) | MET-ICP.MS | 8 |
| DETERMINATION OF METALS AND TRACE ELEMENTS BY ICP/AES | MET-ICP | 15 |
| DETERMINATION OF TRACE METALS BY GRAPHITE FURNACE ATOMIC ABSORPTION SPECTROMETRY (GFAA) | MET-GFAA | 12 |
| FLAME ATOMIC ABSORPTION SPECTROPHOTOMETRIC ANALYSES | MET-FAA | 1 |
| MERCURY ANALYSIS BY COLD VAPOR ABSORPTION SPECTROPHOTOMETRY | MET-HG | 4 |
| MERCURY IN LIQUID WASTE | MET-7470A | 8 |
| MERCURY IN SOLID OR SEMISOLID WASTE | MET-7471A | 9 |
| MERCURY IN WATER | MET-245.1 | 9 |
| MERCURY IN WATER BY OXIDATION, PURGE&TRAP, AND COLD VAPOR ATOMIC FLUORES SPECTROMETRY | MET-1631 | 5 |
| METALS AND SEMIVOLATILES TCLP EXTRACTION (EPA METHOD 1311) | MET-TCLP | 4 |
| METALS DIGESTION | MET-3005A | 3 |
| METALS DIGESTION | MET-3010A | 8 |
| METALS DIGESTION | MET-3020A | 10 |
| METALS DIGESTION | MET-3050 | 6 |
| METALS DIGESTION | MET-7195 | 4 |
| METALS DIGESTION – CLP | MET-DIG | 8 |
| METALS LABORATORY GLASSWARE CLEANING | MET-GC | 2 |
| MULTIPLE EXTRACTION PROCEDURE | MET-MEP | 0 |
| ORGANIC LEAD | MET-ORPB | 4 |
| SAMPLE FILTRATION FOR METALS ANALYSIS | MET-FILT | 0 |
| SAMPLE PREPARATION OF AQUEOUS SAMPLES BY "CLEAN" TECHNIQUES | MET-ACT | 3 |
| SAMPLE PREPARATION OF BIOLOGICAL TISSUES FOR METALS ANALYSIS BY GFAA, ICP-OES, AND ICP-MS | MET-TDIG | 1 |
| SELENIUM BY BOROHYDRIDE REDUCTION ATOMIC ABSORPTION | MET-7742 | 0 |
| TRACE METALS IN WATER BY PRECONCENTRATION USING REDUCTIVE PRECIPITATION FOLLOWED BY ICP-MS | MET-RPMS | 4 |
| | | |
| ANALYSIS OF WATER, SOLIDS AND SOLUBLE WASTE SAMPLES FOR SEMI-VOLATILE FUEL HYDROCARBONS | PET-SVF | 7 |
| GASOLINE RANGE ORGANICS BY GAS CHROMATOGRAPHY | PET-GRO | 6 |
| GRAVIMETRIC DETERMINATION OF HEAXANE EXTRACTABLE MATERIAL (1664) | PET-1664 | 3 |
| | | |
| BOTTLE ORDER PREPARATION AND SHIPPING | SMO-BORD | 5 |
| FOREIGN SOILS HANDLING TREATMENT | SMO-FSHT | 3 |
| SAMPLE DISPOSAL | SMO-SDIS | 5 |
| SAMPLE RECENWG | SMO-GEN | 19 |
| SAMPLE TRACKING AND LABORATORY CHAIN OF CUSTODY | SMO-SCOC | 9 |
| | | |
| BUTYLTINS | SOC-BUTYL | 6 |
| CALIBRATION OF INSTRUMENTS FOR ORGANICS CHROMATOGRAPHIC ANALYSES | SOC-CAL | 5 |

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|---|---|---|
| CARBON CLEANUP | SOC-CARCU | 0 |
| CHLORINATED HERBICIDES | SOC-8151 | 9 |
| CHLORINATED PHENOLICS IN WASTE WATER BY IN-SITU | SOC-1653A | 4 |
| CHLORINATED PHENOLS METHOD 8151 MODIFIED | SOC-8151M | 5 |
| CONFIRMATION PROCEDURE FOR GC AND HPLC ANALYSES | SOC-CONF | 4 |
| CONGENER-SPECIFIC DETERMINATION OF PCBS BY GG/ECD | SOC-8082C | 5 |
| DETERMINATION OF NITROGEN OR PHOSPHORUS CONTAINING PESTICIDES | SOC-8141 | 7 |
| DIMP | SOC-DIMP | 4 |
| DMD SYNTHESIS | SOC-DMD | 1 |
| EXTRACTION METHOD FOR ORGANOTINS IN SEDIMENTS, WATER, AND TISSUE | SOC-OSWT | 4 |
| FORMALDEHYDE BY HPLC | SOC-8315A | 3 |
| GEL PERMEATION CHROMATOGRAPHY | SOC-3640A | 5 |
| GLYCOLS | SOC-8015M | 5 |
| HAZARDOUS AIR POLLUTANTS (HAPS) IN PULP AND PAPER INDUSTRY CONDENSATES | SOC-9901 | 1 |
| METHANOL IN PROCESS LIQUIDS | SOC-9403 | 1 |
| MONOCHLOROACETIC ACID BY GC-ECD | SOC-MCA | 2 |
| NITROAROMATICS AND NITRAMINES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY | SOC-8330 | 8 |
| NITROGLYCERIN AND PETN BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY | SOC-8332 | 3 |
| NITROGUANIDME BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY | SOC-NITG | 1 |
| ORGANOCHLORINE PESTICIDES AND PCBs (METHOD 608) | SOC-608 | 2 |
| ORGANOCHLORINE PESTICIDES BY GAS CHROMATOGRAPHY: CAPILLARY COLUMN TECHNIQUE | SOC-8081 | 7 |
| PCBS AS AROCLORS | SOC-8082A | 7 |
| PERCENT LIPIDS | SOC-LIPID | 0 |
| PICRIC ACID AND PICRAMIC ACID BY HPLC | SCO-PICRIC | 0 |
| POLYNUCLEAR AROMATIC HYDROCARBONS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY SIM | SOC-8270P | 4 |
| POLYNUCLEAR AROMATIC HYDROCARBONS BY HPLC | SOC-8310 | 9 |
| REMOVAL OF SULFUR USING COPPER | SOC-3660 | 3 |
| RESIN AND FATTY ACIDS BY GC/MS | SOC-85.01 | 2 |
| SEMNOLATILE ORGANIC COMPOUNDS BY GC/MS | SOC-625 | 2 |
| SEMNOLATILE ORGANIC COMPOUNDS BY GC/MS | SOC-8270C | 6 |
| SEMIVOLATILE ORGANIC COMPOUNDS BY GUMS - LOW LEVEL PROCEDURE | SOC-8270L | 1 |
| SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS SELECTED ION MONITORING | SOC-8270S | 2 |
| SEMI-VOLATILE ORGANICS SCREENING | SOC-SCR | 2 |
| SILICA GEL CLEANUP | SOC-3630C | 0 |
| SULFURIC ACID CLEANUP | SOC-3665 | 1 |
| | | |
| 1,2-DIBROMOETHANE, 1,2-DIBROMO-3-CHLOROPROPANE, AND 1,2,3-TCP BY GC | SVD-504 | 2 |
| CARBAMATES AND CARBAMOYLOXIMES IN WATER BY POST-COLUMN DERIVITIZATION HPLC | SVD-531 -1 | 2 |

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|---|---|---|
| CHLORINATED HEBICIDES IN DRINKING WATER | SVD-515_4 | 2 |
| DIQUAT AND PARAQUAT BY HPLC | SVD-549 | 2 |
| ENDOTHALL IN DRINKING WATER BY GC/MS | SVD-548 | 2 |
| GLYPHOSATE IN DRINKING WATER BY HPLC | SVD-547 | 2 |
| HALOACETIC ACIDS IN DRINKING WATER | SVD-552 | 2 |
| ORGANOCHLORINE PESTICIDES AND PCBS IN DRINKING WATER | SVD-508 1 | 2 |
| SEMIVOLATILE ORGANIC COMPOUNDS BY GCNS (METHOD 525.2) | SVD-525 | 2 |
| | | |
| AROMATIC VOLATILE ORGANICS (BTEX) BY GC - METHOD 602 | VOC-602BTEX | 1 |
| AROMATIC VOLATILE ORGANICS (BTEX) BY GC - METHOD 8021 | VOC-8021BTEX | 2 |
| PURGE AND TRAP FOR AQUEOUS SAMPLES | VOC-5030 | 3 |
| PURGE AND TRAP/EXTRACTION FOR VOC IN SOIL AND WASTE SAMPLES, CLOSED SYSTEM | VOC-5035 | 4 |
| SAMPLE SCREENING FOR VOLATILE ORGANIC COMPOUNDS IN SOIL. WATER AND MISC. MATRICES | VOC-BVOC | 3 |
| VOA STORAGE BLANKS | VOC-BLAN | 4 |
| VOLATILE ORGANIC COMPOUNDS BY GC/MS | VOC-524.2 | 8 |
| VOLATILE ORGANIC COMPOUNDS BY GC/MS | VOC-624 | 7 |
| VOLATILE ORGANIC COMPOUNDS BY GCNS | VOC-8260B | 9 |
| WA-DOH DRINKING WATER PROTOCOL | VOC-WA.DOH | 2 |
| ZERO HEADSPACE EXTRACTION (EPA METHOD 1311) | VOC-ZHE | 4 |

**PHARMACEUTICAL TESTING SOPS**

| SOP NAME | FILE NAME | REV # |
|---|---|---|
| VALIDATION OF PHARMACEUTICAL AND NUTRACEUTICAL TESTING METHODS | PHM-QA01 | 0 |
| INSTRUMENT QUALIFICATION AND VERIFICATION | PHM-QA02 | 0 |
| PHARMACEUTICAL TESTING QUALITY RECORDS | PHM-QA03 | 0 |
| | | |
| EVALUATING AND SELECTING METHODS FOR PHARMACEUTICAL AND NUTRACEUTICAL TESTING | PHM-QA05 | 1 |
| OUT OF SPECIFICATION (OOS) INVESTIGATION AND RETESTING | PHM-QA06 | 0 |
| CHANGE CONTROL | PHM-QA07 | 0 |
| | | |
| DETERMINATION OF TRACE METALS IN PHARMACEUTICAL EXCIPIENTS BY GFAA | MET-PHAA | 0 |
| MERCURY IN PHARMACEUTICAL EXCIPIENTS | MET-PHHG | 0 |
| DETERMINATION OF ORGANIC VOLATILE IMPURITIES (OVI's) IN PHARMACEUTICAL EXCIPIENTS BY GC | PHC-POVI | 0 |
| FDA EXTRACTABLES | PHC-FDAEX | 0 |
| GC-FJD IMPURITIES IN METHYLSULFONYLMETHANE (MSM) | PHM-MSM | 0 |
| AMINO ACID ASSAY IN PHARMACUETICAL MANUFACTURING MATERIALS USING HPLC | SOC-AALC | 0 |

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FLORIDA DEPARTMENT OF HEALTH

# State of Florida
## Department of Health, Bureau of Laboratories

This is to certify that.

E87412

**Columbia Analytical Services, Inc. - WA**

1317 "South 13th Avenue

Kelso, WA 98626

has complied with Florida Administrative Code 64E-1, for the examination of Environmental samples in the following categories:

Drinking Water

Group I Unregulated Contaminants, Group II Unregulated Contaminants, Group III Unregulated Contaminants, Microbiology, Other Regulated Contaminants, Primary Inorganic Contaminants, Secondary Inorganic contaminants, Synthetic Organic Contaminants

Non-Potable Water

Extractable Organics, General Chemistry, Metals, Microbiology, Pesticides-Herbicides-PCB's, Volatile Organics

Solid and Chemical Materials

Extractable Organics, General Chemistry, Metals, Pesticides-Herbicides-PCB's, Volatile Organics

Biological Tissues

Extractable Organics, General Chemistry, Metals, Pesticides-Herbicides-PCB's

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

**EFFECTIVE JULY 1, 2004** **THROUGH JUNE 30, 2005**

Ming S. Chan, Ph.D.
Bureau Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1697,7103
NON-TRANSFERABLE 05/24/2004-E87412

**THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE**

**State Laboratory ID:** E87412 **EPA Lab Code:** WA00035 **(360j 577-7222**

**E87412**
**Columbia Analytical Scwices, Inc. - WA**
**1317 South 13th Avenue**
**Kelso,** WA 98626

Matrix: Drinking Water

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| 1,1,1-Trichloroethane | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| 1,1,2,2-Tetrachloroethane | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| 1,1,2-Trichloroethane | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| 1,1-Dichloroethane | €PA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| 1,1-Dichloroethylene | EPA 524.2 | Other Regulated Containinants | NELAP | 10/8/2001 |
| 1,1-Dichloropropene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| 1,2,3-Trichlorobenzene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| 1,2,3-Trichloropropane | EPA 504.1 | Group II Unregulated Contaminants | NELAP | 7/17/2003 |
| 1,2,3-Trichloropropane | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| 1,2,4-Trichlorobenzene | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| 1,2,4-Trimethylbenzene | €PA 5242 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| 1.2-Dibromo-3-chloropropane(DBCP) | EPA 504.1 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| 1,2-Dibromoethane (EDB, Ethylene dibromide) | EPA 504.3 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| 1.2-Dichlorobenzene | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| 1,2-Dichloroethane | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| 1.2-Dichloropropane | EPA 524.2 | Other Regulated Contaminants | NELM | 10/8/2001 |
| 1,3,5-Trimethylbenzene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| 1,3-Dichlorobenzene | EPA 524.2 | Group If Unregulated Contaminants | NELAP | 10/8/2001 |
| 1,3-Dichloropropane | €PA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| 1,4-Dichlorobenzene | EPA 5242 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| 2,2-Dichloropropane | EPA 524.2 | Group 11 Unregulated Contaminants | NELAP | 10/8/2001 |
| 2,4,5-T | EPA 515.4 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| 2,4-D | EPA 515.4 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| 2,4-Dinitrotoluene (2,4-DNT) | EPA 525.2 | Group III Unregulated Contaminants | NELAP | 7/17/2003 |
| 2,6-Dinitrotoluene (2,6-DNT) | EPA 525.2 | Group III Unregulated Contaminants | NELAP | 7/17/2003 |
| 2-Chlorotoluene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| 3-Hydroxycarbofuran | EPA 531.1 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| 4,4'-DDD | EPA 508.1 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| 4,4'-DDD | EPA 525.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| 4,4'-DDE | EPA 508.1 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| 4,4'-DDE | EPA 525.2 | Group 1 Unregulated Contaminants | NELAP | 7/17/2003 |
| 4,4'-DDT | EPA 508.1 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| 4,4'-DDT | EPA 525.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| 4-Chlorotoluene | EPA 5243 | Group II Unregulated Contaminants | NELAP | 7/17/2003 |
| 4-Isopropyltoluene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |

"STATE" indicates certification for the analyte by the method specified. "NELAP" further indicates certification compliant with the KELAC Standards.

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**State Laboratory ID:** E87412 **EPA Lab Code:** WA00035 **(360) 577-7222**

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso,** WA 98626

Matrix: Drinking Water

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Acetochlor | EPA 525.2 | Group i Unregulated Contaminants | NELAP | 7/17/2003 |
| Acifluorfen | EPA 515.4 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Alachlor | EPA 525.2 | Synthetic Organic Contaminants | NCLAP | 7/17/2003 |
| Aldicarb (Temik) | EPA 531.1 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Aldicarb sulfone | EPA 531.1 | Group I Unregulated Contaminants | NELAP | 7/1 it2003 |
| Aldicarb sulfoxide | EPA 531.1 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Aldrin | EPA 508.1 | Group I Unregulated contaminants | NELAP | 7/17/2003 |
| Aldrin | EPA 525.2 | Group I Unregulated Contaniinants | NELAP | 7/17/2003 |
| Alkalinity as CaCO3 | SM 2320 B | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Aluminum | EPA 200.7 | Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Aluminum | EPA 200.8 | Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Antimony | EPA 200.7 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Antimony | EPA 200.8 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Antimony | EPA 200.9 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Arsenic | EPA 200.7 | Primary Inorganic contaminants | NELAP | 10/8/2001 |
| Arsenic | EPA 200.8 | Primary Inorganic Contaminants | NELAI' | 10/8/2001 |
| Arsenic | EPA 200.9 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Atrazine | EPA 525.2 | Synthetic Organic Contaninants | NELAP | 7/17/2003 |
| Barium | EPA 200.7 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Barium | EPA 200.8 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Benzene | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Benzo(a)pyrene | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 7/11/2003 |
| Beryllium | EPA 200.7 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Beryllium | EPA 200.8 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| bis(2-Ethylhexyl) phthalate (DEHP) | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Bromate | EPA 300.1 | Primary Inorganic Contaminants | NELAP | 7/17/2003 |
| Bromide | EPA 300.0 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Bromide | EPA 300.1 | Primary Inorganic Contaminants | NELAP | 7/17/2003 |
| Bromoacetic acid | EPA 552.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Bromobenzene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Bromochloroacetic acid | EPA 552.2 | Group I Unregulated contaminants | NELAP | 7/17/2003 |
| Bromochloromethane | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 7/17/2003 |
| Bromodichloromethane | EPA 524.2 | Other Regulated Contaminants,Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Bromoform | EPA 524.2 | Other Regulated Contaminants,Group II Unregulated Contaminants | NELAP | 10/8/2001 |

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**E87412**
**Columbia Analytical Services, Inc. - WA**
***1317* South 13th Avenue**
**Kelso, WA 98626**

**Matrix:** **Drinking water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Butachlor | EPA 525.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Butyl benzyl phthalate | EPA 525.2 | Group III Unregulated Contaminants | NELAP | 7/17/2003 |
| Cadmium | EPA 200.7 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Cadmium | EPA 200.8 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Calcium | EPA 200.7 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Carbaryl (Sevin) | EPA 531.1 | Group 1 Unregulated Contaminants | NELAP | 7/17/2003 |
| Carbofuran (Furaden) | EPA 531.1 | Synthetic Organic Contaminants | NELAP | 7117/2003 |
| Carbon tetrachloride | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Chlordane (tech.) | EPA 508.1 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Chlordane (tech.) | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 71172003 |
| Chloride | EPA 300.0 | Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Chlorite | EPA 300.1 | Primary Inorganic Contaminants | NELAP | 7/17/2003 |
| Chloroacetic acid | EPA 552.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Chlorobenzene | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Chloroethane | EPA 524.2 | Group II Unregulated Containinants | NELAP | 10/8/2001 |
| Chloroform | EPA 5242 | Other Regulated Contaminants,Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Chromium | EPA 200.7 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Chromium | EPA 200.8 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| cis-1.2-Dichloroethylene | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| cis-1,3-Dichloropropene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Color | SM 2120 B | Secondary Inorganic Contaminants | NELAP | 7/17/2003 |
| Conductivity | SM 2510 B | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Copper | EPA 200.7 | Primary Inorganic Contaminants,Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Copper | EPA 200.8 | Primary Inorganic Contaminants,Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Copper | EPA 200.9 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Cyanide | EPA 335.4 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Dacthal (DCPA) | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 711712003 |
| Dalapon | EPA 515.4 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Dalapon | EPA 552.2 | Synthetic Organic Contaminants | NELAP | 7117/2003 |
| DCPA di acid degradate | EPA 515.4 | Gmup I Unregulated Contaminants | NELAP | 7/17/2003 |
| DCPA mono acid degradate | EPA 515.4 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Di(2-ethylhexyl)adipate | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Dibromoacetic acid | EPA 5522 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |

**THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE**

State Laboratory ID: E87412 EPA Lab Code: WA00035 (360) 557-7222

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix: Drinking Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Dibromochloromethane | EPA 524.2 | Other Regulated Contaminants Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Dibromomethane | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Dicamba | EPA 515.4 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Dichloroacetic acid | EPA 552.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Dichlorodifluoromethane | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Dichloromethane (DCM, Methylene chloride) | EPA 5242 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Dieldrin | EPA 508.1 | Group I Unregulated Contaniinants | NELAP | 7/17/2003 |
| Dieldrin | EPA 5252 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Diethyl phthalate | EPA 525.2 | Group 111 Unregulated Contaminants | NELAP | 5/17/2003 |
| Dimethyl phthalate | €PA 525.2 | Group III Unregulated Contaminants | NELAP | 7117/2003 |
| Di-n-butyl phthalate | EPA 525.2 | Group III Unregulated Contaminants | NELAP | 7117/2003 |
| Di-n-octyl phthalate | €PA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP) | EPA 515.4 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Diquat | EPA 549.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Endothall | EFA 548.1 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Endrin | EPA 508.1 | Synthetic Organic Contaminants | NELAP | 7117/2003 |
| Endrin | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| EPTC (Eptam, s-ethyl-dipropyl thio carbamate) | EPA 525.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Ethylbenzene | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Fluoride | EPA 300.0 | Primary Inorganic Contaminants,Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Fluoride | SM 4500 F C | Secondary Inorganic Contaminants,Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| gamma-BHC (Lindone, gamma-Hexachlorocydohexane) | EPA 508.1 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | EPA 525.2 | Synthetic Organic Contaminants | NELAI' | 7/17/2003 |
| Glyphosate | EPA 547 | Synthetic Organic Contaminants | NELAI' | 7/17/2003 |
| Heptachlor | EPA 508.1 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Heptachlor | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Heptachlor epoxide | EPA 508.1 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Heptachlor epoxide | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Heterotrophic plate count | SM 9215 B | Microbiology | NELAP | 7/17/2003 |
| Hexachlorobenzene | EFA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Hexachlorobutadiene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Hexachlorocyclopentadiene | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |

## *Laboratory Scope of Accreditation*



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**State Laboratory ID: E87412** **EPA Lab Code: WA00035** **(360) 577-7222**

**E87412**
**Columbia Analytical Services, Jnc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

Matrix: **Drinking Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Iron | EPA 200.7 | Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Isophorone | €PA 525.2 | Group III Unregulated Contaminants | NELAP | 7/17/2003 |
| Isopropylbenzene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Lead | EPA 200.8 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Lead | EPA 200.9 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Magnesium | EPA 200.7 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Manganese | EPA 200.7 | Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Manganese | EPA 200.8 | Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Mercury | EPA 245.1 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Methacrylonitrile | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Methomyl (Lannate) | EPA 531.1 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Methoxychlor | EPA 508.1 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Methoxychlor | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Methyl acrylate | EPA 5242 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Methyl bromide (Bromomethane) | EPA 5242 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Methyl chloride (Chloromethane) | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Methyl tert-butyl ether (MTBE) | EPA 524.2' | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Metolachlor | EPA 525.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Metribuzin | EPA 525.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Molinate | EPA 5252 | Group I Unregulated Contaminants | NELAP | 7117/2003 |
| Naphthalene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| n-Butylbenzene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Nickel | EPA 200.7 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Nickel | EPA 200.8 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Nitrate | EPA 300.0 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Nitrate | EPA 353.2 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Nitrite | EPA 300.0 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Nitrite | EPA 353.2 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Nitrobenzene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| n-Propylbenzene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Orthophosphate as P | EPA 300.0 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Orthophosphate as P | SM 4500-P F | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Oxamyl | EPA 531.1 | Synthetic Organic Contantinants | NELAP | 7/17/2003 |
| PCBs | €PA 508.1 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Pentachlorophenol | EPA 515.4 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Pentachlorophenol | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |

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State Laboratory ID: E87412 EPA Lab Code: WA00035 (360) 557-5252

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

Matrix: **Drinking Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Perchlorate | EPA 314.0 | Primary Inorganic Contaminants | NELAP | 7/17/2003 |
| pH | EPA 150.1 | Secondary Inorganic Contaminants,Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Picloram | EPA 515.4 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Propaclilor(Ramrod) | EPA 525.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| sec-Butylbenzene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Selenium | EPA 200.8 | Primary Inorganic Contaminants | NELAP | 101812001 |
| Selenium | EPA 200.9 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Silica as SiO2 | EPA 200.7 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Silver | EPA 200.7 | Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Silver | EPA 200.8 | Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Silvex (2,4,5-TP) | EPA 515.4 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Simazine | EPA 525.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Sodium | EPA 200.7 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Styrene | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Sulfate | EPA 300.0 | Secondary Inorganic Contaminants,Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Terbacil | EPA 525.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| tert-Butylbenzene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Tetrachloroethylene (Perchloroethylene) | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Thallium | EPA 200.8 | Primary Inorganic Contaminants | NELAP | 11/18/2004 |
| Thallium | EPA 200.9 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Toluene | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Total coliforms & E. coli | SM 9223 B | Microbiology | NELAP | 10/8/2001 |
| Total dissolved solids | SM 2540 C | Secondary Inorganic Contaminants | NELAP | 10/8/2001 |
| Total haloacetic acids | EPA 552.2 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| Total nitrate-nitrite | EPA 300.0 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Total nitrate-nitrite | EPA 353.2 | Primary Inorganic Contaminants | NELAP | 10/8/2001 |
| Total trihalomethanes | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Toxaphene (Chlorinated camphene) | EPA 508.1 | Synthetic Organic Contaminants | NELAP | 7/17/2003 |
| trans-1,2-Dichloroethylene | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| trans-1,3-Dichloropropylene | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Trichloroacetic acid | EPA 552.2 | Group I Unregulated Contaminants | NELAP | 7/17/2003 |
| Trichloroethene (Trichloroethylene) | EPA 5242 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Trichlorofluoromethane | EPA 524.2 | Group II Unregulated Contaminants | NELAP | 10/8/2001 |
| Turbidity | EPA 180.1 | Secondary Inorganic Contaminants | NELAP | 10/8/2001 |

"STATE" indicates certification for the analyte by the method specified. "NELAP" further indicates certification compliant with the NELAC Standards.

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**Srare Laboratory ID:** EX7412 **EPA Lab Code:** WA00035 *(360)*577-7222

E87412
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix:** **Drinking Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Vinyl chloride | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Xylene (total) | EPA 524.2 | Other Regulated Contaminants | NELAP | 10/8/2001 |
| Zinc | EPA 200.7 | Secondary Inorganic Containinants | NELAP | 10/8/2001 |
| Zinc | EPA 200.8 | Secondary Inorganic Containinants | NELAP | 10/8/2001 |

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State Laboratory ID: E87412 EPA Lab Code; WA00035 *(360)577-1252*

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix: Non-Potable Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 1,1,2-Tetrachloroethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,1,1-Trichloroethane | EPA 624 | Volatile Organics | YELAP | 10/8/2001 |
| 1,1,1-Trichloroethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,1,2,2-Tetrachloroethane | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| 1,1,2,2-Tetrachloroethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,1,2-Trichloroethane | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| 1,1,2-Trichloroethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,1-Dichloroethane | €PA 624 | Volatile Organics | NELAP | 10/8/2001 |
| 1,1-Dichloroethane | EPA 5260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,1-Dichloroethylene | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| 1,1-Dichloroethylene | EPA 8260 | Volatile Orpanics | NELAP | 7/1/2003 |
| 1,1-Dichloropropene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,2,3-Trichlorobenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,2,3-Trichloropropane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,2,4,5-Tetrachlorobenzene | €PA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,2,4-Trichlorobenzene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 1,2,4-Trichlorobenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,2,4-Trichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,2,4-Trimethylbenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,2-Dibromo-3-chloropropane (DBCP) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,2-Dibromoethane (EDB, Ethylene dibromide) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,2-Dichlorobenzene | EPA 624 | Volatile Orpanics | NELAP | 10/8/2001 |
| 1,2-Dichlorobenzene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 1.2-Diclilorobenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,2-Dichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,2-Dichloroethane | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2-Dichloroethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,2-Dichloropropane | EPA 624 | Volatile Organics | NELAI' | 10/8/2001 |
| 1,2-Dichloropropane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,2-Diphenylhydrazine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,3,5-Trimethylbenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1.3.5-Trinitrobenzene (1,3,5-TNB) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 1,3-Dichlorobenzene | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| 1,3-Dichlorobenzene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 1,3-Dichlorobenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,3-Dichlorobenzene | EPA 5270 | Extractable Organics | NELAP | 7/1/2003 |

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State Laboratory ID: E87412 EPA Lab Code: WA00035 (360) 577-7222

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South *13th* Avenue**
**Kelso, WA 98626**

Matrix: Non-Potable Water

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 1,3-Dichloropropane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,3-Dinitrobenzene (1,3-DNB) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,3-Dinitrobenzene (1,3-DNB) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 1,4-Dichlorobenzene | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| 1,4-Dichlorobenzene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 1,4-Dichlorobenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,4-Dichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,4-Dioxane (1,4- Diethyleneoxide) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 1,4-Naphthoquinone | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,4-Phenylenediamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1-Naphthylamine | EYA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/3/2003 |
| 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141) | EPA 8082 | Pesticides-Herbicides-PCBs | NELAP | 7/1/2003 |
| 2,2',3,4,5'-Pentachlorobiphenyl (BZ 87) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,5'-Tetrachlorobiphenyl (BZ 44) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',4,4',5,5'-Hexachlorobiphenyl (RZ 153) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',4,5,5'-Pentachlorobiphenyl (BZ 101) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',5,5'-Tetrachlorobiphenyl (BZ 52) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',5-Trichlorobiphenyl (BZ 18) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2-Dichloropropane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 2,3,3',4',6-Pentachlorobiphenyl (BZ 110) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,3',4,4'-Tetrachlorobiphenyl (BZ 66) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,3,4,6-Tetrachlorophenol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 2,3,4,6-Tetrachlorophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,3-Dichlorobiphenyl (BZ 5) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,4,5-T | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,4',5-Trichlorobiphenyl (BZ 31) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,4,5-Trichlorophenol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4,5-Trichlorophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4,6-Trichlorophenol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |

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**E87412**
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**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix:** Non-Potable Water

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 2,4,6-Trichlorophenol | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4,6-Trichlorophenol | EYA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4,6-Trinitrotoluene (2,4,6-TNT) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4-D | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,4-DB | EPA 8151 | Pesticides-Herbicides-PCBs | NELAP | 7/1/2003 |
| 2,4-Dichlorophenol | EPA 1653 | ExtractabieOrganics | NELAD | 10/8/2001 |
| 2,4-Dichlorophenol | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4-Dichlorophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4-Dimethylphenol | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4-Dimethylphenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2.4-Dinitrophenol | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4-Dinitrophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4-Dinitrotoluene (2,4-DNT) | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4-Dinitrotoluene (2,4-DNT) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4-Dinitrotoluene (2,4-DNT) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 2,6-Dichlorophenol | EPA 1653 | Extractable Organics | NELAI' | 10/8/2001 |
| 2,6-Dichlorophenol | EPA 8270 | ExtractableOrganics | NELAP | 7/1/2003 |
| 2,6-Dichlorosyringaldehyde | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 2,6-Dinitrotoluene (2,6-DNT) | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 2,6-Dinitrotoluene (2,6-DNT) | EPA 8270 | ExtractableOrganics | NELAP | 7/1/2003 |
| 2.6-Dinitrotoluene (2,6-DNT) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Acetylaminofluorene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Amino-4,6-dinitrotoluene (2-am-dnt) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Butanone (Methyl ethyl ketone, MEK) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 2-Chlorobiphenyl (BZ I) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2-Chloroethyl vinyl ether | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| 2-Chloroethyl vinyl ether | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 2-Chloronaphthalene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Chloronaphthalene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Chlorophenol | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Clilorophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Chlorosyringaldehyde | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Chlorotoluene | €PA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 2-Hexanone | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 2-Methyl-4,6-dinitrophenol | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Methyl-4,6-dinitrophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |

**THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE**

State Laborsfory ID: E87412 EPA Lab Code: WA00035 (360) 577-7222

**E87412**
**Colombia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso,** WA **98626**

Matrix: **Non-Potable Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 2-Methylnaphthalene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Methylphenol (o-Cresol) | EPA 8250 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Nitroaniline | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Nitrophenol | €PA 62.5 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Nitrophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Nitrotoluene | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Picoline (2-Methylpyridine) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Sec-butyl-4,6-dinitrophenol (DNBP, Dinoseb) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 3,3'-Dichlorobenzidine | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 3,3'-Dichlorobenzidine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 3,3'-Dimethylbenzidine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 3,4,5-Trichlorocatechol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 3,4,5-Trichloroguaiacol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 3,4,6-Trichlorocatechol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 3,4,6-Trichloroguaiacol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 3,4-Dichlorocatechol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 3,4-Dichloroguaiacol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 3,6-Dichlorocatechol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 3-Methylcholanthrene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 3-Nitroaniline | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 3-Nilrotoluene | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 4,4'-DDD | €PA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| 4,4'-DDD | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 4,4'-DDE | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| 4,4'-DDE | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 4,4'-DDT | EPA 608 | Pesticides-Herbicides-PCBs | NELAP | 7/17/2003 |
| 4,4'-DDT | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 4,5,6-Trichloroguaiacol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 4,5-Dichlorocatechol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 4,5-Dichloroguaiacol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 4,6-Dichloroguaiacol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Amino-2,6-dinitrotoluene (4-am-dnt) | EPA S330 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Aminobiphenyl | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Bromophenyl phenyl ether | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Bromophenyl phenyl ether | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Chloro-3-methylphenol | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |

**'PHIS LISTING OF ACCREDITED ANALYTES SHOULD RE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE**

**State Laboratory ID: E87412** **EPA Lab Code: WA00035** ***(360)*577-7222**

**E87412**
**Columbia Analytical Services, Jnc. - WA**
**1317 South 13th Avenue**
**Kelso,** WA 98626

Matrix: **Non-Potable Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 4-Chloro-3-methylphenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Chloroaniline | EPA S270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Chlorocatechol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Chloroguaiacol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Chlorophenol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Chlorophenyl phenylether | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Chlorophenyl phenylether | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Chlorotoluene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 4-Dimethyl aminoazobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Methyl-2-pentanone(MIBK) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| 4-Methylphenol (p-Cresol) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Nitroaniline | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Nitrophenol | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Nitrophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Nitrotoluene | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 5,6-Dichlorovanillin | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 5-Chlorovanillin | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 5-Nitro-o-toluidine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 6-Chlorovanillin | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| 7,12-Dimethylbenz(a) anthracene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| a-a-Dimethylphenethylamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Acenaphthene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Acenaphthene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Acenaphthene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Acenaphthylene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Acenaphthylene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Acenaphthylene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Acetone | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Acetonitrile | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Acetophenone | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Acrolein (Propenal) | EPA 624 | Volatile Organics | NELAP | 7/17/2003 |
| Acrolein (Propenal) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Acrylonitrile | EPA 624 | Volatile Organics | NELAP | 7/17/2003 |
| Acrylonitrile | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Adsorbable organic halogens (AOX) | EPA 1650 | General Chemistry | NELAP | 10/8/2001 |
| Aldrin | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |

"STATE" indicates certification for the analyte by the method specified. **"NELAP"** further indicates certification compliant with the NELAC Standards.

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**State Laboratory ID:** E87412 EPA Lab Code: WA00035 **(360) 577-7222**

**E87412**
Columbia Analytical Services, fnc. - WA
1317 **South 13th Avenue**
**Kelso, WA 98626**

Matrix: **Non-Potable Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Aldrin | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7,1/2003 |
| Alkalinity as CaCO3 | EPA 310.1 | General Chemistry | NELAP | 10/8/2001 |
| Allyl chloride (3-Chloropmpene) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| alpha-BHC (alpha-Hexachlorocyclohexane) | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| alpha-BHC (alpha-Hexachlorocyclohexane) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aluminum | EPA 200 7 | Metals | NELAP | 10/8/2001 |
| Aluminum | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Aluminum | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Aluminum | EPA 6020 | Metals | NELAP | 711/2003 |
| Aluminum | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Amenable cyanide | EPA 335.1 | General Chemistry | NELAP | 10/8/2001 |
| Ammonia as N | EPA 350.1 | General Chemistry | NELAP | 10/8/2001 |
| Ammonia as N | EPA 350.3 | General Chemistry | NELAP | 10/8/2001 |
| Aniline | EPA 8270 | Extractable Organics | NELAP | 7112003 |
| Anthracene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Anthracene | EPA 8270 | Extractable Organics | NELAP | 711/2003 |
| Anthracene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Antimony | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Antimony | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Antimony | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Antimony | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Antimony | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Aramite | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Aroclor-1016 (PCB-1016) | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Aroclor-1016 (PCB-1016) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-1221 (PCB-1221) | EPA 608 | Pesticides-Herbicides-PCBs | NELAP | 7/17/2003 |
| Aroclor-I221 (PCB-1221) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-1232 (PCB-1232) | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Aroclor-1232 (PCB-I232) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-I242 (PCB-1242) | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7117/2003 |
| Aroclor-1242 (PCB-1242) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-1248 (PCB-1248) | €PA 608 | Pesticides-Herbicides-PCBs | NELAP | 7117/2003 |
| Aroclor-1248 (PCB-1248) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-1254 (PCB-1254) | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Aroclor-1254 (PCB-1254) | EPA 8082 | Pesticides-Herbicides-PCBs | NELAP | 7/1/2003 |
| Aroclor-1260 (PCB-1260) | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |

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**State Laboratory ID:** E87412 **EPA Lab Code:** WA00035 **(360) 577-7222**

**EX7312**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix:** **Pion-Potable Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Aroclor-1260 (PCB-1260) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Arsenic | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Arsenic | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Arsenic | EPA 200.9 | Metals | NELAP | 10/8/2001 |
| Arsenic | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Arsenic | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Arsenic | EPA 7060 | Metals | NELAP | 10/8/2001 |
| Arsenic | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Azinplios-methyl (Guthion) | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Barium | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Barium | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Barium | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Barium | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Barium | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Benzene | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Benzene | EPA 8021 | Volatile Organics | NELAP | 7/1/2003 |
| Benzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Renzidine | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(a)anthracene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(a)anthracene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(a)anthracene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(a)pyrene | EPA 625 | Extractable Organics | NELAY | 10/8/2001 |
| Benzo(a)pyrene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(a)pyrene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(b)fluoranthene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(b)fluoranthene | EPA 8270 | Extractable Organics | NELAI | 7/1/2003 |
| Benzo(b)fluoranthene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(g,h,i)perylene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(g,h,i)perylene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(g,h,i)perylene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(k)fluoranthene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(k)fluoranthene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(k)fluoranthene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Benzoic acid | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzyl alcohol | EYA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Beryllium | EPA 200.7 | Metals | NELAP | 10/8/2001 |

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**State Laboratory ID:** E87412 **EPA Lab** Code: WA00035 (360) 577-7222

E87412
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso,** W.4 98626

Matrix: **Non-Potable** Water

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Beryllium | EP.4 200.8 | Metals | NELAP | 10/8/2001 |
| Beryllium | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Beryllium | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Beryllium | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| beta-BHC (beta-Hexachlorocyclohexme) | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| beta-BHC (beta-Hexachlorocyclohexane) | EPA 808I | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| beta-Naphthylamine | EPA 8270 | Extractable Organics | NELAP | 7/3/2003 |
| Biochemical oxygen demand | EPA 405.1 | General Chemistry | NELAP | 10/8/2001 |
| bis(2-Chloroethoxy)methane | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| bis(2-Chloroethoxy)methane | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| bis(2-Chloroethyl) ether | EPA 625 | Extractable Organics | WELAP | 10/8/2001 |
| bis(2-Chloroethyl) ether | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| bis(2-Chloroisopropyl) ether | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| bis(2-Chloroisopropyl) ether | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| bis(2-Ethylhexyl) phthalate (DEHP) | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| bis(2-Ethylhexyl) phthalate (DEHP) | EPA S270 | Extractable Organics | NELAP | 7/1/2003 |
| Bolstar (Sulprofos) | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Boron | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Bromide | EPA 300.0 | General Chemistry | NELAP | 10/8/2001 |
| Bromobenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Bromochloromethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Bromodichloromethane | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Bromodichloromethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Bromoform | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Bromoform | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Butyl benzyl phthalate | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Butyl benzyl phthalate | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Cadmium | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Cadmium | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Cadmium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Cadmium | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Cadmium | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Calcium | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Calcium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Calcium | lLMW.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Carbazole | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |

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E87412
Columbia Analytical **Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, W A 98626**

**Matrix:** **Non-Potable Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Carbon disulfide | EPA 8260 | Volatile Organics | NELAP | 7/1/2002 |
| Carbon tetrachloride | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Carbon tetrachloride | EPA 8260 | Volatile Organic3 | NELAP | 7/1/2003 |
| Chemical oxygen demand | EPA 410.1 | General Chemistry | NELAP | 10/8/2001 |
| Chlordane (tech.) | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/1772003 |
| Chlordane (tech.) | EPA 8081 | Pesticides-Herbicides-PCBs | NELAP | 7/1/2003 |
| Chloride | EPA 300.0 | General Chemistry | NELAP | 10/8/2001 |
| Chloride | EPA 325.3 | General Chemistry | NELAP | 10/8/2001 |
| Chlorobenzene | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Chlorobenzene | EPA R260 | Volatile Organics | NELAP | 711/2003 |
| Chlorobenzilate | EPA 8270 | Pesticides-Herbicides-PCBs | NELAP | 7/1/2003 |
| Chloroethane | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Chloroethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Chloroform | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Chlorofonn | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Chloroprene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Chlorpyrifos | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Chromium | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Chromium | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Chromium | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Chromium | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Chromium | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Chromium VI | EPA 7195 | Metals | NELAP | 7/1/2003 |
| Chromium VI | EPA 7196 | General Chemistry | NELAP | 7/1/2003 |
| Chrysene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Chrysene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Chrysene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| cis-1,2-Dichloroethylene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| cis-1,3-Dichloropropene | €PA 624 | Volatile Organics | NELAP | 10/8/2001 |
| cis-1,3-Dichloropropene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| cis-1,4-Dichloro-2-butene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Cobalt | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Cobalt | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Cobalt | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Cobalt | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Cobalt | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |

**THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE**

State Laboratory ID: E87412 EPA Lab Code: WA00035 (360) 577-7222

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

Matrix: Non-Potable Water

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Color | EPA 110.2 | General Chemistry | NELAP | 10/8/2001 |
| Conductivity | EPA 120.1 | General Chemistry | NELAP | 10/8/2001 |
| Copper | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Copper | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Copper | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Copprr | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Copper | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Corrosivity (pH) | EPA 9040 | General Chemistry | NELAP | 7/1/2003 |
| Coumaphos | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Dacthal (DCPA) | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Dalapon | EPA 8151 | Pesticides-HerbicidePCB's | NELAP | 7/1/2003 |
| delta-BHC | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| delta-BHC | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Demeton-o | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Diallate | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Diazinon | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Dibenz(a,h) anthracene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Dibenz(a,h) anthracene | EPA 8270 | ExtractableOrganics | NELAP | 7/1/2003 |
| Dibenz(a,h) anthracene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Dibenzofuran | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Dibromochloromethane | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Dibromochlorornethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Dibromomethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Dicamba | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Dichlorodifluoromethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Dichloroprop (Dichlorprop) | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Dichlorovos (DDVP, Dichlorvos) | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Dieldrin | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Dieldrin | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Diesel range organics (DRO) | CA-LUFT | Extractable Organics | NELAP | 7/1/2003 |
| Diesel range organics (DRO) | EPA 8015 | Extractable Organics | NELAP | 7/28/2003 |
| Diesel range organics (DRO) | NWTPH-Dx | Extractable Organics | NELAP | 7/1/2003 |
| Diethyl phthalate | EPA 625 | ExtractableOrganics | NELAP | 10/8/2001 |
| Diethyl phthalate | EPA 8270 | ExtractableOrganics | NELAP | 7/1/2003 |
| Dimethoate | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Dimethyl phthalate | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |

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**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

Matrix: Non-Potable Water

| Analyte | Method/Tech | Category | Certificatiun Type | Effective Date |
|---|---|---|---|---|
| Dimethyl phthalate | EPA 8270 | Extractable Organics | NELAP | 7il/2003 |
| Di-n-butyl phthalate | EPA 625 | Extractable Organics | NLLAP | 10/8/2001 |
| Di-n-butyl phthalate | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Di-n-octyl phthalate | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Di-n-octyl phthalate | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP) | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Diphenylamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Disulfoton | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Disulfoton | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Endosulfan I | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Endosulfan I | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Endosulfan II | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Endosulfan II | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Endosulfan sulfate | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Endosulfan sulfate | EPA 8081 | Pesticides-Herbicides-PCBs | NELAP | 7/1/2003 |
| Endrin | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Endrin | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Endrin aldehyde | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Endrin aldehyde | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Ethanol | EPA 8015 | Volatile Organics | NELAP | 7/1/2003 |
| Ethoprop | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Ethyl methacrylate | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Ethyl methanesulfonate | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Ethylbenzene | EPA 624 | Volatile Organics | NELAD | 10/8/2001 |
| Ethylbenzene | EPA 8021 | Volatile Organics | NELAP | 7/1/2003 |
| Ethylbenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Ethylene glycol | EPA 8015 | Volatile Organics | NELAP | 7/1/2003 |
| Famphur | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Fecal colifonus | SM 9221 E | Microbiology | NELAP | 10/8/2001 |
| Fensulfothion | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Fenthion | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Fluoranthene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Fluoranthene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Fluoranthene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Fluorene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Fluorene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |

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## *Laboratory Scope of Accreditation*



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**State Laboratory ID: E87412** **EPA Lab Code: WA00035** **(360) 577-7222**

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso. WA *98626***

**Matrix: Non-Potable Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Fluorene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Fluoride | EPA 300.0 | General Chemistry | NELAP | 10/8/2001 |
| Fluoride | EPA 340.2 | General Chemistry | NELAP | 10/8/2001 |
| Formaldehyde | EPA 8315 | Extractable Organics | NELAP | 7/1/2003 |
| gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Gasoline range organics (GRO) | CA-LUFT | Extractable Organics | NELAP | 7/1/2003 |
| Gasoline range organics (GRO) | EPA 8015 | Volatile Organics | NELAP | 7/17/2003 |
| Gasoline range organics (GRO) | NWTPH-Gx | Extractable Organics | NELAP | 7/1/2003 |
| Hardness | EPA 130.2 | General Chemistry | NELAP | 10/8/2001 |
| Heptachlor | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Heptachlor | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Heptachlor epoxide | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Heptachlor epoxide | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Hexachlorobenzene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Hexachlorobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Hexachlorobutadiene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Hexachlorobutadiene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Hexachlorobutadiene | EPA 8270 | Extractable Organics | NELAP | 7/112003 |
| Hexachlorocyclopentadiene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Hexachlorocyclopentadiene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Hexachloroethane | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Hexachloroethane | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Hexachlorophene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Hexachloropropene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Ignitability | EPA 1020 | General Chemistry | NELAP | 7/1/2003 |
| Indeno(1,2,3-cd)pyrene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Indeno(1,2,3-cd)pyrene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Indeno(1,2,3-cd)pyrene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Iodomethane (Methyl iodide) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Iron | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Iron | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Iron | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Isobutyl alcohol (2-Methyl-1-propanol) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Isodrin | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Isophorone | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |

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State **Laboratory** ID: EX7112 **EPA Lab Code:** **WA00035** **(360) 577-7232**

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso. WA 98626**

**Matrix: Son-Potable Water**

| Analyte | Method/Tech | Category | Cei-tificrtion Type | Effective Date |
|---|---|---|---|---|
| Isophorone | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Isopropyl alcohol (2-Propanol) | EPA 8015 | Volatile Organics | NELAP | 71112003 |
| Isopropylbenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Isosafrole | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Kepone | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Kjeldahl nitrogen - total | EPA 351.4 | General Chemistry | NELAP | 10/8/2001 |
| Lead | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Lead | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Lead | EPA 200.9 | Metals | NELAP | 10/8/2001 |
| Lead | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Lead | EPA 6020 | Metals | NELAP | 7/112003 |
| Lead | EPA 7421 | Metals | NELAP | 10/8/2001 |
| Lead | ILMO4.I-Exhibit D | Metals | NELAD | 7/1/2003 |
| Magnesium | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Magnesium | EPA 6010 | Metals | NELAP | 7/ V2003 |
| Magnesium | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Malathion | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Manganese | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Manganese | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Manganese | EPA 6010 | Metals | NELAP | 711/2003 |
| Manganese | EPA 6020 | Metals | NELAP | 711/2003 |
| Manganese | ILMO4.I-Exhibit D | Metals | NELAP | 7/1/2003 |
| MCPA | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 71112003 |
| MCPP | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Mercury | EPA 1631 | Metals | NELAP | 10/8/2001 |
| Mercury | EPA 245.1 | Metals | NELAP | 10/8/2001 |
| Mercury | EPA 7470 | Metals | NELAP | 10/8/2001 |
| Mercury | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Merphos | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Methacrylonitrile | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Methanol | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Methanol | NCASI 94.03 | Volatile Organics | NELAP | 10/8/2001 |
| Methanol | NCASI 99.01 | Volatile Organics | NELAP | 10/8/2001 |
| Methapyrilene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Methoxychlor | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Methyl bromide(Bromomethane) | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |

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State Laboratory ID: E87412 EPA Lab Code: WA00035 (360) 577-7222

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

**Matrix: Non-Potable Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Methyl bromide (Bromomethane) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Methyl chloride (Chloromethane) | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Methyl chloride (Chloromethane) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Methyl methacrylate | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Methyl parathion (Parathion, methyl) | EPA 8141 | Pesticides-Herbicides-PCBs | NELAP | 7/1/2003 |
| Methyl parathion (Parathion, methyl) | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Methyl tert-butyl ether (MTBE) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Methylene chloride | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Methylene chloride | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Mevinphos | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Molybdenum | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Molybdenum | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Molybdenum | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Molybdenum | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Naled | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Naphthalene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Naphthalene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Naphthalene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Naphthalene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| n-Butyl alcohol | EPA SOI5 | Volatile Organics | NELAP | 7/1/2003 |
| n-Butylbenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Nickel | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Nickel | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Nickel | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Nickel | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Nickel | ILMW.l-Exhibit D | Metals | NELAP | 7/1/2003 |
| Nitrate as N | EPA 300.0 | General Chemistry | NELAP | 10/8/2001 |
| Nitrate as N | EPA 353.2 | General Chemistry | NELAP | 7/17/2003 |
| Nitrate-nitrite | EPA 353.2 | General Chemistry | NELAP | 10/8/2001 |
| Nitrite as N | EPA 300.0 | General Chemistry | NELAP | 10/8/2001 |
| Nitrite as N | EPA 353.2 | General Chemistry | NELAP | 7/17/2003 |
| Nitrobenzene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Nitrobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Nitrobenzene | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| Nitroquinoline-1-oxide | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| n-Nitrosodiethylamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |

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E87412
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA** 98626

Matrix: Non-Potable Water

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| n-Nitrosodimethylamine | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosodimethylamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| n-Nitroso-di-n-butylamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| n-Nitrosodi-n-propylamine | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosod'i-n-propylamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| n-Nitrosodiphenylamine | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosodiphenylamine | EPA 8270 | Estractable Organics | NELAP | 7/1/2003 |
| n-Nitrosomethylethylamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| n-Nitrosomorpholine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| n-Nitrosopiperidine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| n-Nitrosopyrrolidine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| n-Propanol | EPA 8015 | Volatile Organics | NELAP | 7/1/2003 |
| n-Propylbenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| Oil & Grease | EPA 1664 | General Chemistry | NELAP | 10/8/2001 |
| Orthophosyhate as P | EPA 300.0 | General Chemistry | NELAP | 10/8/2001 |
| Orthophosphate as P | EPA 365.3 | General Chemistry | NELAP | 10/8/2001 |
| o-Toluidine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Parathion, ethyl | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Parathion, ethyl | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Pentachloronitrobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Pentachlorophenol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| Pentachlorophenol | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Pentachlorophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| pH | EPA 150.1 | General Chemistry | NELAP | 10/8/2001 |
| pH | EPA 9040 | General Chemistry | NELAP | 7/1/2003 |
| Phenacetin | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Phenanthrene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Phenanthrene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Phenanthrene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Phenol | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Phenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Phorate | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Phorate | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Phosphorus, total | EPA 365.3 | General Chemistry | NELAP | 10/8/2001 |
| p-Isopropyltoluene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |

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**State Laboratory ID:** E87412 **EPA Lab Code:** WA00035 *(360)* 577-7222

**E87412**
**Columbia Analytical Services. Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

Matrix: **Non-Potable Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Potassium | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Potassium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Potassium | ILM04 1-Exhibit D | Metals | NELAP | 7/1/2063 |
| Pronarnide (Kerb) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Propionifrile (Ethyl cyanide) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Pyrene | EPA 625 | Extractable Organics | NELAP | 10/8/2001 |
| Pyrene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Pyrene | EPA 8310 | Extractable Organics | NELAP | 7/1/2003 |
| Pyridine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| Reactive cyanide | Sec. 7 3 SW-846 | General Chemistry | NELAP | 7/1/2003 |
| Reactive sulfide | Sec. 7.3 SW-846 | General Chemistry | NELAP | 7/1/2003 |
| Residual free chlorine | EPA 330.4 | General Chemistry | NELAP | 10/8/2001 |
| Residue-filterable (TDS) | EPA 160 1 | General Chemistry | NELAP | 10/8/2001 |
| Residue-nonfilterable (TSS) | EPA 1602 | General Chemistry | NELAP | 10/8/2001 |
| Residue-settleable | EPA 160.5 | General Chemistry | NELAP | 10/8/2001 |
| Residue-total | EPA 160.3 | General Chemistry | NELAP | 10/8/2001 |
| Residue-volatile | EPA 160.4 | General Chemistry | NELAP | 10/8/2001 |
| Ronnel | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Safrole | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| sec-Butylbenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Selenium | EPA 200 7 | Metals | NELAP | 10/8/2001 |
| Selenium | EPA 200 8 | Metals | NELAP | 10/8/2001 |
| Selenium | EPA 200 9 | Metals | NELAP | 10/8/2001 |
| Selenium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Selenium | EPA 7740 | Metals | NELAP | 10/8/2001 |
| Selenium | EPA 7742 | Metals | NELAP | 7/17/2003 |
| Selenium | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Silver | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Silver | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Silver | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Silver | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Silver | ILM04 I-Exhibit D | Metals | NELAP | 7/1/2003 |
| Silvex (2,4,5-TP) | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Sodium | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Sodium | EPA 6010 | Metals | NELAP | 7/1/2003 |

"STATE" indicates certification for the analyte by the method specified. "NELAP" further indicates certification compliant with the NELAC Standards.

**THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE**

**State Laboratory ID: E87412** **EPA Lab Code: WA00035** **(360) 577-7222**

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix: Non-Potable Water**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Sodium | ILhlM.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Stirofos | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Styrene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Sulfate | EPA 300 0 | General Chemistry | NELAP | 10/8/2001 |
| Sulfide | EPA 376.1 | General Chemistry | NELAP | 10/8/2001 |
| tert-Butyl alcohol | EPA 8015 | Volatile Organics | NELAP | 7/1/2003 |
| tert-Butylbenzene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Tetrachlorocatechol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| Tetrachloroethylene (Perchloroethylene) | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Tetrachloroethylene (Perchloroethylene) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Tetrachloroguaiacol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| Tetryl (methyl-2,4,6-trinitrophenylnitramine) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| Thallium | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Thallium | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Thallium | EPA 200.9 | Metals | NELAP | 10/8/2001 |
| Thallium | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Thallium | EPA 7841 | Metals | NELAP | 7/112003 |
| Thallium | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Thionazin (Zinophos) | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Tin | EPA 200.7 | Metals | NELAP | 7/17/2003 |
| Titanium | EPA 200.7 | Metals | NELAP | 7/17/2003 |
| Tokuthion (Prothioplms) | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Toluene | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Toluene | EPA 8021 | Volatile Organics | NELAP | 7/1/2003 |
| Toluene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Total coliforms | SM 9221 B | Microbiology | NELAP | 10/8/200 1 |
| Total cyanide | EPA 335.4 | General Chemistry | NELAP | 7/17/2003 |
| Total cyanide | EPA 9010 | General Chemistry | NELAP | 7/112003 |
| Total cyanide. | ILM04.1-Exhibit D | General Chemistry | NELAP | 7/1/2003 |
| Total hardness as CaCO3 | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Total organic carbon | EPA415.1 | General Chemistry | NELAP | 10/8/2001 |
| Total organic carbon | EPA 9060 | General Chemistry | NELAP | 7/1/2003 |
| Total organic halides (TOX) | EPA 9020 | General Chemistry | NELAP | 7/1/2003 |
| Total Petroleum Hydrocarbons (TPH) | EPA 1664 | General Chemistry | NELAP | 10/8/2001 |
| Total Petroleum Hydrocarbons (TPH) | EPA 8015 | Extractable Organics | NELAP | 7/1/2003 |
| Total Petroleum Hydrocarbons (TPH) | NWTPH-HCID | Extractable Organics | NELAP | 7/1/2003 |

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**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix:** Non-Potable Water

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Total phenolics | EPA 420.1 | General Chmnstry | NELAP | 10/8/2001 |
| Toxaphene (Chlorinated camphene) | EPA 608 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Toxaphene (Chlorinated camphene) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| trans-1,2-Dichloroethylene | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| trans-1,2-Dichloroethylene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| trans-1,3-Dichloropropylene | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| trans-1,3-Dichloropropylene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| trans-1,4-Dichloro-2-butene | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Trichloroethene (Trichloroethylene) | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Trichloroethene(Trichloroethylene) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Trichlorofluoromethane | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Trichlorofluoromethane | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Trichloronate | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Trichlorosyringol | EPA 1653 | Extractable Organics | NELAP | 10/8/2001 |
| Turbidity | EPA 180.1 | General Chemistry | NELAP | 10/8/2001 |
| Uranium | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Vanadium | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Vanadium | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Vanadium | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Vanadium | ILh404.1-Exhibit D | Metals | NELAP | 7/1/2003 |
| Vinyl acetate | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Vinyl chloride | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Vinyl chloride | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Xylene (total) | EPA 624 | Volatile Organics | NELAP | 10/8/2001 |
| Xylene (total) | EPA 8021 | Volatile Organics | NELAP | 7/1/2003 |
| Xylene (total) | EPA 8260 | Volatile Organics | NELAP | 7/1/2003 |
| Zinc | EPA 200.7 | Metals | NELAP | 10/8/2001 |
| Zinc | EPA 200.8 | Metals | NELAP | 10/8/2001 |
| Zinc | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Zinc | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Zinc | ILM04.1-Exhibit D | Metals | NELAP | 7/1/2003 |

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**State Laboratory ID:** E87412 **EPA Lab Code:** WA00035 *(360)* 577-7222.

**E87412**
**Columbia Analytical Services. Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix: Solid and Chemical Materials**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 1,1,2-Tetrachloroethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,1,1-Trichloroethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,1,2,2-Tetrachloroethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,1,2-Trichloroethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,1-Dichloroethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,1-Dichloroethylene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,1-Dichloropropene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2,3-Trichlorobenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2,3-Trichloropropane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2,4,5-Tetrachlorobenzene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 1,2,4-Trichlorobenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2,4-Trichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 1,2,4-Trimethylbenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2-Dibromo-3-chloropropane (DBCP) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2-Dibromoethane (EDB, Ethylene dibromide) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2-Dichlorobenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2-Dichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 1,2-Dichloroethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2-Dichloropropane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,2-Diphenylhydrazine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 1,3,5-Trimethylbenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8270 | Extractable Organics | NELAP | 7/17/2003 |
| 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| 1,3-Dichlorobenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,3-Dichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 1,3-Dichloropropane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,3-Dinitrobenzene (1,3-DNB) | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 1,3-Dinitrobenzene (1,3-DNB) | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| 1,4-Dichlorobenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 1,4-Dichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 1,4-Naphthoquinone | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 1,4-Phenylenediamine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 1-Chlorohexane | EPA 8260 | Volatile Organics | NELAP | 7/17/2003 |
| 1-Chloronaphthalene | EPA 8270 | Extractable Organics | NELAP | 7/17/2003 |
| 1-Naphthylamine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 209 | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |

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**THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE**

**State Laboratory ID:** E87412 EPA Lab Code: WA00035 (360) 577-7222

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix: Solid and Chemical Materials**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',3,4,5'-Pentachlorobiphenyl (BZ 87) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',3,5'-Tetrachlorobiphenyl (BZ 44) | EPA 8082 | Pesticides-Herbicides-PCBs | NELAP | 10/8/2001 |
| 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',4,5,5'-Pentachlorobiphenyl (BZ 101) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',5,5'-Tetrachlorobiphenyl (BZ 52) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2',5-Trichlorobiphenyl (BZ 18) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,2-Dichloropropane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 2,3,3',4',6-Pentachlorobiphenyl (BZ 110) | EPA 8082 | Pesticides-Herbicides-PCBs | NELAP | 10/8/2001 |
| 2,3',4,4'-Tetrachlorobiphenyl (BZ 66) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,3,4,6-Tetrachlorophenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2,3-Dichlorobiphenyl (BZ 5) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,4,5-T | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,4',5-Trichlorobiphenyl (BZ 31) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,4,5-Trichlorophenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4,6-Trichlorophenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4,6-Trinitrotoluene (2,4,6-TNT) | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4-D | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,4-DB | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2,4-Dichlorophenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4-Dimethylphenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4-Dinitrophenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4-Dinitrotoluene (2,4-DNT) | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2,4-Dinitrotoluene (2,4-DNT) | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| 2,6-Dichlorophenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2,6-Dinitrotoluene (2,6-DNT) | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2,6-Dinitrotoluene (2,6-DNT) | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Awty laminofluorene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Amino-4,6-dinitrotoluene (2-am-dnt) | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Butinlone (Methyl ethyl ketone, MEK) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |

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State Laboratory ID: E87412 EPA Lab Code: WA00035 (360) 577-7222

**E87412**
**Columbia Analytical Services, Jnc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

Matrix: Solid **and Chemical Materials**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 2-Chlorobiphenyl (BZ 1) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 2-Chloroethyl vinyl ether | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 2-Chloronaphthalene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Chlornphenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Chlorotoluene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 2-Hexanone | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 2-Methyl-4,6-dinitrophenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Methylnaphthalene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Methylphenol (o-Cresol) | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Nitroaniline | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Nitrophenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Nitropropane | EPA 8260 | Volatile Organics | NELAP | 7/17/2003 |
| 2-Nitrotoluene | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Picoline (2-Methylpyridine) | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 2-Sec-butyl-4,6-dinitrophenol (DNBP, Dinoseb) | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 3,3'-Dichlorobenzidine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 3,3'-Dimethylbenzidine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 3-Methylcholanthrene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 3-Methylphenol (m-Cresol) | EPA 8270 | Extractable Organics | NELAP | 7/17/2003 |
| 3-Nitroaniline | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 3-Nitrotoluene | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| 4,4'-DDD | EPA 8081 | Pesticides-Herbicides-PCBs | NELAP | 10/8/2001 |
| 4,4'-DDE | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 4,4'-DDT | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| 4-Amino-2,6-dinitrotoluene (4-am-dnt) | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Aminobiphenyl | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Bromophenylphenyl ether | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Chloro-3-methylphenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Chloroaniline | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Chlorophenyl phenylether | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Chlorotoluene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 4-Dimethyl aminoazobenzene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 4-M'ethyl-2-pentanone(MIBK) | €PA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| 4-Methylphenol (p-Cresol) | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Nitroaniline | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 4-Nitrophenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |

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Stare Laboratory ID: **E87412** **EPA Lab Code:** **WA00035** ***(360)*** **577-7222**

**E87412**
**Columbia Analytical Services. Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix:** **Solid and Chemical Materials**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 4-Nitrotoluene | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| 5-Nitro-o-toluidine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| 7,12-Dimethylbenz(a) anthracene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| a-a-Dimethylphenethylamine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Acenaphthene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Acenaphthene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Acenaphthylene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Acenaphthylene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Acetone | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Acetonitrile | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Acetophenone | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Acrolein (Propenal) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Acrylonitrile | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Aldrin | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Allyl chloride (3-Chloropropene) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| alpha-BHC (alpha-Hexachlorocyclohexane) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| alpha-Chlordane | EPA 8081 | Pesticides-Herbicides-PCBs | NELAP | 7/17/2003 |
| Aluminum | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Aluminum | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Aluminum | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Aniline | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Anthracene | EPA S270 | Extractable Organics | NELAP | 10/8/2001 |
| Anthracene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Antimony | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Antimony | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Antimony | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Aramite | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Aroclor-1016 (PCB-1016) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Aroclor-1221 (PCR-1221) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Aroclor-1232 (PCB-1232) | EPA 8082 | Pesticides-Herbicides-PCBs | NELAP | 10/8/2001 |
| Aroclor-1242 (PCB-1242) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Aroclor-1248 (PCB-1248) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Aroclor-1254 (PCB-1254) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Aroclor-1260 (PCB-1260) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Arsenic | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Arsenic | EPA 6020 | Metals | NELAP | 10/8/2001 |

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**THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE**

Staic Laboratory ID: E87412 EPA Lab Code: WA00035 *(360)*577-7222

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1315 South 13th Avenue**
**Kelso, WA 98626**

**Matrix: Solid and Chemical Materials**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Arsenic | EPA 7060 | Metals | NELAP | 10/8/2001 |
| Arsenic | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Azinphm-methyl (Guthion) | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Barium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Barium | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Barium | ILMO4.1-ExhibitD | Metals | NELAP | 10/8/2001 |
| Benzene | EPA 8021 | Volatile Organics | NELAP | 10/8/2001 |
| Benzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Benzo(a)anthracene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(a)anthracene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(a)pyrene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(a)pyrene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(b)fluoranthene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(b)fluoranthene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(g,h,i)perylene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(g,h,i)perylene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(k)fluoranthene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Benzo(k)fluoranthene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Benzoic acid | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Benzyl alcohol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Beryllium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Beryllium | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Beryllium | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| beta-BHC (beta-Hexachlorocyclohexane) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| beta-Naphthylamine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| bis(2-Chloroethoxy)methane | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| bis(2-Chloroethyl) ether | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| bis(2-Chloroisopropyl) ether | EPA 8270 | Extractable Organics | NEWP | 10/8/2001 |
| bis(2-Ethylhexyl) phthalate (DEHP) | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Bolstar (Sulprofos) | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Bromobenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Bromochloromethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Bromodichloromethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Bromoform | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Butyl benzyl phthalate | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Cadmium | EPA 6010 | Metals | NELAP | 10/8/2001 |

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**State** Laboratory ID: E87412 EPA **Lab Code:** W **400035** **(360) 577-7222**

**E87412**
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

Matrix: **Solid** and Chemical **Materials**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Cadmium | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Cadmium | ILM04 1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Calcium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Calcium | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Carbazole | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Carbon disulfide | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Carbon tetrachloride | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Chlordane (tech.) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAI' | 10/8/2001 |
| Chloride | EPA 90.56 | General Chemistry | NELAP | 7/17/2003 |
| Chlorobenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Chlorobenzilate | EPA S270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Chloroethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Chloroform | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Chloroprene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Chlorpyrifos | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Chromium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Chromium | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Chromium | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Chromium VI | EPA 7195 | Metals | NELAP | 10/8/2001 |
| Chromium VI | EPA 7196 | General Chemistry | NELAP | 10/8/2001 |
| Chrysene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Chrysene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| cis-1,2-Dichloroethylene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| cis-1,3-Dichloropropene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| cis-1,4-Dichloro-2-butene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Cobalt | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Cobalt | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Cobalt | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Copper | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Copper | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Copper | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Corrosivity (pH) | EPA 1110 | General Chemistry | NELAP | 10/8/2001 |
| Corrosivity (pH) | EPA 9040 | General Chemistry | NELAP | 10/8/2001 |
| Coumaphos | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Dacthal (DCPA) | EPA 8151 | Pesticides-Herbicide-PCB's | NELAP | 7/17/2003 |
| Dalapon | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |

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State Laboratory ID: E87412 EPA Lab Code: WA00035 (360) 577-7222

E87412
Columbia Analytical Services, Inc. - WA
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Kelso, WA 98626

Matrix: Solid and Chemical Materials

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| delta-BHC | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Demeton-o | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Demeton-s | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Diallate | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Diazinon | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Dibenz(a,h) anthracene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Dibenz(a,h) anthracene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Dibenzofuran | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Dibromochloromethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Dibromomethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Dicamba | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Dichlorodifluoromethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Dichloroprop (Dichlorprop) | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Dichlorovos (DDVP, Dichlorvos) | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Dieldrin | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Diesel range organics (DRO) | CA-LUFT | Extractable Organics | NELAP | 10/8/2001 |
| Diesel range organics (DRO) | EPA 8015 | Extractable Organics | NELAP | 7/17/2003 |
| Diesel range organics (DRO) | NWTPH-Dx | Extractable Organics | NELAP | 10/8/2001 |
| Diethyl ether | EPA 8260 | Volatile Organics | NELAP | 7/17/2003 |
| Diethyl phthalate | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Dimethoate | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Dimethoate | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Dimethyl phthalate | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Di-n-butyl phthalate | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Di-n-octyl phthalate | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP) | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Diphenylamine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Disulfoton | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Disulfoton | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Endosulfan I | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Endosulfan II | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Endosulfan sulfate | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Endrin | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Endrin aldehyde | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| EPN | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Ethoprop | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |

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**State Laboratory ID:** E87412 **EPA Lab Code:** WA00035 (360) 577-7222

E87412
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso,** WA 98626

**Matrix:** Solid and Chemical **Materials**

| Analyte | Method/Tech | Category | Cerfification Type | Effective Date |
|---|---|---|---|---|
| Ethyl acetate | EPA 8260 | Volatile Organics | NELAP | 7/17/2003 |
| Ethyl methacrylate | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Ethyl methanesulfonate | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Ethylbenzene | EPA 8021 | Volatile Organics | NELAP | 10/8/2001 |
| Ethylbenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Ethylene glycol | EPA 8015 | Volatile Organics | NELAP | 10/8/2001 |
| Farnphur | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Fensulfothion | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Fenthion | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Fluoranthene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Fluoranthene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Fluorene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Fluorene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Fluoride | EPA 9056 | General Chemistry | NELAP | 7/17/2003 |
| Formaldehyde | EPA 8315 | Extractable Organics | NELAP | 10/8/2001 |
| gamma-BHC (Lindane, gamma-Hcsachlorocyclohexane) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| gamma-Chlordane | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Gasoline range organics (GRO) | CA-LUFT | Extractable Organics | NELAP | 10/8/2001 |
| Gasoline range organics (GRO) | EPA 8015 | Extractable Organics | NELAP | 7/17/2003 |
| Gasoline range organics (GRO) | NWTPH-Gx | Extractable Organics | NELAP | 10/8/2001 |
| Heptachlor | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Heptachlor epoxide | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Hexachlorobenzene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Hexachlorobutadiene | EPA 8260 | Volatile Organics | NFLAP | 10/8/2001 |
| Hexachlorobutadiene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Hexachlorocyclopentadiene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Hexachloroethane | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Hexachlorophene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Hexachloropropene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Ignitability | EPA 1020 | General Chemistry | NELAP | 10/8/2001 |
| Indeno(1,2,3-cd)pyrene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Indeno(1,2,3-cd)pyrene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Iodomethane (Methyl iodide) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Iron | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Iron | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Isobutyl alcohol (2-Methyl-1-propanol) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |

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Kelso, WA 98626

Matrix: Solid and Chemical Materials

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Isodrin | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Isophorone | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Isopropylbenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Isosafrole | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Kepone | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Lead | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Lead | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Lead | EPA 7421 | Metals | NELAP | 10/8/2001 |
| Lead | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Magnesium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Magnesium | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Malathion | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Manganese | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Manganese | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Manganese | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| MCPA | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| MCPP | EPA 8151 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Mercury | EPA 7470 | Metals | NELAP | 10/8/2001 |
| Mercury | EPA 7471 | Metals | NELAP | 10/8/2001 |
| Mercury | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Merphos | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Methacrylonitrile | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Methanol | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Methapyrilene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Methoxychlor | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Methyl bromide (Bromomethane) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Methyl chloride (Chloromethane) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Methyl methacrylate | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Methyl methanesulfonate | EPA 8270 | Extractable Organics | NELAP | 7/17/2003 |
| Methyl parathion (Parathion, methyl) | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Methyl parathion (Parathion, methyl) | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Methyl tert-butyl ether (MTBE) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Methylene chloride | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Mevinphos | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Molybdenum | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Molybdenum | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |

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Matrix: Solid and Chemical **Materials**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Naled | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Naphthalene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Naphlhakne | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Naphthalene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| n-Butylbenzene | EP.4 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Nickel | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Nickel | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Nickel | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Nitrate | EPA 9056 | General Chemistry | NELAP | 7/17/2003 |
| Nitrite | EPA 9056 | General Chemistry | NELAP | 7/17/2005 |
| Nitrobenzene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Nitrobenzene | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| Nitroglycerin | EPA 8332 | Extractable Organics | NELAP | 7/17/2003 |
| Nitroquinoline-1-oxide | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosodiethylamine | EPA S270 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosodimethylamine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitroso-di-n-butylamine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosodi-n-propylamine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosodiphenylamine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosomethylethylamine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosomorpholine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosopiperidine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| n-Nitrosopyrrolidine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| n-Propylbenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| o,o,o-Triethyl phosphorothioate | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |
| Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| Oil & Grease | EPA 1664 | General Chemistry | NELAP | 10/8/2001 |
| Oil & Grease | EPA 9071 | General Chemistry | NELAP | 10/8/2001 |
| o-Toluidine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Parathion, ethyl | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Parathion, ethyl | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| p-Dioxane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Pentachlorobenzene | EPA 8270 | Extractable Organics | NELAP | 7/17/2003 |
| Pentachloronitrobenzene | EPA S270 | Extractable Organics | NELAP | 10/8/2001 |
| Pentachlorophenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| pH | EPA 9040 | General Chemistry | NELAP | 10/8/2001 |

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**Matrix: Solid and Chemical Materials**

| Analyte | Method/Tech | Category | certification Type | Effective Date |
|---|---|---|---|---|
| pH | EPA 9045 | General Chemistry | NELAP | 7/17/2003 |
| Phenacetm | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Phenanthrene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Phenanthrene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Phenol | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Phorate | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Phorate | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| p-Isopropyltoluene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Potassium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Potassium | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Yronamide (Kerb) | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Propionitrile (Ethyl cyanide) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Pyrene | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| Pyrene | EPA 8310 | Extractable Organics | NELAP | 10/8/2001 |
| Pyridine | EPA 8270 | Extractable Organics | NELAP | 10/8/2001 |
| RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| Reactive cyanide | Sec. 7.3sw-846 | General Chemistry | NELAP | 10/8/2001 |
| Reactive sulfide | Sec. 7.3 SW-846 | General Chemistry | NELAP | 10/8/2001 |
| Ronnel | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Safrole | EPA 8170 | Extractable Organics | NELAP | 10/8/2001 |
| sec-Butylbenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Selenium | EPA 6010 | Metals | NELAP | 7/17/2003 |
| Selenium | EPA 7740 | Metals | NELAP | 10/8/2001 |
| Selenium | EPA 7742 | Metals | NELAP | 7/17/2003 |
| Selenium | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Silver | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Silver | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Silver | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Silvex (2,4,5-TP) | EPA 8151 | Pesticides-Herbicides-PCBs | NELAP | 10/8/2001 |
| Sodium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Sodium | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Stirofos | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Styrene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Sulfate | EPA 9056 | General Chemistry | NELAP | 7/17/2003 |
| Sulfide | EPA 9030/9034 | General Chemistry | NELAP | 7/17/2003 |
| Sulfotepp | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 7/17/2003 |

**THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE**

State Laboratory ID: E87412 EPA Lab Code: WA00035 (360) 577-7222

E87412
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA** 98626

Matrix: Solid and Chemical **Materials**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Synthetic Precipitation Leaching Procedure | EPA 1312 | General Chemistry | NELAP | 7/17/2003 |
| tert-Butyl alcohol | EPA 8260 | Volatile Organics | NELAP | 7/17/2003 |
| tert-Dutylbenzene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Tetrachloroethylene (Perchloroethylene) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Tetryl (methyl-2,4,6-trinitrophenylnitramine) | EPA 8330 | Extractable Organics | NELAP | 10/8/2001 |
| Thallium | EPA 6010 | Metals | NELAP | 7/17/2003 |
| Thallium | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Thallium | EPA 7841 | Metals | NELAP | 10/8/2001 |
| Thallium | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Thionazin (Zinophos) | EPA 8270 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Tokuthion (Prothiophos) | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Toluene | EPA 8021 | Volatile Organics | NELAP | 10/8/2001 |
| Toluene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Total cyanide | EPA 9010 | General Chemistry | NELAP | 10/8/2001 |
| Total cyanide | ILM04.1-Exhibit D | General Chemistry | NELAP | 10/8/2001 |
| Total organic caibon | EPA 9060 | General Chemistry | WELAP | 10/8/2001 |
| Total organic halides (TOX) | EPA 9020 | General Chemistry | NELAP | 10/8/2001 |
| Total Petroleum Hydrocarbons (TPH) | NWTPH-HCID | Extractable Organics | NELAP | 10/8/2001 |
| Toxaphene (Chlorinated camphene) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Toxicity Characteristic Leaching Procedure | EPA 1311 | General Chemistry | NELAP | 10/8/2001 |
| trans-1,2-Dichloroethylene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| trans-1.3-Dichloropropylene | EPA 8260 | Volatile Orpnics | NELAP | 10/8/2001 |
| trans-1,4-Dichloro-2-butene | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Trichloroethene (Trichloroethylene) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Trichlorofluoromethane | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Trichloronate | EPA 8141 | Pesticides-Herbicides-PCB's | NELAP | 10/8/2001 |
| Vanadium | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Vanadium | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |
| Vinyl acetate | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Vinyl chloride | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Xylene (total) | EPA 8021 | Volatile Organics | NELAP | 10/8/2001 |
| Xylene (total) | EPA 8260 | Volatile Organics | NELAP | 10/8/2001 |
| Zinc | EPA 6010 | Metals | NELAP | 10/8/2001 |
| Zinc | EPA 6020 | Metals | NELAP | 10/8/2001 |
| Zinc | ILM04.1-Exhibit D | Metals | NELAP | 10/8/2001 |

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State Laboratory ID: E87412 EPA Lab Code: WA00035 (360) 577-7222

E87412
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

Matrix: **Biological Tissue**

| Analyte | Method/Tech | Category | Certification Type | Effective Dstc |
|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,2-Dichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,2-Diphenylhydrazine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 1,3-Dichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,3-Dinitrobenzene (1.3-DNB) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 1,3-Dinitrobenzene (1,3-DNB) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 1,4-Dichlorobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170) | EPA 8062 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 5/1/2003 |
| 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,4,5'-Pentachlorobiphenyl (BZ 87) | EPA 8082 | Pesticides-Herbicides-PCBs | NELAP | 7/1/2003 |
| 2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',3,5'-Tetrachlorobiphenyl (BZ 44) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/7003 |
| 2,2',4,5,5'-Pentachlorobiphenyl (BZ 101) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',5,5'-Tetrachlorobiphenyl (BZ 52) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,2',5-Trichlorobiphenyl (B%1X) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,3,3',4',6-Pentachlorobiphenyl (BZ 110) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,3',4,4'-Tetrachlorobiphenyl (BZ 66) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,3-Dichlorobiphenyl (BZ 5) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,4',5-Trichlorobiphenyl (BZ 31) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2,4,5-Trichlorophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4,6-Trichlorophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4,6-Trinitrotoluene (2,4,6-TNT) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4-Dichlorophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4-Dimethylphenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4-Dinitrophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,4-Dinitrotoluene (2,4-DNT) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2.4-Dinitrotoluene (2,4-DNT) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 2,6-Dinitrotoluene (2,6-DNT) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2,6-Dinitrotoluene (2,6-DNT) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |

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State Laboratory ID: E87412 EPA Lab Code: WA00035 (360) 577-7272

**EX7412**
**Columbia Analytical Services. Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix: Biological Tissue**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| 2-Amino-4,6-dinitrotoluene (2-am-onr) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Chlorobiphenyl (BZ I) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 2-Chloronaphthalene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Chlorophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Methyl-4,6-dinitrophenol | ETA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Methylnaphthalene | EPA 8270 | Extraciahle Organics | NELAP | 7/1/2003 |
| 2-Methylphenol (o-Cresol) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Nitroaniline | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Nitrophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 2-Nitrotoluene | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 3,3'-Dichlorobenzidine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 3-Nitroaniline | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 3-Nitrotoluene | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| 4,4'-DDD | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 4.4-DDE | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 4,4'-DDT | ETA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| 4-Amino-2.6-dinitrotoluene (4-am-dnt) | EP.4 8330 | Extractiible Organics | NELAP | 7/1/2003 |
| 4-Bromophenyl phenyl ether | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Chloro-3-methylphenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Chloroaniline | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Chlorophenyl phenylether | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Methylphenol (p-Cresol) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Nitroaniline | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Nitrophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| 4-Niuotoluene | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| Acenaphthene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Acensphthylene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Aldrin | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| alpha-BHC (alpha-Hexachlorocyclohexane) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| alpha-Chlordane | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aluminum | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Aluminum | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Aniline | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Anthracene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Antimony | EPA 6010 | Meals | NELAP | 7/1/2003 |
| Antimony | EPA 6020 | Metals | NELXP | 7/1/2003 |

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**State** Laboratory ID: **E87412** **EPA Lab Code:** **WA00035** **(360) 577-7222**

**E87412**
**Columbia Analytical Services. Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

Matrix: **Biological** Tissue

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Aroclor-1016 (PCB-1016) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-1221 (PCB-1221) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-1232 (PCB-1232) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-1242 (PCB-1242) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-1248 (PCB-1248) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-1254 (PCB-1254) | EPA 8082 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Aroclor-1260 (PCB-i260) | EPA 8082 | Pesticides-Herbicides-PCBs | NELAP | 7/1/2003 |
| Arsenic | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Arsenic | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Arsenic | EPA 7060 | Metals | NELAP | 7/1/2003 |
| Barium | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Barium | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Benzo(a)anthracene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(a)pyrene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(b)fluoranthene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(g,h,i)perylene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzo(k)fluoranthene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzoic acid | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Benzyl alcohol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Beryllium | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Beryllium | EPA 6020 | Metals | NELAP | 7/1/2003 |
| beta-BHC (beta-Hexachlorocyclohexane) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| bis(2-Chloroethoxy)methane | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| bis(2-Chloroethyl) ether | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| bis(2-Chloroisopropyl) ether | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| bis(2-Ethylhexyl) phthalate (DEHP) | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Butyl benzyl phthalate | EPA S270 | Extractable Organics | NELAP | 7/1/2003 |
| Cadmium | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Cadmium | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Carbazole | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Chlordane (tech.) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Chromium | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Chroinium | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Chromium VI | EPA 7196 | Metals | NELAP | 7/1/2003 |
| Chrysene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Cobalt | EPA 6010 | Metals | NELAP | 7/1/2003 |

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**State Laboratory ID:** E87412 **EPA Lab Code:** WA00035 **(360) 577-7222**

E87412
**Columbia Analytical Services, Inc. - WA**
**1317 South 13th Avenue**
**Kelso, WA 98626**

**Matrix:** **Biological Tissue**

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Cobalt | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Copper | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Copper | EPA 6020 | Metals | NELAP | 7/1/2003 |
| delta-BHC | EPA 8061 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Dibenz(a,h) anthracene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Dibenzofuran | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Dieldrin | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Diethyl phthalate | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Dimethyl phthalate | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Di-n-butyl phthalate | EPA 6270 | Extractable Organics | NELAP | 7/1/2003 |
| Di-n-octyl phthalate | EPA 0 7 0 | Extractable Organics | NELAP | 7/1/2003 |
| Endosulfan I | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Endosulfan II | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Endosulfan sulfate | EFA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Endrin | EPA 8581 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Endrin aldehyde | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Endrin ketone | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Fluoranthene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Fluorene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| gamma–BHC (Lindane, gamma-Hexachlorocyclohexane) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 71112003 |
| gamma-Chlordane | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Heptachlor | EPA 8081 | Pesticides-Herbicides-PCBs | NELAP | 7/1/2003 |
| Heptachlor epoxide | EPA 8081 | Pesticides-Herbicides-PCR's | NELAP | 7/1/2003 |
| Hexachlorobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Hexachlorobutadiene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Hexachlorocyclopentadiene | EPA 8270 | Extractable Organics | NELAP | 7/1/2503 |
| Hexachloroethane | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Indeno(1,2,3-cd)pyrene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| iron | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Isophorone | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Lead | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Lead | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Lead | EPA 7421 | Metals | NELAP | 7/1/2003 |
| Manganese | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Manganese | EPA 6020 | Metals | NELAP | 711/2003 |
| Mercury | EPA 7471 | Metals | NELAP | 7/1/2003 |

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State **Laboratory ID:** **E87412** **EPA Lsb Code:** **WA00035** **(360) 577-7272**

**E87412**
**Columbia Analytical Services. Inc. - W A**
**1317 South 13th Avenue**
**Kelso, WA** 98626

Matrix: Biological Tissue

| Analyte | Method/Tech | Category | Certification Type | Effective Date |
|---|---|---|---|---|
| Methoxychlor | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Molybdenum | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Naphthalene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Nickel | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Nickel | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Nitrobenzene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Nitrobenzene | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| n-Nitrosodimethylamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| n-Nitrosodi-n-propylamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| n-Nitrosodiphenylamine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| Pentachlorophenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Phenanthrene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Phenol | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Pyrene | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| Pyridine | EPA 8270 | Extractable Organics | NELAP | 7/1/2003 |
| RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| Selenium | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Selenium | EPA 7740 | Metals | NELAP | 7/1/2003 |
| Selenium | EPA 7742 | Metals | NELAP | 7/1/2003 |
| Silver | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Silver | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Tetryl (methyl-2,4,6-trinitrophenylnitramine) | EPA 8330 | Extractable Organics | NELAP | 7/1/2003 |
| Thallium | EPA 6020 | Metals | NELAP | 7/1/2003 |
| Thallium | EPA 7841 | Metals | NELAP | 7/1/2003 |
| Total cyanide | EPA 9010 | General Chemistry | NELAP | 7/1/2003 |
| Toxaphene (Chlorinated camphene) | EPA 8081 | Pesticides-Herbicides-PCB's | NELAP | 7/1/2003 |
| Vanadium | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Zinc | EPA 6010 | Metals | NELAP | 7/1/2003 |
| Zinc | EPA 6020 | Metals | NELAP | 7/1/2003 |

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Department of Health

# *Certificate*

In accordance with Minnesota Law and Rules

**Columbia Analytical Services**
**1317 South 13th Avenue**
**Kelso, Washington 98626**

**Laboratory Number: 053-999-368**

has been certified for the analytes listed below and in our letter dated October 16, 2003.

**Clean Water Program**

| | | | | | |
|---|---|---|---|---|---|
| Acidity | EPA 305.1 | Solids, Total | EPA 160.3 | Copper | EPA 200.7 |
| Alkalinity | EPA310.1 | Solids, Dissolved | EPA 160.1 | Iron | EPA 200.7 |
| Biochemical Oxygen Demand, 5 day | EPA 405.1 | Solids, Nonfilterable (TSS) | EPA 160.2 | Lead | EPA 239.2 |
| Chloride | EPA 325.3 | Solids, Volatile | EPA 160.4 | Magnesium | EPA 200.7 |
| Cyanide | EPA 335.2 | Specific Conductance | EPA 120.1 | Manganese | EPA 200.7 |
| Nitrogen, Ammonia | EPA 350.1 | Sulfide | EPA 376.1 | Mercury | EPA 245.1 |
| Nitrogen, Ammonia | EPA 350.3 | Surfactant | EPA 425.1 | Molybdenum | EPA 200.7 |
| Nitrogen, Total Kjeldahl | EPA 351.4 | Aluminum | EPA 200.7 | Nickel | EPA 200.7 |
| Nitrogen, Nitrate | EPA 353.2 | Antimony | EPA 200.7 | Potassium | EPA 300.7 |
| Nitrogen, Nitrate + Nitrite | EPA 353.2 | Arsenic | EPA 206.2 | Selenium | EPA 270.2 |
| Nitrogen, Nitrite | EPA 354.1 | Barium | EPA 200.7 | Silver | EPA 200.7 |
| Oil and Grease | EPA 1664 | Beryllium | EPA 200.7 | Sodium | EPA 200.7 |
| Organic Carbon, Total | EPA 415.1 | Boron | EPA 200.7 | Thallium | EPA 279.2 |
| Phenol, Total Compounds | EPA 420.1 | Cadmium | BPA 200.7 | Tin | EPA 200.7 |
| Phosphorus, Ortho | EPA 365.3 | Calcium | EPA 200.7 | Vanadium | EPA 200.7 |
| Phosphorus, Total | EPA 365.3 | Chromium | EPA 200.7 | Zinc | EPA 200.7 |
| | | Cobalt | EPA 200.7 | | |

Certification Expiration Date: July 31, 2005

Dianne Mandernach, Commissioner of Health

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Department of Health

# *Certificate*

In accordance. with Minnesota Law and Rules

**Columbia Analytical Services**
**1317 South 13th Avenue**
**Kelso, Washington 98626**

**Laboratory Number: 053-999-368**

has been certified for the analytes listed below and in our letter dated October 16, Z00?.

**Clean Water Program**

| | |
|---|---|
| Aldrin | EPA 608 |
| alpha-BHC | EPA 608 |
| beta-BHC | EPA 608 |
| delta-BHC | EPA 608 |
| gamma-BHC (Lindane) | EPA 608 |
| Chlordane | EPA 608 |
| 4,4'-DDD | EPA 608 |
| 4,4'-DDE | EPA 608 |
| 4,4'-DDT | EPA 608 |
| Dieldrin | EPA 608 |
| Endosulfan I | EPA 608 |
| Endosulfan II | EPA 608 |
| Endosulfan sulfate | EPA 608 |
| Endrin | EPA 608 |
| Endrin Aldehyde | EPA 608 |
| Heptachlor | EPA 608 |
| Heptachlor epoxide | EPA 608 |
| PCB-I016 | EPA 608 |
| PCB-1221 | EPA 608 |
| PCB-1232 | EPA 608 |
| PCB-1242 | EPA 608 |
| PCB-1248 | EPA 608 |
| PCB-1254 | EPA 608 |
| PCB-1260 | EPA 608 |
| Toxaphene | EPA 608 |
| 4-Chloro-3-methylphenol | EPA 625 |
| 2-Chlorophenol | EPA 625 |
| 2,4-Dichlorophenol | EPA 625 |
| 2,4-Dimethylphenol | EPA 625 |
| 2,4-Dinitrophenol | EPA 625 |
| 2-Methyl-4,6-dinitrophenol | EPA 625 |
| 2-Nitrophenol | EPA 625 |
| Pentachlorophenol | EPA 625 |
| Phenol | EPA 625 |
| 2,4,6-Trichlorophenol | EPA 625 |
| 4-Nitrophenol | EPA 625 |
| Bis-(2-chloroethyl) ether | EPA 625 |
| Bis-(2-chloroethoxy)methane | EPA 625 |
| 4-Bromophenylphenyl ether | EPA 625 |
| 4-Chlorophenylphenyl ether | EPA 625 |
| 2-Chloronaphthalene | EPA 625 |
| Hexachlorobenzene | EPA 625 |
| Hexachlorobutadiene | EPA 625 |
| Hexachloroethane | EPA 625 |
| 1,2,4-Trichlorobenzene | EPA 625 |
| Acenaphthene | EPA 625 |
| Acenaphthylene | EPA 625 |
| Anthracene | EPA 625 |

Certification Expiration Date: July 31,2005

Dianne Mandernach, Commissioner of Health

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Department of Health

# *Certificate*

In accordance with Minnesota Law and Rules

**Columbia Analytical Services**
**1317 South 13th Avenue**
**Kelso, Washington 98626**

## Laboratory Number: 053-999-368

has been certified for the analytes listed below and in our letter dated October 16, 2003.

### Clean Water Program

| | | | | | |
|---|---|---|---|---|---|
| Dichlorodifluoromethane | EPA 624 | 1,2-Dichloropropane | EPA 624 | m+p-Xylene | EPA 624 |
| Chloromethane | EPA 624 | Bromodichloromethane | EPA 624 | o-Xylene | EPA 624 |
| Vinyl,chloride | EPA 624 | cis-1,3-Dichloropropene | EPA 624 | Styrene | EPA 624 |
| Bromomethane | EPA 624 | trans-1,3-Dichloropropene | EPA 624 | Acetone | EPA 624 |
| Chloroethane | EPA 624 | 1,1,2-Trichloroethane | EPA 624 | 2-Chloroeth ylvinylether | EPA 624 |
| Trichlorofluoromethane | EPA 624 | Tetrachloroethene | EPA 624 | Methyl ethyl ketone | EPA 624 |
| 1,l-Dichloroethene | EPA 624 | Chlorodibromomethane | EPA 624 | Acrolein | EPA 624 |
| Methylene chloride | EPA 624 | Chlorobenzene | EPA 624 | Acrylonitrile | EPA 624 |
| trans-1,2-Dichloroethene | EPA 624 | Bromoform | EPA 624 | Butyl benzyl phthalate | EPA 625 |
| 1,1-Dichloroethane | EPA 624 | 1,1,2,2-Tetrachloroethane | EPA 624 | Di-2(ethylhexyl) phthalate | EPA 625 |
| cis-1,2-Dichloroethene | EPA 624 | 1,3-Dichlorobenzene | EPA 624 | Di-n-butyl phthalate | EPA 625 |
| Chloroform | EPA 624 | 1,4-Dichlorobenzene | EPA 624 | Di-n-octyl phthalate | EPA 625 |
| 1,l, 1-Trichloroethane | EPA 624 | 1,2-Dichlorobenzene | EPA 624 | Diethyl phthalate | EPA 625 |
| Carbon tetrachloride | EPA 624 | Benzene | EPA 624 | Dimethyl phthalate | EPA 625 |
| 1,2-Dichloroethane | EPA 624 | Toluene | EPA 624 | | |
| Trichloroethene | EPA 624 | Ethyl benzene | EPA 624 | | |

Certification Expiration Date: July 31,2005

Dianne Mandernach, Commissioner of Health

MINNESOTA
MDH
DEPARTMENT OF HEALTH

Minnesota Department of Health

# *Certificate*

In accordance with Minnesota Law and Rules

**Columbia Analytical Services**
**1317 South 13th Avenue**
**Kelso, Washington 98626**

**Laboratory Number: 053-999-368**

has been certified for the analytes listed below and in our letter dated October 16, 2003.

**Clean Water Program**

| | | | | | |
|---|---|---|---|---|---|
| Benzo(a)anthracene | EPA 625 | Fluorene | EPA 625 | Nitrobenzene | EPA 625 |
| Benzo(a)pyrene | EPA 625 | Indeno(1,2,3-cd)pyrene | EPA 625 | Benzidine | EPA 625 |
| Benzo(b)fluoranthene | EPA 625 | Naphthalene | EPA 625 | 3,3'-Dichlorobenzidine | EPA 625 |
| Benzo(g,h,i)perylene | EPA 625 | Phenanthrene | EPA 625 | N-Nitrosodiphenylamine | EPA 625 |
| Benzo(k)fluoranthene | EPA 625 | Pyrene | EPA 625 | N-Nitrosodi-n-propylamine | EPA 625 |
| Chrysene | EPA 625 | 2,4-Dinitrotoluene | EPA 625 | 1,2-Diphenylhydrazine | EPA 625 |
| Dibenz(a,h)anthracene | EPA 625 | 2,6-Dinitrotoluene | EPA 625 | | |
| Fluoranthene | EPA 625 | Isophorone | EPA 625 | | |

Certification Expiration Date:, July 31, 2005

Dianne Mandernach, Commissioner of Health

MDH

Minnesota Department of Health

# *Certificate*

In accordance with Minnesota Law and Rules

**Columbia Analytical Services**
**1317 South 13th Avenue**
**Kelso, Washington 98626**

## Laboratory Number: 053-999-368

has been certified for the analytes listed below and in our letter dated October 16, 2003.

### Safe Drinking Water Program

| | | | | | |
|---|---|---|---|---|---|
| Cyanide | EPA 335.4 | Cadmium | EPA 200.8 | Bromomethane | EPA 524.2 |
| Fluoride | EPA 300.0 | Chromium | EPA 200.7 | Chloroethane | EPA 524.7 |
| Fluoride | SM 19th ED 4500-F C | Chromium | EPA 200.8 | 1,1-Dichloroethene | EPA 524.2 |
| | | Copper | EPA 200.7 | Methylene chloride | BPA 524.2 |
| Nitrogen, Nitrate | EPA 300.0 | Copper | EPA 200.8 | trans-1,2-Dichloroethene | BPA 524.2 |
| Nitrogen, Nitrate | EPA 353.2 | Copper | EPA 200.9 | 1,1-Dichloroethane | EPA 524.2 |
| Nitrogen, Nitrite | EPA 300.0 | Lead | EPA 200.8 | 2,2-Dichloropropane | EPA 524.2 |
| Nitrogen, Nitrite | EPA 353.2 | Lead | EPA 200.9 | cis-1,2-Dichloroethene | EPA 524.2 |
| Sulfate | EPA 300.0 | Mercury | EPA 245.1 | Chloroform | EPA 524.2 |
| Antimony | EPA 200.8 | Nickel | EPA 200.7 | 1,1,1-Trichloroethane | EPA 524.2 |
| Arsenic | EPA 200.8 | Nickel | EPA 200.8 | 1,l-Dichloropropene | EPA 524.2 |
| Arsenic | EPA 200.9 | Selenium | EPA 200.8 | Carbon tetrachloride | EPA 524.2 |
| Barium | EPA 200.7 | Selenium | EPA 200.9 | 1,2-Dichloroethane | EPA 524.2 |
| Barium | EPA 200.8 | Thallium | EPA 200.8 | Trichloroethene | EPA 524.2 |
| Beryllium | EPA 200.7 | Thallium | EPA 200.9 | 1,2-Dichloropropane | EPA 524.2 |
| Beryllium | EPA 200.8 | Chloromethane | EPA 524.2 | Bromodichloromethane | EPA 524.2 |
| Cadmium | EPA 200.7 | Vinyl chloride | EPA 524.2 | | |

Certification Expiration Date: July 31,2005

Dianne Mandernach, Commissioner of Health

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Department of Health

# *Certificate*

In accordance with Minnesota Law and Rules

**Columbia Analytical Services**
**1317 South 13th Avenue**
**Kelso, Washington 98626**

## Laboratory Number: 053-999-368

has been certified for the analytes listed below and in our letter dated October 16,2003.

### Safe Drinking Water Program

| | |
|---|---|
| Dibromomethane | EPA 524.2 |
| cis-1,3-Dichloropropene | EPA 524.2 |
| trans-1,3-Dichloropropene | EPA 524.2 |
| 1,1,2-Trichloroethane | EPA 524.2 |
| 1,3-Dichloropropane | EPA 524.2 |
| Tetrachloroethene | EPA 524.2 |
| Chlorodibromomethane | EPA 524.2 |
| 1,2-Dibromoethane | EPA 504.1 |
| Chlorobenzene | EPA 524.2 |
| 1,1,1,2-Tetrachloroethane | EPA 524.2 |
| Bromoform | EPA 524.2 |
| 1,1,2,2-Tetrachloroethane | EPA 524.2 |
| 1,2,3-Trichloropropane | EPA 504.1 |
| Bromobenzene | EPA 524.2 |
| 2-Chlorotoluene | EPA 524.2 |
| 4-Chlorotoluene | EPA 524.2 |
| 1,3-Dichlorobenzene | EPA 524.2 |
| 1,4-Dichlorobenzene | EPA 524.2, |
| 1,2-Dichlorobenzene | EPA 524.2 |
| 1,2-Dibromo-3-Chloropropane | EPA 504.1 |
| 1,2,4-Trichlorobenzene | EPA 524.2 |
| Benzene | EPA 524.2 |
| Toluene | EPA 524.2 |
| Ethyl benzene | EPA 524.2 |
| m+p-Xylene | EPA 524.2 |
| o-Xylene | EPA 524.2 |
| Styrene | EPA 524.2 |
| Isopropylbenzene | EPA 524.2 |
| Di-2(ethylhexyl) phthalate | EPA 525.2 |
| Alachlor | EPA 525.2 |
| Aldrin | EPA 508.1 |
| Aldrin | EPA 525.2 |
| Atrazine | EPA 525.2 |
| beta-BHC | EPA 508.1 |
| beta-BHC | EPA 525.2 |
| gamma-BHC (Lindane) | EPA 508.1 |
| gamma-BHC (Lindane) | EPA 525.2 |
| Butachlor | EPA 525.2 |
| Chlordane | EPA 508.1 |
| Chlordane | EPA 525.2 |
| Dieldrin | EPA 508.1 |
| Dieldrin | EPA 525.2 |
| Endrin | EPA 508.1 |
| Endrin | EPA 525.2 |

Certification Expiration Date: July 31,2005

Dianne Mandernach, Commissioner of Health

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Department of Health

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**Columbia Analytical Services**
**1317 South 13th Avenue**
**Kelso, Washington 98626**

## Laboratory Number: 053-999-368

has been certified for the analytes listed below and in our letter dated October 16, 2003.

### Safe Drinking Water Program

| | | | | | |
|---|---|---|---|---|---|
| Heptachlor | EPA 508.1 | Pentachlorophenol | EPA 525.2 | Aldicarb Sulfone | EPA 531.1 |
| Heptachlor | EPA 525.2 | Hexachlorobenzene | EPA 525.2 | Aldicarb Sulfoxide | EPA 531.1 |
| Heptachlor epoxide | EPA 508.1 | Hexachlorocyclopentadiene | EPA 525.2 | Carbaryl | EPA 531.1 |
| Heptachlor epoxide | EPA 525.2 | Benzo(a)pyrene | EPA 525.2 | Carbofuran | EPA 531.1 |
| Methoxychlor | EPA 508.1 | Di-2-(ethylhexyl) adipate | EPA 525.2 | 3-Hydroxycarbofiiran | EPA 531.1 |
| Methoxychlor | EPA 525.2 | 2,4-D | EPA 515.4 | Methomyl | EPA 531.1 |
| Metolachlor | EPA 525.2 | Dicamba | EPA 515.4 | Oxamyl | EPA 531.1 |
| Metribuzin | EPA 525.2 | Dinoseb | EPA 515.4 | Glyphosate | EPA 547 |
| PCBs | EPA508.1 | Picloram | EPA 515.4 | Endothall | EPA 548.1 |
| Propachlor | EPA 525.2 | 2,4,5-T | EPA 515.4 | Diquat | EPA 549.2 |
| Simazine | EPA 525.2 | 2,4,5-TP (Silvex) | EPA 515.4 | | |
| Toxaphene | EPA 508.1 | Aldicarb | EPA 531.1 | | |

Certification Expiration Date: July 31, 2005

Dianne Mandernach, Commissioner of Health

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Department of Health

# *Certificate*

In accordance with Minnesota Law and Rules

**Columbia Analytical Services**
**1317 South 13th Avenue**
**Kelso, Washington 98626**

## Laboratory Number: 053-999-368

has been certified for the analytes listed below and in our letter dated October 16, 2003.

**Resource Conservation and Recovery Program**

| | | | | | |
|---|---|---|---|---|---|
| Arsenic | EPA 6010B | Molybdenum | EPA 6010B | Di-2(ethylhexyl) phthalnte | EPA 8270C |
| Arsenic | EPA 6020 | Molybdenum | EPA 6020 | Di-n-butyl phthalate | EPA 8270C |
| Arsenic | EPA 7060A | Nickel | EPA 6010B | Dimethyl phthalate | EPA 8270C |
| Barium | EPA 6010B | Nickel | EPA 6020 | beta-BHC | EPA 8081A |
| Barium | EPA 6020 | Selenium | EPA 6020 | gamma-BIIC (Lindanc) | EPA 8081A |
| Cadmium | EPA 6010B | Selenium | EPA 7740 | Chlorpyrifos | EPA 8141A |
| Cadmium | EPA 6020 | Silver | EPA 6010B | 4,4'-DDT | EPA 8081A |
| Chromium | EPA 6010B | Silver | EPA 6020 | Endrin | EPA 8081A |
| Chromium | EPA 6020 | Zinc | EPA 6010B | Methyl parathion | EPA 8141A |
| Copper | EPA 6010B | Zinc | EPA 6020 | PCBs | EPA 8082 |
| Copper | EPA 6020 | Acetone | EPA 8260B | PCBs in Oil | EPA 8082 |
| Lead | EPA 6010B | Carbon disulfide | EPA 8260B | Toxaphene | EPA 8081A |
| Lead | EPA 6020 | p-Dioxane | EPA 8260B | 2-methyl phenol | EPA 8270C |
| Lead | EPA 7421 | Methyl ethyl ketone | EPA 8260B | 3-Methylphenol | EPA 8270C |
| Mercury | EPA 7470A | Methyl isobutyl ketone | EPA 8260B | 2,3,4,6-Tetrachlorophenol | EPA 8270C |
| Mercury | EPA 7471A | Butyl benzyl phthalate | EPA 8270C | | |

Certification Expiration Date: July 31, 2005

Dianne Mandernach, Commissioner of Health

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Department of Health

# *Certificate*

In accordance with Minnesota Law and Rules

**Columbia Analytical Services**
**1317 South 13th Avenue**
**Kelso, Washington 98626**

## Laboratory Number: 053-999-368

has been certified for the analytes listed below and in our letter dated October 16,2003,

**Resource Conservation and Recovery Program**

| | | | | | |
|---|---|---|---|---|---|
| Benzo(a)anthracene | EPA 8270C | Fluoranthene | EPA 8270C SIM | Pentachlorobenzene | EPA 8270C |
| Benzo(a)anthracene | EPA 8270C SIM | Indeno(1,2,3-cd)pyrene | EPA 8270C | Pronamide | EPA 8270C |
| Benzo(a)pyrene | EPA 8270C | Indeno(1,2,3-cd)pyrene | EPA 8270C SIM | 1,2,4,5-Tetrachlorobenzene | UNKNOWN |
| Benzo(a)pyrene | EPA 8270C SIM | Pyrene | EPA 8270C | 2,4-D | EPA 8151A |
| Benzo(b)fluoranthene | EPA 8270C | Pyrene | EPA 8270C SIM | Dalapon | EPA 8151A |
| Benzo(b)fluoranthene | EPA 8270C SIM | Benzidine | EPA 8270C | Dinoseb | EPA 8151A |
| Benzo(k)fluoranthene | EPA 8270C | 1,2-Diphenylhydrazine | EPA 8270C | Picloram | EPA 8151A |
| Benzo(k)fluoranthene | EPA 8270C SIM | Benzoic acid | EPA 8270C | 2,4,5-T | EPA 8151A |
| Dibenz(a,h)anthracene | EPA 8270C | N-Nitrosodi-n-butylamine | EPA 82706 | 2,4,5-TP (Silvex) | EPA 8151A |
| Dibenz(a,h)anthracene | EPA 8270C SIM | Bis-(2-chloroisopropyl) | EPA 8270C | MCPA | EPA 8151A |
| Fluoranthene | EPA 8270C | ether | | | |

Certification Expiration Date: July 31, 2005

Dianne Mandernach, Commissioner of Health

MINNESOTA MDH DEPARTMENT OF HEALTH

*Protecting, maintaining and improving the health of all Minnesotans*

October 16, 2003 **CERTIFIED TRACKING #: 7002 0860 0006 5193 3932**

Lee Wolf
Columbia Analytical Services
1317 South 13th Avenue
Kelso, Washington 98626

RE: Laboratory Number 053-999-368

Dear **Mr.** Wolf:

We have received your laboratory's Application for Certification, appropriate fees and performance evaluation results. After reviewing all the information/documents received, we requested more information in **a** letter dated August 7,2003. Your response dated September 11,2003, included much of the information requested. We are issuing certification for additional analytes as listed and described below in accordance with the reciprocity agreement between the states of Washington and Minnesota.

Laboratory Number 053-999-368 Certification Expiration Date: 31-JUL-2005

## Clean Water Program

| | | | |
|---|---|---|---|
| Acidity | EPA 305.1 | Surfactant | EPA 425.1 |
| Alkalinity | EPA 310.1 | Aluminum | EPA 200.7 |
| Biochemical Oxygen Demand, 5 day | EPA 405.1 | Antimony | EPA 200.7 |
| | | Arsenic | EPA 206.2 |
| Chloride | EPA 325.3 | Barium | EPA 200.7 |
| Cyanide | EPA 335.2 | Beryllium | EPA 200.7 |
| Nitrogen, Ammonia | EPA 350.1 | Boron | EPA 200.7 |
| Nitrogen, Ammonia | EPA 350.3 | Cadmium | EPA 200.7 |
| Nitrogen, Total Kjeldahl | EPA 351.4 | Calcium | EPA 200.7 |
| Nitrogen, Nitrate | EPA 353.2 | Chromium | EPA 200.7 |
| Nitrogen, Nitrate + Nitrite | EPA 353.2 | Cobalt | EPA 200.7 |
| Nitrogen, Nitrite | EPA 354.1 | Copper | EPA 200.7 |
| Oil and Grease | EPA 1664 | Iron | EPA 200.7 |
| Organic Carbon, Total | EPA 415.1 | Lead | EPA 239.2 |
| Phenol, Total Compounds | EPA 420.1 | Magnesium | EPA 200.7 |
| Phosphorus, Ortho | EPA 365.3 | Manganese | EPA 200.7 |
| Phosphorus, Total | EPA 365.3 | Mercury | EPA 245.1 |
| Solids, Total | EPA 160.3 | Molybdenum | EPA 200.7 |
| Solids, Dissolved | EPA 160.1 | Nickel | EPA 200.7 |
| Solids, Nonfilterable (TSS) | EPA 160.2 | Potassium | EPA 200.7 |
| Solids, Volatile | EPA 160.4 | Selenium | EPA 270.2 |
| Specific Conductance | EPA 120.1 | Silver | EPA 200.7 |
| Sulfide | EPA 376.1 | Sodium | EPA 200.7 |

| | |
|---|---|
| Thallium | EPA 279.2 |
| Tin | EPA 200.7 |
| Vanadium | EPA 200.7 |
| Zinc | EPA 200.7 |
| Dichlorodifluoromethane | EPA 624 |
| Chloromethane | EPA 624 |
| Vinyl chloride | EPA 624 |
| Bromomethane | EPA 624 |
| Chloroethane | EPA 624 |
| Trichlorofluoromethane | EPA 624 |
| 1,I-Dichloroethene | EPA 624 |
| Methylene chloride | EPA 624 |
| trans-1,2-Dichloroethene | EPA 624 |
| 1,1-Dichloroethane | EPA 624 |
| cis-1,2-Dichloroethene | EPA 624 |
| Chloroform | EPA 624 |
| 1,1,1-Trichloroethane | EPA 624 |
| Carbon tetrachloride | EPA 624 |
| 1,2-Dichloroethane | EPA 624 |
| Trichloroethene | EPA 624 |
| 1,2-Dichloropropane | EPA 624 |
| Bromodichloromethane | EPA 624 |
| cis-1,3-Dichloropropene | EPA 624 |
| trans-1,3-Dichloropropene | EPA 624 |
| 1,1,2-Trichloroethane | EPA 624 |
| Tetrachloroethene | EPA 624 |
| Chlorodibromomethane | EPA 624 |
| Chlorobenzene | EPA 624 |
| Bromoform | EPA 624 |
| I,1,2,2-Tetrachloroethane | EPA 624 |
| 1,3-Dichlorobenzene | EPA 624 |
| 1,4-Dichlorobenzene | EPA 624 |
| 1,2-Dichlorobenzene | EPA 624 |
| Benzene | EPA 624 |
| Toluene | EPA 624 |
| Ethyl benzene | EPA 624 |
| m+p-Xylene | EPA 624 |
| o-Xylene | EPA 624 |
| Styrene | EPA 624 |
| Acetone | EPA 624 |
| 2-Chloroethylvinylether | EPA 624 |
| Methyl ethyl ketone | EPA 624 |
| Acrolein | EPA 624 |
| Acrylonitrile | EPA 624 |
| Butyl benzyl phthalate | EPA 625 |
| Di-2(ethylhexyl) phthalate | EPA 625 |
| Di-n-butyl phthalate | EPA 625 |
| Di-n-octyl phtbalate | EPA 625 |
| Diethyl phthalate | EPA 625 |
| Dimethyl phthalate | EPA 625 |
| Aldrin | EPA 608 |

| | |
|---|---|
| alpha-BHC | EPA 608 |
| beta-BHC | EPA 608 |
| delta-BHC | EPA 608 |
| gamma-BHC (Lindane) | EPA 608 |
| Chlordane | EPA 608 |
| 4,4'-DDD | EPA 608 |
| 4,4'-DDE | EPA 608 |
| 4,4'-DDT | EPA 608 |
| Dieldrin | EPA 608 |
| Endosulfan I | EPA 608 |
| Endosulfan II | EPA 608 |
| Endosulfan sulfate | EPA 608 |
| Endrin | EPA 608 |
| Endrin Aldehyde | EPA 608 |
| Heptachlor | EPA 608 |
| Heptachlor epoxide | EPA 608 |
| PCB-1016 | EPA 608 |
| PCB-1221 | EPA 608 |
| PCB-1232 | EPA 608 |
| PCB-1242 | EPA 608 |
| PCB-1248 | EPA 608 |
| PCB-1254 | EPA 608 |
| PCB-1260 | EPA 608 |
| Toxaphene | EPA 608 |
| 4-Chloro-3-methylphenol | EPA 625 |
| 2-Chlorophenol | EPA 625 |
| 2,4-Dichlorophenol | EPA 625 |
| 2,4-Dimethylphenol | EPA 625 |
| 2,4-Dinitrophenol | EPA 625 |
| 2-Methyl-4,6-dinitrophenol | EPA 625 |
| 2-Nitrophenol | EPA 625 |
| Pentachlorophenol | EPA 625 |
| Phenol | EPA 625 |
| 2,4,6-Trichlorophenol | EPA 625 |
| 4-Nitrophenol | EPA 625 |
| Bis-(2-chloroethyl) ether | EPA 625 |
| Bis-(2-chloroethoxy)methane | EPA 625 |
| 4-Bromophenylphenyl ether | EPA 625 |
| 4-Chlorophenylphenyl ether | EPA 625 |
| 2-Chloronaphthalene | EPA 625 |
| Hexachlorobenzene | EPA 625 |
| Hexachlorobutadiene | EPA 625 |
| Hexachloroethane | EPA 625 |
| 1,2,4-Trichlorobenzene | EPA 625 |
| Acenaphthene | EPA 625 |
| Acenaphthylene | EPA 625 |
| Anthracene | EPA 625 |
| Benzo(a)anthracene | EPA 625 |
| Benzo(a)pyrene | EPA 625 |
| Benzo(b)fluoranthene | EPA 625 |
| Benzo(g,h,i)perylene | EPA 625 |

| | | | |
|---|---|---|---|
| Benzo(k)fluoranthene | EPA 625 | 2,4-Dinitrotoluene | EPA 625 |
| Chrysene | EPA 625 | 2,6-Dinitrotoluene | EPA 625 |
| Dibenz(a,h)anthracene | EPA 625 | Isophorone | EPA 625 |
| Fluoranthene | EPA 625 | Nitrobenzene | EPA 625 |
| Fluorene | EPA 625 | Benzidine | EPA 625 |
| Indeno(1,2,3-cd)pyrene | EPA 625 | 3,3'-Dichlorobenzidine | EPA 625 |
| Naphthalene | EPA 625 | N-Nitrosodiphenylamine | EPA 625 |
| Phenanthrene | EPA 625 | N-Nitrosodi-n-propylamine | EPA 625 |
| Pyrene | EPA 625 | 1,2-Diphenylhydrazine | EPA 625 |

## Safe Drinking Water Program

| | | | |
|---|---|---|---|
| Cyanide | EPA 335.4 | trans-1,2-Dichloroethene | EPA 524.2 |
| Fluoride | EPA 300.0 | 1,1-Dichloroethane | EPA 524.2 |
| Fluoride | SM 19th ED | 2,2-Dichloropropane | EPA 524.2 |
| | 4500-F C | cis-1,2-Dichloroethene | EPA 524.2 |
| Nitrogen, Nitrate | EPA 300.0 | Chloroform | EPA 524.2 |
| Nitrogen, Nitrate | EPA 353.2 | 1,1,1-Trichloroethane | EPA 524.2 |
| Nitrogen, Nitrite | EPA 300.0 | 1,1-Dichloropropene | EPA 524.2 |
| Nitrogen, Nitrite | EPA 353.2 | Carbon tetrachloride | EPA 524.2 |
| Sulfate | EPA 300.0 | 1,2-Dichloroethane | EPA 524.2 |
| Antimony | EPA 200.8 | Trichloroethene | EPA 524.2 |
| Arsenic | EPA 200.8 | 1,2-Dichloropropane | EPA 524.2 |
| Arsenic | EPA 200.9 | Bromodichloromethane | EPA 524.2 |
| Barium | EPA 200.7 | Dibromomethane | EPA 524.2 |
| Barium | EPA 200.8 | cis-1,3-Dichloropropene | EPA 524.2 |
| Beryllium | EPA 200.7 | trans-1,3-Dichloropropene | EPA 524.2 |
| Beryllium | EPA 200.8 | 1,1,2-Trichloroethane | EPA 524.2 |
| Cadmium | EPA 200.7 | 1,3-Dichloropropane | EPA 524.2 |
| Cadmium | EPA 200.8 | Tetrachloroethene | EPA 524.2 |
| Chromium | EPA 200.7 | Chlorodibromomethane | EPA 524.2 |
| Chromium | EPA 200.8 | 1,2-Dibromoethane | EPA 504.1 |
| Copper | EPA 200.7 | Chlorobenzene | EPA 524.2 |
| Copper | EPA 200.8 | 1,1,1,2-Tetrachloroethane | EPA 524.2 |
| Copper | EPA 200.9 | Bromoform | EPA 524.2 |
| Lead | EPA 200.8 | 1,1,2,2-Tetrachloroethane | EPA 524.2 |
| Lead | EPA 200.9 | 1,2,3-Trichloropropane | EPA 504.1 |
| Mercury | EPA 245.1 | Bromobenzene | EPA 524.2 |
| Nickel | EPA 200.7 | 2-Chlorotoluene | EPA 524.2 |
| Nickel | EPA 200.8 | 4-Chlorbtoluene | EPA 524.2 |
| Selenium | EPA 200.8 | 1,3-Dichlorobenzene | EPA 524.2 |
| Selenium | EPA 200.9 | 1,4-Dichlorobenzene | EPA 524.2 |
| Thallium | EPA 200.8 | 1,2-Dichlorobenzene | EPA 524.2 |
| Thallium | EPA 200.9 | 1,2-Dibromo-3-Chloropropane | EPA 504.1 |
| Chloromethane | EPA 524.2 | 1,2,4-Trichlorobenzene | EPA 524.2 |
| Vinyl chloride | EPA 524.2 | Benzene | EPA 524.2 |
| Bromomethane | EPA 524.2 | Toluene | EPA 524.2 |
| Chloroethane | EPA 524.2 | Ethyl benzene | EPA 524.2 |
| 1,1-Dichloroethene | EPA 524.2 | m+p-Xylene | EPA 524.2 |
| Methylene chloride | EPA 524.2 | o-Xylene | EPA 524.2 |

| | | | |
|---|---|---|---|
| Styrene | EPA 524.2 | PCBs | EPA 508.1 |
| Isopropylbenzene | EPA 524.2 | Propachlor | EPA 525.2 |
| Di-2(ethylhexyl) phthalate | EPA 525.2 | Simazine | EPA 525.2 |
| Alachlor | EPA 525.2 | Toxaphene | EPA 508.1 |
| Aldrin | EPA 508.1 | Pentachlorophenol | EPA 525.2 |
| Aldrin | EPA 525.2 | Hexachlorobenzene | EPA 525.2 |
| Atrazine | EPA 525.2 | Hexachlorocyclopentadiene | EPA 525.2 |
| beta-BHC | EPA 508.1 | Benzo(a)pyrene | EPA 525.2 |
| beta-BHC | EPA 525.2 | Di-2-(ethylhexyl) adipate | EPA 525.2 |
| gamma-BHC (Lindane) | EPA 508.1 | 2,4-D | EPA 515.4 |
| gamma-BHC (Lindane) | EPA 525.2 | Dicamba | EPA 515.4 |
| Butachlor | EPA 525.2 | Dinoseb | EPA 515.4 |
| Chlordane | EPA 508.1 | Picloram | EPA 515.4 |
| Chlordane | EPA 525.2 | 2,4,5-T | EPA 515.4 |
| Dieldrin | EPA 508.1 | 2,4,5-TP (Silvex) | EPA 515.4 |
| Dieldrin | EPA 525.2 | Aldicarb | EPA 531.1 |
| Endrin | EPA 508.1 | Aldicarb Sulfone | EPA 531.1 |
| Endrin | EPA 525.2 | Aldicarb Sulfoxide | EPA 531.1 |
| Heptachlor | EPA 508.1 | Carbaryl | EPA 531.1 |
| Heptachlor | EPA 525.2 | Carbofuran | EPA 531.1 |
| Heptachlor epoxide | EPA 508.1 | 3-Hydroxycarbofuran | EPA 531.1 |
| Heptachlor epoxide | EPA 525.2 | Methomyl | EPA 531.1 |
| Methoxychlor | EPA 508.1 | Oxamyl | EPA 531.1 |
| Methoxychlor | EPA 525.2 | Glyphosate | EPA 547 |
| Metolachlor | EPA 525.2 | Endothall | EPA 548.1 |
| Metribuzin | EPA 525.2 | Diquat | EPA 549.2 |

## Resource Conservation and Recovery Program

| | | | |
|---|---|---|---|
| Arsenic | EPA 6010B | Selenium | EPA 7740 |
| Arsenic | EPA 6020 | Silver | EPA 6010B |
| Arsenic | EPA 7060A | Silver | EPA 6020 |
| Barium | EPA 6010B | Zinc | EPA 6010B |
| Barium | EPA 6020 | Zinc | EPA 6020 |
| Cadmium | EPA 6010B | Acetone | EPA 8260B |
| Cadmium | EPA 6020 | Carbon disulfide | EPA 8260B |
| Chromium | EPA 6010B | p-Dioxane | EPA 8260B |
| Chromium | EPA 6020 | Methyl ethyl ketone | EPA 8260B |
| Copper | EPA 6010B | Methyl isobutyl ketone | EPA 8260B |
| Copper | EPA 6020 | Butyl benzyl phthalate | EPA 8270C |
| Lead | EPA 6010B | Di-2(ethylhexyl) phthalate | EPA 8270C |
| Lead | EPA 6020 | Di-n-butyl phthalate | EPA 8270C |
| Lead | EPA 7421 | Dimethyl phthalate | EPA 8270C |
| Mercury | EPA 7470A | beta-BHC | EPA 8081A |
| Mercury | EPA 7471A | gamma-BHC (Lindane) | EPA 8081A |
| Molybdenum | EPA 6010B | Chlorpyrifos | EPA 8141A |
| Molybdenum | EPA 6020 | 4,4'-DDT | EPA 8081A |
| Nickel | EPA 6010B | Endrin | EPA 8081A |
| Nickel | EPA 6020 | Methyl parathion | EPA 8141A |
| Selenium | EPA 6020 | PCBs | EPA 8082 |

| | | | |
|---|---|---|---|
| PCBs in Oil | EPA 8082 | Indeno(1,2,3-cd)pyrene | EPA 8270C SIM |
| Toxaphene | EPA 8081A | Pyrene | EPA 8270C |
| 2-Methylphenol | EPA 8270C | Pyrene | EPA 8270C SIM |
| 3-Methylphenol | EPA 8270C | Benzidine | EPA 8270C |
| 2,3,4,6-Tetrachlorophenol | EPA 8270C | 1,2-Diphenylhydrazine | EPA 8270C |
| Benzo(a)anthracene | EPA 8270C | Benzoic acid | EPA 8270C |
| Benzo(a)anthracene | EPA 8270C SIM | N-Nitrosodi-n-butylamine | EPA 8270C |
| Benzo(a)pyrene | EPA 8270C | Bis-(2-chloroisopropyl) ether | EPA 8270C |
| Benzo(a)pyrene | EPA 8270C SIM | Pentachlorobenzene | EPA 8270C |
| Benzo(b)fluoranthene | EPA 8270C | Pronamide | EPA 8270C |
| Benzo(b)fluoranthene | EPA 8270C SIM | 1,2,4,5-Tetrachlorobenzene | UNKNOWN |
| Benzo(k)fluoranthene | EPA 8270C | 2,4-D | EPA 8151A |
| Benzo(k)fluoranthene | EPA 8270C SIM | Dalapon | EPA 8151A |
| Dibenz(a,h)anthracene | EPA 8270C | Dinoseb | EPA 8151A |
| Dibenz(a,h)anthracene | EPA 8270C SIM | Picloram | EPA 8151A |
| Fluoranthene | EPA 8270C | 2,4,5-T | EPA 8151A |
| Fluoranthene | EPA 8270C SIM | 2,4,5-TP (Silvex) | EPA 8151A |
| Indeno(1,2,3-cd)pyrene | EPA 8270C | MCPA | EPA 8151A |

Enclosed is your laboratory's certificate.

Certification is granted for the following analytes and methods under the Clean Water Program: Ammonia Nitrogen (EPA 350.3), Volatile Solids (EPA 160.4), and Sulfide (EPA 376.1).

Certification is granted for Polyaromatic Hydrocarbons (EPA 8270C SIM) under the Resource Conservation and Recovery Program.

Certificiation is granted for the following Safe Drinking Water Program analytes and methods: Cyanide (EPA 335.4), Fluoride (EPA 300.0 and SM [19] 4500-F C), Nitrate (EPA 300.0), Nitrate (EPA 300.0), Arsenic (EPA 200.9), Barium (EPA 200.8), Beryllium (EPA 200.8), Cadmium (EPA 200.8), Chromium (EPA 200.8), Copper (EPA 200.9), Lead (EPA 200.9), Nickel (EPA 200.8), Selenium (EPA 200.9), Thallium (EPA 200.9), Volatile Organic Compounds (EPA 524.2), EDB/DBCP/123TCP (EPA 504.1), Pesticides (EPA 508.1 and EPA 525.2), PCBs (EPA 508.1), Chlorinated Acids (EPA 515.4), Carbamates (EPA 531.1), Glyphosphate (EPA 547), Endothall (EPA 548.1), and Diquat (EPA 549.2).

The following analytes are not included in the laboratory's scope of accreditation from the State of Washington dated September 3,2003: Sulfate (EPA 375.3), TCLP (EPA 1311), Selenium (EPA 6010B). Certification cannot be extended to these analytes under the reciprocity agreement between the states of Minnesota and Washington. If the laboratory wishes to pursue certification directly through the State of Minnesota, an on-site inspection would be required, along with compliance with all other requirements for certification. Please submit the on-site inspection fee of $2,500 if you wish to pursue certification for any or all of these analytes.

The laboratory changed its citation for Chemical Oxygen Demand under the Clean Water Program from EPA 410.4 to EPA 410.2; however, no standard operating procedure corresponding to EPA 410.2 was provided. Certification for Chemical Oxygen Demand (EPA 410.2) is denied.

The laboratory amended its application for Mercury (EPA 1631) under the Clean Water Program; however, standard operating procedure corresponding to EPA 1631E was not provided. Certification for Mercury (EPA 1631E) is denied.

If your laboratory wishes to renew its certification, send an application, appropriate fees, changes in your QA/Procedure Manual and most recent performance evaluation sample results *to* Certification, Public Health Laboratory, Minnesota Department of Health (MDH), 30 days prior to the expiration date noted above.

Your laboratory must analyze a performance evaluation sample from an approved provider for each certified analyte by July 31,2004. The laboratory must forward the results of these performance evaluation samples to the MDH within 30 days from the date your laboratory receives them. In addition, it is the laboratory's duty to notify the MDH within 30 days of changes in laboratory location or ownership, major analytical equipment, test methodology or supervisory staff, as detailed in Minnesota Rules, Chapter 4740, part 4740.2030, subpart 10.

If you have questions, please call the Environmental Laboratory Certification Program at (612) 676-5200, or you may speak directly with one of the certification staff below:

| | |
|---|---|
| Sharon Dahl | (612) 676-5243 |
| Suzanne Skorich | (612) 676-5676 |
| Susan Wyatt | (612) 676-5674 |

Sincerely,

Suzanne Skorich, Certification Officer
Environmental Laboratory Section
Public Health Laboratory Division
Minnesota Department of Health
P.O. Box 9441
Minneapolis, Minnesota 55440-9441

/te
Enclosure

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:

NFESC 413
April 22,2005

Mr. Lee Wolf
Quality Assurance Manager
Columbia Analytical Services
1317 South 13th Avenue
Kelso, WA 98626

Dear Mi. Wolf,

This correspondence addresses the status of Columbia Analytical Services of Kelso, WA (CAS-Kelso) in the Navy Installation Restoration (IR) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

Your laboratory is accepted to perform sample analysis for the methods listed in Table 1. The period of acceptance expires July 1,2005. This acceptance does not guarantee the delivery of any analytical samples. Acceptance is facility specific and can not be transferred to an affiliated or subcontract laboratory.

The Navy's assessment included a review of the laboratory's QA manual, selected standard operating procedures (SOPs) and SOP master list, list of major analytical instrumentation, performance test (PT) results and onsite assessment documentation'.

The Navy reserves the right to conduct additional laboratory assessments or to suspend or revoke acceptance status for any or all of the listed parameters if deemed necessary.

Table 1

| METHOD | PARAMETER | MATRIX |
|---|---|---|
| 300 Series/9056 | Anions: Bromide, sulfate, fluoride, chloride, nitrate, phosphorous | Water/Solid |
| 8310 | Polyaromatic Hydrocarbons (PAHs) | Water/Solid |
| 8151A | Herbicides | Water/Solid |
| 8081A | Organochlorine Pesticides | Water/Solid |
| 8330 | Explosives - Nitroaromatics & Nitramines | Water/Solid |
| 314.0 | Perchlorate | Water/Solid |
| 8015B (Modified) | Gasoline Range Organics (GRO)/Diesel Range Organics (DRO) | Water/Solid |

[1] State of Florida conducted an on-site assessment under the National Environmental Laboratory Accreditation Program (NELAP) on 14-17 July 2003.

| | | |
|---|---|---|
| 7196A | Hexavalent Chromium | Water/Solid |
| 8082 | Polychlorinated Biphenyls (PCBs) | Water/Solid |
| 8270C | Semivolatile Organics | Water/Solid |
| 8260B | Volatile Organics | Water/Solid |
| 9000 Series | Total Organic Carbon (TOC)/Total Organic Halides (TOX)/Total Phenolics/Cyanides | Water/Solid |
| 601OB /6020<br>7000 Series | | Water/Solid |
| 1664/9071 | Oil & Grease | Water/Solid |
| 8021B | BTEX: Benzene, Toluene, Ethylbenzene, & Xylene | Water/Solid |
| 8141A | Organophosphorus Pesticides | Water/Solid |
| CAS SOP (#SOC-BUTYL) | Butyltins: Mono-n-Butyltin, Di-n-Butyltin, Tri-n-Butyltin, Tetra-n-Butyltin | Water/Sediment/ Tissue |

Acceptance for use for parameters not identified on the table will be determined by Navy project personnel.

The laboratory should notify NFESC **if** there are parameters not presented on Table **1** that the laboratory expects to run on a routine basis in support of Navy installation restoration projects. In these circumstances the laboratory's capability to **run** the tests will be reviewed and the table **will** be modified accordingly.

Questions concerning the information provided should be directed to the NFESC IR QA Program coordinator, Ms. Patricia Moreno **at** (805) 982-1659, or via email at pati.moreno@navy.mil.

Sincerely,

Robert J. Kratzke
Supervisor, Consultation/Information
Management Branch

UNCONTROLLED

# APPENDIX F

## ADDITIONAL AGENCY-SPECIFIC DOCUMENTS

COPY

| METALS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 200.7 (ICP) | Method | Soil | Aluminum | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Antimony | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Barium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Beryllium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Boron | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Cadmium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Calcium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Chromium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Cobalt | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Copper | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Iron | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Lead | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Magnesium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Manganese | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Molybdenum | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Nickel | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Potassium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Silver | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Sodium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Tin | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Vanadium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Zinc | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Water | Aluminum | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Antimony | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Barium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Beryllium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Boron | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Cadmium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Calcium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Chromium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Cobalt | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Copper | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Iron | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Magnesium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Manganese | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Molybdenum | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Nickel | 85-115 | 70-130 | 20 | Method required |

| METALS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 200.7 (ICP) | Method | Water | Potassium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Silver | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Sodium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Tin | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Vanadium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Zinc | 85-115 | 70-130 | 20 | Method required |
| 200.9 | Method | Soil | Arsenic | Ref. | 70-130 | 30 | MS - Method required |
| 200.9 | Method | Soil | Lead | Ref. | 70-130 | 30 | MS - Method required |
| 200.9 | Method | Soil | Selenium | Ref. | 70-130 | 30 | MS - Method required |
| 200.9 | Method | Soil | Thallium | Ref. | 70-130 | 30 | MS - Method required |
| 200.9/206.2 | Method | Water | Arsenic | 85-115 | 70-130 | 20 | Method required |
| 200.9/239.2 | Method | Water | Lead | 85-115 | 70-130 | 20 | Method required |
| 245.1 | Method | Water | Mercury | 85-115 | 70-131 | 20 | Method required |
| 1631 | Method | Water | Mercury | 77-123 | 71-125 | 24 | Method required |
| 200.9/270.2 | Method | Water | Selenium | 85-115 | 70-130 | 20 | Method required |
| 200.9/279.2 | Method | Water | Thallium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Soil/Sed. | Aluminum | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Antimony | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Arsenic | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Barium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Beryllium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Cadmium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Chromium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Cobalt | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Copper | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Lead | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Manganese | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Molybdenum | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Nickel | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Selenium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Silver | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Thallium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Vanadium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Zinc | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Water | Aluminum | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Antimony | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Arsenic | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Barium | 85-115 | 70-130 | 20 | Method required |

## METALS ANALYSES

| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
|---|---|---|---|---|---|---|---|
| 200.8 | Method | Water | Beryllium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Cadmium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Chromium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Cobalt | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Copper | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Lead | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Manganese | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Molybdenum | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Nickel | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Selenium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Silver | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Thallium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Vanadium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Zinc | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Red.Precip. | Seawater | Arsenic | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Beryllium | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Cadmium | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Chromium | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Cobalt | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Copper | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Lead | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Nickel | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Silver | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Thallium | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Zinc | [illegible] | [illegible] | 20 | updated 1/05 |
| 200.8 | 3050B | Tissue | Aluminum | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Antimony | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Arsenic | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Barium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Beryllium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Cadmium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Cobalt | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Copper | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Lead | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Manganese | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Molybdenum | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Nickel | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Silver | Ref. | 70-130 | 30 | MS - Method required |

| METALS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 200.8 | 3050B | Tissue | Thallium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Vanadium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Zinc | Ref. | 70-130 | 30 | MS - Method required |
| 6010B | 3050B | Soil | Aluminum | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Antimony | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Arsenic | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Barium | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Beryllium | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Boron | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Cadmium | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Calcium | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Chromium | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Cobalt | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Copper | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Iron | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Lead | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Magnesium | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Manganese | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Molybdenum | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Nickel | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Potassium | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Selenium | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Silver | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Sodium | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Thallium | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Tin | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Vanadium | Ref. | | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Zinc | Ref. | | 30 | updated 1/05 |
| 6010B | CLP | Water | Aluminum | | | 20 | updated 1/05 |
| 6010B | CLP | Water | Antimony | | | 20 | updated 1/05 |
| 6010B | CLP | Water | Arsenic | | | 20 | updated 1/05 |
| 6010B | CLP | Water | Barium | | | 20 | updated 1/05 |
| 6010B | CLP | Water | Beryllium | | | 20 | updated 1/05 |
| 6010B | CLP | Water | Boron | | | 20 | updated 1/05 |
| 6010B | CLP | Water | Cadmium | | | 20 | updated 1/05 |
| 6010B | CLP | Water | Calcium | | 75-125 | 20 | updated 1/05, default MS |
| 6010B | CLP | Water | Chromium | | | 20 | updated 1/05 |

## METALS ANALYSES

| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
|---|---|---|---|---|---|---|---|
| 6010B | CLP | Water | Cobalt | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Copper | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Iron | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Lead | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Magnesium | [illegible] | 75-125 | 20 | updated 1/05, default MS |
| 6010B | CLP | Water | Manganese | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Molybdenum | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Nickel | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Potassium | [illegible] | 75-125 | 20 | updated 1/05, default MS |
| 6010B | CLP | Water | Selenium | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Silver | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Sodium | [illegible] | 75-125 | 20 | updated 1/05, default MS |
| 6010B | CLP | Water | Thallium | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Tin | 85-115 | 75-125 | 20 | default (method 200.7), insufficient points 1/05 |
| 6010B | CLP | Water | Vanadium | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | CLP | Water | Zinc | [illegible] | [illegible] | 20 | updated 1/05 |
| 6010B | 3050B | Tissue | Chromium | Ref. | 70-130 | 30 | default |
| 6020 | 3050B | Soil/Sed. | Aluminum | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Antimony | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Arsenic | Ref. | [illegible] | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Barium | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Beryllium | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Boron | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Cadmium | Ref. | [illegible] | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Chromium | Ref. | [illegible] | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Cobalt | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Copper | Ref. | [illegible] | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Lead | Ref. | [illegible] | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Manganese | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Molybdenum | Ref. | [illegible] | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Nickel | Ref. | [illegible] | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Selenium | Ref. | [illegible] | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Silver | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Thallium | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Uranium | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Vanadium | Ref. | [illegible] | 30 | Insufficient points 9/04, MS - Method default(200.8 |
| 6020 | 3050B | Soil/Sed. | Zinc | Ref. | [illegible] | 30 | updated 9/04 |

## METALS ANALYSES

| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
|---|---|---|---|---|---|---|---|
| 6020 | CLP/3020A | Water | Aluminum | [illegible] | [illegible] | 20 | updated 9/04, default MS - insufficient points |
| 6020 | CLP/3020A | Water | Antimony | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Arsenic | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Barium | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Beryllium | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Cadmium | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Chromium | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Cobalt | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Copper | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Lead | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Manganese | [illegible] | [illegible] | 20 | updated 9/04, default MS - insufficient points |
| 6020 | CLP/3020A | Water | Molybdenum | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Nickel | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Selenium | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Silver | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Thallium | [illegible] | [illegible] | 20 | updated 9/04 |
| 6020 | CLP/3020A | Water | Vanadium | [illegible] | [illegible] | 20 | updated 9/04, default MS - insufficient points |
| 6020 | CLP/3020A | Water | Zinc | [illegible] | [illegible] | 20 | updated 9/04 |
| 7060A | 3050B | Soil | Arsenic | Ref. | [illegible] | 30 | updated 1/05 |
| 7421 | 3050B | Soil | Lead | Ref. | [illegible] | 30 | updated 1/05 |
| 7471A | Method | Soil | Mercury | Ref. | [illegible] | 30 | updated 1/05 |
| 7740 | 3050B | Soil | Selenium | Ref. | [illegible] | 30 | updated 1/05 |
| 7742/*SM* 3114B | 3050B | Soil | Selenium | Ref. | [illegible] | 30 | updated 1/05 |
| 7841 | 3050B | Soil | Thallium | Ref. | [illegible] | 30 | updated 1/05 |
| 7060A | CLP/3020A | Water | Arsenic | [illegible] | [illegible] | 20 | updated 1/05 |
| 7421 | CLP/3020A | Water | Lead | [illegible] | [illegible] | 20 | updated 1/05 |
| 7470A | Method | Water | Mercury | [illegible] | [illegible] | 20 | updated 1/05 |
| 7740 | CLP/3020A | Water | Selenium | [illegible] | [illegible] | 20 | updated 1/05 |
| 7742/*SM* 3114B | 3010A | Water | Selenium | [illegible] | [illegible] | 20 | updated 1/05 |
| 7841 | CLP/3020A | Water | Thallium | [illegible] | [illegible] | 20 | updated 1/05 |
| 7471A | Method | Tissue | Mercury | Ref. | 60-130 | 30 | default |
| 7740 | 3050B | Tissue | Selenium | Ref. | 60-130 | 30 | default |

# DATA QUALITY CAPABILITIES

# QC CONTROL LIMITS

Metals Analyses ..... Page 2
General Chemistry/Water Chemistry Analyses ..... Page 8
Microbiological Analyses ..... Page 11
Volatile Organic Compounds (VOCs) Analyses ..... Page 12
Semivolatile Organic Compounds (SOCs) Analyses ..... Page 24
Organic Compounds in Drinking Water Analyses ..... Page 57

| METALS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 200.7 (ICP) | Method | Soil | Aluminum | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Antimony | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Barium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Beryllium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Boron | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Cadmium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Calcium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Chromium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Cobalt | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Copper | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Iron | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Lead | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Magnesium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Manganese | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Molybdenum | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Nickel | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Potassium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Silver | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Sodium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Tin | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Vanadium | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Soil | Zinc | Ref. | 70-130 | 30 | MS - Method required |
| 200.7 (ICP) | Method | Water | Aluminum | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Antimony | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Barium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Beryllium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Boron | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Cadmium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Calcium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Chromium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Cobalt | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Copper | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Iron | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Magnesium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Manganese | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Molybdenum | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Nickel | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Potassium | 85-115 | 70-130 | 20 | Method required |

| METALS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 200.7 (ICP) | Method | Water | Silver | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Sodium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Tin | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Vanadium | 85-115 | 70-130 | 20 | Method required |
| 200.7 (ICP) | Method | Water | Zinc | 85-115 | 70-130 | 20 | Method required |
| 200.9 | Method | Soil | Arsenic | Ref. | 70-130 | 30 | MS - Method required |
| 200.9 | Method | Soil | Lead | Ref. | 70-130 | 30 | MS - Method required |
| 200.9 | Method | Soil | Selenium | Ref. | 70-130 | 30 | MS - Method required |
| 200.9 | Method | Soil | Thallium | Ref. | 70-130 | 30 | MS - Method required |
| 200.9/206.2 | Method | Water | Arsenic | 85-115 | 70-130 | 20 | Method required |
| 200.9/239.2 | Method | Water | Lead | 85-115 | 70-130 | 20 | Method required |
| 245.1 | Method | Water | Mercury | 85-115 | 70-131 | 20 | Method required |
| 1631 | Method | Water | Mercury | 77-123 | 71-125 | 24 | Method required |
| 200.9/270.2 | Method | Water | Selenium | 85-115 | 70-130 | 20 | Method required |
| 200.9/279.2 | Method | Water | Thallium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Soil/Sed. | Aluminum | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Antimony | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Arsenic | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Barium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Beryllium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Cadmium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Chromium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Cobalt | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Copper | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Lead | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Manganese | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Molybdenum | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Nickel | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Selenium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Silver | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Thallium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Vanadium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Soil/Sed. | Zinc | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | Method | Water | Aluminum | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Antimony | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Arsenic | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Barium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Beryllium | 85-115 | 70-130 | 20 | Method required |

| METALS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 200.8 | Method | Water | Cadmium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Chromium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Cobalt | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Copper | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Lead | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Manganese | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Molybdenum | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Nickel | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Selenium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Silver | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Thallium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Vanadium | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Method | Water | Zinc | 85-115 | 70-130 | 20 | Method required |
| 200.8 | Red.Precip. | Seawater | Arsenic | 71-125 | 50-145 | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Beryllium | 38-114 | 50-123 | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Cadmium | 79-114 | 64-115 | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Chromium | 76-119 | 50-130 | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Cobalt | 80-112 | 50-151 | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Copper | 81-113 | 50-120 | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Lead | 81-112 | 54-118 | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Nickel | 87-113 | 59-127 | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Silver | 78-110 | 67-104 | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Thallium | 79-110 | 63-111 | 20 | updated 1/05 |
| 200.8 | Red.Precip. | Seawater | Zinc | 75-136 | 50-133 | 20 | updated 1/05 |
| 200.8 | 3050B | Tissue | Aluminum | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Antimony | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Arsenic | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Barium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Beryllium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Cadmium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Cobalt | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Copper | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Lead | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Manganese | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Molybdenum | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Nickel | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Silver | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Thallium | Ref. | 70-130 | 30 | MS - Method required |

| METALS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 200.8 | 3050B | Tissue | Vanadium | Ref. | 70-130 | 30 | MS - Method required |
| 200.8 | 3050B | Tissue | Zinc | Ref. | 70-130 | 30 | MS - Method required |
| 6010B | 3050B | Soil | Aluminum | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Antimony | Ref. | 10-144 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Arsenic | Ref. | 53-145 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Barium | Ref. | 78-129 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Beryllium | Ref. | 86-119 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Boron | Ref. | 61-137 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Cadmium | Ref. | 55-147 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Calcium | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Chromium | Ref. | 57-145 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Cobalt | Ref. | 88-114 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Copper | Ref. | 59-144 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Iron | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Lead | Ref. | 67-146 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Magnesium | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Manganese | Ref. | 23-179 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Molybdenum | Ref. | 66-126 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Nickel | Ref. | 79-124 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Potassium | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Selenium | Ref. | 76-121 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Silver | Ref. | 37-144 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Sodium | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Thallium | Ref. | 47-143 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Tin | Ref. | 75-125 | 30 | Method Default MS |
| 6010B | 3050B | Soil | Vanadium | Ref. | 79-124 | 30 | updated 1/05 |
| 6010B | 3050B | Soil | Zinc | Ref. | 51-148 | 30 | updated 1/05 |
| 6010B | CLP | Water | Aluminum | 92-111 | 67-133 | 20 | updated 1/05 |
| 6010B | CLP | Water | Antimony | 91-113 | 85-119 | 20 | updated 1/05 |
| 6010B | CLP | Water | Arsenic | 90-116 | 85-115 | 20 | updated 1/05 |
| 6010B | CLP | Water | Barium | 68-138 | 91-111 | 20 | updated 1/05 |
| 6010B | CLP | Water | Beryllium | 87-111 | 85-114 | 20 | updated 1/05 |
| 6010B | CLP | Water | Boron | 91-118 | 86-120 | 20 | updated 1/05 |
| 6010B | CLP | Water | Cadmium | 92-112 | 73-123 | 20 | updated 1/05 |
| 6010B | CLP | Water | Calcium | 92-112 | 75-125 | 20 | updated 1/05, default MS |
| 6010B | CLP | Water | Chromium | 93-114 | 76-127 | 20 | updated 1/05 |
| 6010B | CLP | Water | Cobalt | 93-113 | 90-112 | 20 | updated 1/05 |

| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
|---|---|---|---|---|---|---|---|
| 6010B | CLP | Water | Copper | 93-113 | 84-117 | 20 | updated 1/05 |
| 6010B | CLP | Water | Iron | 92-112 | 43-163 | 20 | updated 1/05 |
| 6010B | CLP | Water | Lead | 91-114 | 80-120 | 20 | updated 1/05 |
| 6010B | CLP | Water | Magnesium | 66-131 | 75-125 | 20 | updated 1/05, default MS |
| 6010B | CLP | Water | Manganese | 92-113 | 65-151 | 20 | updated 1/05 |
| 6010B | CLP | Water | Molybdenum | 90-112 | 74-128 | 20 | updated 1/05 |
| 6010B | CLP | Water | Nickel | 92-116 | 89-115 | 20 | updated 1/05 |
| 6010B | CLP | Water | Potassium | 85-120 | 75-125 | 20 | updated 1/05, default MS |
| 6010B | CLP | Water | Selenium | 71-131 | 85-116 | 20 | updated 1/05 |
| 6010B | CLP | Water | Silver | 67-132 | 76-121 | 20 | updated 1/05 |
| 6010B | CLP | Water | Sodium | 91-118 | 75-125 | 20 | updated 1/05, default MS |
| 6010B | CLP | Water | Thallium | 90-116 | 74-127 | 20 | updated 1/05 |
| 6010B | CLP | Water | Tin | 85-115 | 75-125 | 20 | default (method 200.7), insufficient points 1/05 |
| 6010B | CLP | Water | Vanadium | 93-114 | 89-112 | 20 | updated 1/05 |
| 6010B | CLP | Water | Zinc | 93-111 | 90-111 | 20 | updated 1/05 |
| 6010B | 3050B | Tissue | Chromium | Ref. | 70-130 | 30 | default |
| 6020 | 3050B | Soil/Sed. | Aluminum | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Antimony | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Arsenic | Ref. | 70-122 | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Barium | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Beryllium | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Boron | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Cadmium | Ref. | 77-122 | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Chromium | Ref. | 67-138 | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Cobalt | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Copper | Ref. | 50-142 | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Lead | Ref. | 74-117 | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Manganese | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Molybdenum | Ref. | 53-131 | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Nickel | Ref. | 73-121 | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Selenium | Ref. | 69-126 | 30 | updated 9/04 - SOP |
| 6020 | 3050B | Soil/Sed. | Silver | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Thallium | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Uranium | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Vanadium | Ref. | 70-130 | 30 | Insufficient points 9/04, MS - Method default(200.8) |
| 6020 | 3050B | Soil/Sed. | Zinc | Ref. | 51-153 | 30 | updated 9/04 |
| 6020 | CLP/3010A | Water | Aluminum | 53-181 | 70-130 | 20 | updated 9/04, default MS - insufficient points |

## METALS ANALYSES

| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
|---|---|---|---|---|---|---|---|
| 6020 | CLP/3010A | Water | Antimony | 88-109 | 83-113 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Arsenic | 86-112 | 76-125 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Barium | 89-107 | 79-123 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Beryllium | 87-110 | 72-119 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Cadmium | 86-112 | 80-113 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Chromium | 88-110 | 76-118 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Cobalt | 90-106 | 59-131 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Copper | 86-112 | 70-116 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Lead | 89-109 | 59-127 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Manganese | 87-108 | 70-130 | 20 | updated 9/04, default MS - insufficient points |
| 6020 | CLP/3010A | Water | Molybdenum | 81-116 | 78-131 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Nickel | 87-110 | 73-118 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Selenium | 85-116 | 73-125 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Silver | 85-112 | 67-121 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Thallium | 87-111 | 72-116 | 20 | updated 9/04 |
| 6020 | CLP/3010A | Water | Vanadium | 89-105 | 70-130 | 20 | updated 9/04, default MS - insufficient points |
| 6020 | CLP/3010A | Water | Zinc | 84-116 | 65-120 | 20 | updated 9/04 |
| 7060A | 3050B | Soil | Arsenic | Ref. | 41-136 | 30 | updated 1/05 |
| 7421 | 3050B | Soil | Lead | Ref. | 44-138 | 30 | updated 1/05 |
| 7471A | Method | Soil | Mercury | Ref. | 61-129 | 30 | updated 1/05 |
| 7740 | 3050B | Soil | Selenium | Ref. | 33-137 | 30 | updated 1/05 |
| 7742/*SM*3114B | 3050B | Soil | Selenium | Ref. | 64-120 | 30 | updated 1/05 |
| 7841 | 3050B | Soil | Thallium | Ref. | 40-133 | 30 | updated 1/05 |
| 7060A | CLP/3020A | Water | Arsenic | 76-115 | 60-120 | 20 | updated 1/05 |
| 7421 | CLP/3020A | Water | Lead | 77-114 | 62-123 | 20 | updated 1/05 |
| 7470A | Method | Water | Mercury | 81-108 | 72-121 | 20 | updated 1/05 |
| 7740 | CLP/3020A | Water | Selenium | 76-113 | 31-125 | 20 | updated 1/05 |
| 7742/*SM*3114B | 3010A | Water | Selenium | 75-119 | 60-127 | 20 | updated 1/05 |
| 7841 | CLP/3020A | Water | Thallium | 83-114 | 36-131 | 20 | updated 1/05 |
| 7471A | Method | Tissue | Mercury | Ref. | 60-130 | 30 | default |
| 7740 | 3050B | Tissue | Selenium | Ref. | 60-130 | 30 | default |

| GENERAL CHEMISTRY/WATER CHEMISTRY ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 110.2 | NA | Water | Color | 85-115 | NA | 20 | |
| 120.1 / *SM* 2510B | NA | Water | Conductivity | 85-115 | NA | 20 | |
| 130.2 / *SM* 2340C | NA | Water | Hardness as $CaCO_3$ | 85-115 | 75-125 | 20 | |
| 150.1 | NA | Water | pH | 85-115 | NA | NA | |
| 160.1 / *SM* 2540C | NA | Water | Solids, Total Dissolved (Filterable) | 85-115 | NA | 20 | |
| 160.2 | NA | Water | Solids, Total Suspended (Nonfilterable) | 85-115 | NA | 20 | |
| 160.3 | NA | Soil | Solids, Total | NA | NA | 20 | |
| 160.3 | NA | Water | Solids, Total | 92-106 | NA | 14 | Statistical (1/05) |
| 160.4 | NA | Soil | Solids, Volatile | 85-115 | NA | 20 | |
| 160.4 | NA | Water | Solids, Volatile | 85-115 | NA | 20 | |
| 160.5 | NA | Water | Solids, Settleable | NA | NA | 20 | |
| 180.1 | NA | Water | Turbidity | 85-115 | NA | 20 | |
| 300.0M | SOP | Soil | Bromide | 90-110 | 80-120 | 20 | Method required |
| 300.0M | SOP | Soil | Chloride | 90-110 | 80-120 | 20 | Method required |
| 300.0M | SOP | Soil | Fluoride | 90-110 | 80-120 | 20 | Method required |
| 300.0M | SOP | Soil | Nitrate as Nitrogen | 90-110 | 80-120 | 20 | Method required |
| 300.0M | SOP | Soil | Nitrite as Nitrogen | 90-110 | 80-120 | 20 | Method required |
| 300.0M | SOP | Soil | Sulfate | 90-110 | 80-120 | 20 | Method required |
| 300.0 | NA | Water | Bromide | 90-110 | 80-120 | 20 | Method required |
| 300.0 | NA | Water | Chloride | 90-110 | 80-120 | 20 | Method required |
| 300.0 | NA | Water | Fluoride | 90-110 | 80-120 | 20 | Method required |
| 300.0 | NA | Water | Nitrate as Nitrogen | 90-110 | 80-120 | 20 | Method required |
| 300.0 | NA | Water | Nitrite as Nitrogen | 90-110 | 80-120 | 20 | Method required |
| 300.0 | NA | Water | Sulfate | 90-110 | 80-120 | 20 | Method required |
| 300.1 | NA | Water | Bromate | 85-115 | 75-125 | 20 | Method required |
| 300.1 | NA | Water | Bromide | 85-115 | 75-125 | 20 | Method required |
| 300.1 | NA | Water | Chlorite | 85-115 | 75-125 | 20 | Method required |
| 300.1 | NA | Water | Dichloroacetate (surrogate) 90-115 | NA | NA | NA | Method required |
| 305.1 | NA | Water | Acidity as $CaCO_3$ | 85-115 | NA | 20 | |
| 310.1 / *SM* 2320B | NA | Water | Alkalinity as $CaCO_3$ | 85-115 | NA | 20 | |
| 314.0 | NA | Water | Perchlorate | 85-115 | 80-120 | 20 | Method required |
| 325.3 | NA | Water | Chloride, Titrimetric | 85-115 | 75-125 | 20 | |
| 330.4 | NA | Water | Chlorine, Total Residual | 85-115 | NA | 20 | |
| 335.1M | SOP | Soil | Cyanides Amenable to Chlorination | 85-115 | 75-125 | 20 | |
| 335.1 | NA | Water | Cyanides Amenable to Chlorination | 85-115 | 75-125 | 20 | |
| 335.2 / 335.4 | SOP | Soil | Cyanide, Total | 85-115 | 75-125 | 20 | |
| 335.2 / 335.4 | NA | Water | Cyanide, Total | 85-115 | 75-125 | 20 | |
| 340.1M | SOP | Soil | Fluoride, Bellack Distillation | 85-115 | 75-125 | 20 | |
| 340.1 | NA | Water | Fluoride, Bellack Distillation | 85-115 | 75-125 | 20 | |
| 340.2M | SOP | Soil | Fluoride | 85-115 | 75-125 | 20 | |

| GENERAL CHEMISTRY/WATER CHEMISTRY ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 340.2 / *SM* 4500-FC | NA | Water | Fluoride | 85-115 | 75-125 | 20 | |
| 350.1M | SOP | Soil | Ammonia as Nitrogen | 85-115 | 75-125 | 20 | |
| 350.1 | NA | Water | Ammonia as Nitrogen | 90-110 | 90-110 | 20 | |
| 350.3M | SOP | Soil | Ammonia as Nitrogen | 85-115 | 75-125 | 20 | |
| 350.3 | NA | Water | Ammonia as Nitrogen | 85-115 | 75-125 | 20 | |
| 351.4M | SOP | Soil | Nitrogen, Total Kjeldahl | 85-115 | 85-115 | 20 | Default MS&RPD w/in statistical limits (3/04), insufficient new 1/05 |
| 351.4 | NA | Water | Nitrogen, Total Kjeldahl | 85-115 | 85-115 | 20 | Default MS w/in statistical limits (1/05) |
| 353.2M | SOP | Soil | Nitrogen, Nitrate + Nitrite as Nitrogen | 85-115 | 75-125 | 20 | |
| 353.2 | NA | Water | Nitrogen, Nitrate + Nitrite as Nitrogen | 90-110 | 90-110 | 20 | |
| 354.1 | NA | Water | Nitrite as Nitrogen, Colorimetric | 85-115 | 75-125 | 20 | |
| 365.3M | SOP | Soil | Orthophosphate as Phosphorus | 85-115 | 85-115 | 20 | Insuffcient points (1/05) |
| 365.3 | NA | Water | Orthophosphate as Phosphorus | 85-115 | 89-110 | 13 | LCS default w/in stat., stat MS & RPD (3/04), insufficient new 1/05 |
| *SM* 4500P-F | NA | Water | Orthophosphate as Phosphorus | 85-115 | 89-110 | 13 | LCS default w/in stat., stat MS & RPD (3/04), insufficient new 1/05 |
| 365.3M | SOP | Soil | Phosphorus, Total | 94-108 | 85-115 | 12 | Statistical 3/04 (insufficient new 1/05), default MS within statistical |
| 365.3 | NA | Water | Phosphorus, Total | 85-115 | 76-118 | 14 | LCS default w/in stat (1/05), MS statistical (3/04) |
| 376.1 | NA | Water | Sulfide | 85-115 | 75-125 | 20 | |
| 376.2 | NA | Water | Sulfide | 85-115 | 75-125 | 20 | |
| 377.1 | NA | Water | Sulfite | NA | NA | 20 | |
| *SM* 5550B | NA | Water | Tannin and Lignin | 85-115 | 75-125 | 20 | |
| 405.1 | NA | Water | Biological Oxygen Demand | NA | NA | 20 | |
| 410.1 and 410.2M | SOP | Soil | Chemical Oxygen Demand | 85-115 | 75-125 | 20 | |
| 410.1 | NA | Water | Chemical Oxygen Demand | 85-115 | 75-125 | 20 | |
| 410.2 | NA | Water | Chemical Oxygen Demand | 85-115 | 75-125 | 20 | |
| ASTM D4129-82M | NA | Soil | Total Organic Carbon | 85-115 | 75-125 | 20 | |
| 415.1 | NA | Water | Total Organic Carbon | 90-109 | 68-132 | 17 | Statistical (1/05) |
| 420.1M | SOP | Soil | Phenolics, Total | 85-115 | 75-125 | 20 | |
| 420.1 | NA | Water | Phenolics, Total | 85-115 | 75-125 | 20 | |
| 425.1 | NA | Water | Surfactants (MBAS) | 85-115 | 75-125 | 20 | |
| ASTM D1498 | NA | Water | Oxidation-Reduction Potential | NA | NA | 20 | |
| 1020 | NA | Soil | Flashpoint, Setaflash | NA | NA | 20 | |
| 1020 | NA | Water | Flashpoint, Setaflash | NA | NA | 20 | |
| 1110 | NA | Liquid | Corrosivity | NA | NA | 20 | |
| 1650A | NA | Water | Absorbable Organic Halides | 78-116 | 78-116 | 20 | |
| 7196A | 3060A | Soil | Hexavalent Chromium | 85-115 | 85-115 | 20 | |
| 7196A | Method | Water | Hexavalent Chromium | 85-115 | 85-115 | 20 | |
| 9010B/9012A | | Soil | Cyanide, Total and Amenable | 85-115 | 75-125 | 20 | |
| 9010B/9012A | | Water | Cyanide, Total and Amenable | 85-115 | 75-125 | 20 | |
| 9020 | NA | Water | Total Organic Halides | 87-113 | 82-121 | 20 | Stat (10/03), RPD default w/in statistical (3/04) |
| 9030A | Method | Soil | Sulfides | 60-130 | 60-130 | 20 | |
| 9030 | NA | Water | Sulfides | 60-130 | 60-130 | 20 | |
| 9040 | NA | Water | Corrosivity (pH) | NA | NA | 20 | |

| GENERAL CHEMISTRY/WATER CHEMISTRY ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 9045C | NA | Soil | pH | NA | NA | 20 | |
| 9060A | NA | Water | Total Organic Carbon | 90-109 | 68-132 | 17 | Statistical (1/05) |
| 9095 | NA | Soil | Paint Filter Test | 85-115 | NA | NA | |
| 9252 | NA | Water | Chloride, Titrimetric | 85-115 | 75-125 | 20 | |
| Sec. 7.3, SW-846 | NA | Soil | Cyanide, Reactive | 85-115 | NA | 20 | |
| Sec. 7.3, SW-846 | NA | Water | Cyanide, Reactive | 85-115 | NA | 20 | |
| Sec. 7.3, SW-846 | NA | Soil | Sulfide, Reactive | 85-115 | NA | 20 | |
| Sec. 7.3, SW-846 | NA | Water | Sulfide, Reactive | 25-132 | NA | 20 | Statistical LCS (10/03), default RPD, insufficient new 1/05 |

| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
|---|---|---|---|---|---|---|---|
| *SM* 9215B | Method | Water | Heterotrophic Plate Count (Pour) | NA | NA | NA | |
| *SM* 9215C | Method | Water | Heterotrophic Plate Count (Spread) | NA | NA | NA | |
| *SM* 9221B | Method | Water | Coliform, Total (MPN) | NA | NA | NA | |
| *SM* 9221E | Method | Water | Coliform, Fecal (MPN) | NA | NA | NA | |
| *SM* 9223B | Method | Water | [illegible] | NA | [illegible] | [illegible] | |
| *SM* 9230B | Method | Water | Enterococcus | NA | NA | NA | |
| SM 9230B | Method | Water | Fecal Streptococcus | NA | NA | NA | |
| *SM* 10200H | Method | Water | Chlorophyll A | NA | NA | 20 | Method required |

| Method | Prep Method | Matrix | Anaiyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
|---|---|---|---|---|---|---|---|
| 524.2 | Method | Water | Dichlorodifluoromethane (CFC 12) | 70-130 | NA | | Method required |
| 524.2 | Method | Water | Chloromethane | 70-130 | NA | | Method required |
| 524.2 | Method | Water | Vinyl Chloride | 70-130 | NA | | Method required |
| 524.2 | Method | Water | Bromomethane | 70-130 | NA | | Method required |
| 524.2 | Method | Water | Chloroethane | 70-130 | NA | | Method required |
| 524.2 | Method | Water | Trichlorofluoromethane (CFC 11) | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,1-Dichloroethene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Methylene Chloride | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | trans-1,2-Dichloroethene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 2,2-Dichloropropane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | cis-1,2-Dichloroethene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,1-Dichloroethane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Chloroform | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Bromochloromethane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,1,1-Trichloroethane (TCA) | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,1-Dichloropropene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Carbon Tetrachloride | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Benzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,2-Dichloroethane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Trichloroethene (TCE) | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,2-Dichloropropane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Bromodichloromethane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Dibromomethane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | cis-1,3-Dichloropropene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Toluene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | trans-1,3-Dichloropropene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,1,2-Trichloroethane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Tetrachloroethene (PCE) | 70-130 | NA | NA | (Methodrequired |
| 524.2 | Method | Water | 1,3-Dichloropropane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,2,3-Trichlorobenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Dibromochloroinethane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,2-Dibromoethane (EDB) | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Chlorobenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Ethylbenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,1,1,2-Tetrachloroethane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Styrene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Total Xylenes | 70-130 | NA | NA | Method required |

| VOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 524.2 | Method | Water | Bromoform | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Isopropylbenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,1,2,2-Tetrachloroethane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,2,3-Trichloropropane | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Bromobenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | n-Propylbenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,3,5-Trimethylbenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 2-Chlorotoluene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 4-Chlorotoluene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | tert-Butylbenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,2,4-Trimethylbenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | sec-Butylbenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 4-Isopropyltoluene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,3-Dichlorobenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,4-Dichlorobenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | n-Butylbenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,2-Dichlorobenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,2-Dibromo-3-chloropropane (DBCP) | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 1,2,4-Trichlorobenzene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Hexachlorobutadiene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | Naphthalene | 70-130 | NA | NA | Method required |
| 524.2 | Method | Water | 4-Bromofluorobenzene (Surr.) 76-107 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 524.2 | Method | Water | Dibromofluoromethane (Surr.) 80-113 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 524.2 | Method | Water | Toluene-D8 (Surr.) 87-108 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 602 | Method | Water | Benzene | 39-150 | 39-150 | 30 | Method required |
| 602 | Method | Water | Toluene | 46-148 | 46-148 | 30 | Method required |
| 602 | Method | Water | Ethylbenzene | 32-160 | 32-160 | 30 | Method required |
| 602 | Method | Water | Xylenes | 32-160 | 32-160 | 30 | Method required (ethylbenzene) |
| 602 | Method | Water | 1,4-Difluorobenzene (Surr.) 84-115 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 624 | Method | Water | 1,1,1-Trichloroethane (TCA) | 68-137 | 62-155 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | 1,1,2,2-Tetrachloroethane | 58-134 | 29-157 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | 1,1,2-Trichloroethane | 65-131 | 52-140 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | 1,1-Dichloroethane | 66-133 | 59-146 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | 1,1-Dichloroethene | 66-144 | 63-163 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | 1,2-Dichlorobenzene | 70-128 | 61-136 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | 1,2-Dichloroethane (EDC) | 64-131 | 54-142 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | 1,2-Dichloropropane | 66-130 | 57-144 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | 1,3-Dichlorobenzene | 70-129 | 63-140 | 30 | updated 1/05 (Stealth 2004) |

| VOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 624 | Method | Water | 1,4-Dichlorobenzene | 68-130 | 61-139 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | 2-Chloroethyl Vinyl Ether | 10-190 | 10-163 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | Acrolein | 24-159 | 10-186 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | Acrylonitrile | 56-144 | 49-143 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | Benzene | 71-137 | 65-150 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | Bromodichloromethane | 72-131 | 55-146 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | Bromoform | 71-136 | 58-145 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | Bromomethane | 28-178 | 10-173 | 30 | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | Carbon Disulfide | 62-148 | 70-130 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Carbon Tetrachloride | 68-141 | 61-160 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Chlorobenzene | 69-129 | 63-138 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Chloroethane | 58-142 | 50-158 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Chloroform | 70-129 | 47-152 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Chloromethane | 52-151 | 38-167 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | cis-1,2-Dichloroethene | 73-129 | 70-130 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | cis-1,3-Dichloropropene | 66-140 | 10-167 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Dibromochloromethane | 69-132 | 53-144 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Dichlorodifluoromethane | 22-192 | 42-208 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Ethylbenzene | 70-140 | 67-153 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | m,p-Xylenes | 67-144 | 67-159 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Methylene Chloride | 65-136 | 50-149 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | o-Xylene | 69-139 | 65-157 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Styrene | 72-140 | 70-130 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Tetrachloroethene (PCE) | 65-137 | 59-152 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Toluene | 72-137 | 63-150 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | trans-1,2-Dichloroethene | 71-135 | 61-152 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | trans-1,3-Dichloropropene | 57-131 | 16-150 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Trichloroethene (TCE) | 70-136 | 37-192 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Trichlorofluoromethane | 55-139 | 56-156 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Trichlorotrifluoroethane | 64-160 | 70-130 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Vinyl Acetate | 43-194 | 70-130 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Vinyl Chloride | 55-147 | 54-167 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 624 | Method | Water | Dibromofluoromethane (Surr.) 59-133 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | Toluene-D8 (Surr.) 71-132 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 624 | Method | Water | 4-Bromofluorobenzene (Surr.) 66-122 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8021BTEX | 5035/5030B | Soil-mid | Benzene | 76-120 | 56-133 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8021BTEX | 5035/5030B | Soil-mid | Toluene | 76-122 | 53-138 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8021BTEX | 5035/5030B | Soil-mid | Ethylbenzene | 76-123 | 46-149 | 40 | updated 1/05 (Stealth 2003-2004) |

## VOLATILE ORGANICS ANALYSES

| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
|---|---|---|---|---|---|---|---|
| 8021BTEX | 5035/5030B | Soil-mid | m,p-Xylenes | 76-125 | 49-147 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8021BTEX | 5035/5030B | Soil-mid | o-Xylene | 76-121 | 47-143 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8021BTEX | 5035/5030B | Soil-mid | 4-Bromofluorobenzene (Surr.) 27-153 | NA | NA | | updated 1/05 (Stealth 2003-2004) |
| 8021BTEX | 5030B | Water | Benzene | 76-128 | 62-158 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8021BTEX | 5030B | Water | Toluene | 76-129 | 67-135 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8021BTEX | 5030B | Water | Ethylbenzene | 48-153 | 70-135 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8021BTEX | 5030B | Water | m,p-Xylenes | 48-154 | 76-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8021BTEX | 5030B | Water | o-Xylene | 48-151 | 76-127 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8021BTEX | 5030B | Water | 1,4-Difluorobenzene (Surr.) 77-118 | NA | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5030A/5035 | Soil-low | 1,1,1,2-Tetrachloroethane | 64-120 | 10-121 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,1,1-Trichloroethane (TCA) | 64-129 | 23-126 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,1,2,2-Tetrachloroethane | 56-119 | 10-114 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,1,2-Trichloroethane | 64-120 | 19-125 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,1-Dichloroethane | 66-124 | 30-124 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,1-Dichloroethene | 70-132 | 35-127 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,1-Dichloropropene | 61-128 | 19-128 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,2,3-Trichlorobenzene | 64-132 | 10-111 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,2,3-Trichloropropane | 58-124 | 13-123 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,2,4-Trichlorobenzene | 61-139 | 10-111 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,2,4-Trimethylbenzene | 63-131 | 10-124 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,2-Dibromo-3-chloropropane | 58-126 | 10-122 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,2-Dibromoethane (EDB) | 63-122 | 10-124 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,2-Dichlorobenzene | 64-119 | 10-119 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,2-Dichloroethane (EDC) | 62-130 | 21-132 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,2-Dichloropropane | 67-124 | 25-123 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,3,5-Trimethylbenzene | 59-131 | 10-134 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,3-Dichlorobenzene | 64-123 | 10-108 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,3-Dichloropropane | 63-123 | 19-129 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,4-Dichlorobenzene | 65-124 | 10-112 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,4-Dioxane | 10-91 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | 1-Chlorohexane | 61-145 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | 2,2-Dichloropropane | 62-136 | 26-132 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 2-Butanone (MEK) | 53-141 | 12-142 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 2-Chloroethyl Vinyl Ether | 61-140 | 10-134 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 2-Chlorotoluene | 60-129 | 15-113 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 2-Hexanone | 46-146 | 10-140 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 2-Nitropropane | 33-142 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | 3-Chloro-1-propene | 31-152 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |

| VOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8260B | 5030A/5035 | Soil-low | 4-Chlorotoluene | 58-127 | 43-108 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 4-Isopropyltoluene | 57-129 | 10-122 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 4-Methyl-2-pentanone (MIBK) | 53-149 | 14-147 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Acetone | 49-128 | 10-141 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Acetonitrile | 36-138 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | Acrolein | 10-201 | 10-83 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Acrylonitrile | 10-231 | 10-150 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Benzene | 68-126 | 26-125 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Bromobenzene | 62-124 | 13-115 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Bromochloromethane | 68-129 | 26-134 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Bromodichloromethane | 66-127 | 12-129 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Bromoethane | 72-137 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | Bromoform | 64-126 | 10-125 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Bromomethane | 30-157 | 10-146 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Carbon Disulfide | 63-129 | 11-126 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Carbon Tetrachloride | 62-131 | 10-129 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Chlorobenzene | 68-119 | 13-115 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Chloroethane | 38-156 | 13-151 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Chloroform | 67-126 | 28-126 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Chloromethane | 46-152 | 14-147 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Chloroprene | 54-142 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | cis-1,2-Dichloroethene | 67-126 | 26-129 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | cis-1,3-Dichloropropene | 66-132 | 11-127 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | cis-1,4-Dichloro-2-butene | 47-143 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | Cyclohexane | 52-138 | 10-107 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Dibromochloromethane | 64-122 | 10-127 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Dibromomethane | 67-127 | 23-130 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Dichlorodifluoromethane | 30-187 | 12-164 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Diisopropyl Ether | 64-125 | 20-125 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | Ethyl Acetate | 10-194 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | Ethyl Acrylate | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5030A/5035 | Soil-low | Ethyl Methacrylate | 45-146 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | Ethylbenzene | 65-128 | 12-121 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Ethylene Oxide | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5030A/5035 | Soil-low | Hexachlorobutadiene | 56-137 | 10-103 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Iodomethane | 10-228 | 10-157 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Isobutanol | 19-159 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | Isopropylbenzene | 55-120 | 5-111 | 40 | updated 1/05 (Stealth 2004) |

| VOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8260B | 5030A/5035 | Soil-low | m,p-Xylenes | | 64-131 | 5-127 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Methacrylonitrile | | 42-149 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | Methyl Acetate | | 32-146 | 13-135 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Methyl Methacrylate | | 31-152 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | Methyl tert-Butyl Ether | | 60-144 | 19-148 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Methylcyclohexane | | 49-141 | 10-101 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Methylene Chloride | | 60-126 | 17-132 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | n-Butylbenzene | | 56-140 | 10-122 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | n-Hexane | | 40-286 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | n-Propylbenzene | | 58-131 | 10-117 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Naphthalene | | 58-138 | 10-127 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | o-Xylene | | 65-127 | 10-129 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Propionitrile | | 30-147 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | Propylene Oxide | | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5030A/5035 | Soil-low | sec-Butylbenzene | | 60-134 | 10-116 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Styrene | | 65-129 | 10-118 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | tert-Amyl Methyl Ether | | 67-125 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | tert-Butyl Alcohol | | 35-158 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | tert-Butyl Ethyl Ether | | 63-122 | 70-130 | 40 | updated 1/05 (Stealth 2004), MS method default |
| 8260B | 5030A/5035 | Soil-low | tert-Butylbenzene | | 58-128 | 10-114 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Tetrachloroethene (PCE) | | 63-129 | 10-130 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Toluene | | 68-127 | 19-124 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | trans-1,2-Dichloroethene | | 68-128 | 24-126 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | trans-1,3-Dichloropropene | | 56-121 | 10-120 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | trans-1,4-Dichloro-2-butene | | 10-263 | 10-155 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Trichloroethene (TCE) | | 67-130 | 18-130 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Trichlorofluoromethane | | 49-144 | 14-138 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Trichlorotrifluoroethane | | 65-156 | 22-135 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Vinyl Acetate | | 10-181 | 10-114 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Vinyl Chloride | | 46-147 | 17-144 | 40 | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 1,2-Dichloroethane-D4 (Surr.) | 61-123 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | 4-Bromofluorobenzene (Surr.) | 66-122 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Dibromofluoromethane (Surr.) | 70-119 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8260B | 5030A/5035 | Soil-low | Toluene-D8 (Surr.) | 72-121 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8260B | 5035/5030B | Soil-mid | 1,1,1,2-Tetrachloroethane | | 72-128 | 67-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,1,1-Trichloroethane (TCA) | | 72-135 | 67-131 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,1,2,2-Tetrachloroethane | | 58-120 | 33-152 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,1,2-Trichloroethane | | 74-116 | 67-125 | 40 | updated 1/05 (Stealth 2003-2004) |

| VOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8260B | 5035/5030B | Soil-mid | 1,1-Dichloroethane | 74-123 | 68-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,1-Dichloroethene | 71-132 | 66-135 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,1-Dichloropropene | 74-124 | 71-121 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,2,3-Trichlorobenzene | 60-132 | 56-140 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,2,3-Trichloropropane | 68-128 | 48-148 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,2,4-Trichlorobenzene | 60-130 | 59-136 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,2,4-Trimethylbenzene | 78-137 | 71-139 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,2-Dibromo-3-chloropropane | 60-114 | 60-121 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,2-Dibromoethane (EDB) | 72-119 | 67-123 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,2-Dichlorobenzene | 77-113 | 73-116 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,2-Dichloroethane (EDC) | 72-127 | 69-129 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,2-Dichloropropane | 78-118 | 77-115 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,3,5-Trimethylbenzene | 81-129 | 51-150 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,3-Dichlorobenzene | 79-115 | 75-117 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,3-Dichloropropane | 74-118 | 69-123 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,4-Dichlorobenzene | 79-112 | 75-114 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,4-Dioxane | 10-178 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1-Chlorohexane | 71-128 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 2,2-Dichloropropane | 64-136 | 54-129 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 2-Butanone (MEK) | 72-129 | 61-141 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 2-Chloroethyl Vinyl Ether | 10-205 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 2-Chlorotoluene | 79-125 | 55-152 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 2-Hexanone | 69-130 | 54-141 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 2-Nitropropane | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | 3-Chloro-1-propene | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | 4-Chlorotoluene | 78-123 | 65-133 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 4-Isopropyltoluene | 70-132 | 59-140 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 4-Methyl-2-pentanone (MIBK) | 65-130 | 61-134 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Acetone | 65-130 | 54-140 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Acetonitrile | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Acrolein | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Acrylonitrile | 10-91 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Benzene | 83-121 | 78-122 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Bromobenzene | 77-120 | 71-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Bromochloromethane | 79-126 | 72-133 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Bromodichloromethane | 74-124 | 69-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Bromoethane | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Bromoform | 64-132 | 62-131 | 40 | updated 1/05 (Stealth 2003-2004) |

| VOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8260B | 5035/5030B | Soil-mid | Bromomethane | 10-102 | 10-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Carbon Disulfide | 56-140 | 54-144 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Carbon Tetrachloride | 67-143 | 61-137 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Chlorobenzene | 80-113 | 73-118 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Chloroethane | 10-179 | 10-174 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Chloroform | 74-125 | 69-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Chloromethane | 35-131 | 47-140 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Chloroprene | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | cis-1,2-Dichloroethene | 79-120 | 71-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | cis-1,3-Dichloropropene | 76-121 | 74-124 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | cis-1,4-Dichloro-2-butene | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Cyclohexane | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Dibromochloromethane | 69-121 | 65-123 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Dibromomethane | 79-119 | 73-125 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Dichlorodifluoromethane | 19-142 | 33-177 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Diisopropyl Ether | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Ethyl Acetate | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Ethyl Acrylate | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Ethyl Methacrylate | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Ethylbenzene | 84-124 | 74-127 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Ethylene Oxide | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Hexachlorobutadiene | 71-136 | 59-143 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Iodomethane | 10-147 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Isobutanol | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Isopropylbenzene | 75-118 | 68-119 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | m,p-Xylenes | 85-125 | 61-141 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Methacrylonitrile | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Methyl Acetate | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Methyl Methacrylate | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Methyl tert-Butyl Ether | 65-130 | 56-144 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Methylcyclohexane | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Methylene Chloride | 71-125 | 66-129 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | n-Butylbenzene | 63-134 | 55-145 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | n-Hexane | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | n-Propylbenzene | 79-108 | 62-137 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Naphthalene | 53-146 | 42-173 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | o-Xylene | 83-124 | 68-187 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Propionitrile | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |

| VOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8260B | 5035/5030B | Soil-mid | Propylene Oxide | | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | sec-Butylbenzene | | 77-135 | 70-136 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Styrene | | 83-127 | 79-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | tert-Amyl Methyl Ether | | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | tert-Butyl Alcohol | | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | tert-Butyl Ethyl Ether | | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | tert-Butylbenzene | | 79-129 | 71-131 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Tetrachloroethene (PCE) | | 75-123 | 43-149 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Toluene | | 78-126 | 73-127 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | trans-1,2-Dichloroethene | | 76-125 | 70-125 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | trans-1,3-Dichloropropene | | 63-115 | 58-121 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | trans-1,4-Dichloro-2-butene | | 70-130 | 70-130 | 40 | method default, insufficient points 1/05 |
| 8260B | 5035/5030B | Soil-mid | Trichloroethene (TCE) | | 76-131 | 69-134 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Trichlorofluoromethane | | 27-153 | 48-138 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Trichlorotrifluoroethane | | 65-137 | 54-129 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Vinyl Acetate | | 10-208 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Vinyl Chloride | | 55-145 | 58-152 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 1,2-Dichloroethane-D4[g] | 43-148 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | 4-Bromofluorobenzene[g] | 36-150 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Dibromofluoromethane[g] | 46-141 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5035/5030B | Soil-mid | Toluene-D8[g] | 45-147 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8260B | 5030B | Water | 1,1,1,2-Tetrachloroethane | | 72-133 | 75-135 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,1,1-Trichloroethane (TCA) | | 72-132 | 74-141 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,1,2,2-Tetrachloroethane | | 70-122 | 69-125 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,1,2-Trichloroethane | | 76-120 | 76-121 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,1-Dichloroethane | | 76-117 | 71-128 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,1-Dichloroethene | | 76-129 | 76-143 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,1-Dichloropropene | | 72-118 | 75-125 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,2,3-Trichlorobenzene | | 66-131 | 63-131 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,2,3-Trichloropropane | | 73-125 | 71-127 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,2,4-Trichlorobenzene | | 61-135 | 58-136 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,2,4-Trimethylbenzene | | 74-138 | 74-144 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,2-Dibromo-3-chloropropane | | 63-124 | 60-129 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,2-Dibromoethane (EDB) | | 75-120 | 77-119 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,2-Dichlorobenzene | | 81-113 | 77-117 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,2-Dichloroethane (EDC) | | 74-121 | 74-122 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,2-Dichloropropane | | 76-116 | 74-119 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,3,5-Trichlorobenzene | | 71-127 | 91-108 | 30 | updated 1/05 (Stealth 2004) |

| VOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8260B | 5030B | Water | 1,3,5-Trimethylbenzene | 78-132 | 79-138 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,3-Dichlorobenzene | 81-116 | 78-121 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,3-Dichloropropane | 77-121 | 78-120 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,4-Dichlorobenzene | 80-113 | 73-121 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,4-Dioxane | 72-177 | 71-167 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1-Chlorohexane | 70-125 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 2,2-Dichloropropane | 63-142 | 60-151 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 2-Butanone (MEK) | 69-132 | 66-134 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 2-Chloroethyl Vinyl Ether | 10-160 | 10-147 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 2-Chlorotoluene | 82-126 | 80-134 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 2-Hexanone | 67-127 | 62-132 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 2-Nitropropane | 47-171 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 3-Chloro-1-propene | 78-146 | 67-157 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 4-Chlorotoluene | 80-122 | 80-127 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 4-Isopropyltoluene | 62-132 | 64-138 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 4-Methyl-2-pentanone (MIBK) | 70-128 | 64-135 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Acetone | 70-127 | 62-134 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Acetonitrile | 70-146 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Acrolein | 16-154 | 10-160 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Acrylonitrile | 70-145 | 66-146 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Benzene | 78-121 | 75-130 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Bromobenzene | 80-121 | 80-123 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Bromochloromethane | 80-125 | 80-126 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Bromodichloromethane | 74-130 | 74-133 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Bromoform | 63-149 | 62-150 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Bromomethane | 36-158 | 30-165 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Carbon Disulfide | 62-138 | 61-134 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Carbon Tetrachloride | 66-146 | 66-137 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Chlorobenzene | 79-113 | 78-117 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Chloroethane | 62-125 | 61-136 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Chloroform | 76-121 | 76-126 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Chloromethane | 53-135 | 51-146 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Chloroprene | 79-146 | 91-142 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | cis-1,2-Dichloroethene | 83-118 | 70-135 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | cis-1,3-Dichloropropene | 79-123 | 76-124 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | cis-1,4-Dichloro-2-butene | 58-166 | 57-169 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Dibromochloromethane | 72-133 | 72-135 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Dibromomethane | 76-123 | 76-124 | 30 | updated 1/05 (Stealth 2004) |

| VOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8260B | 5030B | Water | Dichlorodifluoromethane | 45-171 | 45-189 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Dichlorofluoromethane (CFC 21) | 80-123 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Diisopropyl Ether | 68-127 | 38-158 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Ethyl Acetate | 25-220 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Ethyl Ether | 44-146 | 43-154 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Ethyl Methacrylate | 72-138 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Ethylbenzene | 84-122 | 83-130 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Hexachlorobutadiene | 66-152 | 61-141 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Iodomethane | 27-192 | 39-176 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Isobutanol | 59-168 | 51-159 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Isopropylbenzene | 72-114 | 74-120 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | m,p-Xylenes | 83-125 | 84-132 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Methacrylonitrile | 79-135 | 91-124 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Methyl Methacrylate | 72-135 | 79-127 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Methyl tert-Butyl Ether | 63-132 | 50-152 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Methylene Chloride | 65-127 | 62-131 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | n-Butylbenzene | 51-138 | 51-146 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | n-Hexane | 56-155 | 58-156 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | n-Propylbenzene | 78-124 | 78-131 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Naphthalene | 53-157 | 56-155 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | o-Xylene | 83-122 | 83-128 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Propionitrile | 66-142 | 55-155 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | sec-Butylbenzene | 72-133 | 73-141 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Styrene | 83-127 | 78-134 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | tert-Amyl Methyl Ether | 68-137 | 74-152 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | tert-Butyl Alcohol | 10-194 | 59-159 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | tert-Butyl Ethyl Ether | 68-121 | 73-124 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | tert-Butylbenzene | 76-126 | 79-132 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Tetrachloroethene (PCE) | 72-124 | 68-134 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Tetrahydrofuran | 10-186 | 26-151 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Toluene | 76-122 | 72-132 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | trans-1,2-Dichloroethene | 81-121 | 82-129 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | trans-1,3-Dichloropropene | 70-117 | 68-118 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | trans-1,4-Dichloro-2-butene | 69-145 | 75-135 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Trichloroethene (TCE) | 79-119 | 69-152 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Trichlorofluoromethane | 66-126 | 69-135 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Trichlorotrifluoroethane | 69-147 | 78-153 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Vinyl Acetate | 27-217 | 63-142 | 30 | updated 1/05 (Stealth 2004) |

| VOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8260B | 5030B | Water | Vinyl Chloride | | 67-130 | 64-144 | 30 | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 1,2-Dichloroethane-D4 (Surr.) | 76-115 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | 4-Bromofluorobenzene (Surr.) | 72-114 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Dibromofluoromethane (Surr.) | 80-119 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8260B | 5030B | Water | Toluene-D8 (Surr.) | 83-113 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8015B | 5035/5030B | Soil | Gasoline Range Petroleum Hydrocarbons | | 73-115 | 42-139 | 40 | updated 1/05 (Stealth 2003-2004) nwtph |
| 8015B | 5035/5030B | Soil | 4-Bromofluorobenzene (Surr.) | 25-133 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) nwtph |
| 8015B | 5030B | Water | Gasoline Range Petroleum Hydrocarbons | | 71-128 | 69-128 | 30 | updated 1/05 (Stealth 2003-2004) nwtph |
| 8015B | 5030B | Water | 1,4-Difluorobenzene (Surr.) | 75-120 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) nwtph |
| AK 101 | Method | Soil | Gasoline Range Petroleum Hydrocarbons | | 60-120 | 42-139 | 40 | Method required LCS, MS updated 1/05 (Stealth 20 |
| AK 101 | Method | Soil | 4-Bromofluorobenzene (Surr.) | 50-150 | 60-120 | NA | NA | Method required |
| AK 101 | Method | Water | Gasoline Range Petroleum Hydrocarbons | | 60-120 | 69-128 | 30 | Method required LCS, MS updated 1/05 (Stealth 20 |
| AK 101 | Method | Water | 1,4-Difluorobenzene (Surr.) | 50-150 | 60-120 | NA | NA | Method required |
| NWTPH-Gx | Method | Soil | Gasoline Range Petroleum Hydrocarbons | | 73-115 | 42-139 | 40 | updated 1/05 (Stealth 2003-2004) |
| NWTPH-Gx | Method | Soil | 4-Bromofluorobenzene (Surr.) | 50-150 | NA | NA | NA | Method required |
| NWTPH-Gx | Method | Water | Gasoline Range Petroleum Hydrocarbons | | 71-128 | 69-128 | 30 | updated 1/05 (Stealth 2003-2004) |
| NWTPH-Gx | Method | Water | 1,4-Difluorobenzene (Surr.) | 50-150 | NA | NA | NA | Method required |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 1664 | 9071A | Soil | Hexane Extractable Material | 78-114 | 78-114 | 18 | Method required |
| 1664 | Method | Water | Hexane Extractable Material | 78-114 | 78-114 | 18 | Method required |
| 600/4-81-045 | Method | Oil | Aroclor 1016 | 39-88 | 10-135 | 40 | updated 1/05 (Stealth 2003-2004) |
| 600/4-81-045 | Method | Oil | Aroclor 1260 | 54-103 | 41-115 | 40 | updated 1/05 (Stealth 2003-2004) |
| 600/4-81-045 | Method | Oil | Decachlorobiphenyl (Surr.) 57-114 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | 4,4'-DDD | 59-135 | 10-163 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | 4,4'-DDE | 45-145 | 10-154 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | 4,4'-DDT | 68-126 | 10-160 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Aldrin | 34-131 | 10-127 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | alpha-BHC | 44-136 | 39-119 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | alpha-Chlordane | 10-188 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Aroclor 1016 | 70-130 | 70-130 | 30 | default - insufficient points 1/05 |
| 608 | 3520C | Water | Aroclor 1260 | 70-130 | 70-130 | 30 | default - insufficient points 1/05 |
| 608 | 3520C | Water | beta-BHC | 46-160 | 18-137 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Chlordane | 70-130 | 70-130 | 30 | default - insufficient points 1/05 |
| 608 | 3520C | Water | delta-BHC | 66-127 | 19-143 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Dieldrin | 44-142 | 10-152 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Endosulfan I | 34-129 | 10-135 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Endosulfan II | 38-137 | 10-136 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Endosulfan Sulfate | 45-150 | 10-154 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Endrin | 48-142 | 10-153 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Endrin Aldehyde | 43-133 | 10-144 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Endrin Ketone | 10-186 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | gamma-BHC (Lindane) | 52-152 | 10-138 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | gamma-Chlordane | 72-119 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Heptachlor | 37-131 | 10-129 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Heptachlor Epoxide | 47-140 | 10-144 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Methoxychlor | 17-188 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Toxaphene | 70-130 | 70-130 | 30 | default - insufficient points 1/05 |
| 608 | 3520C | Water | Decachlorobiphenyl (Surr.) 10-159 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 608 | 3520C | Water | Tetrachloro-*m*-xylene (Surr.) 13-127 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 625 | 3510C/3520C | Water | 1,2,4-Trichlorobenzene | 51-98 | 10-180 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 1,2-Dichlorobenzene | 51-100 | 20-113 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 1,2-Diphenylhydrazine | 54-121 | 10-140 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 1,3-Dichlorobenzene | 50-98 | 22-107 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 1,4-Dichlorobenzene | 48-96 | 21-105 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 2,4,6-Trichlorophenol | 64-111 | 43-117 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 2,4-Dichlorophenol | 61-108 | 34-112 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 625 | 3510C/3520C | Water | 2,4-Dimethylphenol | 57-103 | 10-178 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 2,4-Dinitrophenol | 29-132 | 18-141 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 2,4-Dinitrotoluene | 65-125 | 42-133 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 2,6-Dinitrotoluene | 66-118 | 43-129 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 2-Chloronaphthalene | 53-104 | 10-132 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 2-Chlorophenol | 59-104 | 26-121 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 2-Methyl-4,6-dinitrophenol | 40-130 | 32-123 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 2-Nitrophenol | 59-113 | 29-124 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 3,3'-Dichlorobenzidine | 56-127 | 10-123 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 4-Bromophenyl Phenyl Ether | 62-108 | 10-145 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 4-Chloro-3-methylphenol | 64-112 | 10-165 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 4-Chlorophenyl Phenyl Ether | 58-111 | 10-131 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 4-Methylphenol | 35-119 | 70-130 | 30 | updated 1/05 (Stealth 2004), MS default |
| 625 | 3510C/3520C | Water | 4-Nitrophenol | 10-152 | 20-141 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Acenaphthene | 60-103 | 11-134 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Acenaphthylene | 66-109 | 10-151 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Anthracene | 68-106 | 10-136 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Benz(a)anthracene | 72-108 | 10-147 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Benzidine | 10-258 | 10-292 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Benzo(a)pyrene | 72-110 | 10-140 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Benzo(b)fluoranthene | 67-112 | 10-149 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Benzo(g,h,i)perylene | 64-112 | 10-137 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Benzo(k)fluoranthene | 68-113 | 10-161 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Bis(2-chloroethoxy)methane | 59-103 | 10-179 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Bis(2-chloroethyl) Ether | 58-103 | 30-113 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Bis(2-chloroisopropyl) Ether | 45-114 | 22-124 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Bis(2-ethylhexyl) Phthalate | 67-117 | 10-167 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Butyl Benzyl Phthalate | 66-112 | 10-159 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Chrysene | 69-111 | 10-150 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Di-n-butyl Phthalate | 58-120 | 10-157 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Di-n-octyl Phthalate | 47-140 | 10-182 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Dibenz(a,h)anthracene | 67-112 | 10-143 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Diethyl Phthalate | 59-127 | 20-142 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Dimethyl Phthalate | 64-116 | 12-143 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Fluoranthene | 61-110 | 10-138 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Fluorene | 62-108 | 16-135 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Hexachlorobenzene | 61-115 | 10-148 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Hexachlorobutadiene | 49-99 | 10-137 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 625 | 3510C/3520C | Water | Hexachlorocyclopentadiene | | 10-117 | 10-78 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Hexachloroethane | | 51-101 | 21-108 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Indeno(1,2,3-cd)pyrene | | 64-113 | 10-142 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Isophorone | | 63-122 | 33-137 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | N-Nitrosodi-n-propylamine | | 59-119 | 30-136 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | N-Nitrosodimethylamine | | 26-119 | 27-113 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | N-Nitrosodiphenylamine | | 67-119 | 14-149 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Naphthalene | | 55-97 | 10-149 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Nitrobenzene | | 54-110 | 10-190 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Pentachlorophenol | | 38-123 | 39-124 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Phenanthrene | | 63-103 | 13-187 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Phenol | | 10-130 | 10-128 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | Pyrene | | 59-105 | 10-147 | 30 | updated 1/05 (Stealth 2004), MS 2003-2004 |
| 625 | 3510C/3520C | Water | 2,4,6-Tribromophenol (Surr.) | 44-126 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 625 | 3510C/3520C | Water | 2-Fluorobiphenyl (Surr.) | 45-114 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 625 | 3510C/3520C | Water | 2-Fluorophenol (Surr.) | 22-112 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 625 | 3510C/3520C | Water | Nitrobenzene-d5 (Surr.) | 43-121 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 625 | 3510C/3520C | Water | Phenol-d6 (Surr.) | 10-133 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 625 | 3510C/3520C | Water | Terphenyl-d14 (Surr.) | 22-152 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 1653 | Method | Water | 2,4-Dichlorophenol-D3 (Surr.) | 27-143 | NA | NA | NA | Method required |
| 1653 | Method | Water | 4-Chloroguaiacol-$^{13}C_6$ (Surr.) | 43-168 | NA | NA | NA | Method required |
| 1653 | Method | Water | 3,4,5-Trichlorophenol (Surr.) | 24-167 | NA | NA | NA | Method required |
| 1653 | Method | Water | 5-Chlorovanillin-$^{13}C_6$ (Surr.) | 32-254 | NA | NA | NA | Method required |
| 1653 | Method | Water | 4,5-Dichlorocatechol-$^{13}C_6$ (Surr.) | D-190 | NA | NA | NA | Method required |
| 1653 | Method | Water | 4,5,6-Trichloroguaiacol-$^{13}C_6$ (Surr.) | 51-139 | NA | NA | NA | Method required |
| 1653 | Method | Water | Pentachlorophenol-$^{13}C_6$ (Surr.) | 27-167 | NA | NA | NA | Method required |
| 1653 | Method | Water | Tetrachloroguaiacol-$^{13}C_6$ (Surr.) | 27-161 | NA | NA | NA | Method required |
| 1653 | Method | Water | Tetrachlorocatechol-$^{13}C_6$ (Surr.) | D-184 | NA | NA | NA | Method required |
| 8015B | Method | Water | Ethylene Glycol | | 62-132 | 53-146 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8015B | Method | Water | Isopropyl Ether | | 84-117 | 77-120 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8015B | Method | Water | Propylene Glycol | | 64-129 | 62-134 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8015B | Method | Water | Cyclohexanol (Surr.) | 52-152 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C/3545 | Soil | 2,4'-DDD | | 64-131 | 39-139 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | 2,4'-DDE | | 59-133 | 45-135 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | 2,4'-DDT | | 66-130 | 40-136 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | 4,4'-DDD | | 74-130 | 32-156 | 40 | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8081A | 3540C/3545 | Soil | 4,4'-DDE | | 73-126 | 36-146 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | 4,4'-DDT | | 75-132 | 31-161 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Aldrin | | 67-120 | 39-143 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | alpha-BHC | | 67-130 | 41-148 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | alpha-Chlordane | | 72-116 | 40-140 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | beta-BHC | | 66-134 | 37-152 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Chlordane | | 57-122 | 28-142 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | cis-Nonachlor | | 61-121 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | delta-BHC | | 78-139 | 35-162 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Dieldrin | | 74-121 | 48-142 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Endosulfan I | | 50-112 | 10-141 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Endosulfan II | | 59-116 | 21-135 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Endosulfan Sulfate | | 70-124 | 39-148 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Endrin | | 76-127 | 44-146 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Endrin Aldehyde | | 29-138 | 18-137 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Endrin Ketone | | 72-123 | 37-149 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | gamma-BHC (Lindane) | | 70-125 | 45-153 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | gamma-Chlordane | | 74-117 | 33-161 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Heptachlor | | 69-120 | 35-151 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Heptachlor Epoxide | | 70-117 | 37-148 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Hexachlorobenzene | | 36-114 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Isodrin | | 63-112 | 67-112 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Methoxychlor | | 68-137 | 35-158 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Mirex | | 43-136 | 68-119 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Oxychlordane | | 55-115 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Toxaphene | | 52-142 | 52-156 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | trans-Nonachlor | | 58-117 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Decachlorobiphenyl (Surr.) | 26-166 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8081A | 3540C/3545 | Soil | Tetrachloro-*m*-xylene (Surr.) | 38-125 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | 2,4'-DDD | | 35-157 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | 2,4'-DDE | | 49-134 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | 2,4'-DDT | | 39-153 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | 4,4'-DDD | | 59-126 | 53-115 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | 4,4'-DDE | | 61-117 | 49-112 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | 4,4'-DDT | | 56-130 | 44-121 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Aldrin | | 31-129 | 10-140 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | alpha-BHC | | 48-137 | 32-128 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | alpha-Chlordane | | 48-124 | 48-104 | 30 | updated 1/05 (Stealth 2004) |

| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
|---|---|---|---|---|---|---|---|
| 8081A | 3520C/3535 | Water | beta-BHC | 45-138 | 31-121 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Chlordane | 34-140 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Chlorpyrifos | 47-129 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | cis-Nonachlor | 46-132 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | delta-BHC | 68-125 | 24-149 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Dieldrin | 45-136 | 23-145 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Endosulfan I | 28-121 | 10-147 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Endosulfan II | 35-125 | 20-126 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Endosulfan Sulfate | 44-134 | 29-125 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Endrin | 46-141 | 48-117 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Endrin Aldehyde | 37-120 | 15-110 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Endrin Ketone | 49-128 | 26-128 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | gamma-BHC (Lindane) | 47-135 | 32-126 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | gamma-Chlordane | 23-155 | 45-109 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Heptachlor | 40-126 | 46-102 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Heptachlor Epoxide | 41-134 | 42-101 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Hexachlorobenzene | 30-108 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Hexachlorobutadiene | 10-104 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Hexachloroethane | 10-106 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Isodrin | 35-119 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Methoxychlor | 47-139 | 41-128 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Mirex | 47-122 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Oxychlordane | 50-119 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Toxaphene | 42-177 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | trans-Nonachlor | 48-124 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Decachlorobiphenyl (Surr.) 19-159 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8081A | 3520C/3535 | Water | Tetrachloro-*m*-xylene (Surr.) 23-119 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8081A | 3540C | Tissue | 2,4'-DDD | 46-148 | 10-231 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | 2,4'-DDE | 42-146 | 20-176 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | 2,4'-DDT | 41-156 | 10-196 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | 4,4'-DDD | 49-132 | 16-161 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | 4,4'-DDE | 52-128 | 10-166 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | 4,4'-DDT | 53-136 | 24-151 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Aldrin | 55-118 | 30-140 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | alpha-BHC | 58-124 | 51-122 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | alpha-Chlordane | 53-116 | 41-129 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | beta-BHC | 55-118 | 13-162 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Chlorpyrifos | 45-138 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8081A | 3540C | Tissue | cis-Nonachlor | | 56-112 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | delta-BHC | | 58-135 | 36-140 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Dieldrin | | 56-122 | 25-148 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Endosulfan I | | 43-114 | 17-141 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Endosulfan II | | 52-111 | 29-139 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Endosulfan Sulfate | | 57-118 | 32-137 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Endrin | | 57-128 | 46-135 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Endrin Aldehyde | | 12-104 | 10-109 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Endrin Ketone | | 57-118 | 41-139 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | gamma-BHC (Lindane) | | 61-122 | 40-135 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | gamma-Chlordane | | 53-120 | 32-132 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Heptachlor | | 52-115 | 41-128 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Heptachlor Epoxide | | 53-120 | 43-129 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Hexachlorobenzene | | 47-105 | 30-123 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Hexachlorobutadiene | | 10-145 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Hexachloroethane | | 10-135 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Isodrin | | 49-116 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Methoxychlor | | 56-129 | 31-148 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Mirex | | 52-112 | 38-128 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Oxychlordane | | 55-108 | 21-154 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Toxaphene | | 55-128 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | trans-Nonachlor | | 54-108 | 54-110 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Decachlorobiphenyl (Surr.) | 10-178 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3540C | Tissue | Tetrachloro-*m*-xylene (Surr.) | 10-158 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8081A | 3510C | TCLP | Chlordane | | 54-108 | 32-140 | 30 | updated 1/05 (Stealth 2002-2004) |
| 8081A | 3510C | TCLP | Endrin | | 57-121 | 68-115 | 30 | updated 1/05 (Stealth 2002-2004) |
| 8081A | 3510C | TCLP | gamma-BHC (Lindane) | | 56-115 | 70-109 | 30 | updated 1/05 (Stealth 2002-2004) |
| 8081A | 3510C | TCLP | Heptachlor | | 37-99 | 39-108 | 30 | updated 1/05 (Stealth 2002-2004) |
| 8081A | 3510C | TCLP | Heptachlor Epoxide | | 54-111 | 64-107 | 30 | updated 1/05 (Stealth 2002-2004) |
| 8081A | 3510C | TCLP | Methoxychlor | | 53-122 | 62-118 | 30 | updated 1/05 (Stealth 2002-2004) |
| 8081A | 3510C | TCLP | Toxaphene | | 70-130 | 70-130 | 30 | method default |
| 8081A | 3510C | TCLP | Decachlorobiphenyl (Surr.) | 27-137 | NA | NA | NA | updated 1/05 (Stealth 2002-2004) |
| 8081A | 3510C | TCLP | Tetrachloro-*m*-xylene (Surr.) | 26-94 | NA | NA | NA | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C/3545 | Soil | Aroclor 1016 | | 43-141 | 33-155 | 40 | updated 1/05 (Stealth 2004) |
| 8082 | 3540C/3545 | Soil | Aroclor 1260 | | 50-145 | 36-161 | 40 | updated 1/05 (Stealth 2004) |
| 8082 | 3540C/3545 | Soil | Decachlorobiphenyl (Surr.) | 20-161 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8082 | 3540C/3545 | Soil | Tetrachloro-*m*-xylene (Surr.) | 28-135 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8082 | 3520C/3535 | Water | Aroclor 1016 | | 48-130 | 15-160 | 30 | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8082 | 3520C/3535 | Water | Aroclor 1260 | 56-127 | 36-140 | 30 | updated 1/05 (Stealth 2004) |
| 8082 | 3520C/3535 | Water | Decachlorobiphenyl (Surr.) | 14-139 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8082 | 3520C/3535 | Water | Tetrachloro-*m*-xylene (Surr.) | 35-118 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8082 | 3580A | Oil | Aroclor 1016 | 26-111 | 10-137 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8082 | 3580A | Oil | Aroclor 1260 | 43-123 | 29-136 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8082 | 3580A | Oil | Decachlorobiphenyl (Surr.) | 46-131 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8082 | 3580A | Oil | Tetrachloro-*m*-xylene (Surr.) | 27-110 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8082 | 3540C | Tissue | Aroclor 1016 | 62-124 | 65-125 | 40 | updated 1/05 (Stealth 2004) |
| 8082 | 3540C | Tissue | Aroclor 1260 | 62-129 | 48-142 | 40 | updated 1/05 (Stealth 2004) |
| 8082 | 3540C | Tissue | Decachlorobiphenyl (Surr.) | 37-124 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8082 | 3540C | Tissue | Tetrachloro-*m*-xylene (Surr.) | 51-119 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8082 | 3540C | Soil | PCB 101 | 51-159 | 40-178 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 105 | 45-143 | 41-154 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 114 | 41-143 | 44-147 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 118 | 49-156 | 48-161 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 123 | 46-144 | 52-141 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 126 | 48-140 | 44-147 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 128 | 33-165 | 19-200 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 138 | 39-129 | 29-146 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 153 | 46-135 | 43-136 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 156 | 43-150 | 32-169 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 157 | 36-163 | 34-159 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 158 | 39-147 | 36-163 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 166 | 70-130 | 70-130 | 40 | method default |
| 8082 | 3540C | Soil | PCB 167 | 30-152 | 50-138 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 169 | 46-156 | 53-154 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 170 | 41-147 | 34-156 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 18 | 38-107 | 24-136 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 180 | 45-148 | 39-161 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 183 | 41-141 | 26-160 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 184 | 44-156 | 39-168 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 187 | 10-174 | 10-187 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 189 | 42-149 | 39-152 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 195 | 42-146 | 40-154 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 206 | 43-145 | 46-146 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 209 | 42-143 | 29-163 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 28 | 36-156 | 28-177 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 44 | 44-135 | 26-165 | 40 | updated 1/05 (Stealth 2002-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8082 | 3540C | Soil | PCB 52 | | 36-133 | 21-157 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 60 | | 42-148 | 10-190 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 66 | | 40-129 | 40-135 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 77 | | 31-147 | 20-154 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 8 | | 42-136 | 29-157 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 81 | | 17-165 | 36-151 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 87 | | 40-131 | 18-168 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | PCB 90 | | 41-144 | 41-139 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Soil | Tetrachloro-*m*-xylene (Surr.) | 18-139 | NA | NA | NA | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3520C | Water | PCB 101 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 105 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 114 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 118 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 123 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 126 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 128 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 138 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 153 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 156 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 157 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 158 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 166 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 167 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 169 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 170 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 18 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 180 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 183 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 184 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 187 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 189 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 195 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 206 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 209 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 28 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 44 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 52 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 60 | | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8082 | 3520C | Water | PCB 66 | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 77 | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 8 | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 81 | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 87 | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | PCB 90 | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8082 | 3520C | Water | Tetrachloro-*m*-xylene (Surr.) | 10-147 | NA | NA | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 101 | 46-163 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 105 | 19-157 | 29-150 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 114 | 20-151 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 118 | 24-164 | 34-152 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 123 | 39-140 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 126 | 46-159 | 44-135 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 128 | 37-134 | 24-155 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 138 | 28-135 | 26-140 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 153 | 33-130 | 31-124 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 156 | 33-149 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 157 | 37-153 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 158 | 22-167 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 166 | 70-130 | 70-130 | 40 | method default |
| 8082 | 3540C | Tissue | PCB 167 | 70-130 | 70-130 | 40 | method default |
| 8082 | 3540C | Tissue | PCB 169 | 38-149 | 43-147 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 170 | 31-142 | 37-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 18 | 18-130 | 35-122 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 180 | 32-143 | 35-138 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 183 | 34-140 | 58-122 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 184 | 26-161 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 187 | 70-130 | 10-198 | 40 | method default |
| 8082 | 3540C | Tissue | PCB 189 | 34-145 | 59-136 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 195 | 36-137 | 39-138 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 206 | 33-142 | 39-140 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 209 | 34-140 | 35-141 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 28 | 19-163 | 41-148 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 44 | 28-142 | 47-131 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 52 | 34-182 | 48-127 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 60 | 20-170 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 66 | 26-136 | 35-132 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 77 | 18-166 | 12-191 | 40 | updated 1/05 (Stealth 2002-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8082 | 3540C | Tissue | PCB 8 | 30-147 | 42-138 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 81 | 28-143 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 87 | 26-185 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8082 | 3540C | Tissue | PCB 90 | 70-130 | 70-130 | 40 | method default |
| 8082 | 3540C | Tissue | Tetrachloro-*m*-xylene (Surr.) 26-120 | NA | NA | NA | updated 1/05 (Stealth 2002-2004) |
| 8141A | 3540C/3545 | Soil | Azinphos-methyl (Guthion) | 42-149 | 52-138 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Bolstar (Sulprofos) | 35-131 | 43-124 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Chlorpyrifos | 51-117 | 31-149 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Coumaphos | 46-141 | 52-133 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Demeton-O, S | 10-130 | 10-116 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Diazinon | 48-122 | 45-127 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Dichlorvos | 29-123 | 10-136 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Dimethoate | 51-125 | 41-133 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Disulfoton | 10-132 | 16-122 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | EPN | 48-126 | 53-122 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Ethoprop (Prophos) | 43-119 | 45-122 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Ethyl Parathion | 47-127 | 46-127 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Fensulfothion | 42-157 | 46-149 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Fenthion | 37-131 | 44-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Malathion | 47-133 | 54-125 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Merphos | 20-128 | 24-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Methyl Parathion | 48-124 | 54-121 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Mevinphos | 44-126 | 40-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Phorate | 24-117 | 15-124 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Ronnel | 47-121 | 52-119 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Stirophos (Tetrachlorovinphos) | 42-147 | 51-133 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Sulfotep | 45-112 | 47-115 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Tokuthion (Prothiofos) | 48-127 | 53-123 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Trichloronate | 48-113 | 32-134 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Tributyl Phosphate (Surr.) 17-131 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3540C/3545 | Soil | Triphenyl Phosphate (Surr.) 33-118 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Azinphos-methyl (Guthion) | 48-150 | 26-166 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Bolstar (Sulprofos) | 10-155 | 18-138 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Chlorpyrifos | 41-145 | 16-172 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Coumaphos | 51-144 | 34-147 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Demeton-O, S | 10-154 | 10-102 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Diazinon | 56-124 | 35-133 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Dichlorvos | 36-146 | 14-150 | 30 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8141A | 3520C/3535 | Water | Dimethoate | 40-146 | 26-170 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Disulfoton | 10-150 | 10-151 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | EPN | 57-126 | 36-136 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Ethoprop (Prophos) | 54-125 | 18-145 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Ethyl Parathion | 55-128 | 16-152 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Fensulfothion | 51-156 | 36-163 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Fenthion | 15-152 | 11-154 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Malathion | 59-130 | 36-144 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Merphos | 47-115 | 13-146 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Methyl Parathion | 58-126 | 36-139 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Mevinphos | 60-134 | 48-140 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Phorate | 14-149 | 10-135 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Ronnel | 56-123 | 34-129 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Stirophos (Tetrachlorovinphos) | 59-139 | 31-153 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Sulfotep | 51-119 | 30-124 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Tokuthion (Prothiofos) | 57-126 | 33-133 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Trichloronate | 36-146 | 17-157 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Tributyl Phosphate (Surr.) 29-135 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8141A | 3520C/3535 | Water | Triphenyl Phosphate (Surr.) 30-137 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | 2,4,5-T | 31-136 | 10-140 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | 2,4,5-TP (Silvex) | 33-128 | 11-132 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | 2,4-D | 34-117 | 18-120 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | 2,4-DB | 19-146 | 10-154 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | Dalapon | 14-109 | 10-121 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | Dicamba | 37-127 | 15-132 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | Dichlorprop | 26-122 | 10-125 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | Dinoseb | 10-107 | 10-97 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | MCPA | 22-124 | 10-135 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | MCPP | 10-146 | 10-156 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Soil | 2,4-Dichlorophenylacetic Acid (Surr.) 18-127 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Water | 2,4,5-T | 19-125 | 10-155 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Water | 2,4,5-TP (Silvex) | 24-120 | 19-135 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Water | 2,4-D | 22-110 | 10-141 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Water | 2,4-DB | 10-124 | 10-152 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Water | Dalapon | 10-125 | 10-169 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Water | Dicamba | 27-110 | 18-135 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Water | Dichlorprop | 21-116 | 10-137 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Water | Dinoseb | 16-93 | 10-105 | 30 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8151A | Method | Water | MCPA | 10-121 | 10-146 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Water | MCPP | 10-181 | 10-156 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151A | Method | Water | 2,4-Dichlorophenylacetic Acid (Surr.) 10-116 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Soil | 2,3,4,5-Tetrachlorophenol | 54-116 | 38-163 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Soil | 2,3,5,6-Tetrachlorophenol | 54-128 | 45-160 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Soil | 2,4,5-Trichlorophenol | 44-115 | 60-135 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Soil | 2,4,6-Trichlorophenol | 50-108 | 38-140 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Soil | 3,4,5-Trichlorophenol | 10-121 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Soil | 3,4-Dichlorophenol | 10-173 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Soil | 3,5-Dichlorophenol | 10-88 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Soil | Pentachlorophenol | 59-127 | 48-157 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Soil | 4-Bromo-2,6-dichlorophenol (Surr.) 38-155 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Water | 2,3,4,5-Tetrachlorophenol | 40-112 | 12-147 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Water | 2,3,5,6-Tetrachlorophenol | 41-116 | 20-135 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Water | 2,4,5-Trichlorophenol | 23-115 | 26-115 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Water | 2,4,6-Trichlorophenol | 28-101 | 20-112 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Water | 3,4,5-Trichlorophenol | 10-112 | 10-124 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Water | 3,4-Dichlorophenol | 10-122 | 10-122 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Water | 3,5-Dichlorophenol | 10-92 | 10-125 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Water | Pentachlorophenol | 44-116 | 34-124 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Water | 4-Bromo-2,6-dichlorophenol (Surr.) 35-133 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8151M | Method | Soil | Picric Acid | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8151M | Method | Water | Picric Acid | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8270C | 3541 | Soil | 1,2,4-Trichlorobenzene | 49-90 | 35-98 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 1,2-Dichlorobenzene | 51-89 | 34-96 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 1,2-Diphenylhydrazine | 43-113 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 1,3-Dichlorobenzene | 50-87 | 32-94 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 1,4-Dichlorobenzene | 47-85 | 32-90 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 1,4-Dioxane | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2,3,4,6-Tetrachlorophenol | 58-113 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2,4,5-Trichlorophenol | 58-102 | 39-119 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2,4,6-Trichlorophenol | 57-100 | 31-125 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2,4-Dichlorophenol | 52-96 | 34-115 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2,4-Dimethylphenol | 35-92 | 10-114 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2,4-Dinitrophenol | 33-112 | 10-110 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2,4-Dinitrotoluene | 55-116 | 42-123 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2,6-Diisopropylnaphthalene | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2,6-Dinitrotoluene | 57-107 | 47-113 | 40 | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270C | 3541 | Soil | 2-Chloronaphthalene | 62-92 | 33-111 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2-Chlorophenol | 51-90 | 34-103 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2-Methyl-4,6-dinitrophenol | 44-111 | 10-132 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2-Methylnaphthalene | 51-92 | 34-103 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2-Methylphenol | 49-92 | 31-106 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2-Nitroaniline | 55-107 | 21-144 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2-Nitrophenol | 46-105 | 27-123 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 3,3'-Dichlorobenzidine | 53-110 | 10-121 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 3-Nitroaniline | 54-111 | 25-123 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 4-Bromophenyl Phenyl Ether | 57-99 | 19-140 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 4-Chloro-3-methylphenol | 54-104 | 39-113 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 4-Chloroaniline | 54-94 | 19-109 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 4-Chlorophenyl Phenyl Ether | 49-105 | 35-117 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 4-Methylphenol | 49-91 | 22-114 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 4-Nitroaniline | 41-119 | 24-124 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 4-Nitrophenol | 44-114 | 29-122 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Acenaphthene | 56-96 | 31-115 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Acenaphthylene | 61-104 | 33-129 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Acetophenone | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Aniline | 39-82 | 10-93 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Anthracene | 62-101 | 27-127 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Atrazine | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Benz(a)anthracene | 63-104 | 38-122 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Benzaldehyde | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Benzidine | 10-154 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Benzo(a)pyrene | 59-113 | 32-126 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Benzo(b)fluoranthene | 60-104 | 32-124 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Benzo(g,h,i)perylene | 34-125 | 17-131 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Benzo(k)fluoranthene | 64-105 | 28-129 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Benzoic Acid | 10-105 | 10-91 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Benzophenone | 70-130 | 36-104 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Benzyl Alcohol | 45-97 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Biphenyl | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Bis(2-chloroethoxy)methane | 49-94 | 30-113 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Bis(2-chloroethyl) Ether | 48-96 | 32-103 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Bis(2-chloroisopropyl) Ether | 40-96 | 20-112 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Bis(2-ethylhexyl) Phthalate | 59-111 | 21-149 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Butyl Benzyl Phthalate | 59-108 | 35-129 | 40 | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270C | 3541 | Soil | Caprolactam | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Carbazole | 60-104 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Chrysene | 61-105 | 32-127 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Di-n-butyl Phthalate | 51-112 | 34-119 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Di-n-octyl Phthalate | 57-111 | 27-146 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Diazinon | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Dibenz(a,h)anthracene | 52-115 | 36-124 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Dibenzofuran | 59-97 | 26-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Diethyl Phthalate | 51-116 | 42-122 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Diethylene Glycol Dibenzoate | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Dimethyl Phthalate | 56-106 | 38-125 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Ethylene Glycol Butyl Ether (EGBE) | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Fluoranthene | 54-104 | 24-131 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Fluorene | 58-101 | 24-133 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Hexachlorobenzene | 58-102 | 36-122 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Hexachlorobutadiene | 49-92 | 29-106 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Hexachlorocyclopentadiene | 25-90 | 10-103 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Hexachloroethane | 51-90 | 29-102 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Indeno(1,2,3-cd)pyrene | 47-118 | 24-139 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Isophorone | 54-107 | 35-124 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | n-Dodecane | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | N-Nitrosodi-n-propylamine | 49-104 | 28-127 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | N-Nitrosodimethylamine | 43-96 | 19-111 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | N-Nitrosodiphenylamine | 55-118 | 30-144 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Naphthalene | 51-90 | 27-110 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Nitrobenzene | 43-98 | 34-104 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | O,O,O-Triethyl Phosphorothioate | 70-130 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Pentachlorophenol | 46-104 | 10-119 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Phenanthrene | 58-98 | 22-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Phenol | 50-90 | 34-104 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Pyrene | 54-101 | 27-126 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Pyridine | 21-102 | 10-173 | 40 | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2,4,6-Tribromophenol (Surr.) 29-120 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2-Fluorobiphenyl (Surr.) 27-120 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | 2-Fluorophenol (Surr.) 25-94 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Nitrobenzene-d5 (Surr.) 31-110 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Phenol-d6 (Surr.) 32-103 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3541 | Soil | Terphenyl-d14 (Surr.) 41-137 | NA | NA | NA | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270C | 3520C | Water | 1,2,4-Trichlorobenzene | 57-95 | 58-93 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 1,2-Dichlorobenzene | 53-101 | 49-97 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 1,2-Diphenylhydrazine | 62-114 | 52-122 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 1,3-Dichlorobenzene | 52-98 | 48-94 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 1,4-Dichlorobenzene | 51-94 | 47-93 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 1,4-Dioxane | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2,3,4,6-Tetrachlorophenol | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2,4,5-Trichlorophenol | 69-112 | 62-110 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2,4,6-Trichlorophenol | 69-109 | 46-119 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2,4-Dichlorophenol | 66-101 | 55-105 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2,4-Dimethylphenol | 48-107 | 16-134 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2,4-Dinitrophenol | 55-115 | 56-122 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2,4-Dinitrotoluene | 68-122 | 67-123 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2,6-Diisopropylnaphthalene | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2,6-Dinitrotoluene | 73-112 | 66-117 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2-Chloronaphthalene | 61-101 | 55-103 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2-Chlorophenol | 62-103 | 54-100 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2-Methyl-4,6-dinitrophenol | 59-117 | 62-119 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2-Methylnaphthalene | 10-141 | 56-94 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2-Methylphenol | 62-101 | 30-121 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2-Nitroaniline | 67-115 | 58-116 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2-Nitrophenol | 65-107 | 59-105 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 3,3'-Dichlorobenzidine | 50-120 | 10-147 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 3-Nitroaniline | 64-121 | 42-132 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 4-Bromophenyl Phenyl Ether | 71-103 | 61-106 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 4-Chloro-3-methylphenol | 67-110 | 56-112 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 4-Chloroaniline | 61-110 | 36-117 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 4-Chlorophenyl Phenyl Ether | 67-104 | 56-112 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 4-Methylphenol | 59-101 | 29-122 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 4-Nitroaniline | 57-125 | 25-142 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 4-Nitrophenol | 56-121 | 47-132 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Acenaphthene | 10-155 | 56-106 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Acenaphthylene | 10-168 | 65-108 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Acetophenone | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Aniline | 34-119 | 10-123 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Anthracene | 10-164 | 36-125 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Atrazine | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Benz(a)anthracene | 10-172 | 44-122 | 30 | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270C | 3520C | Water | Benzaldehyde | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Benzidine | 10-232 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Benzo(a)pyrene | 10-164 | 32-126 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Benzo(b)fluoranthene | 10-158 | 40-123 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Benzo(g,h,i)perylene | 10-163 | 39-126 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Benzo(k)fluoranthene | 10-171 | 42-125 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Benzoic Acid | 21-108 | 47-120 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Benzophenone | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Benzyl Alcohol | 68-109 | 57-102 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Biphenyl | 47-110 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Bis(2-chloroethoxy)methane | 61-100 | 60-97 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Bis(2-chloroethyl) Ether | 60-100 | 58-100 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Bis(2-chloroisopropyl) Ether | 52-106 | 54-99 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Bis(2-ethylhexyl) Phthalate | 66-119 | 43-121 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Butyl Benzyl Phthalate | 65-114 | 51-113 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Caprolactam | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Carbazole | 10-172 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Chrysene | 10-173 | 43-127 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Di-n-butyl Phthalate | 65-112 | 48-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Di-n-octyl Phthalate | 54-131 | 41-125 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Diazinon | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Dibenz(a,h)anthracene | 22-150 | 39-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Dibenzofuran | 10-157 | 61-107 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Diethyl Phthalate | 57-123 | 47-138 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Diethylene Glycol Dibenzoate | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Dimethyl Phthalate | 62-115 | 53-126 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Ethylene Glycol Butyl Ether (EGBE) | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Fluoranthene | 10-162 | 48-123 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Fluorene | 10-161 | 60-111 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Hexachlorobenzene | 69-108 | 50-114 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Hexachlorobutadiene | 53-97 | 45-93 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Hexachlorocyclopentadiene | 10-73 | 10-65 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Hexachloroethane | 52-102 | 48-98 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Indeno(1,2,3-cd)pyrene | 28-144 | 36-129 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Isophorone | 67-118 | 68-115 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | n-Dodecane | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | N-Nitrosodi-n-propylamine | 66-111 | 66-108 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | N-Nitrosodimethylamine | 56-111 | 53-102 | 30 | updated 1/05 (Stealth 2004) |

## SEMIVOLATILE ORGANICS ANALYSES

| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
|---|---|---|---|---|---|---|---|---|
| 8270C | 3520C | Water | N-Nitrosodiphenylamine | | 68-115 | 10-152 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Naphthalene | | 10-140 | 56-94 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Nitrobenzene | | 61-103 | 60-98 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | O,O,O-Triethyl Phosphorothioate | | 70-130 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Pentachlorophenol | | 63-110 | 51-111 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Phenanthrene | | 10-161 | 64-104 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Phenol | | 58-102 | 55-100 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Pyrene | | 10-157 | 58-117 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Pyridine | | 43-111 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2,4,6-Tribromophenol (Surr.) | 49-123 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2-Fluorobiphenyl (Surr.) | 48-111 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | 2-Fluorophenol (Surr.) | 38-104 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Nitrobenzene-d5 (Surr.) | 48-114 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Phenol-d6 (Surr.) | 44-108 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3520C | Water | Terphenyl-d14 (Surr.) | 12-155 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C | 3510C | TCLP | 1,2,4-Trichlorobenzene | | 51-98 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 1,2-Dichlorobenzene | | 52-95 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 1,3-Dichlorobenzene | | 52-93 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 1,4-Dichlorobenzene | | 49-91 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2,4,5-Trichlorophenol | | 67-114 | 51-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2,4,6-Trichlorophenol | | 67-109 | 49-129 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2,4-Dichlorophenol | | 65-102 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2,4-Dimethylphenol | | 53-105 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2,4-Dinitrophenol | | 31-127 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2,4-Dinitrotoluene | | 74-122 | 51-132 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2,6-Dinitrotoluene | | 72-114 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2-Chloronaphthalene | | 54-104 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2-Chlorophenol | | 67-97 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2-Methyl-4,6-dinitrophenol | | 62-111 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2-Methylnaphthalene | | 58-93 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2-Methylphenol | | 65-97 | 48-115 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2-Nitroaniline | | 68-113 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2-Nitrophenol | | 67-104 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 3,3'-Dichlorobenzidine | | 67-117 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 3-Nitroaniline | | 72-116 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 4-Bromophenyl Phenyl Ether | | 62-112 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 4-Chloro-3-methylphenol | | 71-105 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 4-Chloroaniline | | 64-103 | NA | 30 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270C | 3510C | TCLP | 4-Chlorophenyl Phenyl Ether | 64-108 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 4-Methylphenol | 61-97 | 52-110 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 4-Nitroaniline | 71-111 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 4-Nitrophenol | 54-105 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Acenaphthene | 61-107 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Acenaphthylene | 66-112 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Aniline | 47-111 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Anthracene | 67-114 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Benz(a)anthracene | 71-113 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Benzo(a)pyrene | 73-118 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Benzo(b)fluoranthene | 67-115 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Benzo(g,h,i)perylene | 56-130 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Benzo(k)fluoranthene | 63-123 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Benzoic acid | 10-111 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Benzyl alcohol | 65-99 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | bis(2-Chloroethoxy)methane | 63-99 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Bis(2-chloroethyl) Ether | 60-102 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Bis(2-chloroisopropyl) Ether | 50-105 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Bis(2-ethylhexyl) Phthalate | 61-123 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Butyl Benzyl Phthalate | 62-121 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Carbazole | 72-112 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Chrysene | 68-115 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Di-n-butyl Phthalate | 69-114 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Di-n-octyl Phthalate | 63-119 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Dibenz(a,h)anthracene | 57-133 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Dibenzofuran | 67-105 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Diethyl Phthalate | 69-116 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Dimethyl Phthalate | 69-111 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Fluoranthene | 64-112 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Fluorene | 63-112 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Hexachlorobenzene | 62-117 | 53-120 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Hexachlorobutadiene | 52-93 | 46-104 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Hexachlorocyclopentadiene | 26-120 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Hexachloroethane | 53-96 | 38-115 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Indeno(1,2,3-cd)pyrene | 60-129 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Isophorone | 69-113 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | N-Nitrosodi-n-propylamine | 64-108 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | N-Nitrosodimethylamine | 61-105 | NA | 30 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270C | 3510C | TCLP | N-Nitrosodiphenylamine | | 72-122 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Naphthalene | | 54-100 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Nitrobenzene | | 64-97 | 50-117 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Pentachlorophenol | | 54-118 | 42-131 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Phenanthrene | | 62-112 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Phenol | | 58-86 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Pyrene | | 55-114 | NA | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Pyridine | | 10-99 | 10-113 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2,4,6-Tribromophenol (Surr.) | 50-122 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2-Fluorobiphenyl (Surr.) | 48-118 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | 2-Fluorophenol (Surr.) | 50-102 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Nitrobenzene-d5 (Surr.) | 56-116 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Phenol-d6 (Surr.) | 51-97 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8270C | 3510C | TCLP | Terphenyl-d14 (Surr.) | 54-149 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8270C-LL | 3541 | Soil-LL | 1,2,4,5-Tetrachlorobenzene | | 50-85 | 30-113 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 1,2,4-Trichlorobenzene | | 37-98 | 10-89 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 1,2-Dichlorobenzene | | 39-96 | 10-82 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 1,3-Dichlorobenzene | | 38-94 | 10-78 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 1,4-Dichlorobenzene | | 38-92 | 10-77 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2,4,5-Trichlorophenol | | 39-101 | 27-116 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2,4,6-Trichlorophenol | | 39-99 | 31-109 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2,4-Dichlorophenol | | 38-98 | 21-109 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2,4-Dimethylphenol | | 10-72 | 10-93 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2,4-Dinitrophenol | | 21-120 | 10-140 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2,4-Dinitrotoluene | | 50-117 | 28-126 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2,6-Dinitrotoluene | | 48-109 | 28-122 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2-Chloronaphthalene | | 37-102 | 23-102 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2-Chlorophenol | | 34-99 | 23-94 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2-Methyl-4,6-dinitrophenol | | 37-113 | 10-118 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2-Methylnaphthalene | | 38-95 | 10-137 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2-Methylphenol | | 17-97 | 10-100 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2-Nitroaniline | | 44-105 | 29-117 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2-Nitrophenol | | 35-106 | 20-105 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 3,3'-Dichlorobenzidine | | 10-104 | 10-80 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 3-Nitroaniline | | 40-106 | 10-97 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 4-Bromophenyl Phenyl Ether | | 47-103 | 26-116 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 4-Chloro-3-methylphenol | | 35-102 | 21-112 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 4-Chloroaniline | | 21-86 | 10-75 | 40 | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270C-LL | 3541 | Soil-LL | 4-Chlorophenyl Phenyl Ether | 42-103 | 22-113 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 4-Methylphenol | 14-99 | 10-116 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 4-Nitroaniline | 41-112 | 10-105 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 4-Nitrophenol | 43-119 | 24-120 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Acenaphthene | 42-98 | 10-140 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Acenaphthylene | 46-106 | 10-136 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Acetophenone | 48-100 | 30-119 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Aniline | 10-65 | 10-55 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Anthracene | 50-106 | 10-162 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Atrazine | 66-111 | 63-115 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Azobenzene | 42-103 | 28-101 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Benz(a)anthracene | 57-115 | 10-164 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Benzaldehyde | 47-88 | 10-138 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Benzo(a)pyrene | 53-120 | 10-168 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Benzo(b)fluoranthene | 54-116 | 10-153 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Benzo(g,h,i)perylene | 45-124 | 10-155 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Benzo(k)fluoranthene | 56-115 | 10-147 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Benzoic Acid | 10-83 | 10-113 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Benzyl Alcohol | 32-102 | 26-106 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Biphenyl | 52-90 | 33-128 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Bis(2-chloroethoxy)methane | 37-99 | 24-101 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Bis(2-chloroethyl) Ether | 35-100 | 13-107 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Bis(2-chloroisopropyl) Ether | 30-101 | 10-92 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Bis(2-ethylhexyl) Phthalate | 52-136 | 10-158 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Butyl Benzyl Phthalate | 54-123 | 23-136 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Caprolactam | 32-101 | 10-177 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Carbazole | 53-115 | 27-125 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Chrysene | 59-120 | 10-150 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Di-n-butyl Phthalate | 49-126 | 20-131 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Di-n-octyl Phthalate | 54-127 | 27-143 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Dibenz(a,h)anthracene | 53-122 | 28-129 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Dibenzofuran | 41-99 | 10-127 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Diethyl Phthalate | 45-114 | 28-116 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Dimethyl Phthalate | 44-107 | 32-111 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Fluoranthene | 51-119 | 10-179 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Fluorene | 43-104 | 10-146 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Hexachlorobenzene | 49-107 | 32-115 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Hexachlorobutadiene | 38-96 | 10-95 | 40 | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270C-LL | 3541 | Soil-LL | Hexachlorocyclopentadiene | | 15-96 | 10-64 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Hexachloroethane | | 38-98 | 10-93 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Indeno(1,2,3-cd)pyrene | | 52-125 | 10-186 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Isophorone | | 42-110 | 22-119 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | N-Nitrosodi-n-propylamine | | 35-110 | 22-115 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | N-Nitrosodimethylamine | | 29-101 | 10-94 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | N-Nitrosodiphenylamine | | 27-128 | 18-165 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Naphthalene | | 39-97 | 10-180 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Nitrobenzene | | 35-100 | 16-102 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Pentachlorophenol | | 25-114 | 10-152 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Phenanthrene | | 48-101 | 10-159 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Phenol | | 30-107 | 21-106 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Pyrene | | 51-109 | 10-173 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Pyridine | | 10-69 | 70-130 | 40 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2,4,6-Tribromophenol (Surr.) | 23-113 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2-Fluorobiphenyl (Surr.) | 10-104 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | 2-Fluorophenol (Surr.) | 11-87 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Nitrobenzene-d5 (Surr.) | 10-99 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Phenol-d6 (Surr.) | 20-99 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3541 | Soil-LL | Terphenyl-d14 (Surr.) | 39-124 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 1,2,4,5-Tetrachlorobenzene | | 47-90 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 1,2,4-Trichlorobenzene | | 25-103 | 26-87 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 1,2-Dichlorobenzene | | 26-103 | 23-90 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 1,2-Diphenylhydrazine | | 70-130 | 70-130 | 30 | method default |
| 8270C-LL | 3520C | Water-LL | 1,3-Dichlorobenzene | | 20-96 | 19-81 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 1,4-Dichlorobenzene | | 21-97 | 20-83 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2,4,5-Trichlorophenol | | 49-182 | 56-132 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2,4,6-Trichlorophenol | | 57-124 | 40-142 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2,4-Dichlorophenol | | 47-138 | 35-137 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2,4-Dimethylphenol | | 10-105 | 10-172 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2,4-Dinitrophenol | | 10-137 | 59-142 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2,4-Dinitrotoluene | | 52-149 | 50-155 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2,6-Dinitrotoluene | | 55-140 | 60-140 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2-Chloronaphthalene | | 42-117 | 49-109 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2-Chlorophenol | | 52-125 | 39-135 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2-Methyl-4,6-dinitrophenol | | 34-139 | 28-151 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2-Methylnaphthalene | | 10-143 | 38-105 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2-Methylphenol | | 44-121 | 17-164 | 30 | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270C-LL | 3520C | Water-LL | 2-Nitroaniline | 51-136 | 10-165 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2-Nitrophenol | 51-131 | 55-141 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 3,3'-Dichlorobenzidine | 10-123 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 3-Nitroaniline | 47-134 | 10-161 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 4-Bromophenyl Phenyl Ether | 49-126 | 42-124 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 4-Chloro-3-methylphenol | 42-140 | 10-176 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 4-Chloroaniline | 10-126 | 10-113 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 4-Chlorophenyl Phenyl Ether | 47-126 | 43-120 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 4-Methylphenol | 42-123 | 15-162 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 4-Nitroaniline | 48-132 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 4-Nitrophenol | 50-141 | 47-169 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Acenaphthene | 12-153 | 34-118 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Acenaphthylene | 20-159 | 42-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Acetophenone | 70-130 | 70-130 | 30 | method default |
| 8270C-LL | 3520C | Water-LL | Aniline | 10-121 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Anthracene | 22-148 | 10-150 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Atrazine | 70-130 | 70-130 | 30 | method default |
| 8270C-LL | 3520C | Water-LL | Azobenzene | 48-153 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Benz(a)anthracene | 10-182 | 29-133 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Benzaldehyde | 70-130 | 70-130 | 30 | method default |
| 8270C-LL | 3520C | Water-LL | Benzo(a)pyrene | 10-182 | 23-136 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Benzo(b)fluoranthene | 11-175 | 26-140 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Benzo(g,h,i)perylene | 21-168 | 23-146 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Benzo(k)fluoranthene | 10-183 | 27-137 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Benzoic Acid | 10-92 | 10-175 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Benzyl Alcohol | 49-133 | 18-154 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Biphenyl | 70-130 | 70-130 | 30 | method default |
| 8270C-LL | 3520C | Water-LL | Bis(2-chloroethoxy)methane | 50-124 | 58-122 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Bis(2-chloroethyl) Ether | 51-129 | 54-122 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Bis(2-chloroisopropyl) Ether | 48-124 | 16-166 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Bis(2-ethylhexyl) Phthalate | 48-151 | 17-179 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Butyl Benzyl Phthalate | 49-144 | 43-136 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Caprolactam | 70-130 | 70-130 | 30 | method default |
| 8270C-LL | 3520C | Water-LL | Carbazole | 37-148 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Chrysene | 15-177 | 39-137 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Di-n-butyl Phthalate | 51-141 | 44-137 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Di-n-octyl Phthalate | 55-148 | 41-136 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Dibenz(a,h)anthracene | 10-186 | 25-144 | 30 | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270C-LL | 3520C | Water-LL | Dibenzofuran | 21-145 | 45-125 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Diethyl Phthalate | 39-148 | 29-153 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Dimethyl Phthalate | 53-133 | 43-150 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Fluoranthene | 28-154 | 24-159 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Fluorene | 24-150 | 39-139 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Hexachlorobenzene | 50-129 | 41-122 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Hexachlorobutadiene | 10-93 | 10-67 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Hexachlorocyclopentadiene | 10-64 | 10-66 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Hexachloroethane | 10-94 | 11-85 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Indeno(1,2,3-cd)pyrene | 16-176 | 24-147 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Isophorone | 52-140 | 44-155 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | N-Nitrosodi-n-propylamine | 47-139 | 42-156 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | N-Nitrosodimethylamine | 41-134 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | N-Nitrosodiphenylamine | 40-145 | 10-151 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Naphthalene | 10-150 | 42-109 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Nitrobenzene | 50-130 | 50-148 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Pentachlorophenol | 37-122 | 30-154 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Phenanthrene | 23-144 | 49-123 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Phenol | 46-139 | 10-170 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Pyrene | 20-150 | 14-148 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Pyridine | 28-101 | 70-130 | 30 | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2,4,6-Tribromophenol (Surr.) 44-135 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2-Fluorobiphenyl (Surr.) 41-117 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | 2-Fluorophenol (Surr.) 38-119 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Nitrobenzene-d5 (Surr.) 47-128 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Phenol-d6 (Surr.) 36-134 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270C-LL | 3520C | Water-LL | Terphenyl-d14 (Surr.) 32-155 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Soil | 1,2,4-Trichlorobenzene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 1,2-Dichlorobenzene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 1,3-Dichlorobenzene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 1,4-Dichlorobenzene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 1-Methylnaphthalene | 44-115 | 33-106 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 1-Methylphenanthrene | 57-119 | 43-124 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,3,4,5-Tetrachlorophenol | 46-135 | 48-141 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,3,4,6-Tetrachlorophenol | 49-123 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,3,4-Trichlorophenol | 45-136 | 35-155 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,3,5,6-Tetrachlorophenol | 45-135 | 27-168 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,3,5-Trichlorophenol | 42-139 | 26-166 | 40 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270-SIM | 3541 | Soil | 2,3,5-Trimethylnaphthalene | 49-114 | 38-107 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,3,6-Trichlorophenol | 42-139 | 25-165 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,4,5-Trichlorophenol | 35-135 | 59-118 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,4,6-Trichlorophenol | 34-137 | 53-121 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,4-Dichlorophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 2,4-Dimethylphenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 2,4-Dinitrophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 2,4-Dinitrotoluene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 2,6-Dimethylnaphthalene | 38-122 | 31-105 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,6-Dinitrotoluene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 2-Chloronaphthalene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 2-Chlorophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 2-Methyl-4,6-dinitrophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 2-Methylnaphthalene | 40-117 | 23-116 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2-Methylphenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 2-Nitroaniline | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 2-Nitrophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 3,3'-Dichlorobenzidine | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 3,4,5-Trichlorophenol | 10-156 | 10-182 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 3-Nitroaniline | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 4-Bromophenyl Phenyl Ether | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 4-Chloro-3-methylphenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 4-Chloroaniline | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 4-Chlorophenyl Phenyl Ether | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 4-Methylphenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 4-Nitroaniline | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | 4-Nitrophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Acenaphthene | 48-110 | 25-122 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Acenaphthylene | 48-112 | 30-117 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Aniline | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Anthracene | 53-118 | 33-129 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Benz(a)anthracene | 51-122 | 17-144 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Benzo(a)pyrene | 55-126 | 19-147 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Benzo(b)fluoranthene | 55-127 | 19-145 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Benzo(e)pyrene | 60-121 | 30-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Benzo(g,h,i)perylene | 50-127 | 15-147 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Benzo(k)fluoranthene | 57-127 | 20-144 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Biphenyl | 44-116 | 20-121 | 40 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270-SIM | 3541 | Soil | Bis(2-chloroethoxy)methane | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Bis(2-chloroethyl) Ether | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Bis(2-chloroisopropyl) Ether | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Bis(2-ethylhexyl) Phthalate | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Butyl Benzyl Phthalate | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Carbazole | 10-157 | 35-164 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Chrysene | 57-122 | 26-139 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Di-n-butyl Phthalate | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Di-n-octyl Phthalate | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Dibenz(a,h)anthracene | 43-133 | 21-143 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Dibenzofuran | 47-113 | 27-121 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Dibenzothiophene | 10-126 | 10-118 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Diethyl Phthalate | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Dimethyl Phthalate | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Fluoranthene | 55-124 | 22-145 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Fluorene | 51-112 | 28-125 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Hexachlorobenzene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Hexachlorobutadiene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Hexachlorocyclopentadiene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Hexachloroethane | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Indeno(1,2,3-cd)pyrene | 43-136 | 15-150 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Isophorone | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | N-Nitrosodi-n-propylamine | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | N-Nitrosodimethylamine | 91-114 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | N-Nitrosodiphenylamine | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Naphthalene | 43-108 | 15-116 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Nitrobenzene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Pentachlorophenol | 20-114 | 15-158 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Perylene | 59-119 | 22-136 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Phenanthrene | 52-114 | 20-136 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | Phenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Soil | Pyrene | 49-131 | 18-146 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Soil | 2,4,6-Tribromophenol (Surr.) 24-123 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Soil | 2-Fluorobiphenyl (Surr.) 10-126 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Soil | 2-Fluorophenol (Surr.) 10-94 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Soil | Fluoranthene-d10 (Surr.) 10-129 | NA | NA | NA | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270-SIM | 3541 | Soil | Fluorene-d10 (Surr.) 10-122 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Soil | Nitrobenzene-d5 (Surr.) 10-130 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Soil | Phenol-d6 (Surr.) 21-130 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Soil | Terphenyl-d14 (Surr.) 32-134 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3510C/20C/35 | Water | 1,4-Dioxane* | 45-103 | 40-104 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 1-Methylnaphthalene | 18-128 | 10-138 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 1-Methylphenanthrene | 20-147 | 15-151 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,3,4,5-Tetrachlorophenol | 28-157 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,3,4,6-Tetrachlorophenol | 10-250 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,3,4-Trichlorophenol | 51-126 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,3,5,6-Tetrachlorophenol | 29-124 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,3,5-Trichlorophenol | 50-125 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,3,5-Trimethylnaphthalene | 10-144 | 27-132 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,3,6-Trichlorophenol | 46-128 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,4,5-Trichlorophenol | 38-138 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,4,6-Trichlorophenol | 37-136 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,4-Dichlorophenol | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | 2,4-Dimethylphenol | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | 2,4-Dinitrophenol | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | 2,6-Dimethylnaphthalene | 10-142 | 28-125 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2-Chlorophenol | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | 2-Methyl-4,6-dinitrophenol | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | 2-Methylnaphthalene | 19-133 | 23-116 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2-Methylphenol | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | 2-Nitrophenol | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | 3,4,5-Trichlorophenol | 64-123 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 3-Methylcholanthrene | 10-125 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 4-Chloro-3-methylphenol | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | 4-Methylphenol | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | 4-Nitrophenol | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | 7,12-Dimethylbenz(a)anthracene | 10-88 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Acenaphthene | 36-126 | 30-117 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Acenaphthylene | 36-128 | 34-116 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Acridine | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Anthracene | 36-134 | 28-122 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Benz(a)anthracene | 45-181 | 28-131 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Benzidine | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Benzo(a)pyrene | 40-138 | 16-140 | 30 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270-SIM | 3510C/20C/35 | Water | Benzo(b)fluoranthene | | 51-135 | 26-138 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Benzo(b)thiophene | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Benzo(e)pyrene | | 19-151 | 18-149 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Benzo(g,h,i)perylene | | 42-139 | 26-132 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Benzo(k)fluoranthene | | 46-139 | 27-135 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Benzofuran | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Benzoic Acid | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Biphenyl | | 10-141 | 10-155 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Bis(2-ethylhexyl) Phthalate | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Carbazole | | 10-189 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Chrysene | | 47-132 | 30-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Dibenz(a,h)anthracene | | 42-143 | 24-139 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Dibenzofuran | | 10-167 | 20-134 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Dibenzothiophene | | 10-179 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Diphenyl Ether | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Fluoranthene | | 45-139 | 32-134 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Fluorene | | 41-130 | 28-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Indan | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Indene | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Indeno(1,2,3-cd)pyrene | | 35-148 | 21-143 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Indole | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Isoquinoline | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | N-Nitrosodimethylamine | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Naphthalene | | 32-124 | 27-109 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Pentachlorophenol | | 10-152 | 10-198 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Perylene | | 11-150 | 12-136 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Phenanthrene | | 43-129 | 36-120 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Phenanthridine | | 70-130 | 70-130 | 30 | method default |
| 8270-SIM | 3510C/20C/35 | Water | Phenol | | 10-188 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Pyrene | | 38-143 | 27-135 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | Quinoline | | 46-125 | 63-106 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3510C/20C/35 | Water | 1,4-Dioxine-d8 (Surr.) | 35-103 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2,4,6-Tribromophenol (Surr.) | 17-158 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2-Fluorobiphenyl (Surr.) | 26-130 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3510C/20C/35 | Water | 2-Fluorophenol (Surr.) | 10-138 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3510C/20C/35 | Water | Fluoranthene-d10 (Surr.) | 26-123 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3510C/20C/35 | Water | Fluorene-d10 (Surr.) | 24-111 | NA | NA | NA | updated 1/05 (Stealth 2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270-SIM | 3510C/20C/35 | Water | Nitrobenzene-d5 (Surr.) 39-146 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3510C/20C/35 | Water | Phenol-d6 (Surr.) 25-154 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3510C/20C/35 | Water | Terphenyl-d14 (Surr.) 25-146 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Tissue | 1,2,4-Trichlorobenzene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 1,2-Dichlorobenzene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 1,3-Dichlorobenzene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 1,4-Dichlorobenzene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 1-Methylnaphthalene | 10-190 | 41-116 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 1-Methylphenanthrene | 18-193 | 76-124 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2,3,4,5-Tetrachlorophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 2,3,4,6-Tetrachlorophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 2,3,4-Trichlorophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 2,3,5,6-Tetrachlorophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 2,3,5-Trichlorophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 2,3,5-Trimethylnaphthalene | 10-193 | 56-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2,3,6-Trichlorophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 2,4,5-Trichlorophenol | 44-121 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2,4,6-Trichlorophenol | 45-120 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2,4-Dichlorophenol | 46-117 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2,4-Dimethylphenol | 10-103 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2,4-Dinitrophenol | 25-138 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2,4-Dinitrotoluene | 61-133 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2,6-Dimethylnaphthalene | 10-194 | 27-133 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2,6-Dinitrotoluene | 36-152 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2-Chloronaphthalene | 49-130 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2-Chlorophenol | 48-114 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2-Methyl-4,6-dinitrophenol | 43-134 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2-Methylnaphthalene | 10-181 | 40-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2-Methylphenol | 41-112 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2-Nitroaniline | 44-127 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2-Nitrophenol | 42-127 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 3,3'-Dichlorobenzidine | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 3,4,5-Trichlorophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | 3-Nitroaniline | 49-130 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 4-Bromophenyl Phenyl Ether | 54-121 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 4-Chloro-3-methylphenol | 45-117 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 4-Chloroaniline | 34-107 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 4-Chlorophenyl Phenyl Ether | 51-116 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270-SIM | 3541 | Tissue | 4-Methylphenol | 35-116 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 4-Nitroaniline | 57-133 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 4-Nitrophenol | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | Acenaphthene | 48-119 | 54-122 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Acenaphthylene | 49-123 | 53-129 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Aniline | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | Anthracene | 53-127 | 58-129 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Benz(a)anthracene | 55-133 | 55-133 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Benzo(a)pyrene | 57-144 | 58-154 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Benzo(b)fluoranthene | 59-137 | 52-133 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Benzo(e)pyrene | 21-192 | 64-121 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Benzo(g,h,i)perylene | 49-145 | 44-134 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Benzo(k)fluoranthene | 59-145 | 53-136 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Biphenyl | 10-185 | 63-112 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Bis(2-chloroethoxy)methane | 46-116 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Bis(2-chloroethyl) Ether | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | Bis(2-chloroisopropyl) Ether | 43-115 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Bis(2-ethylhexyl) Phthalate | 36-161 | 55-155 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Butyl Benzyl Phthalate | 51-145 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Carbazole | 10-209 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Chrysene | 59-133 | 63-124 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Di-n-butyl Phthalate | 54-152 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Di-n-octyl Phthalate | 53-157 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Dibenz(a,h)anthracene | 53-152 | 63-141 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Dibenzofuran | 10-191 | 53-124 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Dibenzothiophene | 10-183 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Diethyl Phthalate | 59-132 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Dimethyl Phthalate | 54-124 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Fluoranthene | 57-136 | 51-144 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Fluorene | 54-121 | 57-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Hexachlorobenzene | 63-121 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Hexachlorobutadiene | 48-109 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Hexachlorocyclopentadiene | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | Hexachloroethane | 46-108 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Indeno(1,2,3-cd)pyrene | 53-149 | 56-144 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Isophorone | 56-131 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8270-SIM | 3541 | Tissue | N-Nitrosodi-n-propylamine | 41-139 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | N-Nitrosodimethylamine | 70-130 | 70-130 | 40 | method default |
| 8270-SIM | 3541 | Tissue | N-Nitrosodiphenylamine | 55-134 | 57-144 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Naphthalene | 42-118 | 33-119 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Nitrobenzene | 46-119 | 67-117 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Pentachlorophenol | 45-120 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Perylene | 19-195 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Phenanthrene | 52-122 | 57-124 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Phenol | 52-116 | 70-130 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | Pyrene | 49-135 | 50-127 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8270-SIM | 3541 | Tissue | 2,4,6-Tribromophenol (Surr.) 54-135 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Tissue | 2-Fluorobiphenyl (Surr.) 57-115 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Tissue | 2-Fluorophenol (Surr.) 51-113 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Tissue | Fluoranthene-d10 (Surr.) 44-112 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Tissue | Fluorene-d10 (Surr.) 47-97 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Tissue | Nitrobenzene-d5 (Surr.) 44-129 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Tissue | Phenol-d6 (Surr.) 57-130 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8270-SIM | 3541 | Tissue | Terphenyl-d14 (Surr.) 56-136 | NA | NA | NA | updated 1/05 (Stealth 2004) |
| 8310 | 3550B | Soil | 2-Methylnaphthalene | 10-170 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Acenaphthene | 49-91 | 27-104 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Acenaphthylene | 54-94 | 10-132 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Anthracene | 52-88 | 22-127 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Benz(a)anthracene | 29-153 | 19-143 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Benzo(a)pyrene | 22-135 | 10-159 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Benzo(b)fluoranthene | 32-156 | 10-162 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Benzo(g,h,i)perylene | 71-107 | 10-174 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Benzo(k)fluoranthene | 33-167 | 10-181 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Chrysene | 33-155 | 10-192 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Dibenz(a,h)anthracene | 41-142 | 10-179 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Fluoranthene | 52-117 | 10-171 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Fluorene | 49-91 | 12-129 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Indeno(1,2,3-cd)pyrene | 30-157 | 10-186 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Naphthalene | 43-91 | 10-121 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Phenanthrene | 41-114 | 15-144 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | Pyrene | 46-124 | 10-159 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3550B | Soil | *p*-Terphenyl (Surr.) 25-160 | NA | NA | NA | updated 1/05 (Stealth 2002-2004) |
| 8310 | 3510C | Water | 2-Methylnaphthalene/Dibenzofuran | 40-109 | 40-102 | 30 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8310 | 3510C | Water | Acenaphthene | 49-105 | 41-111 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Acenaphthylene | 51-103 | 40-114 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Anthracene | 65-104 | 57-112 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Benz(a)anthracene | 72-109 | 63-116 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Benzo(a)pyrene | 65-114 | 56-120 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Benzo(b)fluoranthene | 69-113 | 57-123 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Benzo(g,h,i)perylene | 58-115 | 56-120 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Benzo(k)fluoranthene | 72-110 | 66-114 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Chrysene | 71-112 | 59-122 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Dibenz(a,h)anthracene | 28-138 | 51-124 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Fluoranthene | 66-108 | 47-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Fluorene | 53-103 | 27-133 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Indeno(1,2,3-cd)pyrene | 60-117 | 60-118 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Naphthalene | 45-105 | 40-110 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Phenanthrene | 64-105 | 60-107 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | Pyrene | 68-108 | 34-141 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8310 | 3510C | Water | p-Terphenyl (Surr.) 42-126 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8315 | Method | Soil | Acetaldehyde | 46-124 | 70-130 | 40 | updated 1/05 (Stealth 2002-2004) |
| 8315 | Method | Soil | Formaldehyde | 39-153 | 39-153 | 40 | Method required |
| 8315 | Method | Water | Acetaldehyde | 70-130 | 70-130 | 30 | Method default, insufficient points 1/05 |
| 8315 | Method | Water | Formaldehyde | 39-153 | 39-153 | 30 | Method required |
| 8330 | Method | Soil | 1,3,5-Trinitrobenzene | 82-115 | 75-118 | 18 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | 1,3-Dinitrobenzene | 78-119 | 72-123 | 19 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | 2,4,6-Trinitrotoluene | 79-121 | 72-125 | 23 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | 2,4-Dinitrotoluene | 78-120 | 67-131 | 22 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | 2,6-Dinitrotoluene | 74-117 | 71-118 | 21 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | 2-Amino-4,6-dinitrotoluene | 57-145 | 66-132 | 21 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | 2-Nitrotoluene | 80-114 | 72-118 | 19 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | 3-Nitrotoluene | 77-115 | 68-121 | 21 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | 4-Amino-2,6-dinitrotoluene | 60-141 | 69-125 | 23 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | 4-Nitrotoluene | 78-116 | 70-121 | 19 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | HMX | 78-116 | 70-121 | 25 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | Nitrobenzene | 77-118 | 69-122 | 16 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | RDX | 79-114 | 67-119 | 24 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | Tetryl | 75-134 | 63-130 | 26 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Soil | 1-Chloro-3-nitrobenzene (Surr.) 67-119 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8330 | Method | Water | 1,3,5-Trinitrobenzene | 69-113 | 54-132 | 16 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | 1,3-Dinitrobenzene | 71-117 | 52-144 | 16 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 8330 | Method | Water | 2,4,6-Trinitrotoluene | 68-123 | 57-140 | 16 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | 2,4-Dinitrotoluene | 70-121 | 54-145 | 18 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | 2,6-Dinitrotoluene | 69-117 | 48-146 | 18 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | 2-Amino-4,6-dinitrotoluene | 67-123 | 52-145 | 15 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | 2-Nitrotoluene | 54-113 | 48-145 | 46 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | 3-Nitrotoluene | 53-117 | 48-144 | 40 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | 4-Amino-2,6-dinitrotoluene | 69-120 | 49-146 | 15 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | 4-Nitrotoluene | 57-117 | 48-145 | 35 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | HMX | 66-107 | 51-131 | 17 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | Nitrobenzene | 55-117 | 47-145 | 42 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | RDX | 63-116 | 46-142 | 22 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | Tetryl | 52-138 | 42-145 | 16 | updated 1/05 (Stealth 2003-2004), RPD 3/04 (Stealt |
| 8330 | Method | Water | 1-Chloro-3-nitrobenzene (Surr.) 52-135 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8330 | Method | Tissue | 1,3,5-Trinitrobenzene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | 1,3-Dinitrobenzene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | 2,4,6-Trinitrotoluene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | 2,4-Dinitrotoluene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | 2,6-Dinitrotoluene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | 2-Amino-4,6-dinitrotoluene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | 2-Nitrotoluene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | 3-Nitrotoluene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | 4-Amino-2,6-dinitrotoluene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | 4-Nitrotoluene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | HMX | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | Nitrobenzene | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | RDX | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | Tetryl | 70-130 | 70-130 | 40 | Method default, insufficient points 1/05 |
| 8330 | Method | Tissue | 1-Chloro-3-nitrobenzene (Surr.) 83-110 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8332 | Method | Soil | Nitroglycerine | 39-111 | 42-139 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8332 | Method | Soil | PETN | 80-111 | 77-115 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8332 | Method | Soil | 1-Chloro-3-nitrobenzene (Surr.) 50-135 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8332 | Method | Water | Nitroglycerine | 28-133 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8332 | Method | Water | PETN | 42-126 | 70-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8332 | Method | Water | 2,3-Dimethyl-2,3-dinitrobutane (Surr.) 47-110 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Soil | Dibutyltin | 14-145 | 10-141 | 40 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Soil | Monobutyltin | 10-96 | 10-64 | 40 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Soil | Tetrabutyltin | 10-127 | 10-132 | 40 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Soil | Tributyltin | 13-125 | 10-140 | 40 | updated 1/05 (Stealth 2003-2004) |

| SEMIVOLATILE ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| Organotin | Method | Soil | Tripropyltin (Surr.) | 10-127 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Water | Dibutyltin | | 21-119 | 16-120 | 30 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Water | Monobutyltin | | 28-143 | 23-130 | 30 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Water | Tetrabutyltin | | 10-104 | 10-95 | 30 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Water | Tributyltin | | 24-129 | 28-121 | 30 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Water | Tripropyltin (Surr.) | 23-137 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Tissue | Dibutyltin | | 10-130 | 10-126 | 40 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Tissue | Monobutyltin | | 10-125 | 13-107 | 40 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Tissue | Tetrabutyltin | | 23-117 | 12-104 | 40 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Tissue | Tributyltin | | 23-117 | 10-151 | 40 | updated 1/05 (Stealth 2003-2004) |
| Organotin | Method | Tissue | Tripropyltin (Surr.) | 10-160 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8015M | 3550B | Soil | Diesel Range Petroleum Hydrocarbons | | 74-146 | 62-161 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8015M | 3550B | Soil | Residual Range Petroleum Hydrocarbons | | 70-135 | 57-158 | 40 | updated 1/05 (Stealth 2003-2004) |
| 8015M | 3550B | Soil | Bromofluorobenzene (Surr.) | 37-137 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8015M | 3550B | Soil | o-Terphenyl (Surr.) | 54-140 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8015M | 3510C | Water | Diesel Range Petroleum Hydrocarbons | | 67-151 | 57-158 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8015M | 3510C | Water | Residual Range Petroleum Hydrocarbons | | 59-146 | 45-157 | 30 | updated 1/05 (Stealth 2003-2004) |
| 8015M | 3510C | Water | Bromofluorobenzene (Surr.) | 39-133 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| 8015M | 3510C | Water | o-Terphenyl (Surr.) | 52-128 | NA | NA | NA | updated 1/05 (Stealth 2003-2004) |
| AK 102 | Method | Soil | Diesel Range Petroleum Hydrocarbons | | 75-125 | 60-140 | 20 | Method required |
| AK 102 | Method | Soil | o-Terphenyl (Surr.) | 50-150 | 60-120 | NA | NA | Method required |
| AK 102 | Method | Water | Diesel Range Petroleum Hydrocarbons | | 75-125 | 75-125 | 20 | Method required |
| AK 102 | Method | Water | o-Terphenyl (Surr.) | 50-150 | 60-120 | NA | NA | Method required |
| AK 103 | Method | Soil | Residual Range Petroleum Hydrocarbons | | 60-120 | 60-140 | 20 | Method required |
| AK 103 | Method | Soil | n-Triacontane (Surr.) | 50-150 | 60-120 | NA | NA | Method required |
| NWTPH-Dx | Method | Soil | Diesel Range Petroleum Hydrocarbons | | 62-159 | 37-189 | 40 | updated 1/05 (Stealth 2003-2004) |
| NWTPH-Dx | Method | Soil | o-Terphenyl (Surr.) | 50-150 | NA | NA | NA | Method required |
| NWTPH-Dx | Method | Water | Diesel Range Petroleum Hydrocarbons | | 56-162 | 55-155 | 30 | updated 1/05 (Stealth 2003-2004) |
| NWTPH-Dx | Method | Water | o-Terphenyl (Surr.) | 50-150 | NA | NA | NA | Method required |
| NCASI 94.03 | Method | Water | Methanol | | 76-126 | 47-144 | 30 | updated 1/05 (Stealth 2003-2004) |

| DRINKING WATER ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 504.1 | Method | Water | 1,2-Dibromoethane | 70-130 | 65-135 | NA | Method required |
| 504.1 | Method | Water | 1,2-Dibromo-3-chloropropane | 70-130 | 65-135 | NA | Method required |
| 504.1 | Method | Water | 1,2,3-Trichloropropane | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Aldrin | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Alpha-BHC | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Alpha-Chlordane | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Beta-BHC | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Chlordane | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | 4,4'-DDD | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | 4,4'-DDE | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | 4,4'-DDT | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Delta-BHC | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Dieldrin | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Endosulfan I | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Endosulfan II | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Endosulfan Sulfate | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Endrin | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Endrin Aldehyde | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Gamma-BHC(Lindane) | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Gamma-Chlordane | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Heptachlor | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Heptachlor Epoxide | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Heptachlor Epoxide (isomer A) | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Methoxychlor | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Toxaphene | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Aroclor 1016 | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Aroclor 1221 | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Aroclor 1232 | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Aroclor 1242 | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Aroclor 1248 | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Aroclor 1254 | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | Aroclor 1260 | 70-130 | 65-135 | NA | Method required |
| 508.1 | Method | Water | 4,4'-Dibromooctafluorobiphenyl (Surr.) 70-130 | NA | NA | NA | Method required |
| 515.4 | Method | Water | Aciflurofen | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | Bentazon | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | Chloramben | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | 2,4-D | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | Dalapon | 70-130 | 70-130 | 30 | Reporting purposes only |

3

| DRINKING WATER ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 515.4 | Method | Water | 2,4-DB | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | Dacthal Diacid | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | Dicamba | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | 3,5-Dichlorobenzoic acid | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | Dichlorprop | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | Dinoseb | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | Pentachlorophenol | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | Picloram | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | 2,4,5-T | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | 2,4,5-TP (Silvex) | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | 4-Nitrophenol | 70-130 | 70-130 | 30 | Reporting purposes only |
| 515.4 | Method | Water | 2,4-Dichlorophenylacetic acid (Surr.) 70-130 | NA | NA | 30 | Method required |
| 525.2 | Method | Water | 2,4-Dinitrotoluene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | 2,6-Dinitrotoluene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | 4,4'-DDD | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | 4,4'-DDE | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | 4,4'-DDT | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Acenaphthene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Acenaphthylene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Acetochlor | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Alachlor | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Aldrin | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | alpha-BHC | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Ametryn | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Anthracene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Atraton | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Atrazine | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Benz(a)anthracene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Benzo(a)pyrene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Benzo(b)fluoranthene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Benzo(g,h,i)perylene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Benzo(k)fluoranthene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Benzyl butyl phthalate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Beta-BHC | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Bis(2-ethylhexyl)adipate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Bis(2-ethylhexyl)phthalate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Bromacil | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Butachlor | 70-130 | 70-130 | NA | Method required |

| DRINKING WATER ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 525.2 | Method | Water | Butylate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Caffeine | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Carboxin | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Chlorobenzilate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Chloroneb | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Chlorothalonil | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Chlorpropham | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Chorpyrifos | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Chrysene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | alpha-Chlordane | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | cis-Permethrin | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Cyanazine | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Cycloate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Dacthal | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | delta-BHC | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Diazinon | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Dibenz(a,h)anthracene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Dibutyl phthalate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Dichlorvos | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Dieldrin | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Diethyl Phthalate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Dimethoate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Dimethyl phthalate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Di-n-octyl phthalate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Diphenamide | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Disulfoton | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Endosulfan I | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Endosulfan II | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Endosulfan Sulfate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Endrin | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Endrin Aldehyde | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Endrin Ketone | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | EPTC | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Ethoprophos | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Fenamiphos | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Fenarimol | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Fluoranthene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Fluorene | 70-130 | 70-130 | NA | Method required |

| DRINKING WATER ORGANICS ANALYSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 525.2 | Method | Water | Heptachlor | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Heptachlor Epoxide | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Hexachlorobenzene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Hexachlorocyclopentadiene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Indeno(1,2,3-cd)pyrene | 70-130 | 70-130 | NA | Methodrequired |
| 525.2 | Method | Water | Isophorone | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Lindane (gamma-BHC) | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Malathion | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Merphos | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Methoxychlor | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Metolachlor | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Metribuzin | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Mevinphos | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Molinate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Napropamide | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Nitrobenzene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Norflurazon | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Parathion | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Pebulate | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Pentachlorophenol | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Phenanthrene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Prometon | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Prometryn | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Propachlor | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Propazine | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Propyzamide (Pronamide) | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Pyrene | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Simazine | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Simetryn | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Tebuthiurun | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Terbutryn | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Terbacil | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Terbufos | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Terrazole | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Tetrachlorvinphos | 70-130 | 70-130 | NA | Methodrequired |
| 525.2 | Method | Water | Thiobencarb | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | gamma-Chlordane | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | trans-Nonachlor | 70-130 | 70-130 | NA | Method required |

| DRINKING WATER ORGANICS ANALYSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Method | Prep Method | Matrix | Analyte | | LCS Accuracy (% Rec.) | Matrix Spike (% Rec.) | Precision (RPD) | Source/notes |
| 525.2 | Method | Water | trans-Permethrin | | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Triadimefon | | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Tricyclazole | | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Trifluralin | | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Velpar | | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | Vernolate | | 70-130 | 70-130 | NA | Method required |
| 525.2 | Method | Water | 1,3-dimethyl-2-nitrobenzene (Surr.) | 70-130 | NA | NA | NA | Method required |
| 525.2 | Method | Water | Perylene-D12 (Surr.) | 70-130 | NA | NA | NA | Method required |
| 525.2 | Method | Water | Triphenylphosphate (Surr.) | 70-130 | NA | NA | NA | Method required |
| 531.1 | Method | Water | Aldicarb | | 80-120 | 65-135 | NA | Method required |
| 531.1 | Method | Water | Aldicarb Sulfone | | 80-120 | 65-135 | NA | Method required |
| 531.1 | Method | Water | Aldicarb Sulfoxide | | 80-120 | 65-135 | NA | Method required |
| 531.1 | Method | Water | Baygon(Propoxur) | | 80-120 | 65-135 | NA | Method required |
| 531.1 | Method | Water | Carbaryl | | 80-120 | 65-135 | NA | Method required |
| 531.1 | Method | Water | Carbofuran | | 80-120 | 65-135 | NA | Method required |
| 531.1 | Method | Water | 3-Hydroxycarbofuran | | 80-120 | 65-135 | NA | Method required |
| 531.1 | Method | Water | Methiocarb | | 80-120 | 65-135 | NA | Method required |
| 531.1 | Method | Water | Methomyl | | 80-120 | 65-135 | NA | Method required |
| 531.1 | Method | Water | Oxamyl | | 80-120 | 65-135 | NA | Method required |
| 547 | Method | Water | Glyphosate | | 70-130 | 70-130 | NA | Method required |
| 548.1 | Method | Water | Endothall | | 80-120 | 80-120 | NA | Method required |
| 549.2 | Method | Water | Diquat | | 70-130 | 70-130 | NA | Method required |
| 549.2 | Method | Water | Paraquat | | 70-130 | 70-130 | NA | Method required |
| 552.2 | Method | Water | Bromochloroacetic Acid | | 70-130 | 70-130 | NA | Reporting purposes only |
| 552.2 | Method | Water | Bromodichloroacetic Acid | | 70-130 | 70-130 | NA | Reporting purposes only |
| 552.2 | Method | Water | Chlorodibromoacetic Acid | | 70-130 | 70-130 | NA | Reporting purposes only |
| 552.2 | Method | Water | Dibromoacetic Acid | | 70-130 | 70-130 | NA | Reporting purposes only |
| 552.2 | Method | Water | Dichloroacetic Acid | | 70-130 | 70-130 | NA | Reporting purposes only |
| 552.2 | Method | Water | Monobromoacetic Acid | | 70-130 | 70-130 | NA | Reporting purposes only |
| 552.2 | Method | Water | Monochloroacetic Acid | | 70-130 | 70-130 | NA | Reporting purposes only |
| 552.2 | Method | Water | Trichloroacetic Acid | | 70-130 | 70-130 | NA | Reporting purposes only |
| 552.2 | Method | Water | 2,3-Dibromopropionic acid (Surr.) | 70-130 | NA | NA | NA | Method required |

FLORIDA DEPARTMENT OF HEALTH

# State of Florida
## Department of Health, Bureau of Laboratories

**This is to certify that**

E87412

**Columbia Analytical Services, Inc. - WA**

1317 South 13th Avenue

Kelso, WA 98626

has complied with Florida Administrative Code 64E-1, for the examination of Environmental samples in the following categories:

**DRINKING WATER - Group I Unregulated Contaminants, Group II Unregulated Contaminants, Group III Unregulated Contaminants, Microbiology, Other Regulated Contaminants, Primary Inorganic Contaminants, Secondary Inorganic Contaminants, Synthetic Organic Contaminants**

**NON-POTABLE WATER - Extractable Organics, General Chemistry, Metals, Microbiology, Pesticides-Herbicides-PCB's, Volatile Organics**

**SOLID and CHEMICAL MATERIALS - Extractable Organics, General Chemistry, Metals, Pesticides-Herbicides-PCB's, Volatile Organics**

**BIOLOGICAL TISSUES - Extractable Organics, General Chemistry, Metals, Pesticides-Herbicides-PCB's**

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

**EFFECTIVE JULY 1, 2005 THROUGH JUNE 30, 2006**

Ming S. Chan, Ph.D.
Bureau Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1697, 7/04
NON-TRANSFERABLE 4/19/2005-E87412

# STANDARD OPERATING PROCEDURE

**for**

**Contingency Plan for Laboratory Equipment Failure**

**SOP Number: ADM-EQP**

**Revision: 0**

**July 22, 1999**

**Approved by:** _____ 7-22-99
Quality Assurance Manager — Date

_____ 7-22-99
Laboratory Director — Date

**COLUMBIA ANALYTICAL SERVICES, INC.**
**1317 South 13th Avenue**
Kelso, Washington **98626**

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Annual review of this SOP has been performed
and **the SOP** still **reflects current** practice.
Initials: LW **Date:** 10-26-00
Initials: LW **Date:** 11-21-01
Initials: LW **Date:** 11-18-03
LW 04

DOCUMENT CONTROL
**NON-CONTROLLED COPY**
Will Not Be Updated

Standard Operating Procedure

for

Contingency Plan for Laboratory Equipment Failure

## 1. PURPOSE

CAS makes a substantial financial and time commitment to the maintenance and upgrading of its analytical instrumentation and support equipment. However, even with a strong maintenance program, equipment may break down from time to time. This may hinder CAS's ability to perform analyses in a timely manner. Furthermore, events that are out of our control, such as fire, flood, or earthquake, may disable the laboratory. This procedure outlines a contingency plan for dealing with disabling events that are out of our control.

## 2. APPLICABILITY

The procedure described in this SOP applies to the CAS-Kelso facility. The procedure applies to both analytical equipment and support equipment (i.e. sample storage, DI water system, etc.).

## 3. DEFINITIONS

Analytical Instrument failure: ***An*** instrument is not functional regardless of reason.

Laboratory facilities failure: Failure in operation of supporting equipment (e.g., HVAC, hoods, refrigerators/freezers, computers,) regardless of reason.

Catastrophic events: Events that happen totally out of the control of the laboratory, such as loss of electricity, loss of water, loss of telecommunications, etc.; because of fire, flood, earthquake, **wars,** civil disturbances, explosion, storms, etc..

Circumstance beyond the control of the laboratory: Such circumstances shall include, but not be limited to, acts or orders of any government authority, strike or other labor disputes, difficulties or delays in transportation, mail, or delivery services, inability to obtain sufficient services or supplies from suppliers, or any other cause beyond the laboratory's reasonable control.

## 4. RESPONSIBILITIES

4.1. It is the responsibility of the analyst to perform all routine maintenance as described in the CAS-Kelso QA Manual and as prescribed in specific analytical SOPs.

4.2. It is the responsibility of the supervisor or section manager in conjunction with the analyst to ensure that any instrument malfunction is addressed as quickly as possible.

4.3. It is the responsibility of the Sample Management Office to properly pack and ship samples to another lab in the network, or to a subcontractor, if deemed necessary.

4.4. It is the responsibility of the Project Chemist to coordinate client notification and'relay client's instructions to the appropriate laboratory personnel.

## 5. PROCEDURE

5.1. Instrument Failure

5.1.1. In the event of instrument failure, the analyst will immediately notify the supervisor. The supervisor will then attempt to determine the cause of the failure. If possible, the supervisor will repair (or facilitate the repair of) the instrument, and may order necessary parts, via expedited delivery. If the supervisor is unable to remedy the problem in house, then appropriate outside contractors will be contacted.

5.1.2. Any repairs made will be logged in the appropriate instrument maintenance log. After returning the instrument to service, the analyst must return the instrument to proper operating conditions (establish acceptable parameters, meet method specifications, establish calibration curve, etc.) prior to sample analyses.

5.1.3. CAS-Kelso has backup instrumentation for most major pieces of analytical instrumentation. If an instrument cannot be brought back on line in time to meet project deadlines or holding times, samples will be analyzed on an equivalent instrument, until such time as the primary instrument becomes available.

5.1.4. In the unlikely event that the laboratory does not have the capability to perform the contracted analysis, then CAS-Kelso will submit the sample(s) to another lab within the CAS network. Client approval and certification needs are must be considered. The project chemist will notify the client before submitting the sample to another lab.

5.1.5. If no other lab within the network is available or capable, then the sample will be subcontracted out to another qualified lab, following the CAS SOPs for subcontracting and sample transfer between laboratories. The project chemist will notify the client before the sample is sent.

5.2. Catastrophic Failure

5.2.1. CAS shall assume no responsibility or liability to the client for any failure **or** delay in performance by CAS, which results in whole or in part **from** any catastrophic event or circumstance beyond the reasonable control of the lab (see Section 3 above). In the event of complete catastrophic failure of CAS-Kelso, such as an earthquake or fire, CAS, Inc. will make every attempt, to the best of its ability, to honor all of its commitments, on a case by case basis. Electronic data from completed analysis, **as** well as historical data, is stored both on site, and at a remote location. In the case of a localized event, this data in still available from electronic backups.

5.3. Facilities and support equipment

**5.3.1.** In addition to laboratory staff, CAS-Kelso has maintenance staff which are capable of performing maintenance and making some facilities repairs. In the event of failure beyond the repair capability of lab staff, the laboratory director should be notified. The laboratory director will coordinate maintenance staff efforts.

5.3.2. The laboratory will maintain a list of local contractors available to quickly respond to facilities or support equipment failure and make necessary repairs. In the event that a repair cannot be made in house, a contracted service will be used. Vendors under contract are expected to guarantee response times. The primary contractors for these services are listed below. Other contractors may be needed depending on circumstances.

- Refrigeration: Twin City Service Company
- HVAC: Climate Control
- Fume Hoods: Climate Control (repair), Standard Builders (maintenance)
- **DI** water system: **US** Filter
- Electrical: C&L Electric

**5.4.** Computer systems

The corporate CAS IT department maintains staff and equipment to address most computer failures. The IT group has standard protocols in place for effectively addressing maintenance and repair issues. In the event that a repair cannot be made in house, **a** contracted service will be used.

5.5. Telecommunications equipment

In the event of a local telecommunications failure, the laboratory director will coordinate the efforts of the switchboard staff to ensure that communications are brought back **on** line

as soon as possible. The switchboard should maintain wireless phone capability to facilitate communication with local telephone service.

## 6. RECORDS

**A** maintenance logbook is kept for every piece of analytical equipment. All routine, as well as non-routine maintenance **or** repair must be recorded in this log.

## 7. REFERENCES

**Quality** Assurance Manual for Columbia Analytical Services, Inc. **Kelso.**

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# STANDARD OPERATING PROCEDURE

for

**Manual** Integration of Chromatographic Peaks

SOP Code: ADM-INT

Revision: 2

May 23,2003

Approved by: Lawrence J Sarolay — Quality Assurance Director — May 23, 2003 Date

Chief Quality Officer — 5/30/03 Date

Stephen Vincent — President — 5/30/03 Date

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**13**17 **South** 13th Avenue
Kelso, Washington **98626**

Annual review of this SOP has been performed and the SOP still reflects current practice.
Initials: _____ Date: _____
Initials: _____ Date: _____
Initials: _____ Date: _____

**DOCUMENT** CONTROL

**NUMBER:** _____

Initials: _____ Date: _____

## 1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) describes standard practices for performing and documenting manual integration of chromatographic peaks. This SOP applies to all chromatographic analyses. Specifically, this SOP applies to situations where manual integration of a chromatographic peak, in the judgment of the analyst, is needed to correct errors in the peak integration performed on single-response and multi-response chromatographic peaks by automated chromatography data processing programs. **For** a given analysis, a chromatography data processing program may not be capable of automatically integrating all target analyte peaks; however, the goal of method development should be to establish parameters that will maximize the use of automatic integration and minimize the use of manual integration.

## 2.0 SUMMARY OF METHOD

When performing the technical review of chromatographic raw data, the analyst uses this procedure in conjunction with the **SOP** for the analysis to determine situations when manual peak integration may be used. This procedure differentiates between sample and standard analyses and provides specific instructions when and how manual integration can be performed. Manual integration should only be performed on sample data when substantial matrix interferences result in quantification errors when automated procedures are used. In the event that manual integration is necessary on any analytical standard, strict documentation requirements are to be followed.

All instances of manual integration are to be documented using standard CAS documentation procedures (analyst's initials, date, and explanation). Any instance of manual integration of calibration standards, quality control samples, or sample data will be documented by the analyst who performed the manual integration. Manual integrations must also undergo a documented secondary review.

## 3.0 INTERFERENCES

Interferences should not exist in standards to such extent as **to** require manual integration except for co-eluting or closely-eluting analytes. Should this level of interference exist, the analytical system should be inspected and corrective action taken to improve the chromatography, eliminate the interference(s), or decrease the interference(s) to an insignificant level. Chromatographic conditions and data processing parameters need to be developed to the greatest extent possible so that manual integration will not be necessary on standards data (calibration standards, CCVs, etc.). However, chromatogram complexities and chromatography data processing program limitations may make manual integration unavoidable.

Sample matrix interferences vary greatly depending on sample types, sites, or even sample to sample within the same site. Sample analysis strategies should be developed to decrease the level of sample matrix interferences not only because of analytical reasons but also to reduce the likelihood of having to resort to manual integration. When sample matrix interferences are present to the extent that manual integration(s) are required, the analyst may use the chromatography data processing programs to perform an integration that results in an accurate analyte quantification.

## 4.0 DEFINITIONS

### 4.1 Chromatography Data Processing Program (CDPP)

A software program for processing the data from chromatography instrument detectors. CDPPs include the following:

- Autoion by Dionex;
- Peaknet by Dionex;
- Enviroquant by Hewlett-Packard;
- Maxima by Waters;
- Millennium by Waters;
- OmniIon by Lachat;
- Perkin-Elmer Nelson by Nelson Analytical;
- STAR by Varian;
- Target by ThermoQuest Thru-Put Systems; and
- Opus Quant by Micro Mass.

### 4.2 Chromatographic Peak (or simply, Peak)

The response or signal from a detector on a chromatograph plotted versus time to create a chromatogram. A peak is a curve that results as the detector signal increases, reaches an apex: and then decreases as a substance elutes from the chromatograph. To be a peak, the signal strength at the apex must be at least three times the background noise; i.e., a signal-to-noise ratio of three or more.

### 4.3 Manual Integration

This term applies to a data file in which set-points have been changed and reintegration has occurred under the changed set-points; baselines have been adjusted; peak integration start and stop "ticks" have been changed; or the digital values for signal intensity, peak area, or peak height, are changed after the time of data collection and data file generation.

### 4.4 Reintegration

See Manual Integration.

**4.5 Single-response Analyte**

An analyte that produces a single chromatographic peak when analyzed chromatographically.

**4.6 Multi-response Analyte**

An analyte that produces many chromatographic peaks when analyzed chromatographically. For example, petroleum hydrocarbon analytes like gasoline and diesel.

**4.7 Retention Time**

The time in a chromatogram corresponding to the apex of a peak.

## 5.0 DISCUSSION

**5.1** Manual integration of chromatographic peaks is a matter of professional judgment. Analysts are allowed to manually integrate chromatographic peaks within the guidelines described in this SOP. Likewise, analysts are not mandated to use only automatically integrated peak data. Further, if manual integration is performed, it must follow a pattern of consistency so that (a) automatic and manual integrations are consistent, (b) continuing calibration verification standards are integrated the same as initial calibration standards, and (c) target analytes, surrogates, and matrix spiked analytes in samples are similarly integrated.

5.2 Manual integration of chromatographic *peaks* must be only used to correct incomplete or incorrect integration by the chromatography data processing program **(CDPP).** Incorrect peak integration may result from retention time shifts that can cause peak misidentification and which can also result in quantification errors. If manual integration is used as the mechanism for making qualitative adjustments when a peak is misidentified (e.g., if the CDPP picked the wrong peak), the documentation requirements in this SOP still apply.

**5.3** It is not permissible to alter, by deletion, the chromatogram. It is not permissible to delete peaks or otherwise alter the chromatogram itself by deletion. This is not to be confused with "editing" a peak so that the CDPP ignores it. For example, "Q-deleting" an analyte in the Enviroquant CDPP is permissible.

**5.4** Unacceptable data file manipulation is defined as manipulation of the chromatographic data **for** the purpose of obtaining a compliant result, when that result could clearly and only be obtained by an inappropriate manipulation of the data. Additionally, manual integration must not be used only as a means to satisfy the quality control acceptance criteria for an analysis. Examples of unacceptable manual integration include but are not limited to:

- Altering the **start** and stop times **of** an integration interval such that the samples and calibration standards are integrated in a significantly different manner unless interferences are present that must be taken into consideration;

- Altering an integration interval so that a chromatographic peak displaying a distinct symmetrical Gaussian distribution (bell shaped curve), has an area inappropriately removed or added so that the integration of the symmetrical peak does not follow the symmetry of the curve; and
- Adjusting the peak's baseline above or below the chromatogram's baseline.

5.5 It is important that chromatographic peaks be integrated consistently; i.e., the peak for a particular analyte needs to be integrated consistently (whether automatically or manually) in calibration standards, continuing calibration verification standards, and, as much as is possible, in samples.

## 6.0 RESPONSIBLLITIES

It is the responsibility of the primary analyst and the analyst (or supervisor) performing secondary data review to ensure that all data associated with the generation of sample results are accurate and correct. This includes instances where manual integration is used. These "line-level" or bench level analytical staff are accountable for the correctness of data,

The responsibility of the department manager is to ensure that this SOP is being followed whenever manual integrations are employed. This includes analyst awareness and training. It is also the department manager's responsibility to ensure analysts are trained in correct integration practices. Those involved at the bench level must clearly represent the basis of the integration, including the impact on any associated data.

The responsibility of the Quality Assurance Program Manager (QA PM) is to conduct periodic audits to ensure that the documentation steps associated with this procedure are being followed. It is also the responsibility of the **QA** PM to distribute this **SOP** to the appropriate staff members and to assist in analyst training if necessary.

The CAS Statement of Professional Conduct and Laboratory Practice in Section 5.0 of the ***Quality Assurance Manual*** is reiterated here.

> ***One of the most important aspects of the success of CAS as a company is the emphasis placed on the integrity of the data that are provided and the services that are performed To promote product quality, CAS requires certain standards of conduct and ethical performance among our employees. The following examples of documented CAS policy are representative of these standards, and are not intended to be limiting or all-inclusive:***
>
> ***Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned Such acts are to be reported immediately to senior management for appropriate corrective action.***

***Unless specifically required in writing by a client, alteration, deviation or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.***

***Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible.***

## 7.0 PROCEDURE

### 7.1 Calibration Standards and Quality Control (QC) Samples Analyses

7.1.1 All calibration standards and QC samples data (namely, calibration standards, initial calibration verification standards (ICVs), continuing calibration verification standards (CCVs), continuing calibration blanks (CCBs), method blanks (MBs), and laboratory control samples (LCSs)) are to be reviewed as prescribed in the SOP for the analysis. If upon review of the chromatographic data (and spectral data for GC/MS) the analyst determines that an analyte has been misidentified by the CDPP, peak detection parameters (such as, *peak* thresholds, peak width, minimum *peak* area, peak bunching factor, and others) that will correctly identify the analyte should be determined and the data reprocessed. If suitable parameters cannot be determined, changes should be made to the chromatographic conditions (such as mobile phase flow rate, temperature, etc.) that will result in correct identification in order to improve subsequent chromatography. In all cases, parameters must be established which best provide correct qualitative identification of all components. **All** standards and samples should be processed with the same parameters.

Note. It is acceptable to update retention times from the CCV analysis for the CDPP to use for subsequent samples without having to reprocess calibration standards.

7.1.2 If upon review of calibration standards and QC samples data the analyst determines that an analyte is correctly identified but its peak is incorrectly integrated, peak detection and integration parameters should be determined for the CDPP and the data reprocessed. **All** standards and samples should be processed with the same parameters.

7.1.3 In cases where chromatographic conditions, peak detection parameters, or integration parameters cannot be determined by which a component can be correctly integrated, the integration failure and it's impact on data quality must be documented on the raw data and in associated review steps. Only in limited cases may manual integration be used.

7.1.4 If manual integration is used for quantification of a **standard,** the following documentation steps are required.

7.1.4.1 **A** peak that is manually integrated must be flagged to signify it was manually integrated. For example, Enviroquant CDPP flags manually integrated peaks with an "m" placed next to the result and Autoion CDPP flags manually integrated chromatograms by printing "reprocessed" on the data. If the CDPP does not automatically flag the manually integrated peak(s), the analyst must manually note the manual integration(s) on the hard copy report(s). It is not permitted to delete the flag from a data file if an analyte has been manually integrated.

7.1.4.2 **A** chromatogram (or ion chromatogram for GC/MS) is to be printed that shows the automated (CDPP determined) integration. The chromatogram is to be expanded, enlarged, or "blown up," as needed so that the erroneous integration can be readily seen. This is the "before" chromatogram.

7.1.4.3 After manual integration a chromatogram (or ion chromatogram for GC/MS) is to be printed that shows the manual (analyst determined) integration. The chromatogram is to be expanded, enlarged, or "blown up," **as** needed so that the manual integration can be readily seen. The analyst who did the manual integration will write a brief explanation for the manual integration on this page. The analyst who did the manual integration and the reviewing analyst (or supervisor) both initial and date the page showing the manual integration. This is the "after" chromatogram.

7.1.4.4 Both the initial (or before) and the final (or after) chromatograms are filed with the other raw data associated with the **data** file or standard analysis. If a data package that includes raw data is reported to the client, both these pages shall be included in the package.

7.1.5 **As** much **as** possible, the peak for any given analyte needs to be integrated consistently in all calibration standards and QC samples analyses.

## 7.2 Sample Analyses

7.2.1 **All** sample data (including duplicate and matrix spiked samples) are to be reviewed as prescribed in the **SOP** for the analysis. If upon review of the chromatographic data (and spectral data for GC/MS) the analyst determines that a target analyte may be present, yet the CDPP has not correctly identified the peak using the integration parameters used for the associated standards, the following steps should be taken to determine if manual integration is an acceptable option.

7.2.2 The analyst should determine the level of chromatographic or spectral interference at the retention time of the analyte. If interferences are minimal (or none), the analytical system and integration parameters should be reviewed to determine a possible cause of poor peak identification. Establishing new integration parameters may be required. However, the analyst should keep in mind that parameters must not differ from those used for the associated standards. New integration parameters mean reprocessing standards also.

7.2.3 Only in cases where interferences are present to an extent that correct peak identification by the CDPP is adversely affected, the analyst may use the CDPP to manually integrate the peak. In this case, the chromatogram should be expanded, enlarged, or "blown up," as needed so that the manual integration can be readily seen. The analyst who does the manual integration must provide an explanation for the manual integration on the raw data and document it as described in Section 7.2.5.

7.2.4 The analyst may determine that the CDPP has correctly identified the peak as the target analyte, but the integration does not accurately represent the full response for the component (incomplete integration). Also, the analyst may determine that the CDPP has correctly identified the peak but the integration is biased high, although this should only occur in very rare instances. In both cases, the chromatogram should be expanded, enlarged, or "blown up," as needed so that the manual integration can be readily seen. The analyst who does the manual integration must provide an explanation for the manual integration on the raw data and document it as described in Section 7.2.5.

7.2.5 If manual integration is used for quantification of a sample, the following documentation steps are required.

7.2.5.1 A peak that is manually integrated must be flagged to signify it was manually integrated. For example, Enviroquant CDPP flags manually integrated peaks with an "m" placed next to the result and Autoion CDPP flags manually integrated chromatograms by printing "reprocessed" on the data. If the CDPP does not automatically flag the manually integrated peak(s), the analyst must manually note the manual integration(s) on the hard copy report(s). It is not permitted to delete the flag from a data file if an analyte has been manually integrated.

7.2.5.2 A chromatogram (or ion chromatogram for GC/MS) is to be printed that shows the automated (CDPP determined) integration. The chromatogram is to be expanded, enlarged, or "blown up," as needed so that the erroneous integration can be readily seen. This is the "before" chromatogram.

7.2.5.3 After manual integration a chromatogram (or ion chromatogram for GC/MS) is to be printed that shows the manual (analyst determined) integration. The chromatogram is to be expanded, enlarged, or "blown up," as needed so that the manual integration can be readily seen. The analyst who did the manual integration will write a brief explanation for the manual integration on this page. The analyst who did the manual integration and reviewing analyst (or supervisor) both initial and date the page showing the manual integration. This is the "after" chromatogram.

7.2.5.4 Both the initial (or before) and the final (or after) chromatograms are filed with the other raw data associated with the data file or analysis. If a data package that includes raw data is reported to the client, both these pages shall be included in the package.

7.2.6 As much as possible, the peak for any given analyte should to be integrated consistently with the calibration standards and ***QC*** samples analyses.

**7.3 Manual Integration of Single-response Analytes**

7.3.1 For any manual integration of a peak for a single-response analyte, the integration should not extend more than 1 minute from the absolute retention time at the peak apex unless the peak is asymmetrical. See Section 7.3.2.2.

7.3.2 Analyst judgment and chromatographic experience should be used when any manual integration is performed. The following guidelines should be used when performing manual integration.

7.3.2.1 In cases where there are no interfering peaks (like shoulder peaks, etc.), the manual integration should be baseline to baseline and with the baseline horizontal. Baseline is defined as the level of signal occurring just prior to elution of the peak. See Figure 1.

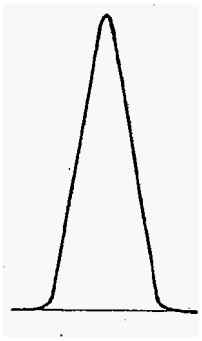

Figure 1

7.3.2.2 In cases where the chromatographicpeak is asymmetrical due to tailing, the manual integration should be baseline to baseline and with the baseline horizontal. See Figure 2. (Note: An asymmetrical peak may be indicative of the need to change chromatographicconditions.)

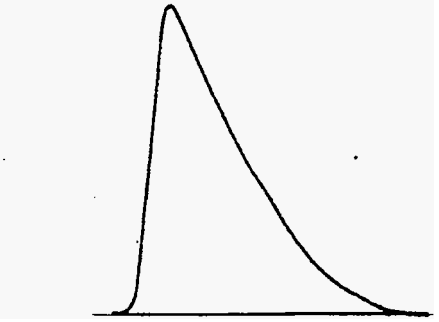

Figure 2

7.3.2.3 In cases where there is a distinct peak but with a baseline rise, the manual integration should extend from the lower of the baselines ('just prior to, or just after the peak) to a vertical line dropped from the baseline representing the other side of the peak. Do not include excess peak tail. Again, the integrated baseline should be horizontal; baseline rise should be minimal. Excessive baseline rise is indicative of carry over of a very late eluting compound, excessive column bleed, etc. and is indicative of the need to perform maintenance. See Figure 3.

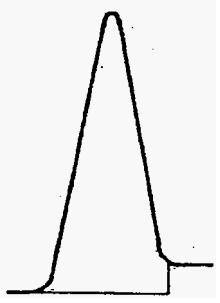

Figure **3**

**7.3.2.4** In cases where there are no distinct interfering peaks, but there is an elevated, sloping baseline, integration is performed baseline to baseline. In this case, the baseline is defined as the level of signal occurring just prior to elution of the peak and extending to the signal level at the peak end, using the same slope. See Figure **4.**

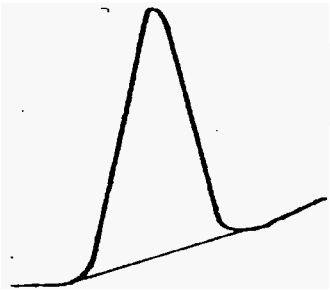

Figure **4**

**7.3.2.5** In cases where there is an interfering peak on one side of the peak of interest, the manual integration should extend from baseline (as viewed on the side opposite of the interfering peak) to a vertical line dropped from the valley between the two peaks. The integrated baseline should be horizontal. See Figures 5 and 6 in which the target peak **is** the big one.

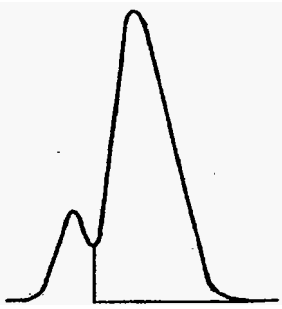

Figure ***5***

**not**

Figure 6

7.3.2.6 In cases where there is an interfering peak on the tail of the peak of interest (which is also tailing), the interfering peak should be skimmed off if the interfering peak is small relative to the peak of interest. See Figure 7. However, if the interfering peak is about the same height (or larger) as the peak of interest, it would be better to drop a vertical from the valley between the two peaks. See Figure 8. Depending upon the relative sizes of the two peaks, the analyst **must** exercise their judgment which technique is appropriate to use.

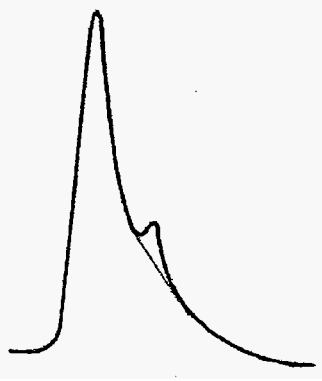

Figure 7

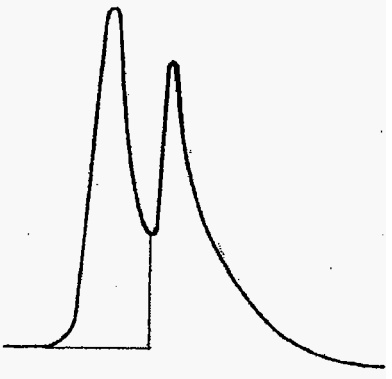

Figure 8

7.3.2.7 If the peak of interest is significantly smaller than the interfering peak, the integration may be "skimmed" using the up-slope of the interfering peak as a pseudo baseline. See Figure 9 in which the target peak is the small one.

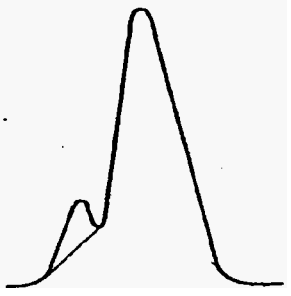

Figure 9

7.3.2.8 In cases where interfering shoulder peaks are on both sides of the peak of interest (the middle peak in the following diagrams), vertical lines are dropped from the valleys to a baseline representative of the chromatographic baseline occurring just prior to the elution of the peaks. The integration is then ''vertical to vertical" using this baseline. See Figures 10 and I 1 in which the target analyte is the middle peak.

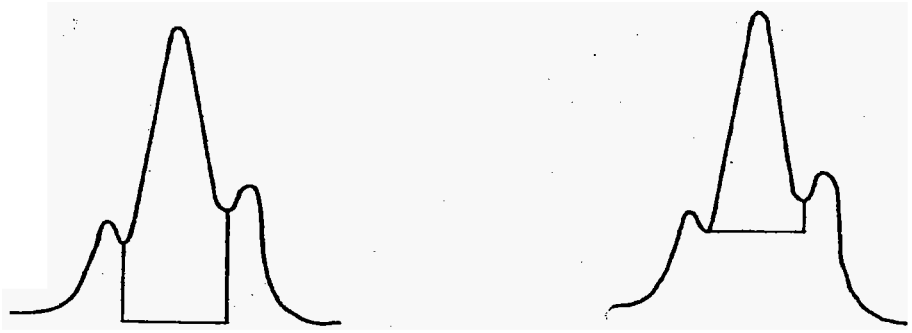

Figure **10** **not** Figure 1I

7.3.2.9 In the cases where the interfering peaks are much larger than the peak of interest, "valley to vertical" may be an option. This would use a flat baseline from the lower of the two valleys to a vertical dropped from the higher ***of*** the two valleys. ***See*** Figures 12 and **14.** Skimming may also be **an** option if the target peak is very small compared to interferences. See Figure 13. (In the figures the target analyte is the middle peak.)

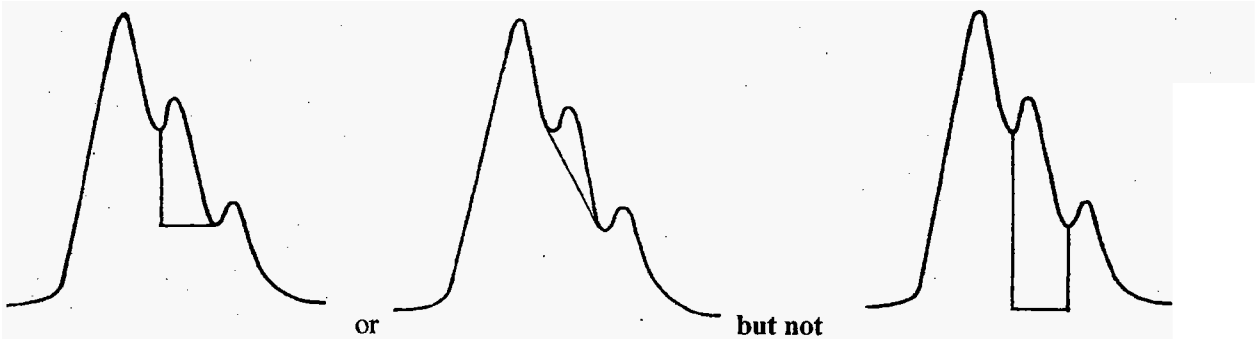

Figure 12 or Figure 13 **but not** Figure 14

### 7.4 Manual Integration of Multi-response Analytes

#### 7.4.1 Analytes Quantified Using Individual Characteristic Peaks

For some multi-response analytes (like toxaphene and PCB Aroclors), individual characteristic peaks are integrated following the procedures described in this **SOP** for single-response analytes.

#### 7.4.2 Analytes Quantified Using an Integration Range

7.4.2.1 For multi-response analytes like gasoline, diesel, and other petroleum hydrocarbon analytes, integration is performed over a range of retention times so that all the peaks falling within that time range are included in the integration.

7.4.2.2 The range of integration is determined by analyzing marker compounds which define the beginning time and ending time of the integration range. Unless specific methods state otherwise, the integration range normally includes the markers. That is, if the integration range begins at C 10, the start time of the integration is at the beginning of the C10 peak (not at the retention time of the C10 peak). And if the integration range ends at C40, the stop time of the integration is at the end of the C40 peak (not at the retention time of the C40 peak).

7.4.2.3 The baseline is horizontal and is drawn at **an** "elevation" that is at the lowest point in the chromatogram after the solvent peak.

7.4.2.4 Vertical lines are dropped at the start time of the beginning marker peak to the baseline and from the stop time of the ending marker peak to the baseline. The analyte integration includes all the peaks between the start and stop times.

## 8.0 QA/QC REQUIREMENTS

This procedure is also applicable to Quality Control analyses as follows:

8.1 Analysis of initial calibration verification standards (ICVs) falls under the procedures described above for calibration data. See Section 7.1.

**8.2** Analysis of method blanks (MBs) falls under the procedures described above for QC sample data. However, the level of interference in method blanks should not require manual integration. **If** frequent manual integrations are needed for method **blanks,** the hardware and/or sample preparation procedures should be evaluated to determine possible analytical improvements. See Section 7.1.

**8.3** Analysis of laboratory control samples (LCSs) falls under the procedures described above for **QC** sample data. However, the level of interference in **LCS** samples should not require manual integration. If frequent manual integrations are needed for **LCS** samples, the system should be evaluated to determine possible analytical improvements. See Section **7.1.**

**8.4** Analysis of matrix spiked samples (MSs and DMSs) falls under the procedures described above for sample analyses. See Section **7.2.**

**8.5** The **QA PM** is required to review manual integration practices and documentation annually.

**8.6** Annual refresher training is required on the guidelines in this SOP.

## 9.0 RECORDS

**9.1** **As** described in this SOP, any instance of manual integration must be documented **as** described for standard or sample analyses. Appropriate hard copy printouts of the integration with the correct and appropriate initials, date, and a brief explanation of the reason for the integration must accompany the raw data for the analysis.

**9.2** To facilitate documenting the explanation for a manual integration, a stamp may be created that has typical reasons for manual integrations. An example of such **a** stamp is shown below. The stamp is stamped on the "after" chromatogram (per Section **7.1.4.3** and **7.2.5.3),**

**MANUAL INTEGRATION EXPLANATION**
1. WRONG PEAK SELECTED
2. POOR INTEGRATION
3. PEAK NOT FOUND; PEAK NOT INTEGRATED
4. RETENTION TIME SHIFT
5. BASELINE INCORRECT OR INACCURATE
6. OTHER _____

ANALYST: _____ RMEWER: _____
DATE: _____ DATE: _____

the appropriate explanation is circled by the analyst who then initials and dates it. The reviewer indicates their agreement by initialing and dating the explanation.

Alternatively, a code may be created for each typical explanation (e.g., BL = baseline incorrect or inaccurate; NI = peak not integrated; etc.) The explanation code **is** written on the "after" chromatogram **by** the analyst who then initials and dates the code. The reviewer indicates their agreement by initialing and dating the explanation.

**9.3** Any instance of integration error that may adversely impact instrument calibration must be documented appropriately. This documentation may be in the form of narrative comments (at a minimum) or by using the ***SOP for Nonconformity and Corrective Action Documentation*** to complete a Nonconformity **and** Corrective Action Report. The appropriate comments must be included in a report narrative.

## 10.0 REFERENCES

10.1 National Environmental Laboratory Accreditation Conference (NELAC), Quality Systems 2001 Standards, Sections 5.10.4 and 5.12.3.3.

10.2 ***Department of Defense Quality Systems Manual for Environmental Laboratories,*** Final Version 2, June 2002, Sections 6.2; 9.4.2.1; 9.4.2.2; 10.4; 12.3.3 and Appendix DOD-A, Appendix DOD-B, and Table B-1.

10.3 Naval Facilities Engineering Service Center, Navy ***Installation Restoration Laboratory Quality Assurance Guide,*** February 1996, Section 3.5.7.

## 11.0 CHANGES FROM PREVIOUS REVISION

- Cover Page — CQO approval replaced Technical Director approval
- Section 2.0 — In first paragraph, "...analytical method..." replaced with "...SOP for the analysis..."
- Section 4.0 — Reformatted
- Section 4.1 — Peaknet by Dionex and Millennium by Waters added
- Section 4.2 — Last sentence underlined for emphasis
- Section 5.5 — New section
- Section 7.1.1
  - End of first sentence, "...analytical method." replaced with "...SOP for the analysis."
  - In second sentence, "peak detection parameters (thresholds, expected retention times, etc.). .." replaced with "...peak detection parameters (such as peak thresholds, peak width, minimum peak area, peak bunching factor, and others). .."
  - Note at end of section is new
- Section 7.1.5 — New section
- Section 7.2.1 — In first sentence, "...in the analytical method and in CAS SOPs." replaced with "...in the SOP for the analysis."
- Section 7.2.6 — New section
- Section 7.3.2 — Subsections numbering corrected
- Section 7.3.2.6 — New section with two new figures, resulting in renumbering subsequent subsections and figures
- Section 7.4 — Reformatted
- Section 7.4.2.1 — Formerly Section 7.4.2; reworded; subsequent subsections renumbered
- Section 9.0 — Paragraphs numbered
- Section 9.2 — New section
- Section 10.0 — References numbered; NELAC and DOD references added

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# SOP CHANGE FORM

| | |
|---|---|
| SOP Title: *SOP for Manual Integration of Chromatographic Peaks* | |
| SOP Code: ADM-INT | |
| SOP Revision No.: 2 | |
| SOP Date: May 23,2003 | |
| SOP Section(s) Affected by Change: Section 7.1.4.3 | |
| Description of Change: Add the following text to the end of Section 7.1.4.3:<br><br>For the AFCEE program, all manual integrations performed on any analyte in an initial calibration standard or in a continuing calibration verification standard **must** be reviewed and approved by the analyst and the Department Manager or Section Supervisor or the laboratory's Quality Assurance Program Manager. | |
| Reason(s) for Change(s):<br>AFCEE QAPP, Version 3.1, Section 11.2.1, second paragraph, states:<br><br>"AFCEE requires the laboratory or section SOP to include instructions for the analyst to document any required manual integrations associated with the initial/continuing calibration. The SOP is to require the following hard copy documentation:<br>• **A** 'before' and 'after' hard copy for the manual integration, with the reason, date **and** signature of the analyst;<br>• Review and approval for the manual integration by the Section supervisor **and** the **QAO."**<br><br>The above change will bring the SOP into compliance with the AFCEE QAPP requirement. | |
| Change(s) Submitted by: **Mark** Fesler/Redding | Date: January 28,2004 |

**Approvals:**

| | |
|---|---|
| Quality Assurance Director Signature: Lawrence V Faraly | Date: 2/4/2004 |
| Chief Quality Officer Signature: | Date: 2/4/04 |
| President Signature: | Date: 2/13/04 |
| Change(s) Effective Date: | |

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# SOP CHANGE FORM

| | |
|---|---|
| SOP Title: *SOP for* ***Manual Integration of Chromatographic Peaks*** | |
| SOP Code: ADM-INT | |
| SOP Revision No.: 2 | |
| SOP Date: May 23,2003 | |
| SOP Section(s) Affected by Change: Section 4.2 | |

Description of Change: Add the following text to end of Section 4.2, Chromatographic Peak:

Analyses for polychlorinated dibenzo-*p*-dioxins (PCDDs) **and** dibenzofurans (PCDFs) by high resolution mass spectrometry (HRMS) require the signal strength at the apex to be 2.5 times the background noise; i.e., a signal-to-noise ratio of 2.5 or more is required.

Reason(s) for Change(s):

Section 4.2 of the SOP defines a chromatographic peak as requiring a signal-to-noise ratio of **three** times the background noise. Changing the required signal-to-noise ratio **is** needed to make the SOP consistent with the PCDDs/PCDFs **HRMS** methods.

Method 1613B, Section 16.2, states,

"The signal-to-noise ratio (S/N) for the GC peak at each exact m/z must be greater than or equal to 2.5 for each CDD or CDF detected in a sample extract, and greater than or equal to 10 for all CDDs/CDFs in the calibration standard (Sections 10.2.3 and 15.3.3)."

Method 8290, Section 7.8.4.3.1, states,

**"All** ion current intensities must be > 2.5 times noise level for positive identification **of** a PCDD/PCDF compound or a group of coeluting isomers. Figure 6 describes the procedure to be followed for the determination of the S/N."

| | |
|---|---|
| Change(s) Submitted by: Jane Freemyer/CAS Houston | Date: February 13,2004 |

| | |
|---|---|
| Quality Assurance Director Signature: Lawrence V Hanley | Date: 2/17/2004 |
| Chief Quality Officer Signature: | Date: 2/18/04 |
| President Signature: | Date: 2/19/04 |

Change(s) Effective Date:

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# STANDARD OPERATING PROCEDURE

for

**EPA CLP ORGANICS ANALYSES**

SOP No.: CLP_ORGA

Revision: 1

March 16, 2001

Approved by: _____ Supervisor — 4/3/01 Date

_____ QA Manager — 4-5-01 Date

_____ Laboratory Manager — 4/9/01 Date

**COLUMBIA ANALYTICAL SERVICES, INC.**
1317 South 13th Avenue
Kelso, Washington 98626

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Annual review of this SOP has been performed and the SOP still reflects current practice.
Initials: _____ Date: 8/2/02
Initials: _____ Date: 12/15/03
Initials: _____ Date: 7/26/04

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**Standard Operating Procedure**
**for**

**EPA CLP ORGANICS ANALYSES**

## 1 SCOPE AND APPLICATION

1.1 This Standard Operating Procedure (SOP) describes the methods used by Columbia Analytical Services Inc. for the analysis of pesticides, volatile organic compounds (VOCs), and semivolatile organic compounds(SOCs) as identified in the USEPA Contract Laboratory Program(CLP).

1.2 This SOP applies to USEPA Statement of Work (SOW) OLM04.2, May 1999.

1.3 This SOP is applicable to the target compound list (TCL) and sample matrices identified in the SOW. The SOP applies to sample preparation and sample analysis by gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS). The Contract Required Quantitation Limit (CRQL) is identified by the SOW. This SOP also describes methods of data interpretation and data reporting.

## 2 SUMMARY OF METHOD

2.1 Volatile Organic Compounds (VOCs)

Samples are analyzed using purge and trap followed by gas chromatography using a mass spectrometer detector for the parameters identified in the TCL. During purge and trap the sample is purged with helium with the purgeable components transferred to the vapor phase. The volatile components of the sample are then "trapped" by a sorbent column at a cool temperature. The sorbent column is then heated and backflushed, releasing the trapped materials to the chromatographic column. Soil/sediment samples may be purged directly (with blank water) or extracted with methanol when the concentration of purgeable components is high. Instrument configuration and calibration is performed as described in the SOW. Method performance is monitored using surrogate compound analyses and matrix spike analyses. Data interpretation is performed as described in the SOW. Data reporting is performed using forms, formats, and flags specified by the SOW. In some cases, specialized data reporting requirements will be specified by contract specifications.

2.2 Semivolatile Organic Compounds (SOCs)

This procedure provides sample preparation techniques using either a liquid/liquid extraction (for water samples) or a sonication extraction for soil/sediment samples. The concentrated sample extract is analyzed by gas chromatography using a mass spectrometer detector for the parameters identified on the TCL. Instrument configuration and calibration is performed as described in the SOW. Method performance is monitored using surrogate compound analyses and matrix spike analyses. Data interpretation is performed as described in the SOW. Data reporting is performed using forms, formats, and flags specified by the SOW. In some cases, specialized data reporting requirements will be specified by contract specifications.

2.3 Organochlorine Pesticides and PCBs (OCPs)

This procedure provides sample preparation techniques using either a liquid/liquid extraction (for water samples) or a sonication extraction for soil/sediment samples. The concentrated sample extract is analyzed by gas chromatography using dual electron capture detectors (ECD) for parameters identified on the TCL. Instrument configuration and calibration is performed as described in the SOW. Method performance is monitored using surrogate compound analyses and matrix spike analyses. Data interpretation is performed as described in the SOW. Data reporting is performed using forms, formats, and flags specified by the SOW. In some cases, specialized data reporting requirements will be specified by contract specifications.

## 3 DEFINITIONS

3.1 Statement of Work: The USEPA Contract Laboratory Program Statement of Work for Organics Analysis, OLM04.2, May, 1999.

3.2 All other definitions can be found in the SOW Exhibit G: Glossary of Terms.

## 4 INTERFERENCES

4.1 Volatile (VOC) analyses

Interferences may be caused by impurities in the purge gas, outgassing from transfer lines or purge and trap plumbing, and solvent vapors in the laboratory. The analytical system must be demonstrated to be free of interferences which adversely affect sample analyses under routine analytical conditions. Samples may be contaminated by diffusion of volatile organics through the vial septum during storage and handling. Contamination by carryover can occur whenever high level samples are analyzed. Precautions must be taken to eliminate any occurrence of carryover from high level samples or contamination of

purging apparatus from samples with suspended solids or high-boiling compounds. Specific guidance on procedures to minimize contamination are described in the SOW.

4.2 Pesticide and Semivolatile organic (OCPs and SOCs) analyses

Interferences may be caused by contaminants in solvents, reagents, glassware, and sample processing hardware. These materials must be demonstrated to be free of interferences which adversely affect sample analyses under routine analytical conditions. Contamination by phthalate esters contained in common flexible plastics must be minimized by avoiding use of plastics in handling samples and sample extracts. Matrix interferences may be caused by contaminants which are co-extracted from samples, to varying extents. Cleanup procedures must be used to achieve required quantitation limits.

## 5 SAFETY

5.1 The toxicity or carcinogenicity of each compound or reagent used in this method has not been precisely determined; however, each chemical compound should be treated as a potential health hazard. Exposure to these compounds should be reduced to the lowest possible level.

5.2 Follow all applicable safety procedures as described in the CAS Safety Manual. A reference file of material safety data sheets is available to all personnel involved in these analyses. CAS also maintains a file of OSHA regulations regarding the safe handling of the chemicals specified in this method.

## 6 SAMPLE COLLECTION, CONTAINERS, PRESERVATION, AND STORAGE

The SOW provides specific requirements for sample collection, preservation, and storage applicable to the analyses. These requirements can be found in Section 8 of each analytical section of the SOW. These sections also contain the holding times requirements.

## 7 APPARATUS AND EQUIPMENT

7.1 VOCs Analysis

The description of the apparatus and equipment applicable to VOCs analyses is given in the SOW, Exhibit D – Volatiles, section 6.

7.2 SOCs Analysis

The description of the apparatus and equipment applicable to SOCs analyses is given in the SOW, Exhibit D – Semivolatiles, section 6.

7.3 OCP/Aroclors Analysis

The description of the apparatus and equipment applicable to OCPs analyses is given in the SOW, Exhibit D – Pesticides/Aroclors, section 6.

## 8 REAGENTS AND STANDARDS

8.1 Reagents

Reagents for each analytical procedure are specified in the SOW (see Exhibit D). The reagents used must meet the requirements of the SOW for suitability (purity, grade, etc.). Solvents must be of pesticide grade or equivalent. The use of "purge and trap" grade methanol is recommended for VOC analyses. It must be demonstrated that all reagents and solvents used do not introduce contamination into the analytical process.

8.2 Standards

8.2.1 Standards used must meet the requirements of the SOW for purity and traceability. Specific guidelines for standard acceptability can be found in the SOW, Exhibit E, section 5. All standards, whether produced from neat chemicals, purchased as a prepared solution, or diluted from a prepared solution, must be documented in a standards logbook as described in the *SOP for Document Control* and in the *SOP for Making Entries Into Logbooks and Onto Benchsheets*. Certificates of Analysis must be available for purchased standards.

8.2.2 Specific instruction for standards preparation, storage, and length of use for each analysis is found in each analytical section of the SOW (Exhibit D, sections 7).

## 9 PREVENTIVE MAINTENANCE

9.1 VOCs Analysis

Preventative maintenance procedures may include cleaning of purge and trap plumbing, transfer lines, and parts which come in contact with the sample; baking out or changing the sorbent trap, baking out or changing the GC column, cleaning the mass spectrometer ion source, and servicing the mass spectrometer vacuum systems. The description of preventative maintenance procedures used for analytical apparatus and equipment must be documented in a maintenance logbook.

9.2 SOCs Analysis

9.2.1 Preventative maintenance procedures for sample preparation equipment may include tuning of the sonic horn, cleaning of GPC plumbing, transfer lines, and parts which come in contact with the sample; repacking the GPC column, or

recalibrating the GPC. Preventative maintenance procedures must be documented in a maintenance logbook.

9.2.2 Preventative maintenance procedures for GC/MS equipment may include replacement or cleaning of the autosampler syringe, replacement or cleaning of the injection port components, baking out, removing a small portion of the front of the column, or changing the GC column; cleaning the mass spectrometer ion source, and servicing the mass spectrometer vacuum systems. A description of preventative maintenance procedures used for analytical apparatus and equipment must be documented in a maintenance logbook.

9.3 OCP/Aroclors Analysis

9.3.1 Preventative maintenance procedures for sample preparation equipment may include tuning of the sonic horn, cleaning of GPC plumbing, transfer lines, and parts which come in contact with the sample; repacking the GPC column, or recalibrating the GPC. Preventative maintenance procedures must be documented in a maintenance logbook.

9.3.2 Preventative maintenance procedures for GC/ECD equipment may include replacement or cleaning of the autosampler syringe, replacement or cleaning of the injection port components, baking out or changing the GC column. Detectors are periodically leak checked. A description of preventative maintenance procedures used for analytical apparatus and equipment must be documented in a maintenance logbook.

## 10 RESPONSIBILITIES

10.1 It is the responsibility of the analyst to perform the analysis according to this SOP and to complete all documentation required for data review. Analysis and interpretation of the results are performed by personnel in the laboratory who have demonstrated the ability to generate acceptable results utilizing this SOP. This demonstration is in accordance with the training program of the laboratory. Final review and sign-off of the data is performed by the department supervisor/manager or designee.

10.2 It is the responsibility or the department supervisor/manager to document analyst training. Documenting method proficiency, as described in OLM04.2, is also the responsibility of the department supervisor/manager.

## 11 PROCEDURE

The detailed procedures for the CLP organics analyses are described in the attached appendices as outlined below. Refer to the appropriate section for specific instruction for the procedure of interest.

Exhibit D - Volatiles: VOCs Analysis

Exhibit D - Semivilatiles: SOCs Analysis

Exhibit D – Pesticides/Aroclors: OCP.Aroclor Analysis

Exhibit E - QA/QC Procedures and Requirements

Exhibit C - Target Compound List and CRQLs

Exhibit B - Reporting and Deliverables

## 12 QA/QC REQUIREMENTS

The description of QA/QC requirements including type, frequency, evaluation procedure, acceptance and rejection criteria, and required corrective actions is given in SOW Exhibit E.

## 13 DATA REDUCTION AND REPORTING

The description of standard CLP data reduction and reporting requirements is found in the analytical sections of the SOW. In some cases contractual requirements may specify other specific reporting and/or deliverable formats. In this case, the deviation from this SOP must be documented accordingly.

## 14 CONTENGENCIES FOR HANDLING OUT-OF-CONTROL OR UNACCEPTABLE DATA

Corrective action measures applicable to specific analysis steps are discussed in the applicable section of this (and other applicable) SOP(s). Also, refer to the SOP for Nonconformity and Corrective Action for correct procedures for identifying and documenting such data. Procedures for applying data qualifiers are described in the SOP for Report Generation or in project-specific requirements.

## 15 METHOD PERFORMANCE

15.1 This method was validated through single laboratory studies of accuracy and precision. Refer to the reference method for additional method performance data available.

15.2 The method detection limit (MDL) is established using the procedure described in the SOP for The Determination of Method Detection Limits (ADM-MDL). Method Reporting

Limits are established for this method based on MDL studies and as specified in the CAS Quality Assurance Manual.

## 16 POLLUTION PREVENTION

It is the laboratory's practice to minimize the amount of solvents and reagents used to perform this method wherever technically sound, feasibly possible, and within method requirements. Standards are prepared in volumes consistent with laboratory use in order to minimize the volume of expired standards to be disposed of. The threat to the environment from solvents and/or reagents used in this method may be minimized when recycled or disposed of properly.

## 17 WASTE MANAGEMENT

The laboratory will comply with all Federal, State, and local regulations governing waste management, particularly the hazardous waste identification rules and land disposal restrictions as specified in the laboratory Safety Manual, Sections 6 and 7.

## 18 TRAINING

18.1 Training outline

18.1.1 Review literature (see references section). Read and understand the SOP. Also review the applicable MSDS for all reagents and standards used. Following these reviews, observe the procedure as performed by an experienced analyst at least three times.

18.1.2 The next training step is to assist in the procedure under the guidance of an experienced analyst. During this period, the analyst is expected to transition from a role of assisting, to performing the procedure with minimal oversight from an experienced analyst.

18.1.3 Perform initial precision and recovery (IPR) study as described above for water samples. Summaries of the IPR are reviewed and signed by the supervisor. Copies may be forwarded to the employee's training file.

18.2 Training is documented following the SOP *for Documentation of Technical Personnel Training.*

NOTE: When the analyst training is documented by the supervisor on internal training documentation forms, the supervisor is acknowledging that the analyst has read and understands this SOP and that adequate training has been given to the analyst to competently perform the analysis independently.

## 19 REFERENCES

**USEPA Contract Laboratory Program, Statement** of **Work For Organic Analysis, OLM04.2,** May, 1999.

# STANDARD OPERATING PROCEDURE

for

**ORGANIC EXTRACTIONS GLASSWARE CLEANING**

**SOP No.: EXT-GC**

**Revision: 2**

**August 16, 1999**

**Approved by:** _____ 8/24/99
Supervisor — Date

_____ 8-24-99
QA Manager — Date

_____ 9-1-99
Laboratory Manager — Date

**COLUMBIA** ANALYTICAL **SERVICES, INC.**
**1317 South 13th Avenue**
**Kelso, Washington 98626**

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Annual review of this SOP has been performed and the SOP still reflects current practice.
Initials: _____ Date: 3-9-01
Initials: _____ Date: 12/30/02
Initials: LJ for DH Date: 12/4/03
12/29/04

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# ORGANIC EXTRACTIONS GLASSWARE CLEANING

## 1. SCOPE AND APPLICATION

The purpose of cleaning glassware is to eliminate the possibility of lab contamination in samples and QC samples. The procedure is applicable to all laboratory glassware routinely used in sample preparation.

## 2. METHOD SUMMARY

This procedue is split into two parts: First, all glassware used in organic analysis is washed and rinsed, then if low level analysis is required a further step is required. Glassware is washed with soap and water, and solvent rinsed. For low level work, a soak or kilning process is required followed by solvent rinsing..

## 3. DEFINITIONS

Low level - Tests that require lower than normal detection limits.

## 4. INTERFERENCES

**4.1.** Some soaps and detergents could contain target compounds. Especially those labeled "Anti-Bacterial" which contain phenols. For this reason, the labels should be checked for ingredients which may be target compounds.

4.2. Solvents may contain trace amounts of target compounds. It is important to verify that each lot has been tested.

**4.3.** Some glassware have small moving parts that can contain contaminants. A thorough cleaning is very important.

## 5. SAFETY

Normal accepted laboratory safety practices should be followed during glassware washing and handling. Each chemical reagent should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. A reference file of material safety data sheets is available to all personnel involved in these analyses. CAS also maintains a file of OSHA regulations regarding the safe handling of the chemicals specified in this method. The appropriate personal protective equipment should be used and safety precautions taken, as described in the CAS Safety Manual.

## 6. HOLDING TIME

"Holding Time" is only a concern with low level tests because target analytes can exist in the atmosphere, paints, glues, and lab surfaces. For this reason, low level glassware is washed just prior to use.

## 7. APPARATUS AND MATERIALS

7.1. Plastic tubs and plastic liners - For collecting glassware and soaking in detergent.

7.2. Drying rack - to allow glassware to dry before storage.

7.3. Protective equipment - Fume hood, gloves, lab coat, apron, and eyeware suitable for solvent usage.

7.4. Kiln - capable of ramping to 300" C and holding 3.5 hours.

7.5. Oven - capable of 200" C over night.

7.6. Brushes - Various sizes and shapes to reach into and scrub the different shaped glassware.

7.7. Sink with hot tap water and DI water plumbed.

## 8. STANDARDS, REAGENTS, AND CONSUMABLES

8.1. Soap - Liqinox or equivalent, prepared per manufacturer directions.

8.2. Hot tap water and DI water for rinsing.

8.3. Acetone - low grade for drying and initial solvent rinse.

8.4. Detergent - Alkanox Detergent 8 or equivalent

## 9. RESPONSIBILITIES

It is the responsibility of the analyst to perform this function according to this SOP. It is the resonsibility of the department supervisor/manager to ensure that the procedure is being implemented correctly.

## 10. PROCEDURE

10.1. Dirty glassware is collected in tubs to await cleaning. Some glassware will require a presoak to remove filth and is placed in a separate tub for this purpose. Use hot water and detergent to soak.

**10.2.** Scrub glassware with brushes and small amounts of soap. Be sure to reach all surfaces including moving parts.

**10.3.** Rinse thoroughly in hot tap water a minimum of three times to remove soap.

10.4. Rinse three times in DI water.

**10.5.** In a fume hood, rinse with Acetone to remove water and "dry" the glassware.

**10.6.** Allow Acetone to evaporate on a drying rack in or near the fume hood.

10.7. Glassware is then placed in its designated storage area to await final method specific solvent rinsing:

10.8. For low level analysis further cleaning is required.

**10.8.1.** Non-volumetric glassware is placed in a kiln and cycle to 300" C and held 3.5 hours. This includes KD's, collectors, beakers, and modified funnels

**10.8.2.** Glass wool is baked in an oven at 200" C over night.

10.8.3. Other glassware is placed in tubs lined with plastic. The tubs are filled with Alconox Detergent 8 (or equivalent) and soaked as directed by detergent manufacturer. Make sure all surfaces are drenched. This includes Teflon sep. funnels, graduated cylinders, and other volumetric glassware.

**10.8.4.** Rinse thoroughly in hot tap water a minimum of three times to remove detergent.

10.8.5. Rinse three time in DI water.

10.8.6. Glassware is now ready for method specific solvent rinsing.

## 11. QA/QC REQUIREMENTS

Method blanks are extracted with each batch per method requirements and is used to verify the absence of lab contamination.

# **STANDARD** OPERATING PROCEDURE

For

## ADDITION OF SPIKES AND SURROGATES

SOP No.: EXT-SAS

Revision: 5

September 10,2004

| | | |
|---|---|---|
| Approved by: | Supervisor | 9/14/04 Date |
| | QA Manager | 9.14.04 Date |
| | Laboratory Manager | 9/14/04 Date |

**COLUMBIA ANALYTICAL SERVICES, INC.**
1317 South 13th Avenue
Kelso, Washington 98626

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**Annual** review **of** this SOP has been performed and the SOP still reflects current practice.
Initials: _____ Date: _____
Initials: _____ Date: _____
Initials: _____ Date: _____

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# ADDITION OF SPIKES AND SURROGATES

## 1. SCOPE AND APPLICATION

This procedure describes all of the necessary steps to assure that our goal of 100% correct spiking of samples is achieved. Using these techniques will ensure that the proper amounts, solutions, and methods are used when adding spikes to a sample. It will include the following:

- Setting Up a Sample Batch
- Location of Solutions and Reordering Procedures
- Spiking and Spiking Order
- Use of Fixed Volume Pipettes
- Responsibilities of the Spiker and Witness
- Naming Conventions for Solutions

## 2. RESPONSIBILITIES

2.1. It is the responsibility of the analyst to perform the analysis according to this **SOP** and to complete all documentation required for data review. Analysis and interpretation of the results are performed by personnel in the laboratory who have demonstrated the ability to generate acceptable results utilizing this **SOP.** This demonstration is in accordance with the training program of the laboratory. Final review and sign-off of the data is performed by the department supervisor/manager or designee.

2.2. It is the responsibility or the department supervisor/manager to document analyst training. Documenting method proficiency, as described in the determinative method, is also the responsibility of the department supervisor/manager.

## 3. SETTING UP A SAMPLE BATCH

**3.1.** Set **up** all samples going from left to **right,** beginning with the first lab ID, second ID, and so on. DUPLICATES follow the sample that they are a duplicate of. Next is MATRIX SPIKE, followed by the DUPLICATE MATRIX SPIKE, with **LAB** CONTROL **SAMPLE** and METHOD BLANK at the right. Label the field samples and QC samples following the standard naming conventions.

3.2. In the case of multiple methods, set **up** each set separately.

## 4. LOCATION OF QC SOLUTIONS AND REORDERING

**4.1.** After all of the samples are set up in the correct order, find the correct surrogate and matrix spike solutions. QC solutions will be kept in designated refrigerators in each extraction lab.

4.2. Solutions will be grouped according to analytical test.

4.3. The number of containers used for surrogates is typically 2 - **4,** and for spikes it is typically 2 or **3.** For analyses where QC solutions are not used as frequently, one bottle is sufficient. Where these are multiple bottles, always use the front solution. This will be the working solution, with the remaining back-up solutions behind.

**4.4.** It is time to order new solutions when starting the second to last bottle. ***It is the responsibility of the prep. analyst to immediately prepare, or arrange to be prepared, new solutions.***

## 5. SAMPLE SPIKING

5.1. First record pertinent information from the bottle label onto the benchsheet. The required information is:

5.1.1. Standard I.D. or Traceability Number

5.1.2. Expiration date

5.1.3. Solution Concentration(s)

5.1.4. Amount added

5.1.5. Method Used (Eppendorf ID, pipette, syringe, etc. )

5.2. Find a witness. (Responsibilities of the witness are outlined in section ***6)***

**5.3.** Add surrogate first. The order is left to right.

**5.4.** Next add matrix spikes. Once again, the order is left to right, beginning with **your** matrix spike, then duplicate matrix spike **and** lab control sample.

***5.5.*** For multiple methods, **only** spike one set of samples at a time. An example would be preparing a set of Herbicide (8151) waters and a set of PAH **(83 10)** waters. Set them up as stated in section 3, but add the Herbicide solutions first, followed by the **PAH** solutions.

5.6. If you run out of a solution mid-batch, note on the bench sheet at what point solutions were changed.

5.7. Refer to the SOP *for Checking Pipette Calibration* for proper usage of the Eppendorf pipettes.

## 6. RESPONSIBILITIES OF THE EXTRACTIONIST

6.1. Pay attention to what you are doing and keep from being distracted!

6.2. Obtain surrogate and spiking solutions.

6.3. Obtain Eppendorf pipettes.

6.4. Transcribe information in Step 5.1 above onto benchsheet.

6.5. Spike samples using proper technique.

6.6. Check benchsheet for errors.

6.7. When extracting a PE sample, be sure to record the lot number from the PE container and the information regarding how the sample was prepared onto the extraction benchsheet.

## 7. RESPONSIBILITIES OF THE WITNESS

NOTE: Only personnel with training or experience in extractions may be witnesses.

7.1. Check the work request to make sure that the correct method is being used.

7.2. Check the solution bottles to make sure that they are correct for the test being performed.

7.3. Check that the correct amount of the solution is being added.

7.4. Using the appropriate marking pens, mark glassware with Blue (surrogate) or Red (matrix spike) only after it has been added to the sample. Be sure to check the technique of the spiker while this is being done.

7.5. Review the benchsheet to make sure that all of the information concerning the spiking procedure is correct.

7.6. Sign (signature) and date the benchsheet when he/she is satisfied that the procedure was done correctly. Note any problems encountered.

7.7. When witnessing a PE sample, be sure to perform the following:

- Read the instruction sheet and confirm with the extractionist that it reflects **what** has been done.
- Review the benchsheet to be sure the lot number from the PE container and the preparation information has been recorded on the extraction benchsheet.
- Compare the lot number on the sample container with the lot number on the instruction sheet to confirm that the correct sample and instructions are used.

STANDARD OPERATING PROCEDURE

# CALIBRATION OF INSTRUMENTS FOR ORGANICS CHROMATOGRAPHIC ANALYSES

**SOC-CAL**

Revision 5

November 21, 2002

Approved By:

| | | |
|---|---|---|
| | Supervisor | 11/22/02 Date |
| | QA Manager | 11-22-02 Date |
| | Laboratory Manager | 11/22/02 Date |

**COLUMBIA ANALYTICAL SERVICES, INC.**
1317 South 13th Avenue
Kelso, Washington **98626**

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Annual review of this SOP **has** been performed and **the** SOP still reflects current practice.
Initials: ____ Date: 12/1/03
Initials: ____ Date: 12/30/04
Initials: ____ Date: ____

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**Standard Operating Procedure**
**for**

# CALIBRATION OF INSTRUMENTS FOR ORGANICS CHROMATOGRAPHIC ANALYSES

## 1. SCOPE AND APPLICATION

1.1. This Standard Operating Procedure (SOP) describes the procedure and policies used for the calibration instruments used in chromatographic analyses. This procedure describes both the initial and continuing calibration steps used for calibration and general CAS policies for calibration.

1.2. This procedure provides default specifications and is consistent with **EPA** Method 8000B, **SW-846,** Third Edition, Update 111. This procedure is to be used for all **SW-846** procedures and should be incorporated into standard operating procedures (SOP) for these procedures by reference. The criteria set forth in this policy may not be applicable to all other environmental methods. The general guidelines described in section 11.1 of the SOP DO APPLY to all GC, GC/MS, and HPLC analyses. Method SOPs that do not incorporate this policy by reference must include the following calibration criteria:

- minimum number of calibration standards permitted in the calibration curve.
- acceptance criteria for the calibration and allowable exceptions.
- second source verification standard criteria and allowable exceptions.
- continuing calibration verification standard criteria and allowable exceptions.
- continuing calibration verification standard frequency requirements.
- internal standard response criteria in verification standards and samples

## 2. METHOD SUMMARY

2.1. The proper calibration of instrumentation is essential for accurate and valid chromatographic analysis. Instrument calibration not only provides the basis for quantitative determinations but also defines the working range for the analysis. Calibration also serves as a measure of instrument stability and sensitivity. Ongoing, or continuing, calibration verifies the validity of the calibration over time.

2.2. In general, a series of calibration standards are introduced into the instrument using the prescribed technique for the analysis. The standards are analyzed using the same procedure used for samples. Response (peak area or height) versus the concentration in the standard is tabulated. The results are used to prepare a calibration curve using average RF, linear regression, or quadratic calibration techniques.

2.3. Continuing calibration is performed by analyzing a standard and comparing the response, or calculated concentration to the calibration curve. The working calibration curve or calibration factor must be verified on each analytical sequence by the analysis of one or more mid-range calibration standards.

## 3. DEFINITIONS

3.1. **Analysis Sequence** - Samples are analyzed in a set referred to as an analysis sequence. The sequence begins with instrument calibration (initial or continuing verification) followed by samples or extracts interspersed with calibration standards (as prescribed by the procedure).

3.2. **Initial Calibration** – The calibration curve which tabulates or plots concentrations of a known analyte standard versus the instrument response to the analyte.

3.3. **Internal standard** - Organic compounds which are similar to the analytes of interest but which are not found in the samples. Internal standards are added to calibration standards and used to calibrate the instrument by compensating for variability in the injection process. An internal standard calibration provides a response factor which is a measure of analyte response relative to internal standard response.

3.4. **External Standard Calibration** – A calibration procedure in which analyte response is directly proportional to concentration and is not adjusted by the use of internal standards or other means.

3.5. **Initial Calibration Verification (ICV)** – A second-source calibration verification standard that is analyzed after initial calibration but prior to sample analysis, in order to verify the validity of the standards used in calibration. The ICV standards are prepared from a materials obtained from a source different from that used to prepare calibration standards. Also known as Second Source Calibration Verification (SSV).

3.6. **Continuing Calibration Verification (CCV)** - A mid-level standard analysis performed at specified intervals. Used to verify that the initial calibration curve is still valid for quantitative purposes.

3.7. **Surrogate** - Surrogates are organic compounds which are similar to analytes **of** interest in chemical composition, extraction and chromatography, but which are not normally found in environmental samples. The purpose of the surrogates is to evaluate the preparation and analysis of samples. These compounds are spiked into all blanks, standards, samples and spiked samples prior to extraction and analysis. Percent recoveries are calculated for each surrogate.

## 4. INTERFERENCES

Interferences from possible sources of contamination should be minimized during calibration. Refer to the determinative procedure or method for a description of possible interferences. Prior to initial calibration, the analyst must ensure that the system is free of interferences that would adversely affect the accuracy of the calibration, particularly near the low end of the calibration range. Analysis of an instrument blank prior to beginning the analysis of the calibration standards may be used to establish that that interferences are minimized.

## 5. SAFETY

5.1. Follow all **CAS** safety practices as described in the **CAS** Safety Manual. Also refer to the determinative procedure or method for a description of safety measures.

5.2. Each chemical compound or reagent should be treated as a potential health hazard. Exposure to these chemicals should be reduced to the lowest possible level. A reference file of material safety data sheets is available to all personnel involved in these analyses. **CAS** also maintains a file of **OSHA** regulations regarding the safe handling of the chemicals specified in this method.

## 6. SAMPLE COLLECTION, CONTAINERS, PRESERVATION, AND STORAGE

Not applicable to this SOP.

## 7. REAGENTS AND STANDARDS

7.1. Refer to the determinative procedure or method **for** a specific description of the standards and reagents required

7.2. Standards must be prepared and stored as required by the procedure and analytical method. Expiration dates must be documented and adhered to.

## 8. EQUIPMENT AND SUPPLIES

Refer to the determinative procedure or method for a description of necessary equipment **and** operating parameters.

## 9. PREVENTIVE MAINTENANCE

**9.1.** All maintenance activities are recorded in a maintenance logbook kept for each instrument. Pertinent information (serial numbers, instrument **I.D.,** etc.) must be in the logbook. Maintenance entries should include date, symptom of problem, corrective

actions, description of maintenance, date, and name. The log should contain a reference to return to analytical control.

*9.2.* The analyst must ensure that the instrument is in proper working order prior to initial calibration. Following an instrument maintenance event, the calibration must be verified or reestablished prior to sample analysis.

## 10. POLLUTION PREVENTION AND WASTE MANAGEMENT

Refer to the determinative procedure or method for a description **of** practices relative to the analysis being performed.

## 11. PROCEDURE

**11.1.** General Calibration Guidelines (GC, GC/MS, and **HPLC** procedures)

**11.1.1.** The method reporting limit (MRL) must be supported by the calibration, typically as the low point in the calibration.

11.1.2. The highest concentration, together with the lowest concentration, defines the calibration range.

11.1.3. All **ICAL** analyses, including the **ICV,** must be completed within **48** hours.

**11.1.4.** **A** calibration may not be interrupted by a maintenance event.

**11.1.5.** Each target analyte and surrogate will be calibrated over a concentration range. The calibration will contain increasing (or decreasing) concentrations (or amounts).

11.1.6. The complete calibration (i.e., all initial calibration levels and the ICV) must be analyzed prior to analysis of field or QC samples on the instrument.

**11.1.7.** Once an **ICAL** has been approved and used on a sample, it may not be changed. **If** an **ICAL is** analyzed but rejected, the most recent previous approved **ICAL** can continue to be used if calibration verification criteria is met. The decision to reject an **ICAL** must be clearly documented on the runlog or equivalent. Once an **ICAL** is rejected it cannot be used.

11.1.8. **A** calibration will be verified by a second source verification (ICV) standard prior to analysis of field or QC samples. The **ICV** should be analyzed each time the calibration curve is analyzed and on each instrument that is calibrated. **If** a second

source standard is not available, a verification standard should be prepared from the most concentrated material by a different analyst.

11.1.9. Point dropping policy:

11.1.9.1. The calibration must contain at least the minimum number of calibration levels prescribed by the analytical method or SOP.

11.1.9.2. The lowest concentration must be at or below the MRL and is not to be dropped unless the MRL is changed to the concentration of the remaining lowest standard.

11.1.9.3. Points may be dropped from the high end, but doing so lowers the calibration range.

11.1.9.4. Points may not be dropped from the "interior" of a curve unless there is an assignable cause* for doing so that affects many (if not all) the analytes in the calibration standard. If a calibration standard is to be dropped from the interior **of** the curve, all the analytes in the calibration standard must be dropped for all the analytes in the standard. In most cases, except when analytes are calibrated in separate calibration mixes, dropping a calibration standard in this manner will result in elimination of that level in the calibration curve.

* Assignable causes:

- standard preparation error
- instrument malfunction (e.g., acquisition is interrupted)
- bad injection or purge
- internal standard(s) missing
- uncharacteristic internal standard response
- >25% of the analytes in a multi-analyte calibration standard have a response that is <50% of the expected response based on the other calibration standards (indicating a standard problem rather than an instrument problem).

11.1.10. A calibration standard may be re-analyzed if the first analysis of the standard has been dropped and the other requirements in this policy are met (e.g., still within 48 hours). If the same calibration standard (i.e., the same concentration) **is** analyzed more than once, picking-and-choosing responses from one analysis or the other is not permitted.

11.1.11. For internal standard calibrations, minimum relative response factor (RRF) criteria will be established for all target analytes and surrogate compounds. If the analytical procedure does not specify minimum RRF criteria for each analyte, a default of 0.01 will be used. Compounds with a RRF below this level must be verified with a daily MRL check standard. Failure to analyze the daily MRL check standard for analytes falling below the minimum RRF will be documented in and discussed in the project case narrative.

11.1.12. For GC, HPLC, and for analysis of isomeric target analytes by GC/MS, adequate resolution must be demonstrated to allow for accurate quantitation of target analytes. **As** a general rule, all individual analytes should demonstrate at least **60%** baseline resolution on the primary analytical column and at least 40% baseline resolution on the confirmation column. If adequate resolution can not be achieved, close eluting and coeluting analytes must be calibrated in separate mixes. In the case of coeluting isomers and congeners, the analytes may be reported together as a summed result if adequate resolution *can* not be achieved on both primary and confirmation columns.

11.1.13. Samples must be quantified against the most current approved ICAL for the instrument. The practice of evaluating a CCV versus historical ICALs is not permitted.

11.1.14. If a CCV analysis at the beginning of an analytical sequence fails to meet acceptance criteria, corrective action is performed and a second CCV may be analyzed. If the second CCV meets criteria, the analysis may continue. If the second CCV fails to meet criteria, the analysis is to be stopped, corrective action is to be taken and documented. In this case, the laboratory has to either demonstrate performance after corrective action with two consecutive successful calibration verifications, or a new initial instrument calibration must be performed. If the laboratory has not demonstrated acceptable performance, sample analyses shall not occur until a new initial calibration curve is established and approved.

11.2. <u>Evaluation Guidelines for Initial Calibrations</u>

11.2.1. Criteria specified in the determinative method or by project specific quality assurance plans take precedence over these guidelines.

11.2.2. Average response factor (Wave) is the preferred calibration technique because linearity through the origin is assumed. **As** such, this technique allows the analyst to perform a more intuitive assessment of data below the lowest calibration standard. However, RFave may not always be the best fit of calibration data. The

analyst should use prior knowledge of the instrument, analyte response, and an assessment of the calibration data in determining whether RFave is appropriate.

11.2.2.1. Acceptance criteria for GC and HPLC:

Relative standard deviation (RSD) equal to or less than 20% for all compounds.

11.2.2.2. Acceptance criteria for GC/MS:

11.2.2.2.1. System performance and calibration check compounds (SPCC and CCC) must meet method criteria.

11.2.2.2.2. Relative standard deviation (RSD) equal to or less than 15% for all compounds.

11.2.2.3. Allowable Exceptions

Some analytes are recognized as marginal performing compounds. For EPA **SW-846** methods, **an** alternative evaluation based on the average RSD for all analytes in the calibration may be used. Acceptance criteria for RFave for these compounds are as follow:

11.2.2.3.1. GC and **HPLC** Procedures

- All analytes in the calibration must be processed using Wave in order to calculate the average RSD.
- The average **RSD** for the calibration, using all analytes in the method, must be less than or equal to 20%.
- The RSD for marginal performing compounds must be less than or equal to 30%.
- Analytes evaluated using these alternative criteria must be documented in the case narrative.

11.2.2.3.2. GC/MS Procedures

- All analytes in the calibration must be processed using Wave in order to calculate the average RSD.

- Method specified CCC and SPCC criteria must be met when these compounds are included in the analysis.
- The average RSD for the calibration, using all analytes in the method, must be less than or equal to 15%.
- The RSD for marginal performing compounds must be less than or equal to 30%.
- Analytes evaluated using these alternative criteria must be documented in the case narrative.

11.2.3. When curves are used, least squares and quadratic fits are permissible. These fits will not be forced through the origin. **As** such, it may become impractical to report estimated concentrations in samples below the lowest standard of calibration. The analyst must be trained on the significance of the Y-intercept when using curve fits. Specifically, the analyst must understand that very low responses may quantify to false positives depending on where the curve intersects the **Y** axis.

Note: Quadratic calibration should not be used to compensate for detector saturation at higher concentrations or to avoid proper instrument maintenance. Quadratic calibration should not be employed for methods or instruments previously shown to exhibit linear calibration for the analytes of interest.

11.2.4. Acceptance criteria for these fits are as follow:

11.2.4.1. Least Squares: $R \geq 0.995$ or $R2 \geq 0.990$

11.2.4.2. Quadratic: $COD \geq 0.990$

11.2.4.3. If a least squares fit is used, the curve must contain a minimum of five (5) calibration levels.

11.2.4.4. If a quadratic fit is used, the curve must contain a minimum of six **(6)** calibration levels and must be continuous along the function (i.e., it must consist of consecutive increasing or consecutive decreasing numerical values).

11.2.5. Because calibration curves cannot be forced through the origin, the analyst should evaluate the effect the y-intercept will have on quantifying detections at or below the lowest standard of calibration. This evaluation should involve extrapolating the curve to a level of one half the lowest standard (using one half the area or area

ratio). If the result is positive and less than the MRL, the curve may be used. If the result is equal to or less than zero, or if the result is equal to or greater than the CAS MRL for the procedure, the curve may not be usable. The analyst should document the potential problems that can arise when target analytes are quantified against the curve. Supervisor approval is required prior to processing samples using the calibration. When this type of calibration is observed, it is recommended that the instrument be recalibrated as soon as possible.

11.2.6. The calibration will be verified by an ICV standard following the initial calibration standards and prior to analysis of field or QC samples. The ICV should be analyzed each time the calibration curve is analyzed and on each instrument that is calibrated.

11.2.6.1. GC and HPLC Acceptance criteria

The maximum allowed %Dif or %Drift is ±15%. At least one of the analytical systems in a dual column or dual detector system must meet the criteria.

11.2.6.2. GC/MS Acceptance criteria

Method specified calibration check compound (CCC) and system performance check compound (SPCC) criteria must be met when these compounds are included in the analysis. When the method specified CCCs are included in the calibration, the maximum allowed %Dif or %Drift is ±20%. For all other analytes in the calibration, the maximum allowable %Dif or %Drift is ±30%.

When the method-specified CCCs are not included in the calibration, each analyte has a maximum allowed %Dif or %Drift of ±20%.

11.3. Evaluation Criteria: Continuing Calibration Verification (CCV) Standards

11.3.1. Criteria specified in the determinative method or by project specific quality assurance **plans** take precedence over these guidelines.

11.3.2. For calibrations using RFave, CCV Standards are evaluated based on % Difference (%Dif) of the response factor. %Dif is calculated as:

$$\%Dif = \frac{RFv - RFave}{RFave} \times 100$$

Where:

- RFv is the response factor (also relative response factor) or calibration factor from the verification standard
- RFave is the average response factor or calibration factor from the calibration.

11.3.3. For calibrations using Least Squares or Quadratic fits, CCV Standards are evaluated based on % Drift (%Drft) of the measured value compared to the expected value. %Drft is calculated as:

$$\%\,Drift = \frac{Measured\ concentration - Expected\ concentration}{Expected\ concentration} \times 100$$

11.3.4. CCV Acceptance Criteria:

11.3.4.1. GC and HPLC Procedures

- The maximum allowed %Dif or %Drift is ±15%. For multi-component pesticides and PCB Aroclors, the maximum allowable %D is ±15% for the average result of the quantitation.

- **If** the 15% criteria is not met, CCVs may be evaluated using the average %D for all analytes in the calibration (in accordance with SW-846 Method 8000B section 7.7). Specifically, the average %D for all analytes in the continuing calibration standard must be < 15%. Additionally, the maximum allowed %D for individual analytes in the calibration is ±25%.

- Non-detected analytes can be reported from analyses prior to a CCV that does meet the criteria. However, the CCV must exhibit a positive bias (i.e., outside the upper control limit), no further documentation is required. However, this is considered a temporary measure and corrective action must be taken in order that subsequent CCVs may pass standard criteria.

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- All confirmed detections for analytes that fail acceptance criteria in the CCV, regardless of concentration, must be reanalyzed to ensure accurate quantification.

11.3.4.2. GC/MS Procedures – With CCC and SPCC Compounds

- Method specified CCC and SPCC criteria must be met when these compounds are included in the analysis.

- The maximum allowed %Dif or %Drift is ±20% for the CCCs. For all other analytes in the calibration, the maximum allowable %Dif or %Drift is ±30%. Samples with confirmed detections of analytes that do not meet this criteria must be reanalyzed.

- For CCVs that **do** not meet the acceptance criteria, nondetected analytes may be reported as follows:

  Analytes exhibiting a positive bias (i.e., outside the upper control limit) in the CCV may be reported. However, the CCC/SPCC criteria must be met in the associated CCV, and no further documentation is required.

  For VOA analyses only, analytes exhibiting a negative bias (i.e., outside the lower control limit) in the CCV may be reported. However, the CCC/SPCC criteria must be met in the associated CCV and the analyte must be assessed for potential false negative results. The analysis of a MRL check standard may be used to document adequate sensitivity for the analysis. A non-conformity and corrective action form should be initiated to document the CCV failure and address the impact of the negative bias. This is considered a temporary measure and corrective action must be taken in order that subsequent CCVs may pass standard criteria.

11.3.4.3. GC/MS Procedures – Without CCC and SPCC Compounds

- When the method specified CCCs are not included in the calibration, each analyte has a maximum allowed %Dif or %Drift of ±20%. All samples associated with a CCV not meeting this criteria must be reanalyzed.

- **All** confirmed detections for analytes that fail acceptance criteria in the CCV, regardless of concentration, must be reanalyzed to ensure accurate quantification.

11.3.5. CCV standards must be analyzed at the start of each analytical sequence (except when the sequence is initiated with an ICAL and ICV).

11.3.6. CCV standards are analyzed at the following frequency:

11.3.6.1. External Standard Calibrations

- CCV standards should be analyzed after every 10 injections of field and QC samples or every 12 hours, which ever is more frequent.

- Samples with confirmed detections must be bracketed by acceptable CCV standards.

- When a closing CCV standard is not acceptable, corrective action must be taken. A new CCV standard may be prepared and analyzed to demonstrate degradation of the standard as the cause of a CCV outlier. In this case, instrument stability will be verified and samples analyzed prior to this CCV can be reported. CCV standards that are reinjected after minor instrument maintenance (e.g., injection port maintenance, column bake-out, installation of a new trap, etc.) do not verify instrument stability. Samples analyzed prior to this CCV must be reanalyzed.

11.3.6.2. Internal Standard Calibrations

- The analysis sequence must be initiated with an acceptable instrument tune (for GC/MS) and an acceptable CCV. The last injection or analysis in the sequence must be started within 12 hours from the time of sequence initiation.

- Internal standard response in the CCV must be within 0.5 - 2 times the response observed in the mid point calibration standard in the curve. Failure to meet this criteria should prompt the analyst to check the internal standard solution for possible degradation or concentration, or may indicate the need for instrument maintenance or calibration.

11.3.6.3. The concentration of CCV standards must be periodically varied within the calibration range. At a minimum, analyze a CCV at a concentration other than the nominal CCV concentration (the next higher or lower ICAL point is recommended) once per initial calibration. It is recommended that this be done just following initial calibration.

## 12. QUALITY CONTROL

12.1. Refer to the determinative procedure or method for a description of routine quality control procedures for the analysis.

12.2. ***An*** acceptable calibration must be established prior to performing any Initial Precision and Recovery studies or Method Detection Limit studies.

## 13. CALCULATIONS, DATA REDUCTION, AND REPORTING

**13.1.** Refer to section 11 above for calculations relative to the calibration.

**13.2.** The instrument and reporting software routinely does calculation of solution concentrations. Instrument (solution) concentrations are done using the following equations:

Average RF - External standard:

$$C = \frac{A_x}{RF_{ave}}$$

where C = concentration
A, = area (response) of analyte being measured
$RF_{ave}$ = average response factor

Average RF - Internal standard:

$$C = \frac{A_x}{A_{i.s.}} x \frac{C_{i.s.}}{RF_{ave}}$$

where C = concentration
$C_{i.s.}$ = concentration of internal standard
A, = area (response) of analyte being measured
$A_{i.s.}$ = area of internal standard
$RF_{ave}$ = average response factor

Linear regression - External standard:

$$C = \frac{A_x - b}{a}$$

where C = concentration
A, = area (response) of analyte being measured
b = y intercept
a = slope of calibration line

Linear regression – Internal standard:

$$C = \frac{\left[\left(\frac{A_x}{A_{i.s.}}\right) - b\right] C_{i.s.}}{a}$$

where C = concentration
$C_{i.s.}$ = concentration of internal standard
**A,** = area of analyte being measured
$\mathbf{A}_{i.s.}$ = area of internal standard
b = y intercept
a = slope of calibration line

Quadratic – External standard:

Given the data system calibration equation

$$R = aC^2 + bC + c$$

where R = response

$$C = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

C = concentration
a = data system 2nd order coefficient
**b** = data system coefficient
c = y intercept (c from equation above) minus R

Quadratic – Internal standard:

Given the data system calibration equation

$$R = aC^2 + bC + c$$

where R = response ratio (analyte response divided by **I.S.** response)

$$C = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

C = concentration
a = data system 2nd order coefficient divided by $C_{i.s.}^2$
b = data system coefficient divided by $C_{i.s.}$
c = y intercept (c from equation above) minus R

13.3. Further calculation procedures (i.e. sample and QC results) are described in the determinative procedure.

13.4. Data Review and Assessment

Following primary data interpretation and calculations, all data is reviewed by a secondary analyst. Refer to the ***SOP for*** *Laboratory Data Review Process* for details.

## 14. CORRECTIVE ACTION

**14.1.** Refer to the SOP for ***Nonconformity and*** *Corrective* ***Action*** for procedures for corrective action. Personnel at all levels and positions in the laboratory are to be alert to identifying problems and nonconformities when errors, deficiencies, or out-of-control situations are detected.

14.2. Handling out-of-control or unacceptable data

14.2.1. On-the-spot corrective actions that are routinely made by analysts and result in acceptable analyses should be documented **as** normal operating procedures, and no specific documentation need be made other than notations in laboratory maintenance logbooks, runlogs, for example.

14.2.2. Documentation of a nonconformity must be done using a Nonconformity and Corrective Action Report (NCAR) when: a) corrective action is not taken or not possible b) corrective action fails to correct an out-of-control problem on a laboratory QC or calibration analysis c) reanalysis corrects the nonconformity but is not a procedurally compliant analysis.

## 15. METHOD PERFORMANCE

Refer to the determinative procedure or method for a description of available method performance data.

## 16. TRAINING

**16.1.** Refer to the determinative procedure for a description of training requirements for the analysis. Also refer to the SOP for *Documentation of Technical Personnel Training*. In general:

16.1.1. Review literature (see references, section 18). Read and understand this SOP and the determinative procedure SOP. Following these reviews, observe the procedure as performed by an experienced analyst.

16.1.2. The next training step is to assist in the procedure under the guidance of an experienced analyst. During this period, the analyst is expected to transition from a role of assisting, to performing the procedure with minimal oversight from **an** experienced analyst.

16.2. Training is documented following the SOP for *Documentation of Technical Personnel Training*. Training for this procedure can be documented through documentation of training for the determinative procedure.

NOTE: When the analyst training is documented by the supervisor on internal training documentation forms, the supervisor is acknowledging that the analyst has read and understands this SOP and that adequate training has been given to the analyst to competently perform the analysis independently.

## 17. RESPONSIBILITIES

17.1. It is the responsibility of the analyst to perform the applicable analysis according to this SOP and to complete all documentation required for data review. Analysis and interpretation of the results are performed by personnel in the laboratory who have demonstrated the ability to generate acceptable results utilizing this **SOP.** This demonstration is in accordance with the training program of the laboratory. Final review and sign-off of the data is performed by the department supervisor/manager or designee.

17.2. It is the responsibility or the department supervisor/manager to document analyst training. Documenting method proficiency, as described in the reference method is also the responsibility **of** the department supervisor/manager.

## 18. REFERENCES

Determinative Chromatographic Separations, Method 8000B, Revision 2, Test Methods for Evaluating Solid Waste, **EPA SW-846,** Final Update III, December **1996.**

# STANDARD OPERATING PROCEDURE

For

**PURGE and TRAP FOR AQUEOUS SAMPLES**

SOP No.: VOC-5030

Revision: **3**

September 8,2004

Approved **by:** _____ Supervisor _____ 9/9/04 Date

_____ QA Manager _____ 9-9-04 Date

_____ Laboratory Manager _____ 9/9/04 Date

**COLUMBIA ANALYTICAL SERVICES, INC.**
**1317** South 13th Avenue
Kelso, Washington **98626**

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Annual review of this SOP has been performed and the SOP **still** reflects current practice.
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**Standard Operating Procedure**

**for**

**PURGE-AND-TRAP FOR AQUEOUS SAMPLES**

## 1. SCOPE AND APPLICATION

1.1. This procedure describes purge-and-trap sample preparation/introduction for the analysis of volatile organic compounds **(VOCs)** using **EPA** Method 5030B. .The procedure is applicable to aqueous samples and water miscible liquid samples. Also described is the analysis of high concentration soil and waste sample extracts prepared in Method 5035. This procedure is used in conjunction with gas chromatographic determinative procedures 8015,8021, and GC/MS 8260 procedure.

1.2. This procedure can be used for most volatile organic compounds that have boiling points below ***200°C*** and are insoluble or slightly soluble in water. Volatile water-soluble compounds can be included in this analytical technique; however, quantitation limits (by ***GC*** or **GC/MS)** are higher because of poor purging efficiency. The procedure is also limited to compounds that elute as sharp peaks from a GC column described in the determinative method. Such compounds include low molecular weight halogenated hydrocarbons, aromatics, ketones, nitriles, acetates, acrylates, ethers, and sulfides.

1.3. Method 5030, in conjunction with Method 8015 (GC/FID), may be used for the analysis of the aliphatic hydrocarbon fraction in the light ends of total petroleum hydrocarbons, e.g., gasoline. For the aromatic fraction (BTEX), use Method 5030 and Method 8021 (GC/PID). **A** total determinative analysis of gasoline fractions may be obtained using Methods 8021 (GC/PID) in series with Method 8015.

1.4. Water samples can be analyzed directly for volatile organic compounds by purge-and-trap extraction and gas chromatography. Higher concentrations of these analytes in water can be determined by direct injection of the, sample into the chromatographic system or by dilution of the sample prior to the purge-and-trap process.

## 2. METHOD SUMMARY

2.1. Aqueous Samples: An inert gas is bubbled through a portion of the aqueous sample at ambient temperature, and the volatile components are transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the volatile components are adsorbed. After purging is completed, the sorbent column is heated and backflushed with inert gas to desorb the components onto a gas chromatographic column.

2.2. High Concentration Extracts from Method 5035: An aliquot of the extract prepared in Method 5035 is combined with organic free reagent water in the purging chamber. It is then analyzed by purge-and-trap GC or GC/MS following the normal aqueous method.

## 3. DEFINITIONS

Refer to the determinative procedure for applicable definitions.

## 4. INTERFERENCES

4.1. Impurities in the purge gas, and from organic compounds out-gassing from the plumbing ahead of the trap, account for the majority of contamination problems. The use of non-polytetrafluoroethylene (non-PTFE) plastic coating, non-PTFE thread sealants, or flow controllers with rubber components in the purging device must be avoided, since such materials out-gas organic compounds which will be concentrated in the trap during the purge operation. These compounds will result in interferences or false positives in the determinative step. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running laboratory reagent blanks.

4.2. Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) through the septum seal of the sample vial during shipment and storage. A trip blank prepared from organic-free reagent water and carried through sampling and handling protocols serves as a check on such contamination.

4.3. Contamination by carryover can occur whenever high-concentration and low-concentration samples are analyzed sequentially. Whenever an unusually concentrated sample is analyzed, it should be followed by an analysis of organic-free reagent water to check for cross-contamination. The trap and other parts of the system are subject to contamination. Therefore, frequent bake-out and purging of the entire system may be required.

4.4. The laboratory where volatiles analysis is performed should be completely free of solvents. Special precautions must be taken to determine methylene chloride. The analytical and sample storage areas should be isolated from all atmospheric sources of methylene chloride. Otherwise random background levels will result. Since methylene chloride will permeate through PTFE tubing, all GC carrier gas lines and purge gas plumbing should be constructed of stainless steel or copper tubing. Laboratory workers' clothing previously exposed to methylene chloride fumes during common liquid/liquid extraction procedures can contribute to sample contamination. The presence of other organic solvents in the laboratory where volatile organics are analyzed will also lead to random background levels and the same precautions must be taken.

## 5. SAFETY

5.1. The toxicity or carcinogenicity of every compound or reagent used in this procedure has not been precisely determined; however, the toxicity of some compounds is well established and documented; therefore, each chemical compound should be treated as a potential health hazard. Exposure to these compounds should be reduced to the lowest possible level. A reference file of material safety data sheets is available to all personnel involved in these analyses. CAS also maintains a file of OSHA regulations regarding the safe handling of the chemicals specified in this method.

5.2. Caution should be used when preparing and using stock standard solutions and other reagents. The MSDS for each of these should be read before handling. Care should also be taken when handling samples. The use of standard lab protective wear (gloves, lab coat, and safety glasses) is advised.

## 6. SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1. Samples should be stored in capped bottles, with minimum headspace, at 4°C or less in an area free of solvent fumes. The size of any bubble caused by degassing upon cooling the sample should not exceed 5 - 6 mm. When a bubble is present, also observe the cap and septum to ensure that a proper seal was made at time of sampling. Is there any evidence of leakage? If the sample was improperly sealed, the sample should be discarded.

6.2. Requirements for preservation at a prescribed pH are found in the determinative method.

6.3. All samples should be analyzed within 14 days of collection. Samples not analyzed within this period must be noted and data are considered minimum values.

6.4. All samples should be collected with corresponding trip blanks. Trip blanks are prepared and labeled as outlined in the SOP for Bottle Order Preparation and Shipping (SMO-BORD).

## 7. APPARATUS AND EQUIPMENT

7.1. Microsyringes - 10-µL, 25-µL, 100-µL, 250-µL, 500-µL, and 1,000-µL. These syringes should be equipped with a 20-gauge (0.006 in ID) needle.

7.2. Syringe valve - Two-way, with Luer ends (three each), if applicable to the purging device.

7.3. Two 5-mL glass hypodermic syringes with Luer-Lok tip (other sizes are acceptable depending on sample volume used).

7.4. Volumetric flasks, Class A - 10-mL and 100-mL, with ground-glass stoppers.

7.5. Vials - 2-mL, for GC autosampler.

7.6. The purge-and-trap device consists of three separate pieces of equipment: the sample purger, the trap, and the desorber. **A** Tekmar LSC 2000,3000 or 0.1. 4460, or equivalent, will be used. Refer to Figures 1-4 in Method 5030B for typical configurations.

7.6.1. The recommended purging chamber is designed to accept 5-mL samples with a water column at least **3** cm deep. The gaseous headspace between the water column and the trap should have a total volume of less than 15 mL. The purge gas must pass through the water column as finely divided bubbles with a diameter of less **than** 3 mm at the origin. The purge gas must be introduced no more than 5 **mm** from the base of the water column. Alternate sample purge devices may be used, provided equivalent or improved performance is demonstrated.

7.6.2. The traps typically used for the determinative methods are listed below. Equivalent alternative traps may be used if acceptable performance is demonstrated.

- Method 8260,8021(PID/Hall): Supelco "K" trap
  part number 2-4920-V(Tekmar) or 2-1 131-V(O.I.)

- Method 8015,8021(FID/PID): Supelco "J" trap
  part number 2-4919 (Tekmar) or 2-1 145 **(O.1.)**

7.6.3. Before initial use, the trap should be conditioned for a minimum of one hour at 270" by backflushing with an inert gas flow of at least 20 mL/min. Vent the trap effluent to the hood, not to the analytical column. Prior to daily use, the trap should be conditioned for 10 min at 260°C with backflushing. The trap may be vented to the analytical column during daily conditioning; however, the column must be **run** through the temperature program prior to analysis of samples.

7.6.4. The desorber must be capable of rapidly heating the trap to 250°C for desorption. The polymer section of the trap should not be heated higher than 260°C, and the remaining sections should not exceed 260°C during bake-out mode. The desorber design illustrated in Figures 2 and 3 meet these criteria.

7.6.5. **At** these increased temperatures, catalytic and thermal decomposition of analytes **has** been reported. The VOCARB 4000 combination has also been demonstrated to catalytically break down 2-chloroethyl vinyl ether, and to partially decompose 2,2-dichloropropane. Bromoform and bromomethane have shown some thermal decomposition.

7.6.6. Heater - capable of maintaining the purging chamber to within 1°C, over a temperature range **from** ambient to 100°C.

7.7. Capillary GC Columns - Any GC column that meets the performance specifications of the determinative method may be used. See the specific determinative method for recommended columns, conditions and retention times.

## 8. REAGENTS

8.1. Organic-free reagent water - All references to water in this method refer to organic-free reagent water, as defined in Chapter One.

8.2. See the determinative method and Method 5000 for guidance on internal and surrogate standards.

## 9. RESPONSIBILITIES

9.1. It is the responsibility of the analyst to perform the analysis according to this SOP and to complete all documentation required for data review. Analysis and interpretation of the results are performed by personnel in the laboratory who have demonstrated the ability to generate acceptable results utilizing this SOP. This demonstration is in accordance with the training program of the laboratory. Final review and sign-off of the data is performed by the department supervisor/manager or designee.

9.2. It is the responsibility or the department supervisor/manager to document analyst training. Documenting method proficiency, as described in the determinative procedure is also the responsibility of the department supervisor/manager.

9.3. This method is restricted to use by or under the supervision of trained analysts. Each analyst must demonstrate the ability to generate acceptable results with this method.

## 10. PREVENTIVE MAINTENANCE

10.1. Carrier gas - Inline purifiers or scrubbers should be in place for all sources of carrier gas. These are selected to remove water, oxygen, and hydrocarbons. Purifiers should be changed as recommended by the supplier.

10.2. Due to high temperatures associated with the use of the traps described in section 7.6.2, care must be taken to assess trap breakdown and contamination on a daily basis. See section 7.6.3. Traps must be replaced when loss of performance is exhibited and when calibration difficulties (attributable to the trap) are encountered. To prevent unexpected downtime, it is suggested that traps be replaced on a regular schedule (every 30-45 days is suggested) when in constant use. Both Supelco traps "J" and "K", under daily use, may not maintain performance for longer than 45 days. Traps used for "short" analyte lists may last longer.

10.3. Samples lines in the autosampler and purge-and-trap unit along with the transfer line to the gas chromatograph have shown susceptibility to contamination and formation of active sites

that may interfere with analysis. Daily assessment, through analysis of standards and blanks, needs to be conducted to determine need for maintenance before sample analysis begins.

10.4. All maintenance activities are recorded in a maintenance logbook kept for each instrument.

## 11. PROCEDURE

11.1. Preparation of calibration standards

11.1.1. The purge-and-trap technique for aqueous samples is found in Sec. 7.2 of Method 5030B and guidance for analysis of solvent extracts fiom the High Concentration Method in Method 5035 is found in Sec. 7.3 of Method 5030B. The gas chromatographic procedures are found in the applicable determinative procedure.

11.1.2. Assemble the purge-and-trap device, using manufacturer's specifications and determinative procedure requirements. Condition the trap at the manufacturer's recommended temperature and recommended time, with an inert gas flow of at least 20 mL/min. Daily conditioning of the trap (by putting a standard through the purge/desorb/bake sequence, or other means) prior to use is recommended.

11.1.3. Connect the purge-and-trap device to a gas chromatograph or gas chromatograph/mass spectrometer system.

11.1.4. To perform initial calibrations, prepare the final solutions containing the required concentrations of calibration standards, including surrogate standards and internal standards where applicable. Standards are prepared in organic-fiee reagent water. Add the aliquot of calibration solution directly to the organic-free reagent water by inserting the needle into the water (when discharging the contents of the micro-syringe, be sure that the end of the syringe needle is well beneath the surface of the organic-free reagent water). Standards can be prepared in volumetric flasks, graduated cylinders with ground-glass stoppers, or directly in the purge device.

11.1.5. To perform continuing calibrations, prepare the calibration standard as in section 11.1.4, using the designated concentration for the determinative procedures continuing calibration.

11.1.6. If the standard is prepared using volumetric flasks or graduated cylinders, transfer the water to the purging device. Alternatively, a vial autosampler may be used where the required volume is transferred directly to the purge vessel along with required internal and surrogate standards.

11.1.7. Follow the purge-and-trap analysis in section 11.3.

**Note:** Cross contamination and memory effects from a high concentration standard are a common problem. Extra rinsing of the purge chamber after analysis normally corrects this. The newer purge-and-trap systems often overcome this problem with better bakeout of the system following the purge-and-trap process. Also, the charcoal traps retain less moisture and decrease the problem.

11.2. Preparation of samples

11.2.1. Screening of the sample prior to purge-and-trap analysis may provide guidance on whether sample dilution is necessary and may prevent contamination of the purge-and-trap system.

11.2.2. Aqueous samples for Method 5030B purge-and-trap analysis typically do not require specific preparation steps. The samples are loaded directly onto the autosampler in the sequence determined by the analyst. However, sample dilution (in organic-free reagent water) may be necessary.

11.2.3. For high concentration extracts from Method 5035, an aliquot of the extract prepared in Method 5035 is combined with organic free reagent water. It is then analyzed by purge-and-trap GC or GC/MS following the normal aqueous method.

11.2.3.1. The GC or GC/MS system should be set up as described in the specific determinative method. This should be done prior to the addition of the solvent extract to organic-free reagent water.

11.2.3.2. Table 2 can be used to determine the volume of solvent extract to add to the 5,10,or 25mL of organic-free reagent water for analysis. If a screening procedure was followed, use the estimated concentration to determine the appropriate volume. Otherwise, estimate the concentration range of the sample from the low-concentration analysis to determine the appropriate volume. If the sample was submitted as a high-concentration sample, start with a 1:50 dilution for GC analyses, or 1:100 for GC/MS. All dilutions should keep the response of the major constituents (previously saturated peaks) in the upper half of the linear range of the curve.

11.2.3.3. Proceed with the analysis as outlined in the specific determinative method. Analyze all reagent blanks on the same instrument as that used for the samples.

11.2.4. Water-miscible liquids are analyzed as water samples after first diluting them at least 50-fold with organic-free reagent water.

Initial and serial dilutions can be prepared by pipetting 1 mL of the sample into a 50-mL volumetric flask or graduated cylinder and diluting to volume with organic-free reagent water. Transfer immediately to a gas-tight syringe or **VOA** vial.

11.2.5. Dilutions may be made in volumetric flasks or graduated cylinders (10-mL to 100-mL). Select the flask or cylinder that will allow for the necessary dilution. Intermediate dilutions may be necessary for extremely large dilutions. All steps must be performed without delays until the diluted sample is in a gas-tight syringe or **VOA** vial.

11.2.5.1. Calculate the approximate volume of organic-free reagent water to be added to the flask or cylinder selected and add slightly less than this quantity of organic-free reagent water to the flask.

11.2.5.2. Using a syringe, inject the proper aliquot of sample into the flask. Dilute the sample to the mark with organic-free reagent water. Cap the **flask** and invert three times.

11.2.5.3. Fill a **VOA** vial with the diluted sample and label.

**Note:** The process of taking an aliquot destroys the validity of the liquid sample for future analysis; therefore, if there is only one VOA vial, the analyst should carefully transfer the remaining sample into a 20-mL VOA vial or fill the vial with glass beads until zero headspace is achieved. Seal the vial with zero headspace.

11.2.6. Add surrogate spiking solution and, if applicable, internal standard spiking solution as required by the determinative method. The surrogate and internal standards may be mixed and added **as** a single spiking solution. Matrix spiking solutions, if indicated, should be added to the designated QC samples at this time. Note that some autosamplers are designed to add these standards automatically. Autosamplers employ a 1µL internal and surrogate standard injection loop so the spiking solution should be prepared at the appropriate concentration.

11.3. Sample introduction and purging

11.3.1. All samples and standard solutions must be allowed to warm to ambient temperature before analysis.

11.3.2. Assemble the purge-and-trap device. The operating conditions for the GC and GC/MS are given in the determinative method. Whole oven cooling may be needed for certain GC columns and/or certain GC/MS systems to achieve' adequate resolution **of** the gases. Make certain that the valve on the purge device is in the position open to the transfer line from the autosampler.

11.3.3. Adjust the purge gas flow rate (nitrogen or helium) to 25-50 mL/min on the purge-and-trap device. Optimize the flow rate to provide the best response for chloromethane and bromoform, if these compounds are analytes. Excessive flow rate reduces chloromethane response, whereas insufficient flow reduces bromoform response.

11.3.4. Load the autosampler with the standards and/or samples to be analyzed.

11.3.5. Purge the sample for the time and at the temperature specified in Table 1. For GC/MS analysis using Method 8260, purge time is 11 minutes at ambient temperature.

11.4. Sample Desorption

11.4.1. The procedures employed for sample desorption depend on the type of GC interface used. Procedures for non-cryogenic and cryogenic interfaces are described below. Analysts should also consult the instructions from the manufacturer of the purge-and-trap system and the supplier of the trap packing material.

11.4.2. After the recommended purge time has elapsed (see Table 1 for guidance on purge times for specific methods), place the purge-and-trap system in the desorb mode and preheat the trap to 240°C (or other temperature recommended for the specific trap packing material) without a flow of carrier gas passing through the trap.

**Note:** Some purge-and-trap systems are capable of performing a moisture removal step (e.g., *dry* purge) which can eliminate excess moisture from the trap and gas lines by purging the trap just prior to the desorption step.

11.4.3. Start the flow of the carrier gas, begin the GC temperature program, and start GC data acquisition. The carrier gas flow rate will depend on the trap employed. **A** flow rate of 15 mL/min is used for the standard silica gel trap, while 10 mL/min may be adequate for other traps. Continue the carrier gas flow for 2 min, or as recommended by the manufacturer. Desorption times as low as 1.5 min may be adequate for analytes in Method 8015.

11.5. Trap Reconditioning

11.5.1. After desorbing the sample, recondition the trap by returning the purge-and-trap device **to** the purge mode. Wait 15 seconds, then close the syringe valve on the purging device to begin gas flow through the trap. The trap temperature should be maintained at 260°C for Methods 8021 **,** 8260, and 8015. After a minimum of 7 min, turn off the trap heater and open the syringe valve to **stop** the gas flow through the trap. When cool, the trap **is** ready for the next sample.

11.5.2. While the trap is being desorbed into the gas chromatograph, empty the purging chamber. Wash the chamber with a minimum of two 5 mL flushes of organic free reagent water (or methanol followed by organic free reagent water) to avoid carryover of volatile organics into subsequent analyses.

## 12. QA/QC REQUIREMENTS

12.1. Before processing any samples, the analyst should demonstrate through the analysis of an organic-free reagent water method blank that all glassware and reagents are interference free. Each time a set of samples is extracted, or there is a change in reagents, a method blank should be processed as a safeguard against chronic laboratory contamination. The blank samples should be carried through all stages of the sample preparation and measurement.

12.2. Refer to the SOP for the determinative method and the SOP for Analytical Batches and Analytical Sequences for minimum QC requirements.

12.3. Any reagent blanks, laboratory control samples, or matrix spike samples should be subjected to exactly the same analytical procedures as those used on actual samples.

12.4. Surrogate standards should be added to **all** samples when specified in the appropriate determinative method.

## 13. DATA REDUCTION AND REPORTING

13.1. If the initial analysis of a sample or a dilution of the sample has a concentration of analytes that exceeds the initial calibration range, the sample must be reanalyzed at a higher dilution. When a sample is analyzed that has a saturated response from a compound, this analysis must be followed by an analysis with a non-detect (<MRL) for the saturated compound. If the analysis immediately following the saturated analysis has a positive hit for the saturated compound, it must be reanalyzed for that compound. Sample analysis for the saturated compound may not resume until an analysis with a non-detect (<MRL) is performed. When an autosampler is used and samples are loaded in a continuous sequence, special care must be taken to prevent carryover. Evaluating sample history and screening information when scheduling sample analysis may minimize the amount of carryover. For grossly contaminated systems, the analysis of blanks may be necessary to decontaminate the system prior to further analyses.

13.2. **All** dilutions should keep the response of the major constituents (previously saturated **peaks)** in the upper half of the linear range of the curve. See Method 8000 and the specific determinative method for details on calculating analyte response.

## 14. REFERENCES

14.1. EPASW846, Test Methods For Evaluating Solid Waste, Third Edition, Update III, December 1996, Method 5030B, Revision 2

14.2. SOP for Bottle Order Preparation'andShipping, SMO-BORD.

# TABLE 1

## PURGE-AND-TRAP OPERATING PARAMETERS

| Instrument Parameter | Analysis Methods 8015/8021/8260 |
|---|---|
| Purge gas | He |
| Purge gas flow rate | 20-40 mL/min. |
| Purge time | 11.0 ± 0.1 min. |
| Purge temperature | Ambient |
| Desorb temperature | 240°C |
| Backflush inert gas flow | 20-60 mL/min.[1] |
| Desorb time | 1.5 - 4 min. |

[1]The desorption flow rate for Method 8021 with a wide bore capillary column will optimize at ~ 10-15 mL/min.

# TABLE 2

## Quantity of Methanol Extract Required for Analysis of High-Concentration Soils/Sediments

| Approximate Concentration Range | Volume of Methanol Extract[1] |
|---|---|
| 500 - 10,000 ug/kg | 100uL |
| 1,000 - 20,000 ug/kg | 50uL |
| 5,000 - 100,000 ug/kg | 10uL |
| 25,000 - 500,000 ug/kg | 100uL of 1:50 dilution[2] |

[1] the volume of methanol added to 5 mL of water being purged should be kept constant. Add to the 5 mL whatever volume of methanol is necessary to maintain 100 uL added to the 5 mL.

[2] Dilute an aliquot of the extract 1:50, then take 100 uL for analysis.

STANDARD OPERATING PROCEDURE

# VOLATILE ORGANIC COMPOUNDS BY GC/MS

VOC-8260B
Revision 9
November 18, 2004

Approved By: _____ Supervisor — 11/19/04 Date

_____ QA Manager — 11-19-04 Date

_____ Laboratory Manager — 11/19/04 Date

**COLUMBIA ANALYTICAL SERVICES, INC.**
1317 South 13th Avenue
Kelso, Washington 98626

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Annual review of this SOP has been performed and the SOP still reflects current practice.
Initials: _____ Date: _____
Initials: _____ Date: _____
Initials: _____ Date: _____

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# VOLATILE ORGANIC COMPOUNDS BY GC/MS

## 1. SCOPE AND APPLICATION

1.1. This procedure is used to determine the concentration of volatile organic compounds in water and soil using USEPA Method 8260B. This method is also applicable to TCLP ZHE leachates and may also be applicable to various types of aqueous and nonaqueous waste samples.

1.2. Table 1 lists the compounds that can be determined by this method and the achievable method reporting limits (MRLs) in water and soil. Equivalent nomenclature for MRL includes Estimated Quantitation Limit (EQL) and Practical Quantitation Limit (PQL). Therefore, MRL=EQL=PQL. The reported MRL may be adjusted if required for specific project requirements, however, the capability of achieving other reported MRLs must be demonstrated. The Method Detection Limits (MDLs) will vary depending on the instrument used.

1.3. The nominal quantitation range for water samples is 0.5 – 80 ug/L. The nominal quantitation range for low-level soils is 5-200 ug/kg. The nominal quantitation range for mid-level soils is 50-8000 ug/kg.

## 2. METHOD SUMMARY

2.1. This procedure gives gas chromatographic/mass spectrometric (GC/MS) conditions for the detection of parts per billion (ppb) levels of volatile organic compounds. A sample aliquot is injected into the gas chromatograph (GC) by either the purge and trap method or by direct injection. The compounds are separated on a fused silica capillary GC column. The compounds are detected by a mass selective detector (MSD), which gives both qualitative as well as quantitative information.

2.2. In the purge and trap process an inert gas, helium, is bubbled through the sample aliquot, at room temperature. This gas stream sweeps the volatile organic compounds out of the aqueous phase and into the gas stream - it purges the compounds out of the sample. The gas stream then passes through a sorbent column which selectively adsorbs, (traps) these compounds out of the helium. The preparation and analysis of soil samples uses procedures described in USEPA Method 5030B or 5035. After the purging sequence is done, the sorbent column (the trap) is heated and desorbed onto the GC column. The GC column separates the compounds and passes then onto the MSD for identification and quantification.

2.3. The sensitively of this method depends on the level of background contamination (i.e. interferences) rather than on instrumental limitations. Highly contaminated waste samples

will require a methanol extraction prior to analysis. This will elevate the reporting levels and may mask low levels of compounds of interest.

2.4. Deviations from the reference method(s): For water samples, a purge volume of 10mL is used, whereas the method (section 7.5.5) states 5 mL or 25 mL. The use of a 10 mL volume ensures sensitivity for "5 mL" type analyses *and,* on the analytical systems in use, meets the sensitivity goals of a 25 mL purge volume analysis. Also, the use of 10 mL rather than 25 mL decreases the negative effects of water being introduced into the P/T-GC-MS system.

## 3. DEFINITIONS

**Analysis Window** - Samples are analyzed in a set referred to as "a window". The window begins with the injection of the tune verification standard. After this standard has passed the method specific criteria a 12 hour analysis window is started. Next, a calibration curve or a continuing calibration standard (CCV see below) is run. If the CCV meets the specified criteria, sample and QC analyses are run until the 12 hour time limit closes. A new window must then be opened and the sequence repeated.

**Internal Standards** - Internal standards are organic compounds which are similar to the analytes of interest but which are not found in the samples. The chosen internal standards are used to help calibrate the instrument's response and to compensate for slight instrument variations from injection to injection.

**Independent Calibration Verification (ICV)** - Verification of the ratio of instrument response to analyte amount, a calibration check, is done by analyzing for analyte standards in an appropriate solvent. ICV solutions are made from a stock solution which is different from the stock used to prepare calibration standards.

**Laboratory Control Sample (LCS)** - In the LCS analysis, predetermined quantities of standard solutions of all analytes are added to a blank matrix prior to sample extraction and analysis. The purpose of the LCS is to monitor analytical control for the sample batch. Percent recoveries are calculated for each of the analytes.

**Matrix Spike/Duplicate Matrix Spike Analysis** - In the matrix spike analysis, predetermined quantities of standard solutions of all analytes are added to a sample matrix prior to sample extraction and analysis. The purpose of the matrix spike is to evaluate the effects of the sample matrix on the methods used for the analyses. Samples are split into duplicates, spiked, and analyzed. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at 5 to 10 times the MRL or at levels specified by a project analysis plan.

**Standard Curve** - A standard curve is a curve which plots concentrations of a known analyte standard versus the instrument response to the analyte.

**Surrogate** - Surrogates are organic compounds which are similar to the analytes of interest in chemical composition, extraction, and chromatography, but which are not normally found in environmental samples. The purpose of the surrogates is to evaluate the preparation and analysis of samples. These compounds are spiked into all blanks, standards, samples, and spiked samples prior to analysis. Percent recoveries are calculated for each surrogate.

**Continuing Calibration Verification Standard (CCV)** - A mid-level standard injected into the instrument at specified intervals and is used to verify the initial calibration.

**Method Blank (MB)** - The method blank (also called continuing calibration blank) is a volume of clean reagent water analyzed on each GC/MS used for sample analysis. The purpose of the blank is to determine the levels of contamination associated with the instrumental analysis itself, particularly with regard to the carry-over of analytes from standards or highly contaminated samples into other analyses.

## 4. INTERFERENCES

4.1. Interferences by common laboratory extraction solvents, such as Methylene Chloride, Acetone, and Freon 113 can cause problems. The area where volatile organic analyses are performed should be free of these solvents.

4.2. Other interferences include but are not limited to impurities in the inert purge gas, dirty plumbing/purge vessels, cross contamination by highly contaminated samples to clean ones in transport and storage, and carry over from one analysis to subsequent ones.

## 5. SAFETY

5.1. All appropriate safety precautions for handling solvents, reagents and samples must be taken when performing this procedure. This includes the use of personnel protective equipment, such as, safety glasses, lab coat and the correct gloves.

5.2. Chemicals, reagents and standards must be handled as described in the CAS safety policies, approved methods and in MSDSs where available. Refer to the CAS Environmental, Health and Safety Manual and the appropriate MSDS prior to beginning this method.

## 6. SAMPLE CONTAINERS, COLLECTION, PRESERVATIONS, AND STORAGE

6.1. Refer to procedures for methods 5030 and 5035 for sample container and collection procedures. All sample containers for volatile organic analyses should be washed with soap and water, deionized water rinsed, and baked at 105°C ± 5°C for approximately 2 hours prior to use. Alternatively, one can buy precleaned sample containers from major lab equipment suppliers. All containers should be of glass or amber glass and equipped with a screw top cap and PFTE (teflon) lined septa.

6.2. Samples collected using EPA Method 5035 should be shipped in Encore sample tubes or collected in VOA vials containing sodium bisulfate (low level) and/or methanol (mid level).

6.3. Collect all samples in duplicate, triplicate when possible. Prepare the proper number of sample bottles/containers prior to the sampling event with preservatives to adjust the samples pH to <2 with 1:1 HCI (water samples).

6.4. Slowly fill sample bottles to just overflowing taking care not to flush out the preservative or to entrain air bubbles in the samples. Seal the bottles with PFTE lined septa toward the sample and invert to check for entrained air bubbles.

6.5. Experimental evidence has shown refrigeration at 4°C alone will not stop biological degradation of some aromatic volatile organics. Adjusting the pH of the replicate samples to less than two (pH <2) with 1:1 HCl (@ 2-3 drops per 40 mLs) preserves samples for 14 days after collection. Residual chlorine can also degrade some organic compounds, generating trihalomethanes (THM's).

6.6. All samples must be stored at 4 ± 2°C and must be analyzed within 14 days of collection. See SOP VOC-5035 for additional holding time information. Any free product samples to be tested do not have any set holding times but should be analyzed as soon as possible.

## 7. APPARATUS AND EQUIPMENT

7.1. Gas chromatograph/Mass Selective Detector Systems

7.1.1. Each GC/MS system is set up with a GC capable of cooling the GC oven/column (subambient capability optional), injection onto a capillary column, and a stainless steel jet separator at the column's detector end prior to the transfer line interfaced with the MSD. Each MSD is a HP5970, HP5971, HP5972, or HP5973 that is controlled by the HP-MSDOS Chemstation software.

7.1.2. An alternate option to the use of a jet separator is to use a split/splitless injector and interfacing the capillary column directly into the MSD.

7.1.3. Instrument systems and associated test methods are listed below. Individual operating conditions for 8260 instruments are given in Attachment A.

| Instrument ID | Description | Tests Performed |
|---|---|---|
| MS02 | 5890/5970 | 8260W, 524.2, 624 |
| MS04 | 5890/5972 | 8260W, 8260S, 524.2, 624 |
| MS05 | 5890/5972 | 8260S |
| MS13 | 6890/5973 | 8260W, 8260S, 624 |
| MS15 | 5890/5970 | 624 |
| MS12 | 5890/5970 | Screening only |

7.2. Purge and Trap with Autosampler

Each volatile GC/MS analytical system uses a purge and trap to introduce the sample onto the GC column. A Tekmar LSC-2000 or its equivalent is needed. Each purge and trap has an autosampler (A/S) attached to run multiple samples, one at a time, and run unattended for extended periods of time. Varian Archon, Tekmar ALS 2016, or equivalents are preferred for extended unattended automated analyses.

7.3. GC Columns

Column 1: J&W Scientific DB-624 (or equivalent) 60 meters x 0.53 mm and fused silica column 1.5μm film thickness.

Column 2: J&W Scientific DB-624 (or equivalent) 60 meters x 0.25 mm and fused silica column 1.4μm film thickness.

Column 3: Restex RTX-Volatiles (or equivalent) 60 M x 0.53mm id fused silica column 2.0μm film thickness

Column 4: Restex RTX-Volatiles (or equivalent) 60 M x 0.32mm id fused silica column 1.8μm film thickness

Column 5: Restex RTX-Volatiles (or equivalent) 30 M x 0.25mm id fused silica column 1.4μm film thickness

Column 6: Restex RTX-624 (or equivalent) 20 M x 0.18mm id fused silica column 1.0μm film thickness

7.4. Each volatile GC/MS data processing station uses the most recent version of the EPA/NIST Mass Spectral Library. The current version is the NIST98k library.

## 8. STANDARDS, REAGENTS, AND CONSUMABLE MATERIALS

8.1. Methanol, purge and trap grade or equivalent.

8.2. Reagent water, prepared from deionized water, by charcoal filtration and then purging for approximately 2 hours prior to use.

8.3. Stock Standard Solutions

Commercially prepared and certified stock standards are used routinely for all the method specified analytes. All such mixtures are also routinely checked against an independent source for both analyte identification and analyte concentration. All such stock standard mixtures have expiration dates given by the manufacturer and must be replaced if the comparison with the independent check standards indicates a problem. Alternatively, stock

standards may be prepared from neat chemicals. Store with minimal headspace, at -10° to -20°C and protect from light.

8.4. Working Standards - Prepare these standards from stock solutions. Prepare at concentrations which facilitate ease of preparation of instrument-level standards (calibration standards, etc.). Refer to Table 2 for Standard Expiration Date Guidelines.

8.5. Calibration Standards

8.5.1. A minimum of five different concentration levels for all the analytes are prepared by diluting working standards into reagent water. The lowest concentration level must be at the method reporting level, or a level corresponding to a sample concentration meeting project-specific data quality objectives, with the remaining four levels defining the working linear range of the analytical system. *The permanent gas stock standards used to prepare calibration standards must not be more than one week old.* See Attachment B for detailed instructions and forms for preparing calibration standards and ICVs.

8.5.2. The suggested levels are 0.5, 2, 10, 20 and 40 ppb for waters; and 5, 20, 50, 100, and 200 ppb for soils. All calibration solutions are made up daily.

8.5.3. QC Spiking Solutions – Prepare LCS and MS spiking solutions the same as ICV solutions. See Attachment B.

8.6. Internal Standards and Surrogates

The surrogates recommended are Dibromofluoromethane, toluene-$d_8$ and 4-bromofluorobenzene. The internal standards recommended are fluorobenzene, 1,4-difluorobenzene, 1,4-dichlorobenzene-$d_4$ and chlorobenzene-$d_5$. Other internal standards and surrogates may be used, depending on the analysis requirements. All surrogates and internal standards are added to every calibration standard. The spike level for samples, blanks, and matrix spikes is 10 ug/L for waters and 50 ug/L for soils.

8.7. Spiking Solutions

Matrix spike and laboratory control spike solutions must be prepared from a separate source than the calibration standards. Spiking solutions should contain the full list of analytes of interest. However, a subset may be reported.

**Note:** Refer to Table 2 for Standard Expiration Date Guidelines.

## 9. PREVENTIVE MAINTENANCE

9.1. All maintenance activities are recorded in a maintenance logbook kept for each instrument.

9.2. Carrier gas - Inline purifiers or scubbers should be in place for all sources of carrier gas. These are selected to remove water, oxygen, and hydrocarbons. Purifiers should be changed as recommended by the supplier.

9.3. Purge and Trap /Autosamplers

9.3.1. The purge/trap system should be baked out and back-flushed daily as needed, generally prior to use on a daily basis.

9.3.2. Replace the trap monthly, or sooner if performance deteriorates.

9.4. Gas Chromatograph

9.4.1. Clipping off a small portion of the head of the column often improves chromatographic performance. When cutting off any portion of the column, make sure the cut is straight and "clean" (uniform, without fragmentation) by using the proper column cutting tool.

9.4.2. Over time, the column will exhibit poorer overall performance, as contaminated sample matrices are analyzed. The length of time for this to occur will depend on the samples analyzed. When a noticeable decrease in column performance is evident and other maintenance options do not result in improvement, the column should be replaced. This is especially true when evident in conjunction with calibration difficulties.

9.5. Mass Spectrometer

9.5.1. Tune the MS as needed to result in consistent and acceptable performance (see section 11).

9.5.2. For units under service contract, certain maintenance is performed by instrument service staff, including pump oil changed, vacuuming boards, etc., as recommended by the manufacturer.

9.5.3. MS source cleaning should be performed as needed, depending on the performance of the unit. This may be done by the analyst or by instrument service staff.

## 10. RESPONSIBILITIES

10.1. It is the responsibility of the analyst to perform the analysis according to this SOP and to complete all documentation required for data review. Analysis and interpretation of the results are performed by personnel in the laboratory who have demonstrated the ability to generate acceptable results utilizing this SOP. This demonstration is in accordance with the training program of the laboratory. Final review and sign-off of the data is performed by the department supervisor/manager or designee.

10.2. It is the responsibility of the department supervisor/manager to document analyst training. Documenting method proficiency, as described in 8260B, is also the responsibility of the department supervisor/manager.

## 11. PROCEDURE

11.1. Sample Preparation

11.1.1. Water Samples

11.1.1.1. No preparation is generally required, other than dilution with reagent water to **bring** analytes into the upper half of the calibration range. Thus, a 10 mL sample volume is run straight from the sample vial. See USEPA Methods 8260B and 5030B for further discussion.

11.1.1.2. All water samples must be checked to have a pH $\leq 2$ after sample analysis has taken place. Narrow range pH paper is used and the results are recorded on the injection log.

11.1.2. TCLP ZHE leachates are diluted 1:400 in reagent water prior to analysis.

11.1.3. Soil samples are analyzed **as** either low-level (5035) or mid-level (methanol extraction w/5030B purge&trap).

11.1.3.1. For low-level analyses, one of the sampling options given in method 5035 is to be used. Depending on the option used, follow the instructions given in the method. The use of EnCore samplers is the preferred sampling technique.

11.1.3.1.1. In the event that low-level analyses are specified but samples were not taken using a 5035 procedure, a portion of the sample is analyzed via direct heated purge of soil and EPA Method 5030A is cited. The analytical report should also be narrated with a statement indicating that 5030A has been deleted from **SW-846.** The low-level analyses require a calibration specific to direct soil analysis.

11.1.3.1.2. For soil, 1-5 grams is weighed out into the sample vial and 5 mL of reagent water is added. QC spikes and internal standards are then added, and the sample is purged at a temperature of **40°C"**±1°. Calibration standards, LCS, and method blanks require 5 grams Ottawa sand **as** the matrix.

11.1.3.2. The mid-level type is a methanol extraction method. In general, a 5 gram wet weight of soil is extracted with 5 mL **of** purge-and-trap methanol in a scintillation vial. **Quickly** add purge-and-trap methanol and the surrogate spike to the soil after transferring the soil aliquot to the vial. Cap and

vortex until the sample is thoroughly mixed. A 1:100 dilution (500uL to 50mL) of this extract is then prepared in reagent water and analyzed using the water calibration. The extract weight, volume used, and methanol lot number are recorded on the injection log (or a bench sheet).

NOTE: For soil/solid samples requiring VOA and non-VOA analyses and only one container was submitted to the lab, sample receiving will label the sample container as "VOA Analysis First'' and/or attach a "VOA FIRST' tag. The VOA department will remove a sample aliquot first for their analyses. The sample should be handled as if it were a Rush analysis, so that the other non-VOA analyses will not be unduly delayed. The VOA analyst who opens the container will either break the custody seal and will initial and date it when the container was opened or sign and date the "VOA FIRST" tag. A VOA Analysis First note will also be included on the SR.

11.2. Calibration

**NOTE:** Refer to the CAS SOP *for Calibration of Instruments for Organics Chromatogaphic Analysis*. The calibration procedure(s) and options chosen must follow the CAS protocols. In general, the calibration procedure is as follows:

11.2.1. BFB Tuning

11.2.1.1. Prior to calibration and sample analyses, analyze a 25ng or 50ng injection of Bromofluorobenzene (BFB). Each volatile GC/MS analytical system set up to run 8260B must meet the criteria listed in Table 3 for the injection of BFB. The analysis time for BFB is used to define the start of the 12-hour window in which all analyses must be performed. Once the instrument is tuned, all subsequent analyses of standards, samples, and QA/QC samples within the same 12-hour window must be analyzed using the identical mass spectrometer operating conditions.

11.2.1.2. Obtain the spectrum for evaluation using one of the following options:

- Three scans (the peak apex scan and the scans immediately preceding and following the apex) are acquired and averaged. Background subtraction is required, and must be accomplished using a single scan acquired no more than 20 scans prior to the elution of BFB. The background subtraction should be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the BFB peak or part of any other closely eluting peak.

- Use one scan at the apex of the peak. Background subtraction is required, and must be accomplished using a single scan acquired no more than 20 scans prior to the elution of BFB. The background subtraction should be designed only to eliminate column bleed or instrument background ions.

Do not subtract part of the BFB peak or part of any other closely eluting peak.

- Use one scan either directly preceding or following the apex of the peak. Background subtraction is required, and must be accomplished using a single scan acquired no more than 20 scans prior to the elution of BFB. The background subtraction should be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the BFB peak or part of any other closely eluting peak.

- Use the average across the entire peak up to a total of 5 scans. Peak integration must be consistent with standard operating procedure. If the peak is wider than 5 scans, the tune will consist of the ***peak*** apex scan and the two scans immediately preceding and following the apex. Background subtraction is required, and must be accomplished using a single scan acquired no more than 20 scans prior to the elution of BFB. The background subtraction should be designed only to eliminate column bleed or instrument background ions. Do not subtract **part** of the BFB peak or **part** of any other closely eluting peak..

11.2.1.3. Evaluate the spectrum against the criteria specified in Table **3.** The criteria used must be the same for all ion abundance criteria checks associated with a given analysis. For example, initial calibration, continuing calibration(s), ***QC,*** and sample analyses for a given sample must all use the same criteria.

11.2.2. GC/MS Analytical System Initial Calibrations

11.2.2.1. Prior to conducting any sample analyses, a multi-point (5 point minimum) calibration must be run. Recommended calibration levels are 0.5, 2, 10, 20, and **40** ppb for waters, and 5, 20, 50, 100, and 200 ppb for soils. Analyze each calibration standard and tabulate the area response of the characteristic quantitation ions (Table **4)** versus concentration for each compound, internal standards and surrogate. Calculate the response factors (RF) for each compound and surrogate relative to the specified internal standard by:

$$RF_x = \frac{(A_x)(C_{ISTD})}{(A_{ISTD})(C_x)}$$

Where:

**A,** = Area of the characteristic quantitation ion for compound x.
$A_{ISTD}$ = Area of the characteristic quantitation ion for the specified internal standard.
$C_x$ = The concentration of the compound added.
$C_{ISTD}$ = The concentration of the specified internal standard.

11.2.2.2. Calculate the mean response factor $(\overline{RF_x})$ for each analyte and surrogate from the five calibration levels. Calculate standard deviation (SD) and the percent relative standard deviations (%RSD) for each analyte from the mean with:

$$\%RSD = \frac{(SD)}{(\overline{RF_x})} 100.$$

11.2.2.3. The % RSD should be less than 15% for each compound. However, the %RSD for each individual CCC must be less than 30%. The CCC's are: 1,1-Dichloroethene, Chloroform, 1,2-Dichloropropane, Toluene, Ethyibenzene and Vinyl Chloride.

11.2.2.4. If a Yo RSD greater than 30% is measured for any CCC, then corrective action to eliminate a system leak and/or column reactive sites is required before performing recalibration.

11.2.2.5. If the % RSD for any compound is 15% or less, linearity can be assumed over the calibration range, and the relative response factor for each analyte and surrogate is used to quantitate sample analytes.

11.2.2.6. In those instances where the %RSD for one or more analytes exceeds 15%, the initial calibration may still be acceptable if the following conditions are met:

- The mean of the RSD values for all analytes in the calibration standards is $\leq$ 15%.
- The mean RSD criteria applies to all target analytes in the calibration standards, regardless of whether or not they are of interest for a specific project.
- The data user must be supplied with an initial calibration summary indicating the compounds which exceed 15% RSD and the result of the mean RSD calculation.

11.2.2.7. If all of the conditions in Section 11.2.2.6 are met and the %RSD is less than 30%, then the average response factor may be used to determine sample concentrations as described in Section 13.1. If the %RSD exceeds 30%, then a linear regression or quadratic calibration is used.

11.2.2.8. The response of 5 SPCC's must also be checked for their minimum $\overline{RF_x}$:

| | |
|---|---|
| Chloromethane | 0.10 |
| 1,1-Dichloroethane | 0.10 |
| Bromoform | 0.10 |
| Chrorobenzene | 0.30 |
| 1,1,2,2-Tetrachloroethane | 0.30 |

11.2.3. Independent Calibration Verification

11.2.3.1. Following initial calibration, analyze an ICV standard. The ICV solution must be obtained for all analytes that are analyzed and reported. Calculate the concentration using the typical procedure used for quantitation. Calculate the percent difference (%D) from the ICV true value. The acceptance limits for the ICV are the same as those for the CCV.

11.2.3.2. If a second source standard is not available or is cost prohibitive (such as certain non-routine analytes), then an independently prepared solution (prepared by analyst other than analyst preparing initial calibration standards) may be used as the ICV and must meet the criteria above.

11.2.3.3. After the multi-point calibration has passed all of the above criteria, and the Independent Calibration Verification has been performed, samples can be analyzed. The calibration curve mid-point standard may serve as the CCV for the opening set of samples within the same 12-hour window as the initial calibration.

11.2.4. Daily GC/MS Calibration

11.2.4.1. The start of a 12-hour analysis window requires a check of the instrument tune via an injection of 25ng or 50 ng of BFB. Refer to section 11.2.1 for the procedure. If the criteria found in Table 3 *are* met, then a check of the initial calibration curve is done. If the first analysis of the BFB fails, inspect the instrument for malfunction and perform maintenance as necessary. A second BFB tune verification may then be performed. If the second run also fails, it may be necessary to retune and recalibrate the system.

11.2.4.2. After the tuning criteria have been verified, the initial calibration must be checked and verified by analyzing a midrange calibration standard. The 10 ppb level for waters and 50 ppb level for soils is recommended. For water, CCVs are prepared by adding 10µl of the 50 ppm 8260 working standard and 5µl of the 2000 ppm ketone mix into 50 mL reagent water, and a 10 mL aliquot is purged (for MS02, the ketones are in the 50ppm 8260 working standard and the ketone mix is not needed). For soil, CCVs are prepared by adding 12.5µl of the 200ppm (nominal) working standard into 50 mL reagent water, and a 5 mL aliquot is purged. The results are compared with those of the initial calibration's $\overline{RF}$. The criteria for the SPCCs, as outlined above,

must be met. Also, the CCCs must meet < 20% drift from the initial calibration curve average RFs. For non-CCC analytes, the maximum allowable %Dif or %Drift is ±30%, except dichlorofluoromethane, chlormethane, bromomethane, 2-Chloroethylvinylether, iodomethane, and vinyl acetate, which are ±40%.

11.2.4.3. If the tune criteria and the continuing calibration criteria are met, then the retention times of all compounds, surrogates, and internal standards are checked against the initial calibration. if the retention time for any internal standard changes by more than 30 seconds from the retention time from the mid-point standard of the most recent initial calibration, the system must be inspected for malfunctions and corrections must be made, as required. If the area for any of the internal standards changes by a factor of 2 (-50% to +100%) from the area from the mid-point standard of the most recent initial calibration, corrections must be made to the system.

11.2.5. Quantitation of all compounds will be based on the initial calibration.

11.3. Identification of Analytes

The **MSD** data system software identifies a sample component by first finding and identifying the surrogate and internal standards. After they have been integrated, the extracted ion chromatogram is searched for all calibrated analytes. The data system makes a positive identification for any peak associated with the proper time window and having the **primary** and secondary ions (**as** specified in the data system "method" file) in characteristic relative abundances. The analyte result is then calculated. The analyst reviews all analyses to confirm (or correct) all data system qualitative interpretations. The analyst should follow interpretation guidelines in the method for identification of analytes. Table **4** lists characteristic ions **as** given in Method 8260B. If there is no peak found for an analyte in the expected retention time window and the mass spectrum does not match according to the method criteria, then the analyte is "not found". Print out spectra for all confirmed hits.

## 12. QA/QC REQUIREMENTS

**Note:** The analyst should refer to the CAS *SOP for **Sample** Batches* and the **CAS** *SOP **for** The Determination of Method Detection Limits.*

12.1. Initial Precision and Recovery Validation

The accuracy and precision **of** the procedure must be validated before analysis of samples begin, or whenever significant changes to the procedures have been made. To do this, analyze four water sample spikes, calculate the average recovery and standard deviation, and evaluate as described in **EPA** SW-846. The concentration of the analytes to be spiked should be in the working calibration range. Initial Precision and Recovery studies should be performed as **part** of analyst training. Copies **of** the studies should be maintained in the lab and in the analyst's training file.

12.2. Method Detection Limits

12.2.1. **A** method detection limit (MDL) study must be undertaken before analysis of samples begins. To establish detection limits that are precise and accurate, the analyst must perform the following procedure. Spike a **minimum** of seven blank replicates with a MDL spiking solution (at a level below the MRL) for each target analyte, extract, and analyze. The MDL studies should be done for each matrix, prep method, and instrument. Refer to the CAS SOP for The Determination of Method Detecion Limits.

12.2.2. Calculate the average concentration found (x) in the sample concentration, and the standard deviation of the concentrations for each analyte. Calculate the MDL for each analyte using the correct T value for the number of replicates. The MDL study should be done annually.

12.3. Ongoing QC Samples required are described in the CAS-Kelso Quality Assurance Manual and in the *SOP for Sample Batches.* For every 12-hour analysis window, after meeting the tune and continuing calibration criteria, at least one method blank, one **LCS,** and one MS/DMS pair must be run for each matrix. Analytical windows must have at least one base (primary) sample analysis to require a MS/DMS pair.

12.3.1. Method blank - **A** method blank is analyzed with every batch of 20 or fewer samples to demonstrate that there are no method interferences. The method blank must demonstrate that interferences from the analytical and preparation steps minimized. No target analytes should be detected above the MRL in the method blank. For some project specific needs, additional requirements or exceptions may be given.

**Note:** For DoD projects, no target analytes should be detected in the Method Blank above ½ the MRL.

12.3.2. **A** lab control sample (LCS) must be prepared and analyzed with every batch of 20 or fewer samples. The LCS is prepared by spiking a blank with the matrix spike solution, and going through the entire preparation and analysis. Calculate percent recovery (%R) as follows:

$$\%R = X/TV \times 100$$

Where X =Concentration of the analyte recovered
TV =True value of amount spiked

Evaluate the recovery using the QC acceptance criteria in Attachment C. If the lab control sample (LCS) fails acceptance limits for any of the control compounds, the analyst must evaluate the sample preparation, analytical system, and calibration. Corrective action must be taken. Corrective action may include re-extraction, re-analysis, and/or recalibration and re-analysis.

12.3.3. A matrix spike/duplicate matrix spike (MS/DMS) must be prepared and analyzed with every batch of 20 or fewer samples. The **MS** is prepared by spiking a sample aliquot with the matrix spike solution, and going through the entire preparation and analysis. Calculate percent recovery (%R) as follows:

$$\%R = \frac{X - X1}{TV} \times 100$$

Where X =Concentration of the analyte recovered
X1 =Concentration of unspiked analyte
TV =True value of amount spiked

Calculate Relative Percent Difference (RPD) **as:**

$$RPD = \frac{R1 - R2}{(RI + R2)/2} \times 100$$

Where R1 = % recovery of the MS
R2 = % recovery of the DMS

Evaluate the recovery and RPD using the QC acceptance criteria in Attachment C. If the MS/DMS recovery is out of acceptance limits for reasons other than matrix effects, corrective action must be taken.

12.3.4. Calculate and evaluate the surrogate recovery using the QC acceptance criteria in Attachment C. If surrogate recovery is outside acceptance criteria, the sample data must be closely evaluated for possible matrix interferences. **If** none are present, then corrective action must be identified.

12.4. Acceptance Criteria

12.4.1. The acceptance criteria for tuning verification, initial, and continuing calibration verification have been outlined above in Section 11.

12.4.2. Current acceptance criteria for matrix spikes, LCSs and surrogates are listed in Attachment C and in **QA** document QCLIMITS.xls. The acceptance criteria listed are current criteria, but are subject to change as control limits are updated.

12.5. Corrective action requirements have been outlined above in Section 11. Also, the corrective action requirements of any project-specific project plan should be used when applicable.

12.6. Additional QA/QC measures include control charting of QC sample results.

## 13. DATA REDUCTION, REVIEW, AND REPORTING

### 13.1. Calculations

13.1.1. The GC/MS data stations, in current use, all use the H-P RTE Integrator to generate the raw data used to calculate the standards $\overline{RF_x}$ values, the sample amounts, and the spike values. The software does three passes through each data file. The first two identify and integrate each internal standard and surrogate. The third pass uses the time-drift information from the first two passes to search for all method analytes in the proper retention times and with the proper characteristic quantitation ions. The results for a water sample are calculated as follows when $\overline{RF_x}$ is used:

$$A_x = \frac{(Resp_x)(Amt_{ISTD})}{(Resp_{ISTD})(\overline{RF_x})}$$

Where: $A_x$ = the amount, in ppb, of the analytes in the sample;
$Resp_x$ = the peak area of the analytes of interest;
$Resp_{ISTD}$ = the peak area of the associated internal standard;
$Amt_{ISTD}$ = the amount, in ppb, of internal standard added

$\overline{RF_x}$ = the average response from the five-point for the analytes of interest.

13.1.2. The results for low-level soil work are calculated by taking the normal print out, in ppb, (see the water results outlined above) and correcting for the total, dry soil sample actually purged:

$$(A_x) = \frac{(5\ grams)}{(ASW_t\ gr)(\%\ Solids)} = A_x\ Low\text{-}Level\ Soil$$

Where: $A_x$ = the amount, in ppb, from the data system; five grams is the nominal amount of soil that is heated and purged;
$ASW_t$ = the actual soil wet weight, in grams, that is purged; and
% Solids the correction factor for dry weight.

13.1.3. Results for a high-level soil extract are calculated as follows:

$$(A_x) = \frac{(Dilution)(10\ ml)}{(ASW_t)(\%\ Solids)} = A_x\ High\text{-}Level\ Soil\ Amt.$$

Where: $A_x$ = the data station results, in ppb;
Dilution = the dilution of the extract.
10ml = the amount of methanol used to extract the soil;
$ASW_t$ = the actual wet weight of soil extracted; and
% Solids = the dry soil correction.

13.2. Data Review

Following primary data interpretation and calculations, all data is reviewed by a secondary analyst. Following generation of the report, the report is also reviewed. Refer to the *SOP for Laboratory Data Review Process* for details.

13.3. Reporting

13.3.1. Reports are generated using the STEALTH Data Reporting System which compiles the SMO login information and Enviroquant data. This compilation is then transferred to a file, which STEALTH uses to generate a report. The forms generated may be CAS standard reports, DOD, or client-specific reports. The compiled data from LIMS is also used to create EDDs.

13.3.2. Alternatively, Excel templates located in R:\VOA\forms may be used to prepare reports from hard-copy data. The analyst should choose the appropriate form and QC pages to correspond to required tier level. The detected analytes, surrogate and matrix spikes are then transferred, by hand, to the templates.

## 14. CONTENGENCIES FOR HANDLING OUT-OF-CONTROL OR UNACCEPTABLE DATA

Corrective action measures applicable to specific analysis steps are discussed in the applicable section of this (and other applicable) SOP(s). Also, refer to the SOP for Nonconformity and Corrective Action for correct procedures for identifying and documenting such data. Procedures for applying data qualifiers are described in the SOP for Report Generation or in project-specific requirements.

## 15. METHOD PERFORMANCE

This method was validated through single laboratory studies of accuracy and precision. Refer to the reference method for additional method performance data available.

The method detection limit (MDL) is established using the procedure described in the **SOP** for *The Determination of Method Detection Limits* (ADM-MDL). Method Reporting Limits are established for this method based on MDL studies and as specified in the CAS Quality Assurance Manual.

## 16. POLLUTION PREVENTION

It is the laboratory's practice to minimize the amount of solvents and reagents used to perform this method wherever technically sound, feasibly possible, and within method requirements. Standards are prepared **in** volumes **consistent** with **laboratory** use in order to minimize the

volume of expired standards to be disposed of. The threat to the environment from solvents and/or reagents used in this method may be minimized when recycled or disposed of properly.

## 17. WASTE MANAGEMENT

17.1. The laboratory will comply with all Federal, State and local regulations governing waste management, particularly the hazardous waste identification rules and land disposal restrictions as specified in the CAS EH&S Manual.

17.2. This method uses non-halogenated solvents and any waste generated from this solvent must be placed in the collection cans in the lab. The solvent will then be added to the hazardous waste storage area and disposed of in accordance with Federal and State regulations.

## 18. TRAINING

18.1. Training Outline

18.1.1. Review literature by reading references. Review the EPA methodology and any applicable state-specific methods. Review the SOP. Also review the MSDS for methanol.

18.1.2. Observe the procedure as performed by an experienced analyst at least three times.

18.1.3. Assist in the procedure under the guidance of an experienced analyst for a period of three months. During this training process, the analyst is expected to transition from a role of assisting, to performing the procedure with minimal oversight from an experienced analyst.

18.1.4. Following the three-month training period the analyst is expected to complete an initial precision and recovery (IPR) study for solid samples by direct, solid samples by extraction, and water samples. Summaries of the IPR are reviewed and signed by the supervisor and forwarded to the employee's training file.

18.1.4.1. Perform IPR studies by preparing and analyzing four replicate laboratory control samples spiked at a level of 10-20 times the MRL. Calculate average percent recovery and relative standard deviation for the four replicate analyses. Refer to Method 8000B and 8260B for analysis and evaluation guidelines.

18.1.4.2. For applicable tests, IPR studies should be performed in order to be equivalent to NELAC's Initial Demonstration of Capability.

18.2. Training is documented following the **SOP** for Documentation **of** Training.

NOTE: When the analyst training is documented by the supervisor on internal training documentation forms, the supervisor is acknowledging that the analyst has read and understands this SOP and that adequate training has been given to the analyst to competently perform the analysis independently.

## 19. REFERENCES

19.1. **CAS** SOP for Purge and Trap for Aqueous Samples (VOC-5030).

19.2. **CAS** SOP for Purge and Trap Extraction for Volatile Organics in Soil and Waste Samples, Closed System (VOC-5035).

19.3. *Volatile Organic Compounds* ***by*** *Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique,* U.S. EPA, SW-846, Final Update III, Method 8260B, Revision 2, December 1996.

19.4. *Purge and Trap,* **U.S.** EPA, SW-846, Final Updates I and III, Methods 5030A (Rev. 1) and 5030B (Rev. 2).

19.5. *Closed System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste,* U.S. **EPA,** SW-846, Final Update III, Method 5035, Revision 0, December 1996.

# TABLE 1
## Method 8260B Analyte List

| Compound | Water MRL ug/L | Soil MRL(low) ug/kg | Soil MRL(mid) mg/kg |
|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 0.5 | 5 | .05 |
| 1,1,1-Trichloroethane (TCA) | 0.5 | 5 | .05 |
| 1,1,2-Trichloroethane | 0.5 | 5 | .05 |
| 1,1-Dichloroethane | 0.5 | 5 | .05 |
| 1,1-Dichloroethene | 0.5 | 5 | .05 |
| 1,1-Dichloropropene | 0.5 | 5 | .05 |
| 1,2-Dibromoethane (EDB) | 2 | 20 | 0.1 |
| 1,2-Dichloroethane | 0.5 | 5 | .05 |
| 1,2-Dichloropropane | 0.5 | 5 | .05 |
| 1,3-Dichloropropane | 0.5 | 5 | .05 |
| 2,2-Dichloropropane | 0.5 | 5 | .05 |
| 2-Butanone (MEK) | 20 | 20 | 1 |
| 2-Hexanone | 20 | 20 | 1 |
| 4-Methyl-2-pentanone (MIBK) | 20 | 20 | 1 |
| Acetone | 20 | 50 | 1 |
| Benzene | 0.5 | 5 | .05 |
| Bromochloromethane | 0.5 | 5 | .05 |
| Bromodichloromethane | 0.5 | 5 | .05 |
| Bromomethane | 0.5 | 5 | .05 |
| Carbon Disulfide | 0.5 | 5 | .05 |
| Carbon Tetrachloride | 0.5 | 5 | .05 |
| Chlorobenzene | 0.5 | 5 | .05 |
| Chloroethane | 0.5 | 5 | .05 |
| Chloroform | 0.5 | 5 | .05 |
| Chloromethane | 0.5 | 5 | .05 |
| *cis*-1,2-Dichloroethene | 0.5 | 5 | .05 |
| *cis*-1,3-Dichloropropene | 0.5 | 5 | .05 |
| Dibromochloromethane | 0.5 | 5 | .05 |
| Dibromomethane | 0.5 | 5 | .05 |
| Dichlorodifluoromethane (CFC 12) | 0.5 | 5 | .05 |
| Ethylbenzene | 0.5 | 5 | .05 |
| Methylene Chloride | 2 | 10 | .25 |
| Tetrachloroethene (PCE) | 0.5 | 5 | .05 |
| Toluene | 0.5 | 5 | .05 |
| *trans*-1,2-Dichloroethene | 0.5 | 5 | .05 |
| *trans*-1,3-Dichloropropene | 0.5 | 5 | .05 |
| Trichloroethene (TCE) | 0.5 | 5 | .05 |
| Trichlorofluoromethane (CFC 11) | 0.5 | 5 | .05 |
| Vinyl Chloride | 0.5 | 5 | .05 |

**TABLE 1, continued**

| Compound | Water MRL ug/L | Soil MRL(low) ug/kg | Soil MRL(mid) mg/kg |
|---|---|---|---|
| Total Xylenes | 1 | 5 | 0.1 |
| Styrene | 0.5 | 5 | .05 |
| Bromoform | 0.5 | 5 | .05 |
| Isopropylbenzene | 2 | 20 | 0.2 |
| 1,1,2,2-Tetrachloroethane | 0.5 | 5 | .05 |
| 1,2,3-Trichloropropane | 0.5 | 5 | .05 |
| Bromobenzene | 0.5 | 5 | .05 |
| n-Propylbenzene | 2 | 20 | .02 |
| 2-Chlorotoluene | 2 | 20 | .02 |
| 4-Chlorotoluene | 2 | 20 | 0.2 |
| 1,3,5-Trimethylbenzene | 2 | 20 | 0.2 |
| tert-Butylbenzene | 2 | 20 | 0.2 |
| 1,2,4-Trimethylbenzene | 2 | 20 | 0.2 |
| sec-Butylbenzene | 2 | 20 | 0.2 |
| 1,3-Dichlorobenzene | 0.5 | 5 | .05 |
| 4-Isopropyltoluene | 2 | 20 | 0.2 |
| 1,4-Dichlorobenzene | 0.5 | 5 | .05 |
| n-Butylbenzene | 2 | 20 | 0.2 |
| 1,2-Dichlorobenzene | 0.5 | 5 | .05 |
| 1,2-Dibromo-3-chloropropane (DBCP) | 2 | 20 | 0.1 |
| 1,2,4-Trichlorobenzene | 2 | 20 | 0.2 |
| 1,2,3-Trichlorobenzene | 2 | 20 | 0.2 |
| Naphthalene | 2 | 20 | 0.1 |
| Hexachlorobutadiene | 2 | 20 | 0.2 |
| Acetonitrile (Methyl Cyanide) | 5 | 1000 | .25 |
| Acrolein | 20 | 500 | 1 |
| Acrylonitrile | 20 | 50 | 1 |
| 2-Chloro-1,3-butadiene (Chloroprene) | 10 | 500 | 0.5 |
| 3-Chloro-1-propene (Allyl Chloride) | 5 | 50 | .25 |
| trans- + cis-1,4-Dichloro-2-butene | 10 | 50 | 0.5 |
| 1,4-Dioxane | 2500 | 12000 | 5 |
| Ethyl Methacrylate | 2 | 50 | 0.1 |
| Iodomethane (Methyl Iodide) | 5 | 50 | .25 |
| Isobutyl Alcohol (2-Methyl-1-propanol) | 200 | 1000 | 1 |
| Methacrylonitrile | 5 | 50 | .25 |
| Methyl Methacrylate | 5 | 50 | .25 |
| Propionitrile (Ethyl Cyanide) | 5 | 250 | .25 |
| Vinyl Acetate | 5 | 50 | .25 |

# TABLE 2

## Standard Expiration Date Guidelines

| Standard | Expiration time |
|---|---|
| **Neat Chemicals** | Expiration date **3** years from date opened, or supplier's assigned date. |
| **Stock Standards (unopened ampules, commercially prepared or lab prepared)** | Supplier's assigned date, or 1 year if no expiration date provided. |
| **Opened ampules (working stocks)** | |
| • concentration ≥ 5000 ppm | ***6*** month expiration date. |
| • concentration 1000 - 5000 ppm | 2 month expiration date. |
| • concentration < 1000 ppm | **1** month expiration date. |
| **Working Standards** | |
| • concentration > 200 ppm (fuels) | 1 month expiration date. |
| • concentration ≤ 200 ppm | 7 day expiration date. |
| **Internal Standard Solutions** | One month expiration date. |

**Note:** The analyst performing specific analytical procedures should use judgement and take into consideration the solution reactivity, volatility, **and** concentration when using standards to prepare calibration curves. Certain standards, depending on use and storage, may have shorter usable life than described in these guidelines.

# TABLE 3

## 4-Bromofluorobenzene Characteristic Ion Abundance Criteria

| Mass | Ion Abundance Criteria MS04, MS05, MS12 | Ion Abundance Criteria MS02 | Ion Abundance Criteria MS13 |
|---|---|---|---|
| 50 | 15-40% of mass 95 | 15-40% of mass 95 | 5-40% of mass 95 |
| 75 | 30-60% of mass 95 | 30-80% of mass 95 | 20-70% of mass 95 |
| 95 | Base peak, 100% relative abundance | Base peak, 100% relative abundance | Base peak, 100% relative abundance |
| 96 | 5-9% of mass 95 | 5-9% of mass 95 | 5-9% of mass 95 |
| 173 | < 2% of mass 174 | < 2% of mass 174 | < 2% of mass 174 |
| 174 | > 50% of mass 95 | > 50% of mass 95 | 50 - 200% of mass 95 |
| 175 | 5-9% of mass 174 | 5-9% of mass 174 | 5-9% of mass 174 |
| 176 | 95 -101% of mass 174 | 95 -101% of mass 174 | 95 -101% of mass 174 |
| 177 | 5-9% of mass 176 | 5-9% of mass 176 . | 5-9% of mass 176 |
| Reference: | EPA 8260B | EPA 524.2 | Manufacturer Specifications |

# TABLE 4

## Characteristic Masses (m/z) for Purgeable Organic Compounds

| | | |
|---|---|---|
| Acetone | 58 | 43 |
| Acetonitrile | 41 | 40, 39 |
| Acrolein | 56 | 55, 58 |
| Acrylonitrile | 53 | 52, 51 |
| Allyl alcohol | 57 | 58, 39 |
| Allyl chloride | 76 | 41, 39, 78 |
| Benzene | 78 | - |
| Benzyl chloride | 91 | 126, 65, 128 |
| Bromoacetone | 136 | 43, 138, 93, 95 |
| Bromobenzene | 156 | 77,158 |
| Bromochloromethane | 128 | 49, 130 |
| Bromodichloromethane | 83 | 85,127 |
| Bromoform | 173 | 175,254 |
| Bromomethane | 94 | 96 |
| iso-Butanol | 74 | 43 |
| n-Butanol | 56 | 41 |
| 2-Butanone | 72 | 43 |
| n-Butylbenzene | 91 | 92, 134 |
| sec-Butylbenzene | 105 | 134 |
| tert-Butylbenzene | 119 | 91, 134 |
| Carbon disulfide | 76 | 78 |
| Carbon tetrachloride | 117 | 119 |
| Chloral hydrate | 82 | 44, 84, 86, 111 |
| Chloroacetonitrile | 48 | 75 |
| Chlorobenzene | 112 | 77,114 |
| 1-Chlorobutane | 56 | 49 |
| Chlorodibromomethane | 129 | 208,206 |
| Chloroethane | 64 | 66 |
| 2-Chloroethanol | 49 | 44, 43, 51, 80 |
| Bis(2-chloroethyl) sulfide | 109 | 111, 158, 160 |
| 2-Chloroethyl vinyl ether | 63 | 65, 106 |
| Chloroform | 83 | 85 |
| Chloromethane | 50 | 52 |
| Chloroprene | 53 | 88, 90, 51 |
| 3-Chloropropionitrile | 54 | 49, 89, 91 |
| 2-Chlorotoluene | 91 | 126 |
| 4-Chlorotoluene | 91 | 126 |
| 1,2-Dibromo-3-chloropropane | 75 | 155, 157 |
| Dibromochloromethane | 129 | 127 |
| 1,2-Dibromoethane | 107 | 109,188 |
| Dibromomethane | 93 | 95,174 |
| 1,2-Dichlorobenzene | 146 | 111,148 |
| 1,3-Dichlorobenzene | 146 | 111,148 |
| 1,4-Dichlorobenzene | 146 | 111,148 |
| cis-1,4-Dichloro-2-butene | 75 | 53, 77, 124, 89 |
| trans-1,4-Dichloro-2-butene | 53 | 88, 75 |

# TABLE 4

## Characteristic Masses (m/z) for Purgeable Organic Compounds (Continued)

| | | |
|---|---|---|
| Dichlorodifluoromethane | 85 | 87 |
| 1,1-Dichloroethane | 63 | 65, 83 |
| 1,2-Dichloroethane | 62 | 98 |
| 1,1-Dichloroethene | 96 | 61, 63 |
| cis-1,2-Dichloroethene | 96 | 61, 98 |
| trans-1,2-Dichloroethene | 96 | 61, 98 |
| 1,2-Dichloropropane | 63 | 112 |
| 1,3-Dichloropropane | 76 | 78 |
| 2,2-Dichloropropane | 77 | 97 |
| 1,3-Dichloro-2-propanol | 79 | 43, 81, 49 |
| 1,1-Dichloropropene | 75 | 110, 77 |
| cis-1,3-Dichloropropene | 75 | 77, 39 |
| trans-1,3-Dichloropropene | 75 | 77, 39 |
| 1,2,3,4-Diepoxybutane | 55 | 57, 56 |
| Diethyl ether | 74 | 45, 59 |
| 1,4-Dioxane | 88 | 58, 43, 57 |
| Epichlorohydrin | 57 | 49, 62, 51 |
| Ethanol | 31 | 45, 27, 46 |
| Ethyl acetate | 88 | 43, 45, 61 |
| Ethylbenzene | 91 | 106 |
| Ethylene oxide | 44 | 43, 42 |
| Ethyl methacrylate | 69 | 41, 99, 86, 114 |
| Hexachlorobutadiene | 225 | 223,227 |
| Hexachloroethane | 201 | 166,199,203 |
| 2-Hexanone | 43 | 58, 57, 100 |
| 2-Hydroxypropionitrile | 44 | 43, 42, 53 |
| Iodomethane | 142 | 127,141 |
| Isobutyl alcohol | 43 | 41, 42, 74 |
| Isopropylbenzene | 105 | 120 |
| p-Isopropyltoluene | 119 | 134, 91 |
| Malononitrile | 66 | 39, 65, 38 |
| Methacrylonitrile | 41 | 67, 39, 52, 66 |
| Methyl acrylate | 55 | 85 |
| Methyl-t-butyl ether | 73 | 57 |
| Methylene chloride | 84 | 86, 49 |
| Methyl ethyl ketone | 72 | 43 |
| Methyl iodide | 142 | 127, 141 |
| Methyl methacrylate | 69 | 41, 100, 39 |
| 4-Methyl-2-pentanone | 100 | 43, 58, 85 |
| Naphthalene | 128 | - |
| Nitrobenzene | 123 | 51, 77 |
| 2-Nitropropane | 46 | - |
| 2-Picoline | 93 | 66, 92, 78 |
| Pentachloroethane | 167 | 130, 132, 165,169 |
| Propargyl alcohol | 55 | 39, 38, 53 |
| b-Propiolactone | 42 | 43, 44 |

# TABLE 4

## Characteristic Masses (m/z) for Purgeable Organic Compounds (Continued)

| | | |
|---|---|---|
| Propionitrile (ethyl cyanide) | 54 | 52, 55, 40 |
| n-Propylamine | 59 | 41, 39 |
| n-Propylbenzene | 91 | 120 |
| Pyridine | 79 | 52 |
| Styrene | 104 | 78 |
| 1,2,3-Trichlorobenzene | 180 | 182, 145 |
| 1,2,4-Trichlorobenzene | 180 | 182, 145 |
| 1,1,1,2-Tetrachloroethane | 131 | 133, 119 |
| 1,1,2,2-Tetrachloroethane | 83 | 131, 85 |
| Tetrachloroethene | 164 | 129,131, 166 |
| Toluene | 92 | 91 |
| 1,1,1-Trichloroethane | 97 | 99, 61 |
| 1,1,2-Trichloroethane | 83 | 97, 85 |
| Trichloroethene | 95 | 97,130, 132 |
| Trichlorofluorornethane | 151 | 101,153 |
| 1,2,3-Trichloropropane | 75 | 77 |
| 1,2,4-Trimethylbenzene | 105 | 120 |
| 1,3,5-Trimethylbenzene | 105 | 120 |
| Vinyl acetate | 43 | 86 |
| Vinyl chloride | 62 | 64 |
| o-Xylene | 106 | 91 |
| m-Xylene | 106 | 91 |
| p-Xylene | 106 | 91 |
| Surrogates: | | |
| 1,2-Dichloroethane-d4 | 65 | 67, 51 |
| 4-Bromofluorobenzene | 95 | 174, 176 |
| Dibrornofluorornethane | 113 | 111, 192 |
| Toluene-d8 | 98 | 99, 70 |
| Internal Standards: | | |
| 1,4-Difluorobenzene | 114 | 63, 88 |
| Fluorobenzene | 96 | 77, 70, 50 |
| 1,4-Dichlorobenzene-d4 | 152 | 115, 150 |
| Chlorobenzene-d5 | 117 | 119, 82 |

# ATTACHMENTS

## Attachment A
## Instrument Operating Parameters

## Attachment B
## Detailed Standard Preparation Instructions

## Attachment C
## QC Acceptance Criteria

**ATTACHMENT A**

## TOPLEVEL PARAMETERS

Method Information For: D:\MS02\METHODS\MS28260J.M

:hod Sections To Run:

( ) Save Copy of Method With Data
( ) Pre-Run Cmd/Macro =
(X) Data Acquisition
(X) Data Analysis
(X) Post-Run Cmd/Macro = MACRO "loctonet.MAC",G

Method Comments:
**8260** METHOD FOR SOIL

## END OF TOPLEVEL PARAMETERS

## ACQUISITION PARAMETERS

### General Information

Inlet : GC
Tune File : JON.U
Acquisition Mode : Scan

### MS Information

Solvent Delay : **2.10** min

EM Absolute : False
EMV Offset : 0.0
Resulting Voltage : 1458.9

[Scan Parameters]

Low Mass : 35
High Mass : 300
Threshold : 500
Sampling # : 3 A/D Samples 8

[Real Time Plot Parameters]

ie Window : **10** min
Ionize Real Time Display : False

Plot 1 type : Total ion
Scale minimum : 0
Scale maximum : 1000000
Plot 2 type : No plot

## GC Temperature Information

[GC Zone Temperatures]

Inj. A : 150 C Off
Inj. B : 0 C Off
Det. A : 175 C
Det. B : 250 C

[Oven Parameters]

Oven Equib Time : 0.10 min
Oven Max : 260 C
Oven : On
Cryo : On

[Oven Program]

Initial Temp. : 20 C
Initial Time : 2.00 min

| Level | Rate (C/min) | Final Temp. (C) | Final Time (min) |
|---|---|---|---|
| 1 | 8.00 | 152 | 0.00 |
| 2 | 30.00 | 220 | 3.23 |
| 3 | 0.00 | | |

Next Run Time : 24.00 min

## Injector Information

Injection Source : Manual

[Purge Information]

| Purge A/B | Init. Value | On Time | Off Time |
|---|---|---|---|
| A | Off | 0.75 | 0.00 |
| B | On | 0.00 | 0.00 |

END OF ACQUISITION PARAMETERS

# DATA ANALYSIS PARAMETERS

M 'hod Name: D:\MS02\METHODS\MS28260J.M

## Percent Report Settings

Sort By: Retention Time

Output Destination
    Screen: No
    Printer: No
    File: No

Integration Events: Meth Default

Generate Report During Run Method: No

Signal Correlation Window: 0.020

## Qualitative Report Settings

Peak Location of Unknown: Apex

| cary to Search | Minimum Quality |
|---|---|
| NBS75K | 0 |

Integration Events: Meth Default

Report Type: Summary

Output Destination
    Screen: No
    Printer: No
    File: No

Generate Report During Run Method: No

## Quantitative Report Settings

Report Type: Summary

Output Destination
    Screen: Yes
    Printer: No
    File: No

rate Report During Run Method: No

## TOPLEVEL PARAMETERS

Method Information For: D:\MS04\METHODS\524W2.M

thod Sections To Run:

( ) Save Copy of Method **With Data**
( ) Pre-Run Cmd/Macro =
(X) Data Acquisition
( ) Data Analysis
(X) Post-Run Cmd/Macro = macro "loctonet.mac",g

Method Comments:
EPA METHOD 8260/APP on **0.25** DB-624 column

END OF TOPLEVEL PARAMETERS

## ACQUISITION PARAMETERS

### General Information

let : GC
Tune File : BFB.U
Acquisition Mode : Scan

### MS Information

Solvent **Delay** : 4.00 min

EM Absolute : False
EMV Offset : **105.9**
Resulting Voltage : **2105.9**

[Scan Parameters]

Low Mass : 35
High Mass : 260
Threshold : 500
Sampling # : 3 **A/D** Samples **8**

[Real Time Plot Parameters]

Time Window : 10 min
onize Real Time Display : False
lot 1 type : Total ion

Scale minimum : 0
Scale maximum : 4000000
Plot 2 type : No plot

## Inlet Information

[Inlet A Temperature Program Information]

Oven Track : Off
Inlet A Off

[Inlet B Temperature Program Information]

Oven Track : Off
Initial Temp. : 250 C
Initial Time : 480.00 min

| Level | Rate (C/min) | Final Temp. (C) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min

[Inlet A Pressure Program Information]

Constant Flow : Off
Initial Pres. : 10.0 psi
Initial Time : 480.00 min

| .vel | Rate(psi/min) | Final Pres.(psi) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min
Pressure Units : psi

[Inlet A Flow Settings]

Column length : 60.00 m
Column diameter : 0.250 mm
Gas : He
Vacuum compensation : Off
Pressure : 26.7 psi
Flow : 1.5 ml/min
Linear velocity : 26.8 cm/sec

[Inlet B Pressure Program Information]

Constant Flow : On 8.0 psi at 40 C
Pressure Units : psi

[Inlet B Flow Settings]

Column length : 60.00 m
lumn diameter : 0.320 mm
as : He

Vacuum compensation : On
Pressure : 8.3 psi
Flow : 1.5 ml/min
Linear velocity : 31.2 cm/sec
Split flow : 20 ml/min
Lit ratio : 13.3

[Auxiliary Channel C Information]

Comment:

Pressure Program:
Initial Pres. : 0.0 psi
Initial Time : 480.00 min

| Level | Rate(psi/min) | Final Pres.(psi) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min

[Auxiliary Channel D Information]

Comment:

Pressure Program:
Initial Pres. : 0.0 psi
Initial Time : 480.00 min

| Level | Rate(psi/min) | Final Pres.(psi) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min

[Auxiliary Channel E Information]

Comment:

Pressure Program:
Initial Pres. : 0.0 psi
Initial Time : 480.00 min

| Level | Rate(psi/min) | Final Pres.(psi) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min

[Auxiliary Channel F Information]

Comment:

Pressure Program:
Initial Pres. : 0.0 psi
Initial Time : 480.00 min

| Level | Rate(psi/min) | Final Pres.(psi) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min

## GC Temperature Information

[GC Zone Temperatures]

Inj, A : 170 C Off
Inj. B : 250 C
Det. A : 170 C Off
Det. B : 250 C
Aux. : 280 C Off

[Oven Parameters]

Oven Equib Time : 0.20 min
Oven Max : 275 C
Oven : On
Cryo : Off
Ambient : 35 C
Cryo Blast : Off

[Oven Program]

Initial Temp. : 45 C
Initial Time : 2.00 min

| vel | Rate (C/min) | Final Temp. (C) | Final Time (min) |
|---|---|---|---|
| 1 | 7.50 | 90 | 1.00 |
| 2 | 15.00 | 160 | 0.00 |
| 3 | 20.00 | 230 | 6.70 |

Next Run Time : 23.87 min

## Injector Information

Injection Source : Manual

[Purge Information]

| Purge A/B | Init. Value | On Time | Off Time |
|---|---|---|---|
| A | On | 0.00 | 0.00 |
| B | On | 0.00 | 0.00 |

END OF ACQUISITION PARAMETERS

## TOPLEVEL PARAMETERS

Method Information For: D:\MS05\METHODS\A_8260.M

'thodSections To Run:

( ) Save Copy of Method With Data
( ) Pre-Run Cmd/Macro =
(X) Data Acquisition
(X) Data Analysis
(X) Post-Run Cmd/Macro ='macro"loctonet.mac",g

Method Comments:
EPA METHOD 8260 FOR SOILS

END OF TOPLEVEL PARAMETERS

## ACQUISITION PARAMETERS

### General Information

| | |
|---|---|
| Inlet | : GC |
| Tune File | : SOIL BFB.U |
| Acquisition Mode | : Scan- |

### MS Information

| | |
|---|---|
| Solvent Delay | : 4.30 min |
| EM Absolute | : False |
| EMV Offset | : 0.0 |
| Resulting Voltage | : 2235.3 |

[Scan Parameters]

| | |
|---|---|
| Low Mass | : 35 |
| High Mass | : 260 |
| Threshold | : 500 |
| Sampling # | : 3 A/D Samples 8 |

[Real Time Plot Parameters]

| | |
|---|---|
| Time Window | : 10 min |
| Ionize Real Time Display | : False |
| Plot 1 type | : Total ion |

Scale minimum : 0
Scale maximum : 2000000
Plot 2 type : No plot

## Inlet Information

[Inlet A Temperature Program Information]

Oven Track : Off
Inlet A Off

[Inlet B Temperature Program Information]

Oven Track : Off
Initial Temp. : 250 C
Initial Time : 480.00 min

| Level | Rate (C/min) | Final Temp. (C) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min

[Inlet A Pressure Program Information]

Constant Flow : On 4.8 psi at 100 C
Pressure Units : psi

[Inlet A Flow Settings]

Column length : 60.00 m
Column diameter : 0.320 mm
Gas : He
Vacuum compensation : On
Pressure : 7.1 psi
Flow : 1.0 ml/min
Linear velocity : 26.2 cm/sec
Split flow : 25 ml/min
Split ratio : 25.0

[Inlet B Pressure Program Information]

Constant Flow : On 4.1 psi at 100 C
Pressure Units : psi

[Inlet B Flow Settings]

Column length : 60.00 m
Column diameter : 0.320 mm
Gas : He
Vacuum compensation : On
Pressure : 4.2 psi
3w : 0.8 ml/min
Linear velocity : 22.7 cm/sec

Split flow : 20 ml/min
Split ratio : 26.7

[Auxiliary Channel C Information]

Comment:

Pressure Program:
Initial Pres. : 0.0 psi
Initial Time : 480.00 min

| Level | Rate(psi/min) | Final Pres.(psi) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min

[Auxiliary Channel D Information]

Comment:

Pressure Program:
Initial Pres. : 0.0 psi
Initial Time : 480.00 min

| Level | Rate(psi/min) | Final Pres.(psi) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min

[Auxiliary Channel E Information]

Comment:

Pressure Program:
Initial Pres. : 0.0 psi
Initial Time : 480.00 min

| Level | Rate(psi/min) | Final Pres.(psi) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min

[Auxiliary Channel F Information]

Comment:

Pressure Program:
Initial Pres. : 0.0 psi
Initial Time : 480.00 min

| Level | Rate(psi/min) | Final Pres.(psi) | Final Time (min) |
|---|---|---|---|
| 1 | 0 | | |

Total Program Time: 480.00 min

## GC Temperature Information

C Zone Temperatures]

Inj. A : 170 C Off
Inj. B : 250 C
Det. A : 170 C Off
Det. B : 250 C
Aux. : 280 C

[Oven Parameters]

Oven Equib Time : 0.00 min
Oven Max : 225 C
Oven : On
Cryo : On
Ambient : 35 C
Cryo Blast : Off

[Oven Program]

Initial Temp. : 40 C
Initial Time : 1.50 min

| Level | Rate (C/min) | Final Temp. (C) | Final Time (min) |
|---|---|---|---|
| 1 | 10.00 | 200 | 0.00 |
| 2 | 30.00 | 220 | 5.83 |
| 3 | 0.00 | | |

xt Run Time : 24.00 min

## Injector Information

Injection Source : Manual

[Purge Information]

| Purge A/B | Init. Value | On Time | Off Time |
|---|---|---|---|
| A | On | 0.00 | 0.00 |
| B | On | 0.00 | 0.00 |

END OF ACQUISITION PARAMETERS

## DATA ANALYSIS PARAMETERS

---

Method Information For: C:\MS13\METHODS\8260W4.M

Method Sections To Run:

( ) Save Copy of Method With Data
( ) Pre-Run Cmd/Macro =
(X) Data Acquisition
(X) Data Analysis
(X) Post-Run Cmd/Macro = macro "loctonet.mac",g

Method Comments:

END OF TOPLEVEL PARAMETERS
---

INSTRUMENT CONTROL PARAMETERS
---

Sample Inlet: GC
Injection Source: External Device
Injection Location: Front
Mass Spectrometer: Enabled

==========

HP6890 GC METHOD

==========

OVEN
Initial temp: 40 'C (On)
Initial time: 2.00 min
Maximum temp: 260 'C
Equilibration time: 0.00 min
Ramps:

| # | Rate | Final temp | Final time |
|---|---|---|---|
| 1 | 4.00 | 65 | 1.00 |
| 2 | 15.00 | 200 | 1.00 |
| 3 | 0.0(Off) | | |

Post temp: 0 'C
Post time: 0.00 min
Run time: 19.25 min

FRONT INLET (UNKNOWN)
Mode: Split
Initial temp: 200 'C (On)
Pressure: 14.26 psi (On)
Split ratio: 100:1
Split flow: 68.8 mL/min
Total flow: 72.8 mL/min
Gas saver: On
Saver flow: 20.0 mL/min
Saver time: 2.00 min

BACK INLET ()

Gas type: Helium

COLUMN 1
Capillary Column
Model Number: J&W 1211324
db-624
Max temperature: 260 'C
Nominal length: 20.0 m
Nominal diameter: 180.00 um
Nominal film thickness: 1.00 um
Mode: constant flow
Initial flow: 0.7 mL/min
Nominal init pressure: 14.27 psi
Average velocity: 37 cm/sec
Inlet: Front Inlet
Outlet: (unspecified)
Outlet pressure: vacuum

COLUMN 2
(not installed)

FRONT DETECTOR (NO DET)

SIGNAL 1
Data rate: 20 Hz
Type: test plot
Save Data: Off
Zero: 0.0 (Off)
Range: 0
Fast Peaks: Off
Attenuation: 0

BACK DETECTOR (NO DET)

SIGNAL 2
Data rate: 20 Hz
Type: test plot
Save Data: Off
Zero: 0.0 (Off)
Range: 0
Fast Peaks: Off
Attenuation: 0

COLUMN COMP 1
(No Detectors Installed)

COLUMN COMP 2
(No Detectors Installed)

THERMAL AUX 2
Use: MSD Transfer Line Heater
Description:
Initial temp: 250 'C (On)
Initial time: 0.00 min

| # | Rate | Final temp | Final time |
|---|---|---|---|
| 1 | 0.0(Off) | | |

POST RUN
Post Time: 0.00 min

TIME TABLE

| Time | Specifier | Parameter & Setpoint |
|---|---|---|

7673 Injector

Front Injector:

| | | |
|---|---|---|
| Sample Washes | 0 | |
| Sample Pumps | 0 | |
| Injection Volume | 1.0 | microliters |
| Syringe Size | 10.0 | microliters |
| Nanoliter Adapter | Off | |
| PostInj Solvent A Washes | 0 | |
| PostInj Solvent B Washes | 0 | |
| Viscosity Delay | 0 | seconds |
| Plunger Speed | Fast | |

Back Injector:

| | | |
|---|---|---|
| Sample Washes | 0 | |
| Sample Pumps | 0 | |
| Injection Volume | 1.0 | microliters |
| Syringe Size | 10.0 | microliters |
| Nanoliter Adapter | Off | |
| PostInj Solvent A Washes | 0 | |
| PostInj Solvent B Washes | 0 | |
| Viscosity Delay | 0 | seconds |
| Plunger Speed | Fast | |

MS ACQUISITION PARAMETERS

General Information
--- ---

| | |
|---|---|
| Tune File | : BFB1.U |
| Acquistion Mode | : Scan |

MS Information
-- ---

| | |
|---|---|
| Solvent Delay | : 1.02 min |
| EM Absolute | : False |
| EM Offset | : 106 |
| Resulting EM Voltage | : 1258.8 |

[Scan Parameters]

| | | |
|---|---|---|
| w Mass | : 35.0 | |
| gh Mass | : 260.0 | |
| Threshold | : 200 | |
| Sample # | : 3 | A/D Samples 8 |

[MSZones]

| | | |
|---|---|---|
| MS Quad | : 150 C | maximum 200 C |
| MS Source | : 250 C | maximum 250 C |

END OF MS ACQUISITION PARAMETERS

END OF INSTRUMENT CONTROL PARAMETERS
---

DATA ANALYSIS PARAMETERS
---

Method Name: J:\MS13\METHODS\082804_8260W.M

Percent Report Settings
---

t By: Signal

Output Destination
Screen: No
Printer: Yes
File: No

Integration Events: Meth Default

Generate Report During Run Method: No

Signal Correlation Window: 0.020

Qualitative Report Settings
---

Peak Location of Unknown: Apex

| Library to Search | Minimum Quality |
|---|---|
| L:\Database\NIST98.L | 0 |

Integration Events: Meth Default

Report Type: Summary

ut Destination
Screen: No
Printer: Yes
File: No

Generate Report During Run Method: No

Quantitative Report Settings
---

Report Type: Summary

Output Destination
Screen: No
Printer: Yes
File: No

Generate Report During Run Method: No

VOA MS13 EPA Method 8260B
Calibration Last Updated: Sun Aug 29 17:56:26 2004

rence Window: 100.00 Minutes

# ATTACHMENT B

# INITIAL CALIBRATION CURVE

Date_____ Analysis: 8260/App.

Prepared By_____ Instrument:

Matrix: Water

Stock Solution #1_____ Analytes: Surrogate Init. Concentration: 100ppm

Stock Solution #2_____ Analytes: Low 8260/Ketones Init. Concentration: 5/10/20/100/200ppm

Stock Solution #3_____ Analytes: 8260 Init. Concentration: 50/100/200/1000/2000ppm

Stock Solution #4_____ Analytes: Ketones Init. Concentration: 2000ppm

| Aliquot of Stock Solution #1 (µL) | Final Conc. of #1 (µg/L) | Aliquot of Stock Solution #2 (µL) | Final Conc. of #2 (µg/L) | Aliquot of Stock Solution #3 (µL) | Final Conc. of #3 (µg/L) | Aliquot of Stock Solution #4 (µL) | Final Conc. of #4 (µg/L) | Final Volume (mL) | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1.5 | 3 | 2.0 | 0.2/.4/.8/4/8 | | | | | 50 | Level ID: 1 |
| 2.0 | 4 | 3.0 | 0.3/.6/1.2/6/12 | | | | | 50 | Level ID: 2 |
| 2.5 | 5 | 5.0 | .5/1/2/10/20 | | | | | 50 | Level ID: 3 |
| 3.0 | 6 | 12.5 | 1.25/2.5/5/25/50 | | | | | 50 | Level ID: 4 |
| 4.0 | 8 | 20 | 2/4/8/40/80 | | | | | 50 | Level ID: 5 |
| 4.5 | 9 | | | 5 | 5/10/20/100/200 | 2.5 | 100 | 50 | Level ID: 6 |
| 5.0 | 10 | | | 10 | 10/20/40/200/400 | 5.0 | 200 | 50 | Level ID: 7 |
| 10 | 20 | | | 20 | 20/40/80/400/800 | 10 | 400 | 50 | Level ID: 8 |
| 20 | 40 | | | 40 | 40/80/160/800/1600 | 20 | 800 | 50 | Level ID: 9 |
| 25 | 50 | | | 80 | 80/160/320/1600/3200 | 40 | 1600 | 50 | Level ID: 10 |

8260 ICV: 10uL of 50/250ppm Accustd ICV ( ) + 50uL of 100ppm Acrolein ( ) +
5uL of 100ppm Dichlorofluoromethane ( ) + 5uL of 200ppm n-Octane/Tetrahydrofuran ( ) +
7.5uL of 200/2000ppm Appendix ICV ( ) + 5uL of 200/1000ppm Oxygenates ( ) to 50mL.

# INITIAL CALIBRATION CURVE

Date_____ Analysis: 8260

Prepared By_____ Instrument:

Matrix: Soil

Stock Solution #1_____ Analytes: Surrogate Init. Concentration: 100ppm

Stock Solution #2_____ Analytes: Low 8260/Ketones Init. Concentration: 10/20/40/50/100ppm

Stock Solution #3_____ Analytes: 8260/Ketones Init. Concentration: 100/200/400/500/1000ppm

| Aliquot of Stock Solution #1 (µL) | Final Conc. of #1 (µg/L) | Aliquot of Stock Solution #2 (µL) | Final Conc. of #2 (µg/L) | Aliquot of Stock Solution #3 (µL) | Final Conc. of #3 (µg/L) | | | Final Volume (mL) | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 2.5 | 5.0 | 5.0 | 1.0/2.0/4.0/5.0/10 | | | | | 50 | Level ID: 1 |
| 5.0 | 10 | 10 | 2.0/4.0/8.010/20 | | | | | 50 | Level ID: 2 |
| 10 | 20 | 25 | 5.0/10/20/25/50 | | | | | 50 | Level ID: 3 |
| 15 | 30 | 50 | 10/20/40/50/100 | | | | | 50 | Level ID: 4 |
| 20 | 40 | | | 10 | 20/40/80/100/200 | | | 50 | Level ID: 5 |
| 25 | 50 | | | 25 | 50/100/200/250/500 | | | 50 | Level ID: 6 |
| 30 | 60 | | | 50 | 100/200/400/500/1000 | | | 50 | Level ID: 7 |
| 40 | 80 | | | 150 | 300/600/1200/1500/3000 | | | 50 | Level ID: 8 |

8260 ICV: 50uL of 50/250ppm Accustd ICV ( ) + 50uL of 100ppm Acrolein ( ) +
12.5uL of 200/1000ppm Oxygenates ( ) to 50mL.

# ATTACHMENT C

## Method 8260 QC Control Limits

| | | | | |
|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | Advisory | LCS | Soil | 76-122 |
| 1,1,1-Trichloroethane (TCA) | Advisory | LCS | Soil | 68-126 |
| 1,1,2,2-Tetrachloroethane | Advisory | LCS | Soil | 69-120 |
| 1,1,2-Trichloroethane | Advisory | LCS | Soil | 77-118 |
| 1,1-Dichloroethane | Advisory | LCS | Soil | 66-120 |
| 1,1-Dichloroethene | **Control** | LCS | Soil | 71-127 |
| 1,1-Dichloropropene | Advisory | LCS | Soil | 70-127 |
| 1,2,3-Trichlorobenzene | Advisory | LCS | Soil | 67-137 |
| 1,2,3-Trichloropropane | Advisory | LCS | Soil | 73-120 |
| 1,2,4-Trichlorobenzene | Advisory | LCS | Soil | 63-139 |
| 1,2,4-Trimethylbenzene | Advisory | LCS | Soil | 76-137 |
| 1,2-Dibromo-3-chloropropane | Advisory | LCS | Soil | 66-120 |
| 1,2-Dibromoethane (EDB) | Advisory | LCS | Soil | 76-120 |
| 1,2-Dichlorobenzene | **Control** | LCS | Soil | 73-123 |
| 1,2-Dichloroethane (EDC) | Advisory | LCS | Soil | 63-129 |
| 1,2-Dichloropropane | Advisory | LCS | Soil | 69-123 |
| 1,3,5-Trimethylbenzene | Advisory | LCS | Soil | 74-132 |
| 1,3-Dichlorobenzene | Advisory | LCS | Soil | 69-129 |
| 1,3-Dichloropropane | Advisory | LCS | Soil | 77-119 |
| 1,4-Dichlorobenzene | Advisory | LCS | Soil | 71-127 |
| 1-Chlorohexane | Advisory | LCS | Soil | 66-127 |
| 2,2-Dichloropropane | Advisory | LCS | Soil | 68-132 |
| 2-Butanone (MEK) | Advisory | LCS | Soil | 37-137 |
| 2-Chloroethyl Vinyl Ether | Advisory | LCS | Soil | 34-149 |
| 2-Chlorotoluene | Advisory | LCS | Soil | 73-129 |
| 2-Hexanone | Advisory | LCS | Soil | 60-124 |
| 4-Chlorotoluene | Advisory | LCS | Soil | 70-128 |
| 4-Isopropyltoluene | Advisory | LCS | Soil | 70-130 |
| 4-Methyl-2-pentanone (MIBK) | Advisory | LCS | Soil | 55-136 |
| Acetone | Advisory | LCS | Soil | 43-119 |
| Acrolein | Advisory | LCS | Soil | 18-148 |
| Acrylonitrile | Advisory | LCS | Soil | 10-197 |
| Benzene | **Control** | LCS | Soil | 78-124 |
| Bromobenzene | Advisory | LCS | Soil | 75-127 |
| Bromochloromethane | Advisory | LCS | Soil | 75-126 |
| Bromodichloromethane | Advisory | LCS | Soil | 67-129 |
| Bromoform | Advisory | LCS | Soil | 72-121 |
| Bromomethane | Advisory | LCS | Soil | 37-145 |
| Carbon Disulfide | Advisory | LCS | Soil | 63-139 |
| Carbon Tetrachloride | Advisory | LCS | Soil | 69-128 |
| Chlorobenzene | **Control** | LCS | Soil | 76-119 |
| Chloroethane | Advisory | LCS | Soil | 44-143 |
| Chloroform | Advisory | LCS | Soil | 70-123 |

| | | | | |
|---|---|---|---|---|
| Chloromethane | Advisory | LCS | Soil | 51-147 |
| cis-1,2-Dichloroethene | Advisory | LCS | Soil | 72-122 |
| cis-1,3-Dichloropropene | Advisory | LCS | Soil | 73-127 |
| Dibromochloromethane | Advisory | LCS | Soil | 74-119 |
| Dibromomethane | Advisory | LCS | Soil | 74-124 |
| Dichlorodifluoromethane | Advisory | LCS | Soil | 43-163 |
| Diisopropyl Ether | Advisory | LCS | Soil | 58-130 |
| Ethylbenzene | Advisory | LCS | Soil | 75-126 |
| Hexachlorobutadiene | Advisory | LCS | Soil | 58-132 |
| Isopropylbenzene | Advisory | LCS | Soil | 62-125 |
| m,p-Xylenes | Advisory | LCS | Soil | 76-131 |
| Methyl tert-Butyl Ether | Advisory | LCS | Soil | 59-124 |
| Methylene Chloride | Advisory | LCS | Soil | 70-127 |
| n-Butylbenzene | Advisory | LCS | Soil | 66-140 |
| n-Propylbenzene | Advisory | LCS | Soil | 70-131 |
| Naphthalene | **Control** | LCS | Soil | 69-134 |
| o-Xylene | Advisory | LCS | Soil | 76-128 |
| sec-Butylbenzene | Advisory | LCS | Soil | 69-135 |
| Styrene | Advisory | LCS | Soil | 75-127 |
| tert-Amyl Methyl Ether | Advisory | LCS | Soil | 58-128 |
| tert-Butyl Alcohol | Advisory | LCS | Soil | 33-152 |
| tert-Butyl Ethyl Ether | Advisory | LCS | Soil | 51-130 |
| tert-Butylbenzene | Advisory | LCS | Soil | 68-131 |
| Tetrachloroethene (PCE) | Advisory | LCS | Soil | 70-124 |
| Toluene | **Control** | LCS | Soil | 75-128 |
| trans-1,2-Dichloroethene | Advisory | LCS | Soil | 68-122 |
| trans-1,3-Dichloropropene | Advisory | LCS | Soil | 68-114 |
| Trichloroethene (TCE) | **Control** | LCS | Soil | 69-128 |
| Trichlorofluoromethane | Advisory | LCS | Soil | 55-134 |
| Trichlorotrifluoroethane | Advisory | LCS | Soil | 58-129 |
| Vinyl Acetate | Advisory | LCS | Soil | 10-144 |
| Vinyl Chloride | Advisory | LCS | Soil | 55-155 |
| 1,1,1,2-Tetrachloroethane | Advisory | MS | Soil | 17-138 |
| 1,1,1-Trichloroethane (TCA) | Advisory | MS | Soil | 41-127 |
| 1,1,2,2-Tetrachloroethane | Advisory | MS | Soil | 15-132 |
| 1,1,2-Trichloroethane | Advisory | MS | Soil | 31-135 |
| 1,1-Dichloroethane | Advisory | MS | Soil | 45-122 |
| 1,1-Dichloroethene | **Control** | MS | Soil | 46-128 |
| 1,1-Dichloropropene | Advisory | MS | Soil | 36-125 |
| 1,2,3-Trichlorobenzene | Advisory | MS | Soil | 10-129 |
| 1,2,3-Trichloropropane | Advisory | MS | Soil | 20-144 |
| 1,2,4-Trichlorobenzene | Advisory | MS | Soil | 10-128 |
| 1,2,4-Trimethylbenzene | Advisory | MS | Soil | 10-147 |
| 1,2-Dibromo-3-chloropropane | Advisory | MS | Soil | 14-126 |

| | | | | |
|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | Advisory | MS | Soil | 22-132 |
| 1,2-Dichlorobenzene | **Control** | MS | Soil | 10-127 |
| 1,2-Dichloroethane (EDC) | Advisory | MS | Soil | 34-134 |
| 1,2-Dichloropropane | Advisory | MS | Soil | 36-129 |
| 1,3,5-Trimethylbenzene | Advisory | MS | Soil | 10-143 |
| 1,3-Dichlorobenzene | Advisory | MS | Soil | 10-128 |
| 1,3-Dichloropropane | Advisory | MS | Soil | 31-134 |
| 1,4-Dichlorobenzene | Advisory | MS | Soil | 10-129 |
| 2,2-Dichloropropane | Advisory | MS | Soil | 35-130 |
| 2-Butanone (MEK) | Advisory | MS | Soil | 10-143 |
| 2-Chloroethyl Vinyl Ether | Advisory | MS | Soil | 70-130 |
| 2-Chlorotoluene | Advisory | MS | Soil | 10-149 |
| 2-Hexanone | Advisory | MS | Soil | 22-126 |
| 4-Chlorotoluene | Advisory | MS | Soil | 10-137 |
| 4-Isopropyltoluene | Advisory | MS | Soil | 10-131 |
| 4-Methyl-2-pentanone (MIBK) | Advisory | MS | Soil | 29-137 |
| Acetone | Advisory | MS | Soil | 20-127 |
| Acrolein | Advisory | MS | Soil | 70-130 |
| Acrylonitrile | Advisory | MS | Soil | 70-130 |
| Benzene | **Control** | MS | Soil | 45-129 |
| Bromobenzene | Advisory | MS | Soil | 10-143 |
| Bromochloromethane | Advisory | MS | Soil | 41-134 |
| Bromodichloromethane | Advisory | MS | Soil | 19-138 |
| Bromoform | Advisory | MS | Soil | 10-136 |
| Bromomethane | Advisory | MS | Soil | 15-140 |
| Carbon Disulfide | Advisory | MS | Soil | 19-139 |
| Carbon Tetrachloride | Advisory | MS | Soil | 25-131 |
| Chlorobenzene | **Control** | MS | Soil | 17-130 |
| Chloroethane | Advisory | MS | Soil | 28-149 |
| Chloroform | Advisory | MS | Soil | 37-132 |
| Chloromethane | Advisory | MS | Soil | 36-148 |
| cis-1,2-Dichloroethene | Advisory | MS | Soil | 36-130 |
| cis-1,3-Dichloropropene | Advisory | MS | Soil | 11-135 |
| Dibromochloromethane | Advisory | MS | Soil | 10-137 |
| Dibromomethane | Advisory | MS | Soil | 34-137 |
| Dichlorodifluoromethane | Advisory | MS | Soil | 34-154 |
| Ethylbenzene | Advisory | MS | Soil | 15-138 |
| Hexachlorobutadiene | Advisory | MS | Soil | 10-117 |
| Isopropylbenzene | Advisory | MS | Soil | 10-129 |
| m,p-Xylenes | Advisory | MS | Soil | 15-138 |
| Methyl tert-Butyl Ether | Advisory | MS | Soil | 37-132 |
| Methylene Chloride | Advisory | MS | Soil | 41-131 |
| n-Butylbenzene | Advisory | MS | Soil | 10-138 |
| n-Propylbenzene | Advisory | MS | Soil | 10-145 |

| | | | | |
|---|---|---|---|---|
| Naphthalene | **Control** | MS | Soil | 10-131 |
| o-Xylene | Advisory | MS | Soil | 12-143 |
| sec-Butylbenzene | Advisory | MS | Soil | 10-138 |
| Styrene | Advisory | MS | Soil | 10-138 |
| tert-Butylbenzene | Advisory | MS | Soil | 10-138 |
| Tetrachloroethene (PCE) | Advisory | MS | Soil | 10-139 |
| Toluene | **Control** | MS | Soil | 31-136 |
| trans-1,2-Dichloroethene | Advisory | MS | Soil | 33-128 |
| trans-1,3-Dichloropropene | Advisory | MS | Soil | 10-131 |
| Trichloroethene (TCE) | **Control** | MS | Soil | 18-153 |
| Trichlorofluoromethane | Advisory | MS | Soil | 37-135 |
| Trichlorotrifluoroethane | Advisory | MS | Soil | 46-110 |
| Vinyl Chloride | Advisory | MS | Soil | 34-165 |
| 1,1,1,2-Tetrachloroethane | Advisory | LCS | Soil-mid | 80-116 |
| 1,1,1-Trichloroethane (TCA) | Advisory | LCS | Soil-mid | 70-137 |
| 1,1,2,2-Tetrachloroethane | Advisory | LCS | Soil-mid | 46-131 |
| 1,1,2-Trichloroethane | Advisory | LCS | Soil-mid | 79-112 |
| 1,1-Dichloroethane | Advisory | LCS | Soil-mid | 69-129 |
| 1,1-Dichloroethene | **Control** | LCS | Soil-mid | 68-130 |
| 1,1-Dichloropropene | Advisory | LCS | Soil-mid | 82-123 |
| 1,2,3-Trichlorobenzene | Advisory | LCS | Soil-mid | 63-129 |
| 1,2,3-Trichloropropane | Advisory | LCS | Soil-mid | 70-127 |
| 1,2,4-Trichlorobenzene | Advisory | LCS | Soil-mid | 64-131 |
| 1,2,4-Trimethylbenzene | Advisory | LCS | Soil-mid | 92-127 |
| 1,2-Dibromo-3-chloropropane | Advisory | LCS | Soil-mid | 65-110 |
| 1,2-Dibromoethane (EDB) | Advisory | LCS | Soil-mid | 78-110 |
| 1,2-Dichlorobenzene | **Control** | LCS | Soil-mid | 78-113 |
| 1,2-Dichloroethane (EDC) | Advisory | LCS | Soil-mid | 68-133 |
| 1,2-Dichloropropane | Advisory | LCS | Soil-mid | 82-113 |
| 1,3,5-Trimethylbenzene | Advisory | LCS | Soil-mid | 89-123 |
| 1,3-Dichlorobenzene | Advisory | LCS | Soil-mid | 83-113 |
| 1,3-Dichloropropane | Advisory | LCS | Soil-mid | 78-113 |
| 1,4-Dichlorobenzene | Advisory | LCS | Soil-mid | 82-110 |
| 1-Chlorohexane | Advisory | LCS | Soil-mid | 73-125 |
| 2,2-Dichloropropane | Advisory | LCS | Soil-mid | 59-134 |
| 2-Butanone (MEK) | Advisory | LCS | Soil-mid | 70-125 |
| 2-Chloroethyl Vinyl Ether | Advisory | LCS | Soil-mid | 10-246 |
| 2-Chlorotoluene | Advisory | LCS | Soil-mid | 82-128 |
| 2-Hexanone | Advisory | LCS | Soil-mid | 55-132 |
| 4-Chlorotoluene | Advisory | LCS | Soil-mid | 78-126 |
| 4-Isopropyltoluene | Advisory | LCS | Soil-mid | 86-119 |
| 4-Methyl-2-pentanone (MIBK) | Advisory | LCS | Soil-mid | 61-129 |
| Acetone | Advisory | LCS | Soil-mid | 60-138 |
| Acrolein | Advisory | LCS | Soil-mid | 70-130 |

| | | | | |
|---|---|---|---|---|
| Acrylonitrile | Advisory | LCS | Soil-mid | 10-93 |
| Benzene | **Control** | LCS | Soil-mid | 90-115 |
| Bromobenzene | Advisory | LCS | Soil-mid | 80-119 |
| Bromochloromethane | Advisory | LCS | Soil-mid | 72-128 |
| Bromodichloromethane | Advisory | LCS | Soil-mid | 75-122 |
| Bromoform | Advisory | LCS | Soil-mid | 68-121 |
| Bromomethane | Advisory | LCS | Soil-mid | 10-97 |
| Carbon Disulfide | Advisory | LCS | Soil-mid | 60-139 |
| Carbon Tetrachloride | Advisory | LCS | Soil-mid | 64-147 |
| Chlorobenzene | **Control** | LCS | Soil-mid | 86-107 |
| Chloroethane | Advisory | LCS | Soil-mid | 10-174 |
| Chloroform | Advisory | LCS | Soil-mid | 72-127 |
| Chloromethane | Advisory | LCS | Soil-mid | 44-122 |
| cis-1,2-Dichloroethene | Advisory | LCS | Soil-mid | 76-119 |
| cis-1,3-Dichloropropene | Advisory | LCS | Soil-mid | 77-120 |
| Dibromochloromethane | Advisory | LCS | Soil-mid | 70-117 |
| Dibromomethane | Advisory | LCS | Soil-mid | 79-119 |
| Dichlorodifluoromethane | Advisory | LCS | Soil-mid | 23-133 |
| Diisopropyl Ether | Advisory | LCS | Soil-mid | 70-130 |
| Ethylbenzene | Advisory | LCS | Soil-mid | 88-119 |
| Hexachlorobutadiene | Advisory | LCS | Soil-mid | 71-133 |
| Isopropylbenzene | Advisory | LCS | Soil-mid | 85-110 |
| m,p-Xylenes | Advisory | LCS | Soil-mid | 88-120 |
| Methyl tert-Butyl Ether | Advisory | LCS | Soil-mid | 56-131 |
| Methylene Chloride | Advisory | LCS | Soil-mid | 71-123 |
| n-Butylbenzene | Advisory | LCS | Soil-mid | 85-124 |
| n-Propylbenzene | Advisory | LCS | Soil-mid | 85-128 |
| Naphthalene | **Control** | LCS | Soil-mid | 55-144 |
| o-Xylene | Advisory | LCS | Soil-mid | 88-119 |
| sec-Butylbenzene | Advisory | LCS | Soil-mid | 90-126 |
| Styrene | Advisory | LCS | Soil-mid | 90-120 |
| tert-Amyl Methyl Ether | Advisory | LCS | Soil-mid | 70-130 |
| tert-Butyl Alcohol | Advisory | LCS | Soil-mid | 70-130 |
| tert-Butyl Ethyl Ether | Advisory | LCS | Soil-mid | 70-130 |
| tert-Butylbenzene | Advisory | LCS | Soil-mid | 87-123 |
| Tetrachloroethene (PCE) | Advisory | LCS | Soil-mid | 73-122 |
| Toluene | **Control** | LCS | Soil-mid | 85-119 |
| trans-1,2-Dichloroethene | Advisory | LCS | Soil-mid | 73-121 |
| trans-1,3-Dichloropropene | Advisory | LCS | Soil-mid | 64-117 |
| Trichloroethene (TCE) | **Control** | LCS | Soil-mid | 75-137 |
| Trichlorofluoromethane | Advisory | LCS | Soil-mid | 39-146 |
| Trichlorotrifluoroethane | Advisory | LCS | Soil-mid | 65-126 |
| Vinyl Acetate | Advisory | LCS | Soil-mid | 10-274 |
| Vinyl Chloride | Advisory | LCS | Soil-mid | 61-142 |

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| 1,1,1,2-Tetrachloroethane | Advisory | MS | Soil-mid | 75-119 |
| 1,1,1-Trichloroethane (TCA) | Advisory | MS | Soil-mid | 58-137 |
| 1,1,2,2-Tetrachloroethane | Advisory | MS | Soil-mid | 41-135 |
| 1,1,2-Trichloroethane | Advisory | MS | Soil-mid | 74-119 |
| 1,1-Dichloroethane | Advisory | MS | Soil-mid | 62-130 |
| 1,1-Dichloroethene | **Control** | MS | Soil-mid | 60-132 |
| 1,1-Dichloropropene | Advisory | MS | Soil-mid | 69-125 |
| 1,2,3-Trichlorobenzene | Advisory | MS | Soil-mid | 68-127 |
| 1,2,3-Trichloropropane | Advisory | MS | Soil-mid | 56-147 |
| 1,2,4-Trichlorobenzene | Advisory | MS | Soil-mid | 67-129 |
| 1,2,4-Trimethylbenzene | Advisory | MS | Soil-mid | 74-136 |
| 1,2-Dibromo-3-chloropropane | Advisory | MS | Soil-mid | 64-118 |
| 1,2-Dibromoethane (EDB) | Advisory | MS | Soil-mid | 76-116 |
| 1,2-Dichlorobenzene | **Control** | MS | Soil-mid | 73-116 |
| 1,2-Dichloroethane (EDC) | Advisory | MS | Soil-mid | 65-134 |
| 1,2-Dichloropropane | Advisory | MS | Soil-mid | 77-115 |
| 1,3,5-Trimethylbenzene | Advisory | MS | Soil-mid | 46-158 |
| 1,3-Dichlorobenzene | Advisory | MS | Soil-mid | 73-118 |
| 1,3-Dichloropropane | Advisory | MS | Soil-mid | 74-118 |
| 1,4-Dichlorobenzene | Advisory | MS | Soil-mid | 73-116 |
| 1-Chlorohexane | Advisory | MS | Soil-mid | 70-130 |
| 2,2-Dichloropropane | Advisory | MS | Soil-mid | 48-129 |
| 2-Butanone (MEK) | Advisory | MS | Soil-mid | 69-131 |
| 2-Chloroethyl Vinyl Ether | Advisory | MS | Soil-mid | 70-130 |
| 2-Chlorotoluene | Advisory | MS | Soil-mid | 58-150 |
| 2-Hexanone | Advisory | MS | Soil-mid | 51-140 |
| 4-Chlorotoluene | Advisory | MS | Soil-mid | 71-128 |
| 4-Isopropyltoluene | Advisory | MS | Soil-mid | 61-132 |
| 4-Methyl-2-pentanone (MIBK) | Advisory | MS | Soil-mid | 62-126 |
| Acetone | Advisory | MS | Soil-mid | 49-143 |
| Acrolein | Advisory | MS | Soil-mid | 70-130 |
| Acrylonitrile | Advisory | MS | Soil-mid | 70-130 |
| Benzene | **Control** | MS | Soil-mid | 74-122 |
| Bromobenzene | Advisory | MS | Soil-mid | 74-122 |
| Bromochloromethane | Advisory | MS | Soil-mid | 70-130 |
| Bromodichloromethane | Advisory | MS | Soil-mid | 72-122 |
| Bromoform | Advisory | MS | Soil-mid | 68-122 |
| Bromomethane | Advisory | MS | Soil-mid | 10-118 |
| Carbon Disulfide | Advisory | MS | Soil-mid | 55-137 |
| Carbon Tetrachloride | Advisory | MS | Soil-mid | 54-143 |
| Chlorobenzene | **Control** | MS | Soil-mid | 76-113 |
| Chloroethane | Advisory | MS | Soil-mid | 10-164 |
| Chloroform | Advisory | MS | Soil-mid | 67-127 |
| Chloromethane | Advisory | MS | Soil-mid | 50-134 |

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| cis-1,2-Dichloroethene | Advisory | MS | Soil-mid | 64-129 |
| cis-1,3-Dichloropropene | Advisory | MS | Soil-mid | 75-123 |
| Dibromochloromethane | Advisory | MS | Soil-mid | 70-119 |
| Dibromomethane | Advisory | MS | Soil-mid | 75-123 |
| Dichlorodifluoromethane | Advisory | MS | Soil-mid | 36-172 |
| Diisopropyl Ether | Advisory | MS | Soil-mid | 70-130 |
| Ethylbenzene | Advisory | MS | Soil-mid | 76-123 |
| Hexachlorobutadiene | Advisory | MS | Soil-mid | 67-130 |
| Isopropylbenzene | Advisory | MS | Soil-mid | 71-114 |
| m,p-Xylenes | Advisory | MS | Soil-mid | 73-127 |
| Methyl tert-Butyl Ether | Advisory | MS | Soil-mid | 58-130 |
| Methylene Chloride | Advisory | MS | Soil-mid | 65-124 |
| n-Butylbenzene | Advisory | MS | Soil-mid | 64-139 |
| n-Propylbenzene | Advisory | MS | Soil-mid | 70-133 |
| Naphthalene | **Control** | MS | Soil-mid | 58-151 |
| o-Xylene | Advisory | MS | Soil-mid | 62-141 |
| sec-Butylbenzene | Advisory | MS | Soil-mid | 74-131 |
| Styrene | Advisory | MS | Soil-mid | 82-125 |
| tert-Amyl Methyl Ether | Advisory | MS | Soil-mid | 70-130 |
| tert-Butyl Alcohol | Advisory | MS | Soil-mid | 70-130 |
| tert-Butyl Ethyl Ether | Advisory | MS | Soil-mid | 70-130 |
| tert-Butylbenzene | Advisory | MS | Soil-mid | 72-127 |
| Tetrachloroethene (PCE) | Advisory | MS | Soil-mid | 32-158 |
| Toluene | **Control** | MS | Soil-mid | 75-118 |
| trans-1,2-Dichloroethene | Advisory | MS | Soil-mid | 66-122 |
| trans-1,3-Dichloropropene | Advisory | MS | Soil-mid | 61-122 |
| Trichloroethene (TCE) | **Control** | MS | Soil-mid | 60-142 |
| Trichlorofluoromethane | Advisory | MS | Soil-mid | 37-147 |
| Trichlorotrifluoroethane | Advisory | MS | Soil-mid | 70-130 |
| Vinyl Acetate | Advisory | MS | Soil-mid | 70-130 |
| Vinyl Chloride | Advisory | MS | Soil-mid | 55-157 |
| 1,2-Dichloroethane-D4 | **Control** | SURR | Soil | 80-118 |
| 4-Bromofluorobenzene | **Control** | SURR | Soil | 74-116 |
| Dibromofluoromethane | **Control** | SURR | Soil | 81-120 |
| Toluene-D8 | **Control** | SURR | Soil | 77-131 |
| 1,2-Dichloroethane-D4 | **Control** | SURR | Soil-mid | 33-155 |
| 4-Bromofluorobenzene | **Control** | SURR | Soil-mid | 35-144 |
| Dibromofluoromethane | **Control** | SURR | Soil-mid | 36-148 |
| Toluene-D8 | **Control** | SURR | Soil-mid | 35-153 |
| 1,1,1,2-Tetrachloroethane | Advisory | LCS | Water | 85-122 |
| 1,1,1-Trichloroethane (TCA) | Advisory | LCS | Water | 80-127 |
| 1,1,2,2-Tetrachloroethane | Advisory | LCS | Water | 66-127 |
| 1,1,2-Trichloroethane | Advisory | LCS | Water | 80-120 |
| 1,1-Dichloroethane | Advisory | LCS | Water | 76-120 |

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| 1,1-Dichloroethene | **Control** | LCS | Water | 76-128 |
| 1,1-Dichloropropene | Advisory | LCS | Water | 79-128 |
| 1,2,3-Trichlorobenzene | Advisory | LCS | Water | 72-137 |
| 1,2,3-Trichloropropane | Advisory | LCS | Water | 76-125 |
| 1,2,4-Trichlorobenzene | Advisory | LCS | Water | 74-136 |
| 1,2,4-Trimethylbenzene | Advisory | LCS | Water | 86-138 |
| 1,2-Dibromo-3-chloropropane | Advisory | LCS | Water | 66-123 |
| 1,2-Dibromoethane (EDB) | Advisory | LCS | Water | 78-121 |
| 1,2-Dichlorobenzene | **Control** | LCS | Water | 82-117 |
| 1,2-Dichloroethane (EDC) | Advisory | LCS | Water | 76-125 |
| 1,2-Dichloropropane | Advisory | LCS | Water | 80-117 |
| 1,3,5-Trichlorobenzene | Advisory | LCS | Water | 43-121 |
| 1,3,5-Trimethylbenzene | Advisory | LCS | Water | 85-131 |
| 1,3-Dichlorobenzene | Advisory | LCS | Water | 85-119 |
| 1,3-Dichloropropane | Advisory | LCS | Water | 82-119 |
| 1,4-Dichlorobenzene | Advisory | LCS | Water | 83-116 |
| 1,4-Dioxane | Advisory | LCS | Water | 12-161 |
| 1-Chlorohexane | Advisory | LCS | Water | 72-124 |
| 2,2-Dichloropropane | Advisory | LCS | Water | 60-142 |
| 2-Butanone (MEK) | Advisory | LCS | Water | 75-129 |
| 2-Chloroethyl Vinyl Ether | Advisory | LCS | Water | 10-165 |
| 2-Chlorotoluene | Advisory | LCS | Water | 81-131 |
| 2-Hexanone | Advisory | LCS | Water | 65-135 |
| 2-Nitropropane | Advisory | LCS | Water | 18-106 |
| 3-Chloro-1-propene | Advisory | LCS | Water | 11-147 |
| 4-Chlorotoluene | Advisory | LCS | Water | 80-129 |
| 4-Isopropyltoluene | Advisory | LCS | Water | 78-131 |
| 4-Methyl-2-pentanone (MIBK) | Advisory | LCS | Water | 69-134 |
| Acetone | Advisory | LCS | Water | 68-140 |
| Acetonitrile | Advisory | LCS | Water | 66-126 |
| Acrolein | Advisory | LCS | Water | 20-180 |
| Acrylonitrile | Advisory | LCS | Water | 50-131 |
| Benzene | **Control** | LCS | Water | 87-122 |
| Bromobenzene | Advisory | LCS | Water | 84-121 |
| Bromochloromethane | Advisory | LCS | Water | 79-125 |
| Bromodichloromethane | Advisory | LCS | Water | 81-120 |
| Bromoform | Advisory | LCS | Water | 80-126 |
| Bromomethane | Advisory | LCS | Water | 48-140 |
| Carbon Disulfide | Advisory | LCS | Water | 69-147 |
| Carbon Tetrachloride | Advisory | LCS | Water | 76-137 |
| Chlorobenzene | **Control** | LCS | Water | 85-114 |
| Chloroethane | Advisory | LCS | Water | 66-126 |
| Chloroform | Advisory | LCS | Water | 80-120 |
| Chloromethane | Advisory | LCS | Water | 58-129 |

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| Chloroprene | Advisory | LCS | Water | 15-138 |
| cis-1,2-Dichloroethene | Advisory | LCS | Water | 81-119 |
| cis-1,3-Dichloropropene | Advisory | LCS | Water | 82-126 |
| cis-1,4-Dichloro-2-butene | Advisory | LCS | Water | 10-137 |
| Dibromochloromethane | Advisory | LCS | Water | 78-121 |
| Dibromomethane | Advisory | LCS | Water | 81-121 |
| Dichlorodifluoromethane | Advisory | LCS | Water | 52-179 |
| Dichlorofluoromethane (CFC 21) | Advisory | LCS | Water | 60-129 |
| Diisopropyl Ether | Advisory | LCS | Water | 64-128 |
| Ethyl Acetate | Advisory | LCS | Water | 18-101 |
| Ethyl Ether | Advisory | LCS | Water | 10-151 |
| Ethyl Methacrylate | Advisory | LCS | Water | 21-117 |
| Ethylbenzene | Advisory | LCS | Water | 89-124 |
| Hexachlorobutadiene | Advisory | LCS | Water | 75-130 |
| Iodomethane | Advisory | LCS | Water | 10-195 |
| Isobutanol | Advisory | LCS | Water | 10-144 |
| Isopropylbenzene | Advisory | LCS | Water | 76-127 |
| m,p-Xylenes | Advisory | LCS | Water | 89-126 |
| Methacrylonitrile | Advisory | LCS | Water | 13-136 |
| Methyl Methacrylate | Advisory | LCS | Water | 13-135 |
| Methyl tert-Butyl Ether | Advisory | LCS | Water | 67-117 |
| Methylene Chloride | Advisory | LCS | Water | 75-119 |
| n-Butylbenzene | Advisory | LCS | Water | 73-138 |
| n-Hexane | Advisory | LCS | Water | 12-152 |
| n-Propylbenzene | Advisory | LCS | Water | 83-134 |
| Naphthalene | **Control** | LCS | Water | 64-145 |
| o-Xylene | Advisory | LCS | Water | 86-129 |
| Propionitrile | Advisory | LCS | Water | 17-131 |
| sec-Butylbenzene | Advisory | LCS | Water | 82-137 |
| Styrene | Advisory | LCS | Water | 90-130 |
| tert-Amyl Methyl Ether | Advisory | LCS | Water | 63-123 |
| tert-Butyl Alcohol | Advisory | LCS | Water | 34-136 |
| tert-Butyl Ethyl Ether | Advisory | LCS | Water | 63-127 |
| tert-Butylbenzene | Advisory | LCS | Water | 81-132 |
| Tetrachloroethene (PCE) | Advisory | LCS | Water | 79-123 |
| Tetrahydrofuran | Advisory | LCS | Water | 10-153 |
| Toluene | **Control** | LCS | Water | 84-120 |
| trans-1,2-Dichloroethene | Advisory | LCS | Water | 79-118 |
| trans-1,3-Dichloropropene | Advisory | LCS | Water | 76-116 |
| trans-1,4-Dichloro-2-butene | Advisory | LCS | Water | 12-132 |
| Trichloroethene (TCE) | **Control** | LCS | Water | 82-124 |
| Trichlorofluoromethane | Advisory | LCS | Water | 69-129 |
| Trichlorotrifluoroethane | Advisory | LCS | Water | 67-134 |
| Vinyl Acetate | Advisory | LCS | Water | 10-210 |

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| Vinyl Chloride | Advisory | LCS | Water | 74-138 |
| 1,1,1,2-Tetrachloroethane | Advisory | MS | Water | 77-130 |
| 1,1,1-Trichloroethane (TCA) | Advisory | MS | Water | 77-135 |
| 1,1,2,2-Tetrachloroethane | Advisory | MS | Water | 59-136 |
| 1,1,2-Trichloroethane | Advisory | MS | Water | 72-128 |
| 1,1-Dichloroethane | Advisory | MS | Water | 71-126 |
| 1,1-Dichloroethene | **Control** | MS | Water | 66-147 |
| 1,1-Dichloropropene | Advisory | MS | Water | 76-136 |
| 1,2,3-Trichlorobenzene | Advisory | MS | Water | 64-145 |
| 1,2,3-Trichloropropane | Advisory | MS | Water | 66-134 |
| 1,2,4-Trichlorobenzene | Advisory | MS | Water | 64-146 |
| 1,2,4-Trimethylbenzene | Advisory | MS | Water | 76-147 |
| 1,2-Dibromo-3-chloropropane | Advisory | MS | Water | 54-134 |
| 1,2-Dibromoethane (EDB) | Advisory | MS | Water | 71-127 |
| 1,2-Dichlorobenzene | **Control** | MS | Water | 73-125 |
| 1,2-Dichloroethane (EDC) | Advisory | MS | Water | 72-128 |
| 1,2-Dichloropropane | Advisory | MS | Water | 76-122 |
| 1,3,5-Trimethylbenzene | Advisory | MS | Water | 75-142 |
| 1,3-Dichlorobenzene | Advisory | MS | Water | 75-128 |
| 1,3-Dichloropropane | Advisory | MS | Water | 74-126 |
| 1,4-Dichlorobenzene | Advisory | MS | Water | 74-123 |
| 1,4-Dioxane | Advisory | MS | Water | 88-158 |
| 1-Chlorohexane | Advisory | MS | Water | 71-131 |
| 2,2-Dichloropropane | Advisory | MS | Water | 52-150 |
| 2-Butanone (MEK) | Advisory | MS | Water | 68-135 |
| 2-Chloroethyl Vinyl Ether | Advisory | MS | Water | 10-159 |
| 2-Chlorotoluene | Advisory | MS | Water | 72-140 |
| 2-Hexanone | Advisory | MS | Water | 55-141 |
| 2-Nitropropane | Advisory | MS | Water | 49-113 |
| 3-Chloro-1-propene | Advisory | MS | Water | 77-154 |
| 4-Chlorotoluene | Advisory | MS | Water | 70-139 |
| 4-Isopropyltoluene | Advisory | MS | Water | 70-141 |
| 4-Methyl-2-pentanone (MIBK) | Advisory | MS | Water | 61-139 |
| Acetone | Advisory | MS | Water | 58-142 |
| Acetonitrile | Advisory | MS | Water | 70-130 |
| Acrolein | Advisory | MS | Water | 50-135 |
| Acrylonitrile | Advisory | MS | Water | 53-140 |
| Benzene | **Control** | MS | Water | 81-130 |
| Bromobenzene | Advisory | MS | Water | 74-131 |
| Bromochloromethane | Advisory | MS | Water | 75-130 |
| Bromodichloromethane | Advisory | MS | Water | 73-129 |
| Bromoform | Advisory | MS | Water | 69-134 |
| Bromomethane | Advisory | MS | Water | 36-150 |
| Carbon Disulfide | Advisory | MS | Water | 58-159 |

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| Carbon Tetrachloride | Advisory | MS | Water | 67-150 |
| Chlorobenzene | **Control** | MS | Water | 77-123 |
| Chloroethane | Advisory | MS | Water | 54-143 |
| Chloroform | Advisory | MS | Water | 76-126 |
| Chloromethane | Advisory | MS | Water | 55-136 |
| Chloroprene | Advisory | MS | Water | 49-160 |
| cis-1,2-Dichloroethene | Advisory | MS | Water | 68-131 |
| cis-1,3-Dichloropropene | Advisory | MS | Water | 75-129 |
| cis-1,4-Dichloro-2-butene | Advisory | MS | Water | 51-130 |
| Dibromochloromethane | Advisory | MS | Water | 69-128 |
| Dibromomethane | Advisory | MS | Water | 76-126 |
| Dichlorodifluoromethane | Advisory | MS | Water | 45-194 |
| Dichlorofluoromethane (CFC 21) | Advisory | MS | Water | 70-130 |
| Ethyl Acetate | Advisory | MS | Water | 62-121 |
| Ethyl Ether | Advisory | MS | Water | 64-132 |
| Ethyl Methacrylate | Advisory | MS | Water | 70-130 |
| Ethylbenzene | Advisory | MS | Water | 80-135 |
| Hexachlorobutadiene | Advisory | MS | Water | 62-143 |
| Iodomethane | Advisory | MS | Water | 23-197 |
| Isobutyl Alcohol | Advisory | MS | Water | 52-151 |
| Isopropylbenzene | Advisory | MS | Water | 70-135 |
| m,p-Xylenes | Advisory | MS | Water | 81-135 |
| Methacrylonitrile | Advisory | MS | Water | 54-154 |
| Methyl Methacrylate | Advisory | MS | Water | 75-131 |
| Methyl tert-Butyl Ether | Advisory | MS | Water | 65-119 |
| Methylene Chloride | Advisory | MS | Water | 70-123 |
| n-Butylbenzene | Advisory | MS | Water | 66-147 |
| n-Hexane | Advisory | MS | Water | 80-142 |
| n-Propylbenzene | Advisory | MS | Water | 74-143 |
| Naphthalene | **Control** | MS | Water | 54-160 |
| o-Xylene | Advisory | MS | Water | 80-137 |
| Propionitrile | Advisory | MS | Water | 70-133 |
| sec-Butylbenzene | Advisory | MS | Water | 73-147 |
| Styrene | Advisory | MS | Water | 80-138 |
| tert-Butylbenzene | Advisory | MS | Water | 73-141 |
| Tetrachloroethene (PCE) | Advisory | MS | Water | 67-135 |
| Toluene | **Control** | MS | Water | 76-130 |
| trans-1,2-Dichloroethene | Advisory | MS | Water | 75-127 |
| trans-1,3-Dichloropropene | Advisory | MS | Water | 68-121 |
| trans-1,4-Dichloro-2-butene | Advisory | MS | Water | 44-127 |
| Trichloroethene (TCE) | **Control** | MS | Water | 63-138 |
| Trichlorofluoromethane | Advisory | MS | Water | 66-139 |
| Trichlorotrifluoroethane | Advisory | MS | Water | 61-149 |
| Vinyl Acetate | Advisory | MS | Water | 30-179 |

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| Vinyl Chloride | Advisory | MS | Water | 65-153 |
| 1,2-Dichloroethane-D4 | **Control** | SURR | Water | 79-112 |
| 4-Bromofluorobenzene | **Control** | SURR | Water | 72-115 |
| Dibromofluoromethane | **Control** | SURR | Water | 85-115 |
| Toluene-D8 | **Control** | SURR | Water | 86-114 |

# APPENDIX B

# FIELD
# STANDARD OPERATING PROCEDURES

# SOP 1

# EVALUATION OF EXISTING MONITORING WELLS AND WATER LEVEL MEASUREMENT

## 1.0 PURPOSE

The purpose of this procedure is to provide reference information regarding the proper methods for evaluating existing monitoring wells, and determining water level measurements.

## 2.0 SCOPE

The procedures described herein are applicable to all existing monitoring wells and, for the most part, are independent of construction materials and methods.

## 3.0 GLOSSARY

Hydraulic Head - The height to which water will rise in a well.

Water Table - A surface in an unconfined aquifer where groundwater pressure is equal to atmospheric pressure (i.e., the pressure head is zero).

## 4.0 RESPONSIBILITIES

Site Geologist/Hydrogeologist - Has overall responsibility for obtaining water level measurements and developing groundwater contour maps. The site geologist/hydrogeologist (in concurrence with the Project Manager) shall specify the reference point from which water levels are measured (usually a specific point on the upper edge of the inner well casing), the number of data points needed and which wells shall be used for a contour map, and how many complete sets of water levels are required to adequately define groundwater flow directions (e.g., if there are seasonal variations).

Field Personnel - Must have a basic familiarity with the equipment and procedures involved in obtaining water levels, and must be aware of any project-specific requirements.

## 5.0 PROCEDURES

Accurate, valid and useful groundwater monitoring requires that four important conditions be met:

- Proper characterization of site hydrogeology.
- Proper design of the groundwater monitoring program, including adequate numbers of wells installed at appropriate locations and depths.
- Satisfactory methods of groundwater sampling and analysis to meet the data quality objectives (DQOs).
- The assurance that specific monitoring well samples are representative of water quality conditions in the monitored interval.

To insure that these conditions are met, adequate descriptions of subsurface geology, well construction methods and well testing results must be available. The following steps will help to insure that the required data are available to permit an evaluation of the utility of existing monitoring wells for collecting additional samples.

## 5.1 Preliminary Evaluation

A necessary first step in evaluating existing monitoring well data is the study and review of the original work plan for monitoring well installation (if available). This helps to familiarize the site geologist/hydrogeologist with site-specific conditions, and will promote an understanding of the original purpose of the monitoring wells.

The next step of the evaluation should involve a review of all available information concerning borehole drilling and well construction. This will allow interpretation of groundwater flow conditions and area geology, and will help to establish consistency between hydraulic properties of the well and physical features of the well or formation. The physical features which should be identified and detailed, if available, include:

- The well identification number, permit number and location by referenced coordinates, the distance from prominent site features, or the location of the well on a map.
- The installation dates, drilling methods, well development methods, and contractors.
- The depth to bedrock -- where rock cores were not taken, auger refusal, drive casing refusal or penetration test results (blow counts for split-barrel sampling) may be used to estimate bedrock interface.
- The soil profile and stratigraphy.
- The borehole depth and diameter.
- The elevation of the top of the protective casing, the top of the well riser, and the ground surface.
- The total depth of the well.
- The type of well materials, screen type, slot size, and length, and the elevation/depths of the screen, interval, and/or monitored interval.
- The elevation/depths of the tops and bottom of the filter pack and well seals and the type and size.

## 5.2 Field Inspection

During the onsite inspection of existing monitoring wells, features to be noted include:

- The condition of the protective casing, cap and lock.
- The condition of the cement seal surrounding the protective casing.
- The presence of depressions or standing water around the casing.
- The presence of any electrical cable and its connections.

If the protective casing, cap and lock have been damaged or the cement collar appears deteriorated, or if there are any depressions around the well casing capable of holding water, surface water may have

infiltrated into the well. This may invalidate previous sampling results since the time when leakage started is unknown.

The routine physical inspection must be followed by a more detailed investigation to identify other potential routes of contamination or sampling equipment malfunction. Any of these occurrences may invalidate previously collected water quality data. If the monitoring well is to be used in the future, considerations shown in the steps described above should be rectified to rehabilitate the well. After disconnecting any wires, cables or electrical sources, remove the lock and open the cap. Check for the presence of organic vapors with a photoionization detector (PID) or flame-ionization detector (FID) and combustible gas meter to determine the appropriate worker safety level. The following information should be noted:

- Cap function.
- Physical characteristics and composition of the inner casing or riser, including inner diameter and annular space.
- Presence of grout between the riser and outer protective casing and the existence of drain holes in the protective casing.
- Presence of a riser cap, method of attachment to casing, and venting of the riser.
- Presence of dedicated sampling equipment; if possible, remove such equipment and inspect size, materials of construction and condition.

The final step of the field inspection is to confirm previous hydraulic or physical property data and to obtain data not previously available. This includes the determination of static water levels, total well depth and well obstruction. This may be accomplished using a weighted tape measure that can also be used to check for sediment (the weight will advance slowly if sediment is present, and the presence of sediment on the weight upon removal should be noted). If sediment is present, the well be should be redeveloped before sampling.

Lastly, as a final step, the location, condition and expected water quality of the wells should be reviewed in light of their usefulness for the intended purpose of the investigation.

## 5.3 Water Level (Hydraulic Head) Measurements

### 5.3.1 General

Groundwater level measurements can be made in monitoring wells, private or public water wells, piezometers, open boreholes, or test pits (after stabilization). Groundwater measurements should generally not be made in boreholes with drilling rods or auger flights present. If groundwater sampling activities are to occur, groundwater level measurements shall take place prior to well evacuation or sampling.

All groundwater level measurements shall be made to the nearest 0.01 foot, and recorded in the site geologist/hydrogeologist's field notebook or on the Groundwater Level Measurement Sheet, along with the date and time of the reading. The total depth of the well shall be measured and recorded, if not already known. Weather changes that occur over the period of time during which water levels are being taken, such as precipitation and barometric pressure changes, should be noted.

In measuring groundwater levels, there shall be a clearly established reference point of known elevation, which is normally identified by a mark on the upper edge of the inner well casing. The reference point

shall be noted in the field notebook. To be useful, the reference point should be tied in with an established USGS benchmark or other properly surveyed elevation datum. An arbitrary datum could be used for an isolated group of wells, if necessary.

Cascading water within a borehole or steel well casing can cause false readings with some types of sounding devices (chalked line, electrical). Oil layers may also cause problems in determining the true water level in a well. Special devices (interface probes) are available for measuring the thickness of oil layers and true depth to groundwater, if required.

Water level readings shall be taken regularly, as required by the site geologist/hydrogeologist. Monitoring wells or open-cased boreholes that are subject to tidal fluctuations should be read in conjunction with a tidal chart (or preferably in conjunction with readings of a tide staff or tide level recorder installed in the adjacent water body); the frequency of such readings shall be established by the site hydrogeologist. All water level measurements at a site used to develop a groundwater contour map shall be made in the shortest practical time to minimize affects due weather changes, and at least during the same day.

### 5.3.2 Water Level Measuring Techniques

There are several methods for determining standing or changing water levels in boreholes and monitoring wells. Certain methods have particular advantages and disadvantages depending upon well conditions. A general description of these methods is presented, along with a listing of various advantages and disadvantages of each technique. An effective technique shall be selected for the particular site conditions by the site geologist/hydrogeologist.

In most instances, preparation of accurate potentiometric surface maps requires that static water level measurements be obtained to a precision of 0.01 feet. To obtain such measurements in individual accessible wells, chalked tape or electrical water level indicator methods have been found best, and thus are the most often utilized. Other, less precise methods, such as the popper or bell sound, or bailer line methods, may be appropriate for developing preliminary estimates of hydraulic conditions. When a large number of (or continuous) readings are required, time-consuming individual readings are not usually feasible. In such cases, it is best to use the float recorder or pressure transducer methods. When conditions in the well limit readings (i.e., turbulence in the water surface or limited access through small diameter tubing), less precise, but appropriate methods such as the air line or capillary tubing methods can be used (see subsequent SOP section for discussion of these devices).

### 5.3.3 Methods

Water levels can be measured by several different techniques, but the same steps shall be followed in each case. The proper sequence is as follows:

1. Check operation of recording equipment above ground. Prior to opening the well, don personal protective equipment, as required.

2. Record all information specified below in the geologist/hydrogeologist's field notebook or on the Groundwater Level Measurement Sheet:

   - Well number.
   - Water level (to the nearest 0.01 foot; 0.3 cm). Water levels shall be taken from the surveyed reference mark on the top edge of the inner well casing.
   - Time and day of the measurement.

Water level measuring devices with permanently marked intervals shall be used when possible. If water level measuring devices marked by metal or plastic bands clamped at intervals along the measuring line

are used, the spacing and accuracy of these bands shall be checked frequently as they may loosen and slide up or down the line, resulting in inaccurate reference points.

### 5.3.4 Water Level Measuring Devices

**Chalked Steel Tape**

The water level is measured by chalking a weighted steel tape and lowering it a known distance (to any convenient whole foot mark) into the well or borehole. The water level is determined by subtracting the wetted chalked mark from the total length lowered into the hole.

The tape shall be withdrawn quickly from the well because water has a tendency to rise up the chalk due to capillary action. A water finding paste may be used in place of chalk. The paste is spread on the tape the same way as the chalk, and turns red upon contacting water.

Disadvantages to this method include the following: depths are limited by the inconvenience of using heavier weights to properly tension longer tape lengths; ineffective if borehole/well wall is wet or inflow is occurring above the static water level; chalking the tape is time-consuming; difficult to use during periods of precipitation.

**Electric Water Level Indicators**

These devices consist of a spool of small-diameter cable and a weighted probe attached to the end. When the probe contacts the water, an electrical circuit is closed and a meter, light, and/or buzzer attached to the spool will signal the contact.

There are a number of commercial electric sounders available, none of which is entirely reliable under all conditions likely to occur in a contaminated monitoring well. In conditions where there is oil on the water, groundwater with high specific conductance, water cascading into the well, steel well casing, or a turbulent water surface in the well, measuring with an electric sounder may be difficult.

For accurate readings, the probe shall be lowered slowly into the well. The electric tape is marked at the measuring point where contact with the water surface was indicated. The distance from the mark to the nearest tape band is measured using an engineer's folding ruler or steel tape, and added to the band reading to obtain the depth to water. If the band is not a permanent-marking band, spacing shall be checked periodically as described in Section 5.3.6.

**Popper or Bell Sounder**

A bell- or cup-shaped weight that is hollow on the bottom is attached to a measuring tape and lowered into the well. A "plopping" or "popping" sound is made when the weight strikes the surface of the water. An accurate reading can be determined by lifting and lowering the weight in short strokes, and reading the tape when the weight strikes the water. This method is not sufficiently accurate to obtain water levels to 0.01 feet, and thus is more appropriate for obtaining only approximate water levels quickly.

**Float Recorder**

A float or an electromechanically actuated water-seeking probe may be used to detect vertical changes of the water surface in the hole. A paper-covered recording chart drum is rotated by the up and down motion of the float via a pulley and reduction gear mechanism, while a clock drive moves a recording pen horizontally across the chart. To ensure continuous records, the recorder shall be inspected, maintained,

and adjusted periodically. This type of device is useful for continuously measuring periodic water level fluctuations, such as tidal fluctuations or influences of pumping wells.

**Air Line**

An air line is especially useful in pumped wells where water turbulence may preclude the use of other devices. A small-diameter weighted tube of known length is installed from the surface to a depth below the lowest water level expected. Compressed air (from a compressor, bottled air, or air pump) is used to purge the water from the tube, until air begins to escape the lower end of the tube, and is seen (or heard) to be bubbling up through the water in the well. The pressure needed to purge the water from the air line multiplied by 2.307 (feet of water for 1 psi) equals the length in feet of submerged air line. The depth to water below the center of the pressure gauge can be calculated by subtracting the length of air line below the water surface from the total length of the air line.

The disadvantages to this method include the need for an air supply and lower level of accuracy (unless a very accurate air pressure gauge is used, this method cannot be used to obtain water level readings to the nearest 0.01 ft).

**Capillary Tubing**

In small diameter piezometer tubing, water levels are determined by using a capillary tube. Colored or clear water is placed in a small "U"-shaped loop in one end of the tube (the rest of the tube contains air). The other end of the capillary tube is lowered down the piezometer tubing until the water in the loop moves, indicating that the water level has been reached. The point is then measured from the bottom of the capillary tube or recorded if the capillary tube is calibrated. This is the best method for very small diameter tubing monitoring systems such as Barcad and other multilevel systems. Unless the capillary tube is calibrated, two people may be required to measure the length of capillary tubing used to reach the groundwater. Since the piezometer tubing and capillary tubing usually are somewhat coiled when installed, it is difficult to accurately measure absolute water level elevations using this method. However, the method is useful in accurately measuring differences or changes in water levels (i.e., during pumping tests).

**Pressure Transducer**

Pressure transducers can be lowered into a well or borehole to measure the pressure of water and therefore the water elevation above the transducer. The transducer is wired into a recorder at the surface to record changes in water level with time. The recorder digitizes the information and can provide a printout or transfer the information to a computer for evaluation (using a well drawdown/recovery model). The pressure transducer should be initially calibrated with another water level measurement technique to ensure accuracy. This technique is very useful for hydraulic conductivity testing in highly permeable material where repeated, accurate water level measurements are required in a very short period of time. A sensitive transducer element is required to measure water levels to 0.01 foot accuracy.

**Borehole Geophysics**

Approximate water levels can be determined during geophysical logging of the borehole (although this is not the primary purpose for geophysical logging and such logging is not cost effective if used only for this purpose). Several logging techniques will indicate water level. Commonly-used logs that will indicate saturated/unsaturated conditions include the spontaneous potential (SP) log and the neutron log.

### 5.3.5 Data Recording

Water level measurements, time, data, and weather conditions shall be recorded in the geologist/hydrogeologist's field notebook or on the Groundwater Level Measurement Sheet. All water level measurements shall be measured from a known reference point. The reference point is generally a marked point on the upper edge of the inner well casing that has been surveyed for an elevation. The exact reference point shall be marked with permanent ink on the casing since the top of the casing may not be entirely level. It is important to note changes in weather conditions because changes in the barometric pressure may affect the water level within the well.

### 5.3.6 Specific Quality Control Procedures for Water Level Measuring Devices

All groundwater level measurement devices must be cleaned before and after each use to prevent cross contamination of wells. Manufacturer's instructions for cleaning the device shall be strictly followed. Some devices used to measure groundwater levels may need to be calibrated. These devices shall be calibrated to 0.01 foot accuracy and any adjustments/corrections shall be recorded in the field logbook/notebook. After the corrections/adjustments are made to the measuring device and entered in the field logbook/notebook, the corrected readings shall be entered onto the Groundwater Level Measurement Sheet. Elevations will be entered on the sheet when they become available.

## 5.4 Health and Safety Considerations

Groundwater contaminated by volatile organic compounds may release toxic vapors into the air space inside the well pipe. The release of this air when the well is initially opened is a health/safety hazard that must be considered. Initial monitoring of the well headspace and breathing zone concentrations using a PID (e.g., HNu) or FID (e.g., OVA) and combustible gas meters shall be performed to determine required levels of protection.

## 6.0 RECORDS

A record of all field procedures, tests and observations must be recorded in the site logbook or designated field notebook. Entries in the log/notebook should include the individuals participating in the field effort, and the date and time. The use of annotated sketches may help to supplement the evaluation.

# SOP 2

# GROUNDWATER SAMPLE ACQUISITION AND ONSITE WATER QUALITY TESTING

## 1.0 PURPOSE

The purpose of this procedure is to provide information regarding the purge and sample method that shall be used to sample groundwater monitoring wells and methods to sample pumping wells at the Naval Industrial Reserve Ordnance Plant (NIROP) in Fridley, Minnesota.

## 2.0 SCOPE

This procedure provides information on proper sampling equipment, onsite water quality testing, and techniques for groundwater sampling. Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling techniques. The techniques described shall be followed whenever applicable, noting that site-specific conditions or project-specific plans may require modifications to methodology.

## 3.0 GLOSSARY

Conductance - The conductance of a conductor 1 centimeter long and 1 square centimeter in cross-sectional area. For groundwater measurements, a volume of water contained in a 1 cm x 1 cm sample container (the water acts as the conductor). Conductivity and specific conductance are used synonymously.

Electrolytic Cell - An electrochemical cell in which electrical energy is supplied from an external source. This cell functions in much the same way as a galvanic cell, only the current flows in the opposite direction due to the external source of applied voltage. Electrolytic cells are used in dissolved oxygen measurement.

Galvanic Cell - An electrochemical cell in which chemical energy is spontaneously converted to electrical energy. The electrical energy produced is supplied to an external circuit. Galvanic cells are used in dissolved oxygen measurement.

Ohm - Standard unit of electrical resistance (R). Used in specific conductance measurement. A siemen (or umho) is the standard unit of electrical conductance, the inverse of the ohm.

Oxidation-Reduction Potential (ORP) - A measure of the activity ratio of oxidizing and reducing species as determined by the electromotive force developed by a noble metal electrode, immersed in water, as referenced against a standard hydrogen electrode.

pH - The negative logarithm (base 10) of the hydrogen ion activity. The hydrogen ion activity is related to the hydrogen ion concentration, and, in a relatively weak solution, the two are nearly equal. Thus, for all practical purposes, pH is a measure of the hydrogen ion concentration.

pH Paper - Indicator paper that turns different colors depending on the pH of the solution to which it is exposed. Comparison with color standards supplied by the manufacturer will then give an indication of the solution's pH.

Resistance - A measure of the solution's ability to oppose the passage of electrical current. For metals and solutions, resistance is defined by Ohm's Law, $E = IR$, where E is the potential difference, I is the current, and R is the resistance. Used in measurement of specific conductance.

## 4.0 RESPONSIBILITIES

Project Hydrogeologist - Responsible for selecting and detailing the specific groundwater sampling techniques, onsite water quality testing (type, frequency, and location), and equipment to be used, and providing detailed input in this regard to the project plan documents. The project hydrogeologist is also responsible for properly briefing and overseeing the performance of the site sampling personnel.

Project Geologist - is primarily responsible for the proper acquisition of the groundwater samples. He/she is also responsible for the actual analyses of onsite water quality samples, as well as instrument calibration, care, and maintenance. When appropriate, such responsibilities may be performed by other qualified personnel (e.g., field technicians).

## 5.0 PROCEDURES

### 5.1 General

Groundwater monitoring wells shall be sampled using the purge and sample method outlined in the MPCA Sampling Guidance. Wells shall be purged of stagnant casing water to ensure that formation water representative of groundwater from the screened interval of each well is collected for laboratory analysis. The equipment and methods for purging the well, showing stabilization of the field parameters to document proper purging and field documentation of these procedures are detailed in the sections that follow.

### 5.2 Sampling, Monitoring, and Evacuation Equipment

Sample containers shall conform to the guidelines expressed in SOP4 and the project planning documents.

The following equipment shall be on hand when sampling ground water wells:

- Sample packaging and shipping equipment - Coolers for sample shipping and cooling, chemical preservatives, appropriate sampling containers and filler, ice, labels and chain-of-custody documents.

- Field tools and instrumentation - Thermometer, pH paper/meter, camera and film (if appropriate), appropriate keys (for locked wells), engineer's rule, water level indicator, specific conductivity meter, and turbidity meter (as applicable).

- Pumps

  - Shallow-well pumps: Centrifugal, pitcher, suction, or peristaltic pumps with droplines, air-lift apparatus (compressor and tubing) where applicable.

  - Deep-well pumps: Submersible pump and electrical power-generating unit, or air-lift apparatus where applicable.

- Other sampling equipment - Submersible centrifugal pumps shall be used to obtain samples for volatile organics from shallow and deep groundwater wells.

- Pails - Plastic, graduated.

- Decontamination solutions - Deionized water, laboratory detergents, 10% nitric acid solution (as required), and analytical-grade solvents (e.g., methanol, acetone, hexane), as required.

Ideally, sample withdrawal equipment shall be completely inert, economical, easily cleaned, cleaned prior to use, reusable, able to operate at remote sites in the absence of power sources, and capable of delivering variable rates for well flushing and sample collection.

## 5.3 Calculations of Well Volume

To insure that the proper volume of water has been removed from the well prior to sampling it is first necessary to know the volume of standing water in the well pipe. This volume can be easily calculated by the following method. Calculations shall be entered in the site logbook or field notebook or on a sample log sheet form:

- Obtain all available information on well construction (location, casing, screens, etc.).
- Determine well or casing diameter.
- Measure and record static water level (depth below ground level or top of casing reference point).
- Determine depth of well by sounding using a clean, decontaminated, weighted tape measure.
- Calculate number of linear feet of static water (total depth or length of well pipe minus the depth to static water level).
- Calculate one static well volume in gallons: $V = (0.163)(T)(r^2)$

| | | |
|---|---|---|
| V | = | Static volume of well in gallons. |
| T | = | Thickness of water table in the well measured in feet (i.e., feet of static water). |
| r | = | Inside radius of well casing in inches. |
| 0.163 | = | A constant conversion factor which compensates for the conversion of the casing radius from inches to feet, the conversion of cubic feet to gallons, and pi. |

- Per evacuation volumes discussed above, determine the minimum amount to be evacuated before sampling.

## 5.4 Evacuation of Static Water (Purging)

### 5.4.1 General

Before a well is sampled it shall be evacuated of casing water (purged) to ensure that samples consist of fresh formation water from the screened interval of the monitoring well. Prior to the start of purging, the volume of water in the well shall be calculated according to Section 5.3. While the well is being purged, water quality parameters described in MPCA Sampling Guidance Section 3.4, "Field Water-Quality Measurements," and the quantity of water evacuated shall be recorded on the Sampling and Information Sheet and in the field logbook. A pumping rate that shall minimize draw down, while still allowing the well to be purged in a reasonable length of time, shall be used and the rate recorded in the field log. Care shall be taken to avoid any significant amount of cascading or turbulence in the well.

The well shall be purged by withdrawing water from the top of the water column in the well. The pump shall be adjusted vertically as necessary as the level of the water column in the well drops due to pumping. Samples for laboratory analysis shall be collected only after a minimum of three water-column volumes have been purged and stabilization of field water-quality parameters has been demonstrated by meeting the target criteria defined in Section 5.5. A maximum of five water-column volumes shall be removed and if stabilization of field water-quality parameters is not demonstrated a sample may be collected and the lack

of stabilization noted in the Field Log Book and on the Sampling Information Sheet. The pump shall be positioned several feet above the top of the screen to collect the sample after purging of the well has been demonstrated.

Wells with extremely slow recharge rates, due to tight formations, shall require alternate purging and sampling methods. If normal purging is clearly impractical, the well shall be pumped to near dryness and allowed to recover so that sufficient water is available to collect a sample. Sampling shall commence as soon as possible after evacuation. The maximum reasonable time limit shall be one hour.

Past chemical data for each well shall be reviewed to determine if Health Risk Limits (HRLs) are met or exceeded for the well. If the review indicates that the HRLs are exceeded for the well, all purge water shall be containerized and properly disposed. A note of the disposition of purge water shall be recorded in the field logbook and the Sampling Information Sheet.

### 5.4.2 Evacuation Devices

The following discussion is limited to those devices used during sampling at NIROP.

Submersible Pumps

Submersible pumps take in water and push the sample up a sample tube to the surface. The power sources for these samplers may be compressed gas or electricity. The operation principles vary and the displacement of the sample can be by an inflatable bladder, sliding piston, gas bubble, or impeller. Pumps are available for 2-inch-diameter wells and larger. These pumps can lift water from considerable depths (several hundred feet).

Limitations of this class of pumps include:

- They may have low delivery rates.
- Many models of these pumps are expensive.
- Compressed gas or electric power is needed.
- Sediment in water may cause clogging of the valves or eroding the impellers with some of these pumps.
- Decontamination of internal components can be difficult and time-consuming.

## 5.5 Onsite Water Quality Testing

This section describes the procedures and equipment required to measure the following parameters of an aqueous sample in the field:

- pH
- Specific Conductance
- Temperature
- Dissolved Oxygen (DO) Concentration
- Oxidation Reduction Potential
- Certain Dissolved Constituents Using Specific Ion Elements
- Turbidity

During well purging at NIROP, certain field water quality parameters shall be measured for stabilization every 3 to 5 minutes or after each water-column volume has been purged. The following target criteria for three consecutive measurements (every 3 to 5 minutes or one water-column apart) will be used to determine stabilization:

- pH +/- 0.1 units
- temperature +/- 0.1 degrees Celsius
- specific conductance (temperature corrected EC) +/-20 mv
- turbidity: less than or equal to 5 NTU

If field parameters do not stabilize after 5 water-column volumes, then lack of stabilization of field parameters shall be noted in the Field Log Book and on the Field Sampling Sheet and the sample collected with a notation of the volume of water purged.

### 5.5.1 Measurement of pH

5.5.1.1 General

Measurement of pH is one of the most important and frequently used tests in water chemistry. Practically every phase of water supply and wastewater treatment such as acid-base neutralization, water softening, and corrosion control is pH dependent. Likewise, the pH of leachate can be correlated with other chemical analyses to determine the probable source of contamination. It is therefore important that reasonably accurate pH measurements be taken.

Two methods are given for pH measurement: the pH meter and pH indicator paper. The indicator paper is used when only a rough estimate of the pH is required, and the pH meter when a more accurate measurement is needed. The response of a pH meter can be affected to a slight degree by high levels of colloidal or suspended solids, but the effect is usually small and generally of little significance. Consequently, specific methods to overcome this interference are not described. The response of pH paper is unaffected by solution interferences from color, turbidity, colloidal or suspended materials unless extremely high levels capable of coating or masking the paper are encountered. In such cases, use of a pH meter is recommended.

5.5.1.2 Principles of Equipment Operation

Use of pH papers for pH measurement relies on a chemical reaction caused by the acidity or basicity of the solution created by the addition of the water sample reacting with the indicator compound on the paper. Various types of pH papers are available, including litmus (for general acidity or basicity determination) and specific pH range hydrion paper.

Use of a pH meter relies on the same principle as other ion-specific electrodes. Measurement relies on establishment of a potential difference across a glass or other type of membrane in response to (in this instance, hydrogen) ion concentration across that membrane. The membrane is conductive to ionic species and, in combination with a standard or reference electrode, a potential difference proportional to the ion concentration is generated and measured.

5.5.1.3 Equipment

The following equipment is needed for taking pH measurements:

- Stand-alone portable pH meter, or combination meter (e.g., Horiba U-10), or combination meter equipped with an in-line sample chamber.

- Combination electrode with polymer body to fit the above meter (alternately a pH electrode and a reference electrode can be used if the pH meter is equipped with suitable electrode inputs).

- Buffer solutions, as specified by the manufacturer.

- pH indicator paper, to cover the pH range 2 through 12.
- Manufacturer's operation manual.

5.5.1.4 Measurement Techniques for Field Determination of pH

**pH Meter**

The following procedure is used for measuring pH with a pH meter (meter standardization is according to manufacturer's instructions):

- Inspect the instrument and batteries prior to initiation of the field effort.
- Check the integrity of the buffer solutions used for field calibration. Buffer solutions need to be changed often because of degradation upon exposure to the atmosphere.
- Immerse the tip of the electrodes in water overnight. If this is not possible due to field conditions, immerse the electrode tip in water for at least an hour before use. The electrode tip may be immersed in a rubber or plastic sack containing buffer solution for field transport or storage. This is not applicable for all electrodes as some must be stored dry.
- If applicable, make sure all electrolyte solutions within the electrode(s) are at their proper levels and that no air bubbles are present within the electrode(s).
- Calibrate on a daily use basis following manufacturer's instructions. Record calibration data on an equipment calibration log sheet.
- Immerse the electrode(s) in the unknown solution, slowly stirring the probe until the pH stabilizes. Stabilization may take several seconds to minutes. If the pH continues to drift, the sample temperature may not be stable, a physical reaction (e.g., degassing) may be taking place in the sample, or the meter or electrode may be malfunctioning. This must be clearly noted in the logbook.
- Read and record the pH of the solution. pH shall be recorded to the nearest 0.1 pH unit. Also, record the sample temperature.
- Rinse the electrode(s) with deionized water.
- Store the electrode(s) in an appropriate manner when not in use.

Any visual observation of conditions that may interfere with pH measurement, such as oily materials, or turbidity, shall be noted.

**pH Paper**

Use of pH paper is very simple and requires no sample preparation, standardization, etc. pH paper is available in several ranges, including wide-range (indicating approximately pH 1 to 12), mid-range (approximately pH 0 to 6, 6 to 9, 8 to 14) and narrow-range (many available, with ranges as narrow as 1.5 pH units). The appropriate range of pH paper shall be selected. If the pH is unknown the investigation shall start with wide-range paper and proceed with successively narrower range paper until the sample pH is adequately determined.

### 5.5.2 Measurement of Specific Conductance

5.5.2.1 General

Conductance provides a measure of dissolved ionic species in water and can be used to identify the direction and extent of migration of contaminants in groundwater or surface water. It can also be used as a measure of subsurface biodegradation or to indicate alternate sources of groundwater contamination.

Conductivity is a numerical expression of the ability of a water sample to carry an electric current. This value depends on the total concentration of the ionized substances dissolved in the water and the temperature at which the measurement is made. The mobility of each of the various dissolved ions, their valences, and their actual and relative concentrations affect conductivity.

It is important to obtain a specific conductance measurement soon after taking a sample, since temperature changes, precipitation reactions, and absorption of carbon dioxide from the air all affect the specific conductance.

5.5.2.2 Principles of Equipment Operation

An aqueous system containing ions will conduct an electric current. In a direct-current field, the positive ions migrate toward the negative electrode, while the negatively charged ions migrate toward the positive electrode. Most inorganic acids, bases and salts (such as hydrochloric acid, sodium carbonate, or sodium chloride, respectively) are relatively good conductors. Conversely, organic compounds such as sucrose or benzene, which do not disassociate in aqueous solution, conduct a current very poorly, if at all.

A conductance cell and a Wheatstone Bridge (for the measurement of potential difference) may be used for measurement of electrical resistance. The ratio of current applied to voltage across the cell may also be used as a measure of conductance. The core element of the apparatus is the conductivity cell containing the solution of interest. Depending on ionic strength of the aqueous solution to be tested, a potential difference is developed across the cell which can be converted directly or indirectly (depending on instrument type) to a measurement of specific conductance.

5.5.2.3 Equipment

The following equipment is needed for taking specific conductance (SC) measurements:

- Stand alone portable conductivity meter, or combination meter (e.g., Horiba U-10), or combination meter equipped with an in-line sample chamber.
- Calibration solution, as specified by the manufacturer.
- Manufacturer's operation manual.

A variety of conductivity meters is available which may also be used to monitor salinity and temperatures. Probe types and cable lengths vary, so equipment must be obtained to meet the specific requirement of the sampling program.

5.5.2.4 Measurement Techniques for Specific Conductance

The steps involved in taking specific conductance measurements are listed below (standardization is according to manufacturer's instructions):

- Check batteries and calibrate instrument before going into the field.
- Calibrate on a daily use basis, according to the manufacturer's instructions and record all pertinent information on an equipment calibration log sheet.
- Rinse the cell with one or more portions of the sample to be tested or with deionized water.
- Immerse the electrode in the sample and measure the conductivity. Adjust the temperature setting to the sample temperature (if applicable).
- Read and record the results in a field logbook or sample log sheet.
- Rinse the electrode with deionized water.

If the specific conductance measurements become erratic, recalibrate the instrument and see the manufacturer's instructions for details.

**5.5.3 Measurement of Temperature**

5.5.3.1 General

In combination with other parameters, temperature can be a useful indicator of the likelihood of biological action in a water sample. It can also be used to trace the flow direction of contaminated groundwater. Temperature measurements shall be taken in-situ, or as quickly as possible in the field. Collected water samples may rapidly equilibrate with the temperature of their surroundings.

5.5.3.2 Equipment

Temperature measurements may be taken with alcohol-toluene, mercury filled or dial-type thermometers. In addition, various meters such as specific conductance or dissolved oxygen meters, which have temperature measurement capabilities, may also be used. Using such instrumentation along with suitable probes and cables, in-situ measurements of temperature at great depths can be performed.

5.5.3.3 Measurement Techniques for Water Temperature

If a thermometer is used to determine the temperature for a water sample:

- Immerse the thermometer in the sample until temperature equilibrium is obtained (1-3 minutes). To avoid the possibility of cross-contamination, the thermometer shall not be inserted into samples that will undergo subsequent chemical analysis.
- Record values in a field logbook or sample log sheet.

If a temperature meter or probe is used, the instrument shall be calibrated according to manufacturer's recommendations.

### 5.5.4 Measurement of Dissolved Oxygen Concentration

5.5.4.1 General

Dissolved oxygen (DO) levels in natural water and wastewater depend on the physical, chemical and biochemical activities in the water body. Conversely, the growth of many aquatic organisms as well as the rate of corrosivity, are dependent on the dissolved oxygen concentration. Thus, analysis for dissolved oxygen is an important test in water pollution and waste treatment process control. If possible, DO measurements shall be taken in-situ, since concentration may show a large change in a short time if the sample is not adequately preserved.

The monitoring method discussed herein is limited to the use of dissolved oxygen meters only. Chemical methods of analysis (i.e., Winkler methods) are available, but require more equipment and greater sample manipulation. Furthermore, DO meters, using a membrane electrode, are suitable for highly polluted waters, because the probe is submersible, and is not susceptible to interference caused by color, turbidity, colloidal material or suspended matter.

5.5.4.2 Principles of Equipment Operation

Dissolved oxygen probes are normally electrochemical cells that have two solid metal electrodes of different nobility immersed in an electrolyte. The electrolyte is retained by an oxygen-permeable membrane. The metal of highest nobility (the cathode) is positioned at the membrane. When a suitable potential exists between the two metals, reduction of oxygen to hydroxide ion (OH) occurs at the cathode surface. An electrical current is developed that is directly proportional to the rate of arrival of oxygen molecules at the cathode.

Since the current produced in the probe is directly proportional to the rate of arrival of oxygen at the cathode, it is important that a fresh supply of sample always be in contact with the membrane. Otherwise, the oxygen in the aqueous layer along the membrane is quickly depleted and false low readings are obtained. It is therefore necessary to stir the sample (or the probe) constantly to maintain fresh solution near the membrane interface. Stirring, however, shall not be so vigorous that additional oxygen is introduced through the air-water interface at the sample surface. To avoid this possibility, some probes are equipped with stirrers to agitate the solution near the probe, while leaving the surface of the solution undisturbed.

Dissolved oxygen probes are relatively unaffected by interferences. Interferences that can occur are reactions with oxidizing gases (such as chlorine) or with gases such as hydrogen sulfide, which are not easily depolarized from the indicating electrode. If a gaseous interference is suspected, it shall be noted in the field log book and checked if possible. Temperature variations can also cause interference because probes exhibit temperature sensitivity. Automatic temperature compensation is normally provided by the manufacturer.

5.5.4.3 Equipment

The following equipment is needed to measure dissolved oxygen concentration:

- Stand alone portable dissolved oxygen meter, or combination meter (e.g., Horiba U-10), or combination meter equipped with an in-line sample chamber.
- Sufficient cable to allow the probe to contact the sample.
- Manufacturer's operation manual.

5.5.4.4 Measurement Techniques for Dissolved Oxygen Determination

Probes differ as to specifics of use. Follow the manufacturer's instructions to obtain an accurate reading. The following general steps shall be used to measure the dissolved oxygen concentration:

- The equipment shall be calibrated and have its batteries checked before going to the field.
- The probe shall be conditioned in a water sample for as long a period as practical before use in the field. Long periods of dry storage followed by short periods of use in the field may result in inaccurate readings.
- The instrument shall be calibrated in the field according to manufacturer's recommendations.
- Record all pertinent information on an equipment calibration sheet.
- Rinse the probe with deionized water.
- Immerse the probe in the sample. Be sure to provide for sufficient flow past the membrane by stirring the sample. Probes without stirrers placed in wells can be moved up and down.
- Record the dissolved oxygen content and temperature of the sample in a field logbook or sample log sheet.
- Rinse the probe with deionized water.
- Recalibrate the probe when the membrane is replaced, or as needed. Follow the manufacturer's instructions.

Note that in-situ placement of the probe is preferable, since sample handling is not involved. This however, may not always be practical. Be sure to record whether the liquid was analyzed in-situ, or if a sample was taken.

Special care shall be taken during sample collection to avoid turbulence, which can lead to increased oxygen solubilization and positive test interferences.

### 5.5.5 Measurement of Oxidation-Reduction Potential

5.5.5.1 General

The oxidation-reduction potential (ORP) provides a measure of the tendency of organic or inorganic compounds to exist in an oxidized state. The ORP parameter therefore provides evidence of the likelihood of anaerobic degradation of biodegradable organics or the ratio of activities of oxidized to reduced species in the sample.

5.5.5.2 Principles of Equipment Operation

When an inert metal electrode, such as platinum, is immersed in a solution, a potential is developed at that electrode depending on the ions present in the solution. If a reference electrode is placed in the same solution, an ORP electrode pair is established. This electrode pair allows the potential difference between the two electrodes to be measured and is dependent on the concentration of the ions in solution. By this measurement, the ability to oxidize or reduce species in solution may be determined. Supplemental measurements, such as dissolved oxygen, may be correlated with ORP to provide knowledge of the quality of the solution, water, or wastewater.

5.5.5.3 Equipment

The following equipment is needed for measuring the oxidation-reduction potential of a solution:

- Portable pH meter or equivalent, with a millivolt scale.
- Platinum electrode to fit above pH meter.
- Reference electrode such as a calomel, silver-silver chloride, or equivalent.
- Reference solution as specified by the manufacturer.
- Manufacturer's operation manual.

5.5.5.4 Measurement Techniques for Oxidation-Reduction Potential

The following procedure is used for measuring oxidation-reduction potential:

- The equipment shall be calibrated and have its batteries checked before going to the field.

- Check that the platinum probe is clean and that the platinum bond or tip is unoxidized. If dirty, polish with emery paper or, if necessary, clean the electrode using aqua regia, nitric acid, or chromic acid, in accordance with manufacturer's instructions.

- Thoroughly rinse the electrode with deionized water.

- Verify the sensitivity of the electrodes by noting the change in millivolt reading when the pH of the test solution is altered. The ORP will increase when the pH of the test solution decreases and the ORP will decrease if the test solution pH is increased. Place the sample in a clean container and agitate the sample. Insert the electrodes and note the ORP drops sharply when the caustic is added (i.e., pH is raised) thus indicating the electrodes are sensitive and operating properly. If the ORP increases sharply when the caustic is added, the polarity is reversed and must be corrected in accordance with the manufacturer's instructions. If the ORP does not respond as above when the caustic is added, the electrodes shall be cleaned and the above procedure repeated.

- After the assembly has been checked for sensitivity, wash the electrodes with three changes of water or by means of a flowing stream of deionized water from a wash bottle. Place the sample in a clean container and insert the electrodes. Set temperature compensator throughout the measurement period. Read the millivolt potential of the solution, allowing sufficient time for the system to stabilize and reach temperature equilibrium. Measure successive portions of the sample until readings on two successive portions differ by no more than 10 mV. A system that is very slow to stabilize properly will not yield a meaningful ORP. Record all results in a field logbook or sample logsheet, including ORP (to nearest 10 mV), sample temperature and pH at the time of measurement.

### 5.5.6 Measurement of Turbidity

5.5.6.1 General

Turbidity in water is caused by suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, and microscopic organisms, including plankton. Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in a straight line through the sample.

It is important to obtain a turbidity reading immediately after taking a sample, since irreversible changes in turbidity may occur if the sample is stored too long.

5.5.6.2 Principles of Equipment Operation

Turbidity is measured by the Nephelometric Method. This method is based on a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. The higher the scattered light intensity, the higher the turbidity.

Formazin polymer is used as the reference turbidity standard suspension because of its ease of preparation combined with a higher reproducibility of its light-scattering properties than clay or turbid natural water. The turbidity of a specified concentration of formazin suspension is defined as 40 nephelometric units. This same suspension has an approximate turbidity of 40 Jackson units when measured on the candle turbidimeter. Therefore, nephelometric turbidity units (NTU) based on the formazin preparation will approximate units derived from the candle turbidimeter but will not be identical to them.

5.5.6.3 Equipment

The following equipment is needed for turbidity measurement:

- Stand alone portable turbidity meter, or combination meter (e.g., Horiba U-10), or combination meter equipped with an in-line sample chamber.
- Calibration solution, as specified by the manufacturer.
- Manufacturer's operation manual.

5.5.6.4 Measurements Techniques for Turbidity

The steps involved in taking turbidity measurements are listed below (standardization is according to manufacturer's instructions):

- Check batteries and calibrate instrument before going into the field.
- Check the expiration date (etc.) of the solutions used for field calibration.
- Calibrate on a daily use basis, according to the manufacturer's instructions and record all pertinent information on an equipment calibration log sheet.
- Rinse the cell with one or more portions of the sample to be tested or with deionized water.
- Immerse the probe in the sample and measure the turbidity. The reading must be taken immediately as suspended solids will settle over time resulting in a lower, inaccurate turbidity reading.
- Read and record the results in a field logbook or sample log sheet. Include a physical description of the sample, including color, qualitative estimate of turbidity, etc.
- Rinse the electrode with deionized water.

## 5.6 Sampling

### 5.6.1 Sampling Plan

The sampling approach consisting of the following, shall be developed as part of the project plan documents which are approved prior to beginning work in the field:

- Background and objectives of sampling.
- Brief description of area and waste characterization.
- Identification of sampling locations, with map or sketch, and applicable well construction data (well size, depth, screened interval, reference elevation).
- Intended number, sequence volumes, and types of samples. If the relative degrees of contamination between wells are unknown or insignificant, a sampling sequence that facilitates sampling logistics may be followed. Where some wells are known or strongly suspected of being highly contaminated, these shall be sampled last to reduce the risk of cross-contamination between wells because of the sampling procedures.
- Sample preservation requirements.
- Work schedule.
- List of team members.
- List of observers and contacts.
- Other information, such as the necessity for a warrant or permission of entry, requirement for split samples, access problems, location of keys, etc.

### 5.6.2 Sequence of Sampling Steps

The collection of a groundwater sample consists of the following steps:

1. The site Health & Safety Officer (or designee) will first open the well cap and use volatile organic detection equipment (PID or FID) on the escaping gases at the well head to determine the need for respiratory protection.
2. When proper respiratory protection has been donned, sound the well for total depth and water level (using clean equipment) and record these data on a groundwater sampling log sheet; then calculate the fluid volume in the well pipe (as previously described in this SOP).
3. Calculate well volume to be removed as stated in Section 5.3.
4. Select the appropriate purging equipment. If an electric submersible pump with packer is chosen, go to Step 10.
5. Lower the purging equipment or intake into the well to a short distance below the water level and begin water removal. Collect the purged water and dispose of it in an acceptable manner (as applicable). Lower the purging device, as required, to maintain submergence.

6. Measure the rate of discharge frequently. A graduated bucket and stopwatch are most commonly used; other techniques include use of pipe trajectory methods, weir boxes or flow meters.

7. Observe the peristaltic pump intake for degassing "bubbles." If bubbles are abundant and the intake is fully submerged, this pump is not suitable for collecting samples for volatile organics. Never collect volatile organics samples using a vacuum pump.

8. Purge a minimum of three to five casing volumes before sampling. In low-permeability strata (i.e., if the well is pumped to dryness), one volume will suffice. Purged water shall be collected in a designated container and disposed in an acceptable manner.

9. If sampling using a pump, lower the pump intake to within 2 feet of the water column and collect the sample. If sampling with a bailer, lower the bailer to the sampling level before filling.

10. (For pump and packer assembly only). Lower the assembly into the well so that the packer is positioned just above the screen or open section. Inflate the packer. Purge a volume equal to at least twice the screened interval (or unscreened open section volume below the packer) before sampling. Packers shall always be tested in a casing section above ground to determine proper inflation pressures for good sealing.

11. In the event that recovery time of the well is very slow (e.g., 24 hours or greater), sample collection can be delayed until the following day. If the well has been purged early in the morning, sufficient water may be standing in the well by the day's end to permit sample collection. If the well is incapable of producing a sufficient volume of sample at any time, take the largest quantity available and record this occurrence in the site logbook.

12. Fill sample containers; preserve and label as required (containers may be pre-preserved).

13. Replace the well cap and lock as appropriate. Make sure the well is readily identifiable as the source of the samples.

14. Process sample containers as described in SOP 4.

15. Decontaminate equipment as described in project planning documents.

Refer to MPCA sampling guidance provided in Appendix C of the RAMP for a detailed description of groundwater sampling.

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# SOP 3

# SURFACE WATER AND SEDIMENT SAMPLING

## 1.0 PURPOSE

This procedure describes methods and equipment commonly used for collecting environmental samples of surface water and aquatic sediment for either onsite examination and chemical testing, or for subsequent laboratory analysis.

## 2.0 SCOPE

The information presented in this guideline is generally applicable to all environmental sampling of surface waters (Section 5.3) and aquatic sediments (Section 5.5), except where the analyte(s) may interact with the sampling equipment. The collection of concentrated sludges or hazardous waste samples from disposal or process lagoons often requires methods, precautions and equipment different from those described herein.

## 3.0 GLOSSARY

Environmental Sample - a sample containing (or suspected to contain) low-level concentrations of contaminants, which does not require special handling or transport considerations as detailed in SOP SA-6.1.

Hazardous Waste Sample - a sample containing (or suspected to contain) higher concentrations of contaminants thus requiring special handling and/or transport considerations per SOP 4.

## 4.0 RESPONSIBILITIES

Project Manager - The Project Manager has the overall responsibility for seeing that all surface water and sediment sampling activities are properly conducted by appropriately trained personnel.

Field Operations Leader - The Field Operations Leader (FOL) is responsible for the in-field supervision of the conduct of onsite water quality analyses, ensuring the completion and accuracy of all field documentation, and making sure that custody of all samples obtained is maintained according to proper procedures.

## 5.0 PROCEDURES

### 5.1 Introduction

Collecting a representative sample from surface water or sediments is difficult because of water movement, stratification or patchiness. To collect representative samples, one must standardize sampling bias related to site selection, sampling frequency, sample collection, sampling devices, and sample handling, preservation, and identification.

Representativeness is a qualitative description of the degree to which an individual sample accurately reflects population characteristics or parameter variations at a sampling point. It is therefore an important characteristic not only of assessment and quantification of environmental threats posed by the site, but also for providing information for engineering design and construction. Proper sample location selection and proper sample collection methods are important to ensure that a truly representative sample has been taken. Regardless of quality control applied during laboratory analyses and subsequent scrutiny of

analytical data packages, reported data are not better than the confidence that can be placed in the representativeness of the samples.

## 5.2 Defining the Sampling Program

Many factors must be considered in developing a sampling program for surface water or sediments including study objectives, accessibility, site topography, physical characteristics of the water body (such as flow and mixing), point and diffuse sources of contamination, and personnel and equipment available to conduct the study. For waterborne constituents, dispersion depends on the vertical and lateral mixing within the body of water. For sediments, dispersion depends on bottom current or flow characteristics, sediment characteristics (density, size) and geochemical properties (which affect adsorption/desorption). The hydrogeologist developing the sampling plan must therefore know not only the mixing characteristics of streams and lakes, but also must understand the role of fluvial-sediment transport, deposition, and chemical sorption.

### 5.2.1 Sampling Program Objectives

The objective of surface water sampling is to determine the surface water quality entering, leaving or remaining within the site. The scope of the sampling program must consider the sources and potential pathways for transport of contamination to or within a surface water body. Sources may include point sources (leaky tanks, outfalls, etc.) or nonpoint sources (e.g., spills). The major pathways for surface water contamination (not including airborne deposition) are overland runoff, leachate influx to the waterbody, direct waste disposal (solid or liquid) into the water body; and groundwater flow influx from upgradient. The relative importance of these pathways, and therefore the design of the sampling program, is controlled by the physiographic and hydrologic features of the site, the drainage basin(s) which encompass the site, and the history of site activities.

Physiographic and hydrologic features to be considered include slopes and runoff direction, areas of temporary flooding or pooling, tidal effects, artificial surface runoff controls such as berms or drainage ditches (and when they were constructed relative to site operation), and locations of springs, seeps, marshes, etc. In addition, the obvious considerations such as the location of man-made discharge points to the nearest stream (intermittent or flowing), pond, lake, estuary, etc., shall be considered.

A more subtle consideration in designing the sampling program is the potential for dispersion of dissolved or sediment-associated contaminants away from the source. The dispersion could lead to a more homogeneous distribution of contamination at low or possibly non-detectable concentrations. Such dispersion does not, however, always readily occur. For example, obtaining a representative sample of contamination from a main stream immediately below an outfall or a tributary is difficult because the inflow frequently follows a stream bank with little lateral mixing for some distance. Sampling alternatives to overcome this situation are: (1) move the site far enough downstream to allow for adequate mixing, or (2) collect integrated samples in a cross section. Also, nonhomogeneous distribution is a particular problem with regard to sediment-associated contaminants, which may accumulate in low-energy environments (coves, river bends, deep spots, or even behind boulders) near or distant from the source while higher-energy areas (main stream channels) near the source may show no contaminant accumulation.

The distribution of particulates within a sample itself is an important consideration. Many organic compounds are only slightly water soluble and tend to adsorb onto particulate matter. Nitrogen, phosphorus, and the heavy metals may also be transported by particulates. Samples must be collected with a representative amount of suspended material; transfer from the sampling device shall include transferring a proportionate amount of the suspended material.

### 5.2.2 Location of Sampling Stations

Accessibility is the primary factor affecting sampling costs. The desirability and utility of a sample for analysis and consideration of site conditions must be balanced against the costs of collection as controlled by accessibility. Bridges or piers are the first choice for locating a sampling station on a stream because bridges provide ready access and also permit the sampling technician to sample any point across the stream. A boat or pontoon (with an associated increase in cost) may be needed to sample locations on lakes and reservoirs, as well as those on larger rivers. Frequently, however, a boat will take longer to cross a water body and will hinder manipulation of the sampling equipment. Wading for samples is not recommended unless it is known that contaminant levels are low so that skin contact will not produce adverse health effects. This provides a built in margin of safety in the event that wading boots or other protective equipment should fail to function properly. If it is necessary to wade into the water body to obtain a sample, the sampler shall be careful to minimize disturbance of bottom sediments and must enter the water body downstream of the sampling location. If necessary, the sampling technician shall wait for the sediments to settle before taking a sample.

Sampling in marshes or tidal areas may require the use of an all-terrain vehicle (ATV). The same precautions mentioned above with regard to sediment disturbance apply.

Under ideal and uniform contaminant dispersion conditions in a flowing stream, the same concentrations of each would occur at all points along the cross section. This situation is most likely downstream of areas of high turbulence. Careful site selection is needed in order to ensure, as nearly as possible, that samples are taken where uniform flow or deposition and good mixing conditions exist.

The availability of streamflow and sediment discharge records can be an important consideration in choosing sampling sites in streams. Streamflow data in association with contaminant concentration data are essential for estimating the total contaminant loads carried by the stream. If a gauging station is not conveniently located on a selected stream, the project hydrogeologist shall explore the possibility of obtaining streamflow data by direct or indirect methods.

### 5.2.3 Frequency of Sampling

The sampling frequency and the objectives of the sampling event will be defined by the project plan documents. For single-event site or area characterization sampling, both bottom material and overlying water samples shall be collected at the specified sampling stations. If valid data are available on the distribution of the contaminant between the solid and aqueous phases, it may be appropriate to sample only one phase, although this is not often recommended. If samples are collected primarily for monitoring purposes (i.e., consisting of repetitive, continuing measurements to define variations and trends at a given location), water samples shall be collected at a pre-established and constant interval as specified in the project plans (often monthly or quarterly, and during droughts and floods). Samples of bottom material shall be collected from fresh deposits at least yearly, and preferably seasonally, during both spring and fall.

The variability in available water-quality data shall be evaluated before determining the number and collection frequency of samples required to maintain an effective monitoring program.

## 5.3 Surface Water Sample Collection

### 5.3.1 Streams, Rivers, Outfalls and Drainage Features (Ditches, Culverts)

Methods for sampling streams, rivers, outfalls and drainage features at a single point vary from the simplest of hand-sampling procedures to the more sophisticated multi-point sampling techniques known as the equal-width-increment (EWI) method or the equal-discharge-increment (EDI) methods (see below).

Samples from different depths or cross-sectional locations in the watercourse taken during the same sampling episode, shall be composited. However, samples collected along the length of the watercourse or at different times may reflect differing inputs or dilutions and therefore shall not be composited. Generally, the number and type of samples to be taken depend on the river's width, depth, discharge and on the suspended sediment the stream or river transports. The greater the number of individual points that are sampled, the more likely that the composite sample will truly represent the overall characteristics of the water.

In small streams less than about 20 feet wide, a sampling site can generally be found where the water is well mixed. In such cases, a single grab sample taken at mid-depth in the center of the channel is adequate to represent the entire cross section.

For larger streams, at least one vertical composite shall be taken with one sample each from just below the surface, at mid-depth, and just above the bottom. The measurement of DO, pH, temperature, conductivity, etc., shall be made on each aliquot of the vertical composite and on the composite itself. For rivers, several vertical composites shall be collected, as directed in the project plan documents.

### 5.3.2 Lakes, Ponds and Reservoirs

Lakes, ponds, and reservoirs have a much greater tendency to stratify than rivers and streams. The relative lack of mixing requires that more samples be obtained.

The number of water sampling sites on a lake, pond, or impoundment will vary with the size and shape of the basin. In ponds and small lakes, a single vertical composite at the deepest point may be sufficient. Similarly, the measurement of DO, pH, temperature, etc., is to be conducted on each aliquot of the vertical composite and on the composite itself. In naturally formed ponds, the deepest point may have to be determined empirically; in impoundments, the deepest point is usually near the dam.

In lakes and larger reservoirs, several vertical composites shall be composited to form a single sample. These verticals are often taken along a transect or grid. In some cases, it may be of interest to form separate composites of epilimnetic and hypolimnetic zones. In a stratified lake, the epilimnion is the thermocline that is exposed to the atmosphere. The hypolimnion is the lower, "confined" layer which is only mixed with the epilimnion and vented to the atmosphere during seasonal "overturn" (when density stratification disappears). These two zones may thus have very different concentrations of contaminants if input is only to one zone, if the contaminants are volatile (and therefore vented from the epilimnion but not the hypolimnion), or if the epilimnion only is involved in short-term flushing (i.e., inflow from or outflow to shallow streams). Normally, however, a composite consists of several verticals with samples collected at various depths.

In lakes with irregular shape and with bays and coves that are protected from the wind, separate composite samples may be needed to adequately represent water quality since it is likely that only poor mixing will occur. Similarly, additional samples are recommended where discharges, tributaries, land use characteristics, and other such factors are suspected of influencing water quality.

Many lake measurements are now made in-situ using sensors and automatic readout or recording devices. Single and multi-parameter instruments are available for measuring temperature, depth, pH, oxidation-reduction potential (ORP), specific conductance, dissolved oxygen, some cations and anions, and light penetration.

### 5.3.3 Estuaries

Estuarine areas are by definition, zones where inland freshwaters (both surface and ground) mix with oceanic saline waters. Estuaries are generally categorized into three types dependent upon freshwater inflow and mixing properties. Knowledge of the estuary type is necessary to determine sampling locations. Each type of estuarine area is described below:

- Mixed Estuary - characterized by the absence of a vertical halocline (gradual or no marked increase in salinity in the water column) and a gradual increase in salinity seaward. Typically this type of estuary is shallow and is found in major freshwater sheetflow areas. Being well mixed, the sampling locations are not critical in this type of estuary.

- Salt Wedge Estuary - characterized by a sharp vertical increase in salinity and stratified freshwater flow along the surface. In these estuaries, the vertical mixing forces cannot override the density differential between fresh and saline waters. In effect, a salt wedge tapering inland moves horizontally, back and forth, with the tidal phase. If contamination is being introduced into the estuary from upstream, water sampling from the salt wedge may miss it entirely.

- Oceanic Estuary - characterized by salinities approaching full-strength oceanic waters. Seasonally, freshwater inflow is small with the preponderance of the fresh-saline water mixing occurring near, or at, the shoreline.

Sampling in estuarine areas is normally based upon the tidal phases, with samples collected on successive slack tides (i.e., when the tide turns). Estuarine sampling programs shall include vertical salinity measurements at 1- to 5-foot increments, coupled with vertical dissolved oxygen and temperature profiles.

### 5.3.4 Surface Water Sampling Equipment

The selection of sampling equipment depends on the site conditions and sample type to be acquired. The most frequently used samplers are:

- Open tube.
- Dip sampler.
- Weighted bottle.
- Hand pump.
- Kemmerer.
- Depth-Integrating Sampler.

The dip sampler and the weighted bottle sampler are used most often, and detailed discussions for these devices only (and the Kemmerer sampler) are addressed subsequently in this section.

The criteria for selecting a sampler include:

- Disposability and/or easy decontamination.
- Inexpensive cost (if the item is to be disposed).
- Ease of operation.
- Nonreactive/noncontaminating properties - Teflon-coated, glass, stainless-steel or PVC sample chambers are preferred (in that order).

As specified in the project plan documents, each sample (grab or each aliquot collected for compositing) shall be measured for the following:

- Specific conductance.
- Temperature.
- pH.
- Dissolved oxygen (optional).

Sample measurements shall be conducted as soon as the sample is acquired. Measurement techniques described in SOP 2 shall be followed. All pertinent data and results shall be recorded in a field notebook or on sample logsheets. These analyses will provide information on water mixing/stratification and potential contamination.

Dip Sampling

Water is often sampled by filling a container either attached to a pole or held directly, from just beneath the surface of the water (a dip or grab sample). Constituents measured in grab samples are only indicative of conditions near the surface of the water and may not be a true representation of the total concentration that is distributed throughout the water column and in the cross section. Therefore, whenever possible, it is recommended to augment dip samples with samples that represent both dissolved and suspended constituents and both vertical and horizontal distributions.

Weighted Bottle Sampling

A grab sample can also be taken using a weighted holder that allows a bottle to be lowered to any desired depth, opened for filling, closed, and returned to the surface. This allows discrete sampling with depth. Several of these samples can be combined to provide a vertical composite. Alternatively, an open bottle can be lowered to the bottom and raised to the surface at a uniform rate so that the bottle collects sample throughout the total depth and is just filled on reaching the surface. The resulting sample using either method will roughly approach what is known as a depth-integrated sample.

A closed weighted bottle sampler consists of a stopped glass or plastic bottle, a weight and/or holding device, and lines to open the stopper and lower or raise the bottle. The procedure for sampling with this device is:

- Gently lower the sampler to the desired depth so as not to remove the stopper prematurely (watch for bubbles).
- Pull out the stopper with a sharp jerk of the sampling line.
- Allow the bottle to fill completely, as evidenced by the absence of air bubbles.
- Raise the sampler and cap the bottle.
- Decontaminate the outside of the bottle. This bottle can be used as the sample container as long as the bottle is an approved container type.

Kemmerer

If samples are desired at a specific depth, and the parameters to be measured do not require a Teflon coated sampler, a standard Kemmerer sampler may be used. The Kemmerer sampler is a brass, stainless-steel or acrylic cylinder, with rubber stoppers that leave the ends open while being lowered in a vertical position (thus allowing free passage of water through the cylinder). A "messenger" is sent down

the line when the sampler is at the designated depth, to cause the stoppers to close the cylinder, which is then raised. Water is removed through a valve to fill sample bottles.

### 5.3.5 Surface Water Sampling Techniques

Most samples taken during site investigations are grab samples. Typically, surface water sampling involves immersing the sample container in the body of water; however, the following suggestions are made to help ensure that the samples obtained are representative of site conditions:

- The most representative samples are obtained from mid-channel at a 0.6-foot stream depth in a well-mixed stream.
- Although the containers used to obtain the samples are previously laboratory cleaned,' it is suggested that the sample container be rinsed at least once with the water to be sampled before the sample is taken. This is not applicable when sample containers are provided "pre-preserved."
- For sampling running water, it is suggested that the farthest downstream sample be obtained first, and that subsequent samples be taken as one works upstream. In general, work from zones suspected of low contamination to zones of high contamination.
- To sample a pond or other standing body of water, the surface area may be divided into grids. A series of samples taken from each grid node is combined into one sample, or several grid nodes are selected at random.
- Care should be taken to avoid excessive agitation of the water, as loss of volatile constituents could result.
- When obtaining samples in 40 mL septum vials for volatile organics analysis, it is important to exclude any air space in the top of the bottle and to be sure that the Teflon liner of the septum faces in after the vial is filled and capped. The vial can be turned upside down to check for air bubbles.
- Do not sample at the surface, unless sampling specifically for a known constituent that is immiscible and on top of the water. Instead, the sample container should be inverted, lowered to the approximate depth, and held at about a 45-degree angle with the mouth of the bottle facing upstream. When sample containers are provided "pre-preserved," use a dedicated, clean, un-preserved bottle for sampling and transfer to an appropriately preserved container.

## 5.4 Onsite Water Quality Testing

Onsite water quality testing shall be conducted as described in **SOP** 2.

## 5.5 Sediment Sampling

### 5.5.1 General

Sediment samples are usually collected at the same verticals at which water samples were collected. If only one sediment sample is to be collected, the sampling location shall be approximately at the center of the water body.

Generally, the coarser grained sediments are deposited near the headwaters of the reservoir. Bed sediments near the center of a water body will be composed of fine-grained materials that may, because of their lower porosity and greater surface area available for adsorption, contain greater concentrations of contaminants. The shape, flow pattern, bathometry (i.e., depth distribution), and water circulation patterns

must all be considered when selecting sediment sampling sites. In streams, areas likely to have sediment accumulation (e.g., bends, behind islands or boulders, quiet shallow areas or very deep, low-velocity areas) shall be sampled while areas likely to show net erosion (i.e., high-velocity, turbulent areas) and suspension of fine solid materials, shall be avoided.

Chemical constituents associated with bottom material may reflect an integration of chemical and biological processes. Bottom samples reflect the historical input to streams, lakes, and estuaries with respect to time, application of chemicals, and land use. Bottom sediments (especially fine-grained material) may act as a sink or reservoir for adsorbed heavy metals and organic contaminants (even if water column concentrations are below detection limits). Therefore, it is important to minimize the loss of low-density "fines" during any sampling process.

All relevant information pertaining to sediment sampling shall be documented as applicably described in SOP 5.

### 5.5.2 Sampling Equipment and Techniques

A bottom-material sample may consist of a single scoop or core, or may be a composite of several individual samples in the cross section. Sediment samples may be obtained using onshore or offshore techniques.

When boats are used for sampling, life preservers must be provided and two individuals must undertake the sampling. An additional person shall remain onshore in visual contact at all times.

The following samplers may be used to collect bottom materials:

- Scoop sampler.
- Dredge samplers.

Each type of sampler is discussed subsequently.

Scoop Sampler

A scoop sampler consists of a pole to which a jar or scoop is attached. The pole may be made of bamboo, wood or aluminum and be either telescoping or of fixed length. The scoop or jar at the end of the pole is usually attached using a clamp.

If the water body can be sampled from the shore or if it can be waded, the easiest and best way to collect a sediment sample is to use a scoop sampler. This reduces the potential for cross-contamination. This method is accomplished by reaching over or wading into the water body and, while facing upstream (into the current), scooping the sampler along the bottom in the upstream direction. It is very difficult not to disturb fine-grained materials of the sediment-water interface when using this method.

Dredges

Dredges are generally used to sample sediments that cannot easily be obtained using coring devices (i.e., coarse-grained or partially-cemented materials) or when large quantities of sample are required. Dredges generally consist of a clam shell arrangement of two buckets. The buckets either may close upon impact or be activated by use of a "messenger". Most dredges are heavy (up to several hundred pounds) and require use of a winch and crane assembly for sample retrieval. ,There are three major types of dredges: Peterson, Eckman and Ponar dredges.

The Peterson dredge is used when the bottom is rocky, in very deep water, or when the flow velocity is high. The Peterson dredge shall be lowered very slowly as it approaches bottom, because it can force out and miss lighter materials if allowed to drop freely.

The Eckman dredge has only limited usefulness. It performs well where bottom material is unusually soft, as when covered with organic sludge or light mud. It is unsuitable, however, for sandy, rocky, and hard bottoms and is too light for use in streams with high flow velocities.

The Ponar dredge is a Peterson dredge modified by the addition of side plates and a screen on the top of the sample compartment. The screen over the sample compartment permits water to pass through the sampler as it descends thus reducing the "shock wave" and permitting direct access to the secured sample without opening the closed jaws. The Ponar dredge is easily operated by one person in the same fashion as the Peterson dredge. The Ponar dredge is one of the most effective samplers for general use on all types of substrates.

## *6.0* REFERENCES

American Public Health Association, 1980. Standard Methods for the Examination of Water and Wastewater, 15th Edition, APHA, Washington, D.C.

Feltz, H. R., 1980. Significance of Bottom Material Data in Evaluating Water Quality in Contaminants and Sediments. Ann Arbor, Michigan, Ann Arbor Science Publishers, Inc., V. 1, p. 271-287.

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U.S. EPA, 1980. Standard Operating Procedures and Quality Assurance Manual. Water Surveillance Branch, USEPA Surveillance and Analytical Division, Athens, Georgia.

U.S. Geological Survey, 1977. National Handbook of Recommended Methods for Water-Data Acquisition. Office of Water Data Coordination, USGS, Reston, Virginia.

# SOP 4

# SAMPLE HANDLING

## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on sample preservation, packaging, and shipping procedures to be used in handling environmental samples submitted for chemical constituent, biological, or geotechnical analysis. Sample chain-of-custody procedures and other aspects of field documentation are addressed in SOP 5.

## 2.0 SCOPE

This procedure:

- Describes the appropriate containers to be used for samples depending on the analyses to be performed, and the steps necessary to preserve the samples when shipped off site for chemical analysis.
- Provides instruction for sample packaging and shipping in accordance with current U.S. Department of Transportation (DOT) regulations.

## 3.0 GLOSSARY

Hazardous Material - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been *so* designated. Under 49 CFR, the term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials, as well as materials designated as hazardous under the provisions of 5172.101 and 5172.102 and materials that meet the defining criteria for hazard classes and divisions in Part 173.

Hazardous Waste - Any substance listed in 40 CFR 261, Subpart D, or otherwise characterized as ignitable, corrosive, reactive, or toxic (as defined by Toxicity Characteristic Leaching Procedure, TCLP, analysis) as specified under 40 CFR 261, Subpart C, that would be subject to manifest requirements specified in 40 CFR 262. Such substances are defined and regulated by EPA.

Marking - A descriptive name, identification number, instructions, cautions, weight, specification or UN marks, or combination thereof required on outer packaging of hazardous materials.

n.o.i - Not otherwise indicated (may be used interchangeably with n.o.s.).

n.o.s. - Not otherwise specified.

ORM - Other regulated material (see DOT 49 CFR 173.144).

Packaging - A receptacle and any other components or materials necessary for compliance with the minimum packaging requirements of 49 CFR 174, including containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank-car tanks to perform a containment function in conformance with the minimum packaging requirements of 49 CFR 173.24(a) & (b).

Placard - Color-coded, pictorial sign which depicts the hazard class symbol and name and which is placed on the side of a vehicle transporting certain hazardous materials.

Common Preservatives:

- Hydrochloric Acid - HCl
- Sulfuric Acid - $H_2SO_4$
- Nitric Acid - $HNO_3$
- Sodium Hydroxide- NaOH

Other Preservatives

- Zinc Acetate
- Sodium Thiosulfate - $Na_2S_2O_3$

Normality (N) - Concentration of a solution expressed as equivalent per liter, an equivalent being the amount of a substance containing **1** gram-atom of replaceable hydrogen or its equivalent. Thus, a one-molar solution of HCl, containing **1** gram-atom of H, is "one normal," whereas a one-molar solution of $H_2SO_4$, containing 2 gram-atoms of H, is "two normal."

Reportable Quantity (RQ) - For the purposes of this **SOP,** means the quantity specified in column 3 of the Appendix to DOT **49** CFR §172.101 for any material identified in column **1** of the appendix. A spill greater than the amount specified must be reported to the National Response Center.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the location and time of collection.

## 4.0 RESPONSIBILITIES

Field Operations Leader - Directly responsible for the bottling, preservation, labeling, packaging, shipping, and custody of samples up to and including release to the shipper.

Field Samplers - Responsible for initiating the Chain-of-Custody Record (per SOP SA-6.3), implementing the packaging and shipping requirements, and maintaining custody of samples until they are relinquished to another custodian or to the common carrier.

## 5.0 PROCEDURES

Sample identification, labeling, documentation, and chain-of-custody are addressed by SOP SA-6.3.

### 5.1 Sample Containers

Different types of chemicals react differently with sample containers made of various materials. For example, trace metals adsorb more strongly to glass than to plastic, whereas many organic chemicals may dissolve various types of plastic containers. In general, the sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample warms during transport. However, for collection of volatile organic compounds, headspace shall be omitted. The analytical laboratory will generally provide certified-clean containers for samples to be analyzed for chemical constituents. Shelby tubes or other sample containers are generally provided by the driller for samples requiring geotechnical analysis. Sufficient lead time shall be allowed for a delivery of bottle orders. Therefore, it is critical to use the correct container to maintain the integrity of the sample prior to analysis.

Once opened, the container must be used at once for storage of a particular sample. Unused but opened containers are to be considered contaminated and must be discarded; because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused

containers which appear contaminated upon receipt, or which are found to have loose caps or a missing Teflon liner (if required for the container), shall be discarded.

## 5.2 Sample Preservation

Many water and soil samples are unstable and therefore require preservationto prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Although complete and irreversible preservation of samples is not possible, preservation does retard the chemical and biological changes that inevitably take place after the sample is collected. Preservation techniques are usually limited to pH control, chemical addition(s), and refrigeration/ freezing (certain biological samples only).

### 5.2.1 Overview

The preservation techniques to be used for various analytes are listed in project planning documents. Reagents required for sample preservation either will be added to the sample containers by the laboratory prior to their shipment to the field or be added in the field (in a clean environment). Only high purity reagents shall be used for preservation. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to **4°C.** Medium-concentration aqueous samples and high-hazard organics samples are typically not preserved. Low-concentration aqueous samples for metals are acidified with $HNO_3$, whereas medium-concentration and high-hazard aqueous metal samples are not preserved. Low- or medium-concentration soil samples for metals are cooled to 4°C, whereas high-hazard samples are not preserved.

The following subsections describe the procedures for preparing and adding chemical preservatives. Attachments A and B indicate the specific analytes that require these preservatives.

### 5.2.2 Preparation and Addition of Reagents

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade or purer and shall be diluted to the required concentration with deionized water before field sampling commences. To avoid uncontrolled reactions, be sure to Add Acid to water (not vice versa). A dilutions guide is provided below.

| Acid/Base | Dilution | Concentration | Estimated Amount Required for Preservation |
|---|---|---|---|
| Hydrochloric Acid (HCl) | 1 part concentrated HCl: 1 part double-distilled, deionized water | 6N | 5-10 mL |
| Sulfuric Acid ($H_2SO_4$) | 1 part concentrated $H_2SO_4$: 1 part double-distilled, deionized water | 18N | 2 - 5 mL |
| Nitric Acid ($HNO_3$) | Undiluted concentrated $HNO_3$ | 16N | 2 - 5 mL |
| Sodium Hydroxide (NaOH) | 400 grams solid NaOH dissolved in 870 mL double-distilled, deionized water; yields 1 liter of solution | 10N | 2 mL |

The amounts required for preservation shown in the above table assumes proper preparation of the preservative and addition of the preservative to one liter of aqueous sample (assuming that the sample is initially at pH 7, is poorly buffered, and does not contain particulate matter; as these conditions vary, more preservative may be required). Consequently, the final sample pH must be checked using narrow-range pH paper, as described in the generalized procedure detailed below:

- Pour off 5-10 mL of sample into a dedicated, clean container. Use some of this sample to check the initial sample pH using wide range (0-14) pH paper. Never dip the pH paper into the sample; always apply a drop of sample to the pH paper using a clean stirring rod or pipette.

- Add about one-half of the estimated preservative required to the original sample bottle. Cap and invert gently several times to mix. Check pH (as described above) using medium range pH paper (pH 0-6 or pH 7.5-14, as applicable).

- Cap sample bottle and seal securely.

Additional considerations are discussed below:

- To test if ascorbic acid must be used to remove oxidizing agents present in the sample before it can be properly preserved, place a drop of sample on KI-starch paper. **A** blue color indicates the need for ascorbic acid addition.

  If required, add a few crystals of ascorbic acid to the sample and retest with the KI-starch paper. Repeat until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 grams of ascorbic acid per each liter of sample volume.

  Continue with proper base preservation of the sample as described, generally, above.

- Samples for sulfide analysis must be treated by the addition of **4** drops (0.2 mL) of 2N zinc acetate solution per 100ml of sample.

  The 2N zinc acetate solution is made by dissolving 220 grams of zinc acetate in 870 mL of double-distilled, deionized water to make 1 liter of solution.

  The sample pH is then raised to 9 using the NaOH preservative.

- To test of sodium thiosulfate must be added to remove residual chlorine from a sample, test the sample for residual chlorine using a field test kit especially made for this purpose.

  If residual chlorine is present, add 0.08 grams of sodium thiosulfate per liter of sample to remove the residual chlorine.

  Continue with proper acidification of the sample as described, generally, above.

For biological samples, 10% buffered formalin or isopropanol may also be required for preservation. Questions regarding preservation requirements should be resolved through communication with the laboratory before sampling begins.

### 5.3 Field Filtration

At times, field-filtration may be required to provide for the analysis of dissolved chemical constituents. Field-filtration must be performed prior to the preservation of samples as described above. General procedures for field filtration are described below:

- The sample shall be filtered through a non-metallic, 0.45-micron membrane filter, immediately after collection. The filtration system shall consist of dedicated filter canister, dedicated silicon tubing, and a peristaltic pump with pressure or vacuum pumping squeeze action (since the sample is filtered by mechanical peristalsis, the sample travels only through the tubing).

- To perform filtration, thread the silicon tubing through the peristaltic pump head. Attach the filter canister to the discharge end of the silicon tubing (note flow direction arrow); attach the aqueous sample container to the intake end of the silicon tubing. Turn the peristaltic pump on and perform filtration.

- Continue by preserving the filtrate (contained in the filter canister), as applicable and generally described above.

### 5.4 Sample Packaging and Shipping

Samples collected for shipment from a site shall be classified as either environmental or hazardous material samples. Samples from drums containing materials other than Investigative Derived Waste (IDW) and samples obtained from waste piles or bulk storage tanks are generally shipped as hazardous materials. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples (if there is any doubt, a sample shall be considered hazardous and shipped accordingly.)

- Protect the health and safety of transport and laboratory personnel receiving the samples (special precautions are used by the shipper and at laboratories when hazardous materials are received.)

Detailed procedures for packaging environmental and hazardous material samples are outlined in the remainder of this section.

#### 5.4.1 Environmental Samples

Environmental samples are packaged as follows:

- Place sample container, properly identified and with lid securely fastened in a plastic bag (e.g. Ziploc baggie), and seal the bag.

- Place sample in a cooler constructed of sturdy material that has been lined with a large, plastic (e.g. "garbage" bag).

- Pack with enough noncombustible, absorbent, cushioning materials such as vermiculite (shoulders of bottles must be iced if required) to minimize the possibility of the container breaking.

- If cooling is required, double-bag ice in Ziploc baggies and place around container shoulders and on top of absorbent packing material (minimum of 8 pounds of ice for a medium-size cooler). "Blue ice" may also be used.

- Seal (i.e., tape or tie top in knot) large liner bag.

- The original (top, signed copy) and extra carbonless copies of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment.

- Close and seal outside of cooler as described in SOP 5. Signed custody seals must be used.

Coolers must be marked as containing "Environmental Samples." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required; there are no DOT restrictions on mode of transportation.

**5.4.2** Determination of Shipping Classification for Hazardous Material Samples

Samples not determined to be environmental samples, or samples known or expected to contain hazardous materials, must be considered hazardous material samples and transported according to the requirements listed below.

5.4.2.1 Known Substances

If the substance in the sample is known or can be identified, package, mark, label, and ship according to the specific instructions for that material (if it is listed) in the DOT Hazardous Materials Table, 49 CFR 172.101.

To determine the proper shipping name, use the following steps to help locate the shipping name on the Hazardous Materials Table, DOT 49 CFR 172.101.

1. Look first for the chemical or technical name of the material, for example, ethyl alcohol. Note that many chemicals have more than one technical name, for example, perchloroethylene (not listed in 172.101) is listed as tetrachloroethylene (listed 172.101). It may be useful to consult a chemist for all possible technical names a material can have. If your material is not listed by its technical name, then . . .

2. Look for the chemical family name. For example, pentyl alcohol is not listed but the chemical family name is: alcohol, n.o.s. (not otherwise specified). If the chemical family name is not listed, then . . .

3. Look for a generic name based on end use. For example, Paint, n.o.s or Fireworks, n.o.s. If a generic name based on end use is not listed, then. . .

4. Look for a generic family name based on end use, for example, drugs, n.o.s. or cosmetics, n.o.s. Finally, if your material is not listed by a generic family name but you suspect or know the material is hazardous because it meets the definition of one or more hazardous classes, then . . .

5. You will have to use the general hazard class for a proper shipping name. For example, Flammable Liquid, n.o.s, or Oxidizer, n.o.s.

5.4.2.2 Unknown Substances

For samples of hazardous substances of unknown content, select the appropriate transportation category according to the DOT hazardous materials classification of a material having more than one hazard. This procedure is outlined in DOT Regulation 49 CFR 173.2a.

The correct shipping classification for an unknown sample is selected through a process of elimination, as outlined in DOT Regulation 49 CFR 172.101(c)(11). By using the provisions in this paragraph, the proper shipping name and description will be determined. A step-by-step guide is provided by the Department of Transportation (DOT).

### 5.4.3 Packaging and Shipping of Samples Classified as Flammable Liquid (or Solid)

5.4.3.1 Packaging

Applying the word "flammable" to a sample does not imply that it is in fact flammable. The word prescribes the class of packaging according to DOT regulations.

1. Containerize sample as required. To prevent leakage, fill container no more than 90 percent full. Seal lid with teflon tape or wire.

2. Complete sample label and attach securely *to* sample container.

3. Seal container and place in 2-mil-thick (or thicker) polyethylene bag (e.g., Ziploc baggie), one sample per bag. Position sample identification label so that it can be read through bag. Seal bag.

4. For soil jars, place sealed bag inside metal can (available from laboratory or laboratory supplier) and cushion it with enough noncombustible, absorbent material (for example, vermiculite or diatomaceous earth) between the bottom and sides of the can and bag to prevent breakage and absorb leakage. Pack one bag per can. Use clips, tape, **or** other positive means to hold can lid securely, tightly and permanently. Mark can as indicated in Paragraph 1 of Section 5.3.4.2, below. Single 1-gallon bottles do not need to be placed in metal cans.

5. Place one or more metal cans (or a single 1-gallon bottle) into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround cans (or bottle) with noncombustible, absorbent cushioning materials for stability during transport. The absorbent material should be able to absorb the entire contents of the container. Mark container as indicated in Paragraph 2 below.

5.4.3.2 Marking/Labeling

1. Use abbreviations only where specified. Place the following information, either hand-printed or in label form, on the metal can (or 1-gallon bottle):

   - Laboratory name and address.

   - Proper shipping name from the hazardous materials table (DOT Regulation CFR 49 172.101). Example: "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325." This will include packing group (see Section 5.3.4.2, No. 2.)

     Not otherwise specified (n.o.s) is not used if the flammable liquid (or solid) is identified. If identified, the name of the specific material is listed before the category (for example, Acetone, Flammable Liquid), followed by its appropriate UN number found in the DOT Hazardous Materials table (49 CFR 172.101).

2. Determine packing group. The packing group is part of the proper shipping name and must be included on the shipping papers in the description section.

   I. Most Hazardous
   II. Medium Hazard
   III. Least Hazardous

   The packing group will be listed in the hazardous materials table, column 5.

3. Place all information on outside shipping container as on can (or bottle), specifically:

   - Proper shipping name
   - UN or NA number
   - Proper label(s)
   - Addressee and sender

   Place the following labels on the outside shipping container: "Cargo Aircraft Only" and DOT label such as: "Flammable Liquid" (or "Flammable Solid"). "Dangerous When Wet" label shall be used if the Flammable Solid has not been exposed to a wet environment. "Laboratory Samples" and "THIS SIDE UP" or "THIS END UP" shall also be marked on the top of the outside container, and upward-pointing arrows shall be placed on all four sides of the container.

5.4.3.3 Shipping Papers

1. Use abbreviations only where specified. Complete the carrier-provided bill of lading and sign certification statement. Provide the following information in the order listed (one form may be used for more than one exterior container):

   - Proper shipping name. (Example: "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325 Packing Group I, II, III").

   - "Limited Quantity" (or "Ltd. Qty."). (See No. 3, below.)

   - "Cargo Aircraft Only."

   - Net weight (wt) or net volume (vol), just before or just after "Flammable Liquid, n.o.s." or "Flammable Solid, n.o.s.," by item, if more than one metal can is inside an exterior container.

   - "Laboratory Samples" (if applicable).

2. Include Chain-of-Custody Record, properly executed in outside container; use custody seals.

3. "Limited Quantity" means the maximum amount of a hazardous material for which there is a specific labeling or packaging exception (DOT CFR 49 171.8). This may mean that packages are exempted from labeling requirements. To determine if your sample meets the Limited Quantity Exception, refer to DOT Regulation CFR 49 Subpart C 173.50 through 173.156. First, determine the proper classification and shipping name for the material; then refer to the exception requirements for that particular class of material beginning with 173.50.

   Example: "Flammable Liquid n.o.s. UN1993 Packing Group 1." The outer package can weigh no more than 66 pounds gross weight. The inner package or container can weigh no more than 0.1 gallon net capacity for each container.

   To determine whether the material can be shipped as a "Limited Quantity," you must check the specific requirement for that class of material.

5.4.3.4 Transportation

1. The majority of unknown hazardous substance samples will be classified as flammable liquids. The samples will be transported by rented or common carrier truck, railroad, or express overnight package services. Do not transport samples on any passenger-carrying air transport system, even if the system has cargo-only aircraft. DOT regulations permit regular airline cargo-only aircraft, but difficulties with most suggest avoiding them. Instead, ship by airline carriers that carry only cargo. If unsure of what mode of transportation to use, consult the FOL or Project Manager.

2. For transport by government-owned vehicle, including aircraft, DOT regulations do not apply. However, procedures described above, with the exception of execution of the bill of lading with certification, shall still be followed.

3. . In some cases, various materials may react if they break during shipment.

## 5.0 REFERENCES

American Public Health Association, 1981. Standard Methods for the Examination of Water and Wastewater, 15th Edition. APHA, Washington, D.C.

U.S. Department of Transportation, 1993. Hazardous Materials Regulations, 49 CFR 171-177.

U.S. EPA, 1984. "Guidelines Establishing Test Procedures for the Analysis of Pollutants under Clean Water Act." Federal Register, Volume 49 (209), October 26, 1984, p. 43234.

U.S. EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, U.S. EPA-EMSL, Cincinnati, Ohio.

# SOP 5

# FIELD DOCUMENTATION

## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs and reports generally initiated and maintained for documenting field activities.

## 2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all field activities, as applicable. Other or additional documents may be required by specific client contracts.

## 3.0 GLOSSARY

None

## 4.0 RESPONSIBILITIES

Proiect Manaaer - The Project Manager is responsible for obtaining hardbound, controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all forms used in site activities (i.e., records, field reports, and upon the completion of field work, the site logbook) in the project's central file.

Field Operations Leader (FOL) - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate forms and field reports illustrated in this guideline (and any additional forms required by the client) are correctly used, accurately filled out, and completed in the required time-frame.

## 5.0 PROCEDURES

### 5.1 Site Logbook

#### 5.1.1 General

The site logbook is a hard-bound, paginated controlled-distribution record book in which all major onsite activities are documented. At a minimum, the following activities/events shall be recorded (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start or completion of borehole/trench/monitoring well installation or sampling activities
- Daily onsite activities performed each day
- Sample pickup information
- Health and Safety issues (level of protection observed, etc.)
- Weather conditions

A site logbook shall be maintained for each project. The site logbook shall be initiated at the start of the first onsite activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day

that onsite activities take place. Upon completion of the fieldwork, the site logbook must become part of the project's central file.

The following information must be recorded on the cover of each site logbook:

- Project name
- Project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2), but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable).

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the site notebook in which the measurements are recorded.

All logbook, notebook, and log sheet entries shall be made in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used must be signed and dated. The site logbook must also be signed by the Field Operations Leader at the end of each day.

### 5.1.2 Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they must be numbered sequentially to correspond to logbook entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook. If possible, such techniques shall be avoided, since they can adversely affect the admissibility of photographs as evidence. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation requires chain-of-custody procedures. Adequate logbook notation and receipts must be compiled to account for routine film processing. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook descriptions. The site photographs and associated negatives must be docketed into the project's central file.

## 5.2 Site Notebooks

Key field team personnel may maintain a separate dedicated notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a separate site notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a site notebook.

## 5.3 Sample Forms

Example forms are provided at the end of this SOP. Forms may be altered or revised for project-specific needs contingent upon client approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOP.

### 5.3.1 Sample Collection, Labeling, Shipment and Request for Analysis

#### 5.3.1.1 Sample Log Sheet

Sample Log Sheets are used to record specified types of data while sampling. The data recorded on these sheets are useful in describing the waste source and sample as well as pointing out any problems encountered during sampling. A log sheet must be completed for each sample obtained, including field quality control (QC) samples.

#### 5.3.1.2 Sample Label

Adhesive labels must be completed and applied to every sample container. Sample labels can usually be obtained from the appropriate Program source or are supplied from the laboratory subcontractor.

#### 5.3.1.3 Chain-of-Custodv Record Form

The Chain-of-Custody (COC) Record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site. One part of the completed COC form is retained by the field crew while the other two or three portions are sent to the laboratory. The original (top, signed copy) and extra carbonless copies of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment. Once the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed COC form (any discrepancies between the sample labels and COC form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the Project Manager). The COC form is signed and one of the remaining two parts are retained by the laboratory while the last part becomes part of the samples' corresponding analytical data package. Internal laboratory chain-of-custody procedures are documented in the Laboratory Quality Assurance Plan (LQAP).

A checklist of information that is to be included on the example chain-of-custody form is provided below. Note that the actual form may differ slightly depending on the laboratory used.

- Project No. – Sampling contractor project number.
- Site Name – NIROP Fridley.
- Samples – Signatures of person(s) who collected the sample.
- Station No. – Sample Location.
- Date – Day, month, and year sample was collected.
- Time – Time of sample collection. Include a.m. or p.m. if not using 24-hour clock.
- Sample Station ID – Unique sample identification number.
- No. of Containers – Total number of bottles that are filled for each sample.
- Diagonal lines – Analyses requested and type of sample container (e.g., VOCs, 40-ml vial).
- Intersection of Station Location and Analyses Requested – Number of sample bottles for the analysis requested.
- Remarks (right side of form) – Write any pertinent comments here.

- Relinquished By – Sign and print name when relinquishing custody of the samples.
- Remarks (bottom of form) – Enter the overnight carrier air bill number.

5.3.1.4 Chain-of-Custodv Seal

The Custody seal is also an adhesive-backed label. It is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transit to the laboratory. The COC seals are signed and dated by the samplers and affixed across the opening edges of each cooler containing environmental samples. COC seals may be available from the laboratory; these seals may also be purchased from a supplier.

### 5.3.2 Groundwater Level Measurement Sheet

A groundwater level measurement sheet must be filled out for each round of water level measurements made at a site.

### 5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring or test equipment is necessary to assure the proper operation and response of the equipment, to document the accuracy, precision or sensitivity of the measurement, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device used in the field; entries must be made for each day the equipment is used.

# APPENDIX C

# VOLATILE ORGANIC COMPOUND DATA VALIDATION STANDARD OPERATING PROCEDURES

## TABLE OF CONTENTS

| SECTION | | PAGE |
|---|---|---|
| 1.0 | VOLATILE ORGANICS BY GC/MS | 2 |
| 1.1 | VOLATILES (SW-846 METHOD 82606) | 2 |
| 1.1.1 | Applicability | 2 |
| 1.1.2 | Interferences | 2 |
| 1.1.3 | General Laboratory Practices | 2 |
| 1.1.4 | Sample Preparation | 3 |
| 1.1.5 | Data Overview Prior to Validation | 3 |
| 1.1.6 | Technical Evaluation Summary | 3 |
| 1.1.7 | Deliverables Guidance | 6 |

## 1.0 VOLATILE ORGANICS BY GC/MS

### 1.1 Volatiles (SW-846 Method 8260B)

#### 1.1.1 Applicability

SW-846 Method 8260B volatile methodology is used to determine organic compounds in most matrices including groundwater, sludges, caustic liquors, acid liquors, waste solvents, oily wastes, mousses, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments.

The CLP volatile Target Compound List (TCL) includes the following compounds:

Acetone
Benzene
Brornodichloromethane
Bromoform
Bromomethane
2-Butanone
Carbon Disulfide
Carbon Tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
Cyclohexane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
Trichlorofluoromethane
1,4-Dichlorobenzene
1,2-Dibromo-3-chloro-propane
Dibromochloromethane
Dichlorodifluoromethane
1,2-Dibromoethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
cis-1.3-Dichloropropene
trans-1,3-Dichloropropene
Ethyl Benzene
2-Hexanone
Isopropylbenzene
Methyl acetate
Methylcyclohexane
Methylene Chloride
4-Methyl-PPentanone
MJBE
Styrene
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,1,2-Trichloro-1,2,2-Trifluoroethane
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Vinyl Chloride
Xylenes (total)

#### 1.1.2 Interferences

Samples can be contaminated by diffusion of volatile organics (particularly chlorofluorocarbons and methylene chloride) through the sample container septum during shipment and storage. Associated field quality control blanks are analyzed in order to monitor this.

Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. To reduce carryover, the sample syringe or purging device is rinsed with reagent water between samples. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of reagent water to check for cross contamination.

If sample or matrix interferences are encountered, a secondary or alternate analytical column may be used to resolve the compounds of interest.

#### 1.1.3 General Laboratory Practices

A method blank consisting of organic free water spiked with surrogates and internal standards should be analyzed immediately following each daily calibration, and also after the analysis of every high concentration sample.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) analyses should be conducted to determine the effects of sample matrix upon the compounds of interest.

### 1.1.4 Sample Preparation

A purge- and -trap procedure is performed to prepare and extract volatile compounds from samples and to introduce those compounds into the GC/MS.

For highly volatile matrices, direct injection preceded by dilution should be used to prevent gross contamination of the instrumentation. For pastes, dilution of the sample until it becomes free-flowing is used to ensure adequate interfacial area. The success of this method depends on the level of interferences in the sample: results may vary due to the large variability and complicated matrices of solid waste samples.

### 1.1.5 Data Overview Prior to Validation

Before commencing validation, the reviewer must preview the associated Chain-of-Custody (COC) reports to determine:

- If the appropriate numbers of samples are present in the data package and if each sample was correctly analyzed for the parameters and methods specified.
- The identity of all associated field quality control blanks and field duplicate pairs.

Because many samples may have required dilutions, re-extractions and/or re-analyses, the validator should preview the data package contents to determine which analyses represent the better quality data.

Unless specifically directed by client protocol, never annotate the laboratory data package. Before beginning evaluation, prepare working copies (i.e., photocopies) of all Form I reports (including those for samples, laboratory method blanks and MS/MSD analyses), and all laboratory quality control summary forms (including all initial and continuing calibration summary statistics).

### 1.1.6 Technical Evaluation Summary

All data evaluations must be conducted in accordance with the National Functional Guidelines for Organic Data Review (USEPA, 1999a) to the greatest extent practicable.

General parameters such as Data Completeness, Overall System Performance, Chromatographic Quality, and Detection Limits are evaluated concurrently with the parameters discussed in the following subsections.

#### 1.1.6.1 Holding Times

Holding times are evaluated by reviewing the COC reports, the individual sample Form I reports, and the associated laboratory raw data. Holding times are calculated from date of collection to date of analysis.

For unpreserved aqueous samples, generally a 7-day maximum holding time allowance for aromatic compounds, along with a 14-day maximum holding time allowance for chlorinated hydrocarbons is used.

The technical maximum holding time allowance for aqueous samples preserved with hydrochloric acid (HCL) is 14 days.

A 14 day holding time for solid matrices is currently being used; 48 hours to methanol preservation for encore sampling devices.

Positive results in affected samples are generally qualified as estimated (J); nondetects (UJ). These results are biased low. If the holding times are exceeded by a factor of 2 or more, the holding time exceedance is considered to be gross, and positive results are generally qualified as estimated (J); non-detects are generally considered to be unreliable and are qualified (R). Results for which the holding time was grossly exceeded are biased very low.

**1.1.6.2** Calibration

Check that an initial calibration was performed for each instrument used for analysis and that all calibrations were performed at all appropriate concentration levels within 12 hours of the associated instrument tuning.

Review the data package Form Vs (tuning) to ensure that the following ion abundance criteria are met:

Bromofluorobenzene (BFB)

| m/z | ION ABUNDANCE CRITERIA |
|---|---|
| 50 | 8.0-40.0% of m/z 95 |
| 75 | 30.0-66.0% of m/z 95 |
| 95 | Base Peak, 100% relative abundance |
| 96 | 5.0-9.0% of m/z 95 |
| 173 | Less than 2.0% of m/z 174 |
| 174 | 50.0-120.0% of m/z 95 |
| 175 | 4.0-9.0% of m/z 174 |
| 176 | 93.0-101.0% of m/z 174 |
| 177 | 5.0-9.0% of m/z 176 |

Review initial calibration Form VIs and the associated laboratory raw data. Determine which compounds have average Relative Response Factors (RRFs) <0.050 and which compounds have Percent Relative Standard Deviations (%RSDs) >30%. Circle these noncompliance's on your working copies of these Forms. Spot-check (i.e., recalculate) a few of the RRFs and %RSDs to verify the laboratory's computation.

Determine which samples are affected by reviewing the continuing calibration Form VIIs. Check the initial calibration date(s) noted in the headings of the Form VIIs to determine which continuing calibrations are associated *with* which initial calibrations. Next, review the sample listings given on the data package Form Vs. Match the indicated continuing calibration run with the appropriate Form VII by matching the laboratory file ID numbers. Write the affected samples (those listed on the matched Form V) on your working copies of the appropriate Form VI and VII.

Review the continuing Calibration Form VIIs and the associated laboratory raw data. Determine which compounds have RRFs <0.050 and which compounds have Percent Differences (%Ds) >25%; circle the noncompliance's on your working copies of these Forms. Spot-check (i.e., recalculate) a few of the RRFs and %Ds to verify the laboratory's computation.

Generally, affected positive results for compounds for which RRFs are <0.050 are qualified as estimated (J); non-detects are rejected (R). Bias for these results is very low.

Generally, positive results for compounds for which %RSD exceeds 30% or %D exceeds 25% are qualified as estimated (J); non-detects (UJ). Bias for these results cannot be determined.

Generally, positive results for compounds for which %RSD is between 30%-50% are qualified as estimated, (J). Qualification of non-detects is protocol-specific. Follow the rules given in the appropriate validation protocol.

1.1.6.3 Blank Contamination

When using the information given below, keep in mind that the validation action levels derived are sample specific and must be adjusted for dilution, sample aliquot used for analysis, and sample moisture content (when applicable).

The blank contamination review process is completed by first considering the maximum amount of a particular contaminant occurring in the laboratory method blanks. (Do not consider lab blanks run after high concentration samples for purposes of determining carryover as laboratory method blanks!) Then repeat the process for contaminants occurring in the associated field quality control blanks. Action levels for qualification (10X or 5X depending upon whether or not the contaminant is a common contaminant) are then set. The list of common contaminants consists of methylene chloride, acetone, and 2-butanone. The "B" flag should not be removed from the data. The following examples should be used to qualify data based on laboratory blanks and/or field quality blanks:

Example 1. Sample result is less than the 5X or 10X multiple of the blank result.

| | 10X | Rule | 5x |
|---|---|---|---|
| Blank Result | 7 | | 7 |
| CRQL | 5 | | 5 |
| Sample Result | 60B | | 30B |
| Final Sample Result | 60BU | | 30BU |

Example 2. Sample result is greater than the 5X or 10X multiple of the blank result.

| | 10X | Rule | 5x |
|---|---|---|---|
| Blank Result | 10 | | 10 |
| CRQL | 5 | | 5 |
| Sample Result | 120B | | 60B |
| Final Sample Result | 120BJ | | 60BJ |

1.1.6.4 Surrogates

Surrogates are evaluated by reviewing the laboratory data package Form II reports and the laboratory raw data. The quality control ranges are given on the laboratory data package Form IIs; circle any noncompliance's on your working copies of these Forms.

Results for all compounds in an affected sample are qualified if any one of the surrogate spike compounds fail to meet the quality control criteria provided. Samples having a surrogate recovery <10%, positive results are qualified as estimated (J), non-detects are rejected (R). These results are biased low. For samples having a surrogate recovery which is low but >10%, positive results are qualified as estimated (J); non-detects (UJ). For samples having a surrogate recovery which is high, positive results are qualified as estimated (J); non-detects are not qualified based on high surrogate recoveries.

1.1.6.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD recoveries are evaluated by reviewing the laboratory data package Form III reports and the laboratory raw data. Samples with compounds that have recoveries outside the acceptance windows are qualified estimated (J) for those compounds. Samples with compounds that have recoveries less than 10

%, those compounds are qualified estimated (J) for positive results and rejected (R) for non-detected results. Qualification for that particular noncompliant compound is qualified in the original unspiked sample.

1.1.6.6 Internal Standards

Intemal standards are evaluated by reviewing the data package Form VIIIs and the laboratory raw data. The quality control ranges are given on the Form VIIIs. Circle any noncompliance's on your working copies of these forms; evaluate and qualify as outlined below.

If an IS area count for a sample is less than 10 % of the area of the associated standard:

Positive results for compounds quantitated using that IS are qualified as estimated (J).

Non-detected compounds are rejected (R) as unusable.

If an IS area count for a sample is outside the -50% or +100% of the area for the associated standard:

Positive results for compounds quantitated using that IS are qualified as estimated (J).

Non-detected compounds quantitated using an IS area count less than 50% are reported at the sample quantitation limit and qualified estimated (UJ). Non-detected compounds quantitated using an IS area count greater than 100% are not qualified.

If an IS retention time is outside of the ±0.5 relative time units:

Non-detected compounds are rejected (R) as unusable. Positive results are not qualified if confirmed by mass spectra.

1.1.6.7 Field Duplicates

The relative percent difference (RPD) between field duplicate results for the aqueous matrix should be less than 35%; for soil matrix results, less than 50%. Qualification of the sample data is limited to the specific field duplicate pair. Positive results for compounds showing imprecision are qualified as estimated (J); non-detects (UJ). Bias for these results cannot be determined.

1.1.6.8 Taraet Compound Identification

The relative retention times (RRTs) must be within d.06 RRT units of the standard RRT.

Mass spectra of the sample compound and a current laboratory-generated standard must match according to the following criteria:

All ions present in the standard mass spectrum at a relative intensity greater than 10% must be present in the sample spectrum.

The relative intensities of these ions must agree within ±20% between the standard and sample spectra.

Ions present at greater than 10% in the sample mass spectrum but not present in the standard spectrum must be considered and accounted for.

The application of qualitative criteria for GC/MS analysis of target compounds requires professional judgment. It is up to the reviewer's discretion to obtain additional information from the laboratory. If it is determined that incorrect identifications were made, all such data are qualified as not detected (U) or rejected (R). Laboratory precision can be evaluated by comparing the unspiked sample results with MS/MSD analyses results for unspiked compounds. Consider non-detects and results reported at concentrations less than the Contract Required Quantitation Limit (CRQL) to be in agreement. Use professional judgment in determining whether to qualify sample results based on the comparison.

**1.1.6.9** Other Considerations

Laboratory precision can be evaluated by comparing the unspiked sample results with MS/MSD analyses results for unspiked compounds. Consider non-detects and results reported at concentrations less than the Contract Required Quantitation Limit (CRQL) to be in agreement. Use professional judgment in determining whether to qualify sample results based on the comparison.

Data will be qualified according to the "Percent Solids" rule. For example, if a sediment sample contains <30% solids, all associated data are considered to be estimated and are qualified (J) and (UJ) accordingly.

**1.1.6.10** Quantitation

Verify and record the quantitation of at least one compound per analytical fraction. If no positive results are reported, use the MS/MSD data to confirm proper computation by the laboratory. Validator and laboratory quantitations must agree within 10 %.

If verification of analytical results cannot be confirmed, the data reviewer must contact the laboratory in order to resolve quantitative variances.

**1.1.7 Deliverables Guidance**

In addition to the data validation memorandum and data summary spreadsheets, all laboratory data package quality control summary forms, sample Form I reports, method blank Form Is, and the Chain-of-Custody report must be given to the Data Validation Quality Assurance Officer (DV/QAO) for quality assurance review.

The validator should ensure that the format of the data validation deliverable is complete and correct (in accordance with the project specific requirements and/or laboratory technical specifications) and that the validation narrative is free of transcription and typographical errors before submitting all requested items for DV/QAO review..