N00164.AR.000480
NSWC CRANE
5090.3a

DEPARTMENT OF THE NAVY
CRANE DIVISION
NAVAL SURFACE WARFARE CENTER
300 HIGHWAY 361
CRANE, INDIANA 47522-5000

IN REPLY REFER TO:

5090
Ser 095/9199
20 OCT 1999

U.S. Environmental Protection Agency, Region V
Waste, Pesticides, & Toxics Division
Waste Management Branch
Illinois, Indiana, and Michigan Section
ATTN: Mr. Peter Ramanauskas (DW-8J)
77 West Jackson Blvd.
Chicago, IL 60604

Dear Mr. Ramanauskas:

Crane Division, Naval Surface Warfare Center (NAVSURFWARCENDIV Crane) submits two copies of the change pages for the Field Sampling Plan as enclosure (1). This plan is for ground water monitoring at the Ammunition Burning Grounds, Old Rifle Range, Demolition Range, and Old Jeep Trail. The changes address U.S. EPA comments from a letter dated August 25, 1999, as well as hand written comments on Attachment F of the Internal Draft Subpart X permit. Enclosure (2) is the required Certification Statement.

NAVSURFWARCENDIV Crane point of contact is Mr. Thomas J. Brent, Code 09510, telephone 812-854-6160.

Sincerely,

James M. Hunsicker
Director, Environmental
Protection Department
By direction of the Commander

Encl:
(1) Field Sampling Plan Change Pages
(2) Certification Statement

Copy to:
ADMINISTRATIVE RECORD (w/2 copies)
SOUTHNAVFACENGCOM (Code 1864) (w/o encl)
IDEM (Mike Sickels) (w/1 copy)
TTNUS (Ralph Basinski)

CHANGE PAGES
FOR THE

FIELD SAMPLING PLAN

FOR
GROUND WATER MONITORING
AT THE

AMMUNITION BURNING GROUNDS,
OLD RIFLE RANGE,
DEMOLITION RANGE,
AND OLD JEEP TRAIL.

Enclosure (1)

FIELD SAMPLING PLAN
FOR
RCRA GROUND WATER MONITORING
AT THE
AMMUNITION BURNING GROUNDS, OLD RIFLE RANGE, DEMOLITION RANGE, AND OLD JEEP TRAIL

NAVAL SURFACE WARFARE CENTER, CRANE DIVISION
CRANE, INDIANA

REVISION 3
SEPTEMBER 1999

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 0038

_____ Date_____
RALPH R. BASINSKI, Q.E.P.
TASK ORDER MANAGER
TETRA TECH NUS, INC.

_____ Date_____
PAUL V. FRANK
QUALITY ASSURANCE MANAGER
TETRA TECH NUS, INC.

_____ Date_____
PETER RAMANAUSKAS
PERMITTING PROJECT MANAGER
U.S. EPA REGION 5

_____ Date_____
E.P. JOHNS
ENGINEER IN CHARGE U.S. NAVY
NAVAL FACILITIES ENGINEERING COMMAND

_____ Date_____
TOM BRENT
PERMIT PROJECT MANAGER
NSWC CRANE

_____ Date_____
DEBBIE WROBLEWSKI
PROGRAM MANAGER
TETRA TECH NUS, INC.

_____ Date_____
ALLEN DEBUS
QUALITY ASSURANCE REVIEWER
U.S. EPA REGION 5

_____ Date_____
JIM HUNSIKER
ENVIRONMENTAL DEPARTMENT MANAGER
NSWC CRANE

_____ Date_____
KARYL SCHMIDT
HAZARDOUS WASTE GEOLOGIST
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

1.0 INTRODUCTION

This Field Sampling Plan (FSP) for the Naval Surface Warfare Center Crane (NSWC Crane), Indiana, was prepared for the U.S. Department of the Navy (Navy) by Tetra Tech NUS, Inc. (TtNUS) under the Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) contract, Contract Number N62467-94-D-0888, Contract Task Order (CTO) 038. A copy of this FSP is maintained at the NSWC Crane Environmental Division offices.

This FSP describes the standard sampling procedures to be used for the long-term ground water monitoring program for the Ammunition Burning Grounds (ABG), Old Rifle Range (ORR), and Demolition Range (DR) at the NSWC Crane, Indiana. The sampling procedures also apply to corrective action monitoring at the Old Jeep Trail (OJT). Specific monitoring points and analyses have not yet been identified for the OJT. The FSP supports a scope of work for the completion of the RCRA Quality Assurance Project Plan (QAPP). This FSP specifies requirements for all field sampling work that may be undertaken under this QAPP at the NSWC Crane facility and serves as a stand-alone guide for use in the field by all members of the field team. All monitoring will comply with applicable Indiana and United States Environmental Protection Agency (U.S. EPA) regulations. This document has been prepared in accordance with the U.S. EPA Region 5 QAPP Policy (U.S. EPA Region 5, April 1998).

All field sampling activities will be conducted in accordance with the site security and Health and Safety Plan developed for the field sampling activities described in this FSP.

The ground water monitoring program at the ABG, ORR, DR, and OJT of the NSWC Crane facility will consist of the following tasks:

- Ground water sampling
- Maintain permanent monitoring wells
- Ground water spring sampling
- Surface water sampling
- Equipment decontamination

- Ground water-level measurements

- Investigation-derived waste handling and disposal

This FSP consists of five sections. Section 1.0 presents this introduction. Section 2.0 provides a brief description of the background information at the site. Section 3.0 details the present ground water monitoring system. Section 4.0 provides detailed information on site-specific aspects of the environmental sampling procedures and field operations. Section 5.0 provides a project schedule for implementation of the FSP.

Boring logs/monitoring well construction sheets, Field Forms, and Standard Operating Procedures (SOPs) for these activities are included in Appendices A, B, and C, respectively. Appendix D contains a table that summarizes subsets of the explosives constituents list to be used for the ground water monitoring program.

1.1 PROJECT ORGANIZATION AND RESPONSIBILITIES

This section presents the project management for the RCRA Ground Water and Surface Water Monitoring program to be conducted at the NSWC Crane ABG, ORR, and DR and the Corrective Action Monitoring program for the OJT. Included in the following sections are the staffing and coordination requirements.

1.1.1 Project Organization Chart

At the direction of the Navy, TtNUS is responsible for the overall management and implementation of contract field activities. Personnel from the Navy will be actively involved and will coordinate with TtNUS personnel in a number of areas. The authorities and organizational relationship of key personnel are depicted in Figure 1-1. Corresponding addresses and telephone numbers of key personnel are listed by organization in Table 1-1. 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 responsibilities to the extent that the specific person is available to perform the stated activities.

FIGURE 1-1

PROJECT ORGANIZATION CHART NAVAL SURFACE WARFARE CENTER CRANE, INDIANA

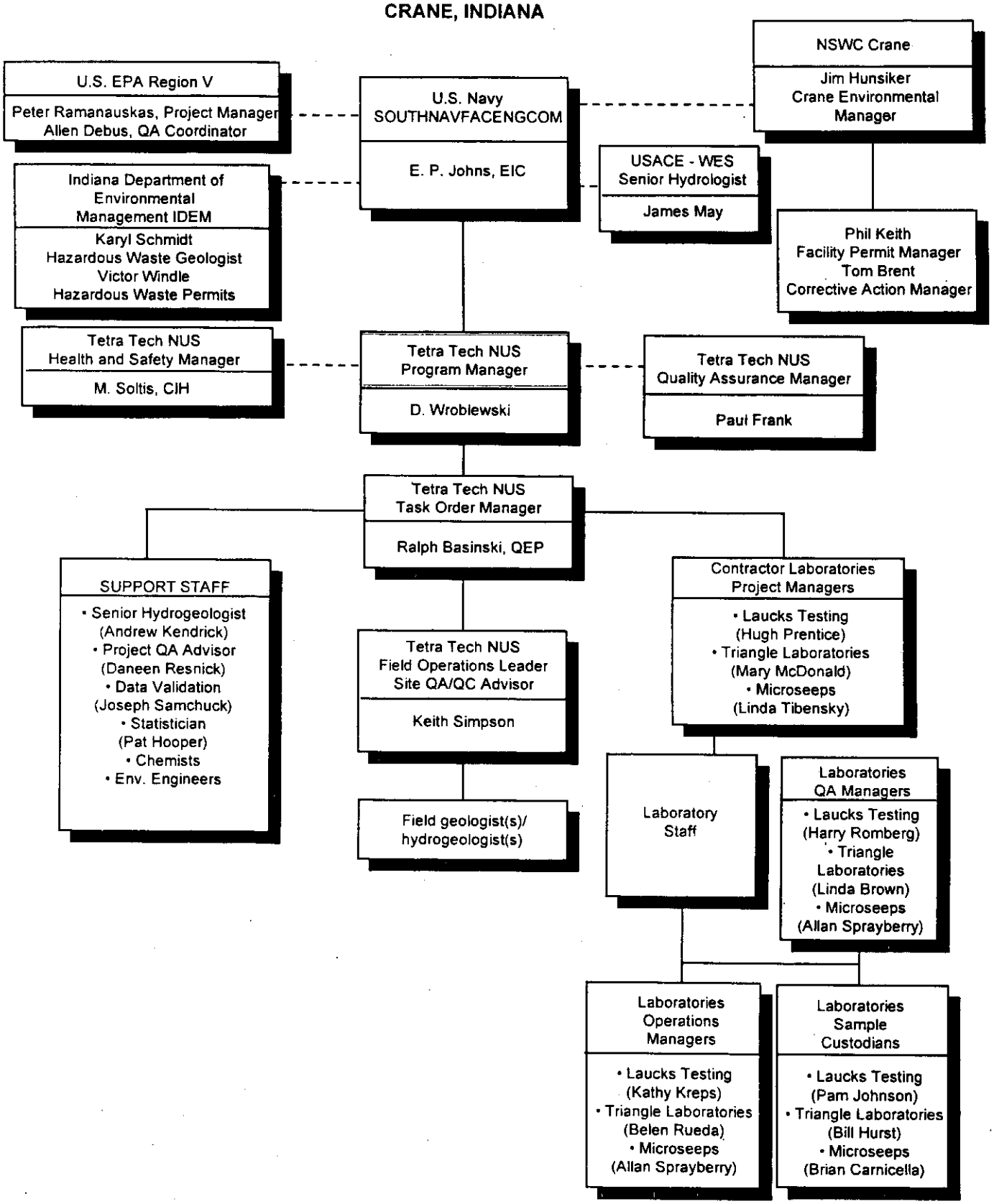

TABLE 1-1

CONTACT LIST
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA
PAGE 1 OF 3

PERSON/ TITLE/ ORGANIZATION	ADDRESS	TELEPHONE
Peter Ramanauskas Project Manager U.S. EPA Region V	EPA Region V 77 West Jackson Street Chicago, Illinois 60604	(312) 886-6146 FAX: (312) 353-4788
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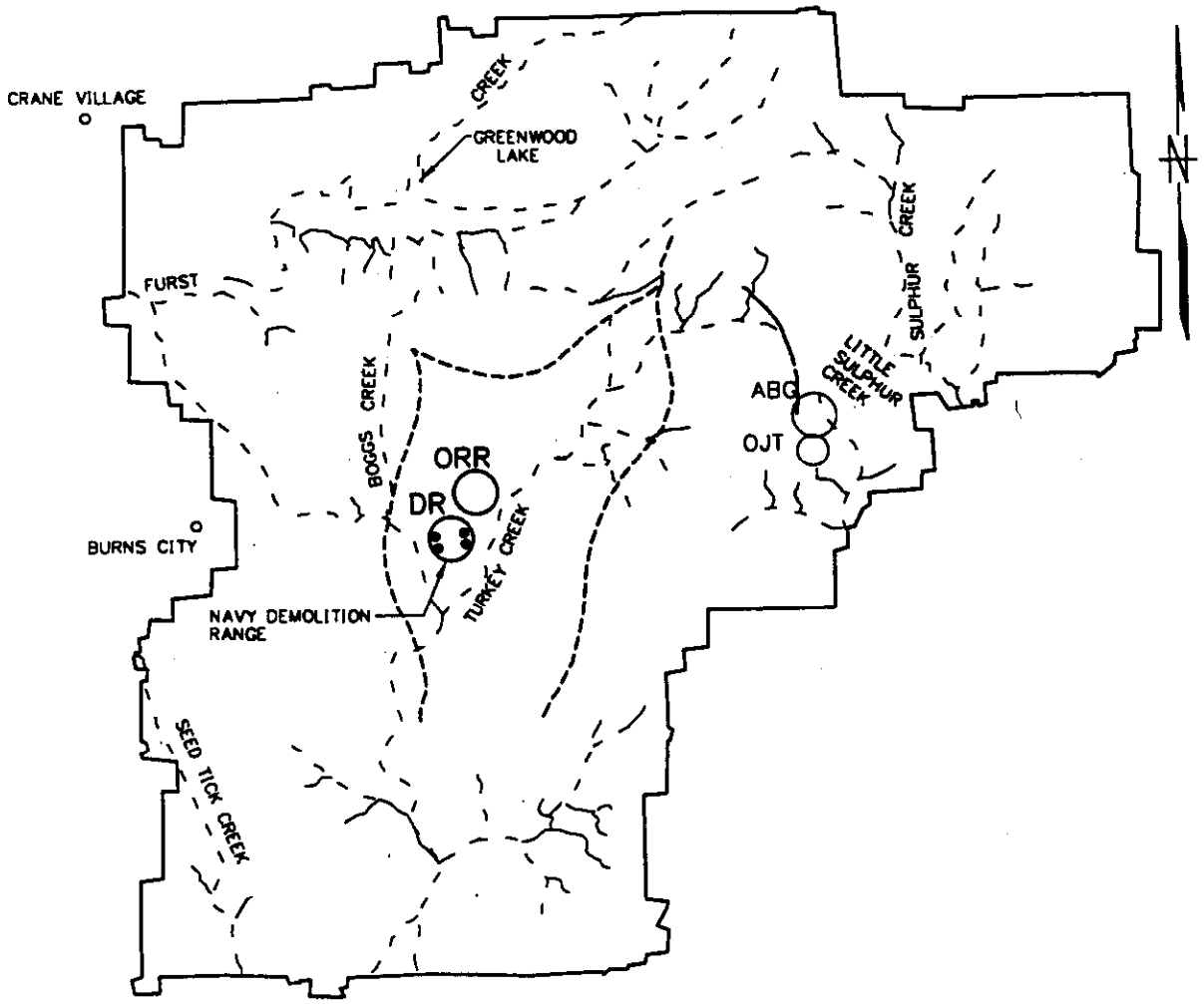
E. P. Johns Engineer In Charge U.S. Navy SOUTHNAVFACENGCOM	Department of Navy SOUTHNAVFACENGCOM Code 1829 2155 Eagle Drive Charleston, SC 29406	(843) 820-5523 FAX: (843) 820-7465
Jim Hunsiker Crane Environmental Manager NSWC Crane	NSWC Crane Code 095 B-3260 300 Highway 361 Crane, Indiana 47522-5009	(812) 854-3233 FAX: (812) 854-4177
Tom Brent Corrective Action Manager NSWC Crane	NSWC Crane Code 095 B-3260 300 Highway 361 Crane, Indiana 47522-5009	(812) 854-6160 FAX: (812) 854-4177
Phil Keith Facility Permit Manager NSWC Crane	NSWC Crane Code 095 B-3260 300 Highway 361 Crane, Indiana 47522-5009	(812) 854-6163 FAX: (812) 854-4177
Debbie Wroblewski Program Manager Tetra Tech NUS	Tetra Tech NUS 661 Andersen Drive Pittsburgh, PA 15220-2745	(412) 921-8968 FAX: (412) 921-4040

ACAD: 7651CM01.dwg 05/04/99 MF



LEGEND:

● SEDIMENTATION POND

0 2 4
APPROXIMATE SCALE IN MILES

SUBTITLE: TECHNICAL REPORT GL-88-27
GEOLOGY AND HYDROGEOLOGY OF THE AMMUNITION BURNING GROUND
CRANE NAVAL WEAPONS SUPPORT CENTER
VOLUME I: MAIN TEXT
RICHARD HUNT
DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS
OCTOBER 1988

DRAWN BY MF DATE 5/4/99			CONTRACT NO. 7651
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-5 / REV. 0

LOCATION OF DEMOLITION RANGE (DR)
AND SURROUNDING FEATURES
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

south by the confluence of the two creeks. The ridge is approximately 100 to 500 feet wide, and its topographic ridge slopes steeply to the east, south, and west. The maximum elevation at the DR is approximately 685 feet NGVD. The minimum elevation of Turkey and Boggs Creek in the area is approximately 475 feet NGVD. The maximum topographic relief at the site is approximately 210 feet (Murphy and Wade, 1995, p. 25). Figure 2-5 shows the DR, ORR and surrounding features.

2.2.4 Old Jeep Trail

The OJT is located along Little Sulphur Creek, approximately ¼ mile south of the ABG. The OJT site is situated in the northwest-southeast-trending valley incised by Little Sulphur Creek. Little Sulphur Creek turns south at the southeastern corner of the OJT site. The topographic relief at the central portion of the site ranges from 550 feet mean sea level (msl) in the valley to approximately 610 feet on the valley walls (Murphy, 1994). The stream valley is approximately 350 feet wide. Figure 2-6 shows the OJT in relationship to the ABG and Little Sulfur Creek.

2.3 CLIMATOLOGY

NSWC Crane is located in a warm, temperate climatic zone. In general, the summers are warm and humid, and winters are mild with occasionally short cold periods. The temperature ranges from an average maximum July temperature of 89°F to an average minimum January temperature of 26°F. Precipitation is fairly evenly distributed throughout the calendar year, with the maximum precipitation occurring during the spring and early summer. The average annual precipitation received at the facility is 44 inches, consisting of 42 inches of rain and 15 inches of snow. The average humidity ranges from 40 to 90 percent in summer and 60 to 90 percent in winter. The RCRA Air Quality Assessment (B&R Environmental, 1997c) has additional details on climatology.

2.4 HYDROLOGY

The summary information on surface waters contained in this section was obtained from the following documents:

- RCRA RFI SWMU 06/09 Demolition Area (Murphy and Wade, 1995).

4.0 GROUND WATER SAMPLING AND ANALYSIS AND FIELD OPERATIONS

The following sections describe the details concerning the monitoring wells, surface water, and spring waters to be sampled, frequency of sampling, sampling procedures, and target constituents for the NSWC Crane facility, as outlined by the RCRA Ground Water Monitoring Requirements as described in 40 CFR 264 Subpart F and the approved Ground Water Monitoring Plan.

4.1 SELECTION OF MONITORING WELLS AND SPRINGS FOR SAMPLING AND ANALYSIS

A total of 18 monitoring wells, two surface water locations, and two ground water springs from the ABG, 14 monitoring wells from the ORR, and 11 monitoring wells from the DR (monitoring well 06C08 is slated for sampling under both the ORR and the DR) will be sampled under the direction of the approved Ground Water Monitoring Plan and this approved FSP. OJT wells have not yet been selected. Following is a description of the field-sampling program for each unit. Table 1-1 of the approved QAPP summarizes the overall objectives of the ground water monitoring program. The approved QAPP also contains the detailed field and laboratory QA/QC requirements.

4.1.1 Ammunition Burning Grounds

Table 4-1 lists each of the ABG ground water, spring water, and surface water monitoring points and, for each monitoring well, the associated screened formation. Quarterly analysis shall take place for a minimum of 3 years or 1 year after contaminated soil is removed and cleaned up, whichever is later. Seminannual monitoring shall continue after that point for the same parameters. Monitoring for natural attenuation will occur during the first eight quarters. Table 4-2 describes the monitoring points and sample analyses that will be conducted on each monitoring point every quarter for the first eight quarters. Table 4-3 describes the monitoring points and the sample analyses that will be conducted after monitoring for natural attenuation is complete. Table 4-4 describes the monitoring points and sample analyses of Appendix IX parameters that will be conducted at each compliance monitoring point annually throughout the compliance period. The Appendix IX analyses are in addition to the quarterly and seminannual monitoring. Field measurements, including specific conductance, pH, temperature, turbidity, oxidation-reduction potential (ORP), and dissolved oxygen, will be obtained by a meter at each sampling location. Water-level measurements will be made for all wells during all sampling events using a water-level meter at each sampling location. Alkalinity (carbonate, bicarbonate, and hydroxide) will be analyzed in the field for each monitoring point using a field test kit. Additional field analyses will be conducted for ground water, spring water, and surface water included in the natural attenuation-monitoring program, as

TABLE 4-1

AMMUNITION BURNING GROUNDS
GROUND WATER/SURFACE WATER/SPRING WATER MONITORING POINTS
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Monitoring Points	Screened Formation
03B02	Al
03B04	Al
03C02P2	BC
03C03	BB
03C04	BC
03C07	BC
03C08P2	BC
03C09P2	BC
03C10	BC
03C11	BC
03C12	BC
03C15	BC
03C17	BC
03C20	BC
03C25	BC
03C26	BC
03C27	BC
03C30	BC
Little Sulphur Creek Below Spring A	NA
Little Sulphur Creek at Boundary	NA
Spring A	NA
Spring C	NA

Legend:

Al - Alluvium
BB - Beaver Bend
BC - Beech Creek
NA – Not applicable

TABLE 4-2

AMMUNITION BURNING GROUNDS
QUARTERLY MONITORING - QUARTERS 1 THROUGH 8
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Monitoring Point	Field[1]	Volatiles[1]	Dissolved Gases[1]	Explosives[1]	Metals[1] (Total)	Metals[1] (Dissolved)	Cyanide	TOX	TOC	Sulfide	Sulfate	Phosphorus (Total and Dissolved)	Chloride
03B02	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
03B04	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
03C02P2	A, B	B		A	A, D	A, C, D	•	•	•		•	•	•
03C03	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
03C04	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
03C07	A, B	B		A	A, D	A, C, D	•	•	•		•	•	•
03C08P2	A, B	B		A	A, D	A, C, D	•	•	•		•	•	•
03C09P2	A, B	B		A	A, D	A, C, D	•	•	•		•	•	•
03C10	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
03C11	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
03C12	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
03C15	A, B	B		A	A, D	A, C, D	•	•	•		•	•	•
03C17	A, B	B		A	A, D	A, C, D	•	•	•		•	•	•
03C20	A, B	B		A	A, D	A, C, D	•	•	•		•	•	•
03C25	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
03C26	A, B	B		A	A, D	A, C, D	•	•	•		•	•	•
03C27	A, B	B		A	A, D	A, C, D	•	•	•		•	•	•
03C30	A, B	B		A	A, D	A, C, D	•	•	•		•	•	
Little Sulphur Creek Below Spring A	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
Little Sulphur Creek at Boundary	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
Spring A	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•
Spring C	A, B, C	B, C	A	A, B	A, B, D	A, C, D	•	•	•	•	•	•	•

1 The letters A, B, C, etc., indicate subsets of the parameter group shown in the column headings. Specific parameters included in each subset are listed in Appendix D of this approved FSP.

TABLE 4-3

AMMUNITION BURNING GROUNDS
QUARTERLY AND SEMINANNUAL MONITORING AFTER QUARTER 8
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Monitoring Point	Field[1]	Volatiles[1]	Explosives[1,2]	Metals [1] (Total)	Metals [1] (Dissolved)	Cyanide	TOX	TOC	Sulfate	Phosphorus (Total and Dissolved)	Chloride
03C02P2	A, B	B	A	A	A, C	•	•	•	•	•	•
03C03	A, B	B	A	A	A, C	•	•	•	•	•	•
03C04	A, B	B	A	A	A, C	•	•	•	•	•	•
03C07	A, B	B	A	A	A, C	•	•	•	•	•	•
03C08P2	A, B	B	A	A	A, C	•	•	•	•	•	•
03C09P2	A, B	B	A	A	A, C	•	•	•	•	•	•
03C15	A, B	B	A	A	A, C	•	•	•	•	•	•
03C17	A, B	B	A	A	A, C	•	•	•	•	•	•
03C20	A, B	B	A	A	A, C	•	•	•	•	•	•
03C25	A, B	B	A	A	A, C	•	•	•	•	•	•
03C26	A, B	B	A	A	A, C	•	•	•	•	•	•
03C27	A, B	B	A	A	A, C	•	•	•	•	•	•
03C30	A, B	B	A	A	A, C	•	•	•	•	•	•
Spring A	A, B	B	A	A	A, C	•	•	•	•	•	•
Spring C	A, B	B	A	A	A, C	•	•	•	•	•	•

1 The letters A, B, C, etc., indicate subsets of the parameter group shown in the column headings. Specific parameters included in each subset are listed in Appendix D of this approved FSP.

2 Explosives Subset A will be analyzed unless natural attenuation demonstration shows that explosives from Subset B are present and need to be monitored further.

Note: Monitoring for natural attenuation is scheduled only for the first eight quarters. Therefore the analytical scheme has been modified to discontinue analysis of natural attenuation parameters.

TABLE 4-4
AMMUNITION BURNING GROUNDS
ANNUAL APPENDIX IX MONITORING
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Monitoring Points	Appendix IX Volatile Organic Compounds (1)	Appendix IX Semivolatile Organic Compounds (1)	Appendix IX Pesticides/ PCBs (1)	Appendix IX Herbicides (1)	Appendix IX Dioxins/ Furans (1)	Sulfide
03C02P2	A	A	A	A	A	•
03C03	A	A	A	A	A	•
03C04	A	A	A	A	A	•
03C07	A	A	A	A	A	•
03C08P2	A	A	A	A	A	•
03C09P2	A	A	A	A	A	•
03C15	A	A	A	A	A	•
03C17	A	A	A	A	A	•
03C20	A	A	A	A	A	•
03C25	A	A	A	A	A	•
03C26	A	A	A	A	A	•
03C27	A	A	A	A	A	•
03C30	A	A	A	A	A	•
Spring A	A	A	A	A	A	•
Spring C	A	A	A	A	A	•

1 The letters A, B, C, etc., indicate subsets of the parameter group shown in the column headings. Specific parameters included in each subset are listed in Appendix D of this approved FSP.

Note Annual Appendix IX monitoring will be performed in conjunction with quarterly and semiannual monitoring. Because the analytes included in volatile subsets B and C are completely contained within volatile subset A, separate analyses for volatile subsets B and C will not be performed when analyzing a sample for volatile subset A.

identified in Table 4-2, using field test kits. These additional field analyses include carbon dioxide, dissolved oxygen, ferrous iron, hydrogen sulfide, nitrate, and nitrite.

Section 7 of the approved Ground Water Monitoring Plan contains details on the purposes for which ground water, surface water, and spring water monitoring is being conducted at the ABG and the use of monitoring data.

4.1.2 Old Rifle Range

Table 4-5 lists each of the ORR ground water monitoring points and the associated screened formation. Table 4-6 describes the sample analysis that will be conducted on each monitoring point quarterly. Field parameters including specific conductivity, pH, temperature, turbidity, ORP, dissolved oxygen, and water level will be measured for all wells during each quarterly sampling event. Sample laboratory analysis will include explosives, RCRA Appendix IX total and dissolved metals, ammonia, cyanide, Total Organic Carbon (TOC), and Total Organic Halides (TOX). Table 4-7 describes the sample analysis for Appendix IX parameters that will be conducted annually. Appendix IX monitoring will be in addition to the quarterly monitoring described in Table 4-6. Ground water will be sampled for laboratory analysis of RCRA Appendix IX Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), pesticides/PCBs, herbicides, dioxins/furans, and sulfide.

Monitoring well 06C08 is slated for sampling under both the ORR and the DR monitoring programs. This well is upgradient for the DR and ORR. Thus, taking only one ground water sample from this well is sufficient for the requirements at both the ORR and the DR.

Section 8 of the approved Ground Water Monitoring Plan contains details on the purposes for which ground water monitoring is being conducted at the ORR and the use of the data.

4.1.3 Demolition Range

Table 4-8 lists each of the DR ground water monitoring points and associated screened formations. Table 4-9 describes the analyses that will be conducted on samples from each monitoring point semiannually. Field parameters, including specific conductivity, pH, temperature, turbidity, ORP, dissolved oxygen, and water level, will be measured and recorded from all wells in the field during each sampling event. Semiannual samples for laboratory analysis will include explosives, RCRA Appendix IX total and dissolved metals, cyanide, TOC, and TOX.

TABLE 4-9

DEMOLITION RANGE
SEMIANNUAL MONITORING
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Wells	Field[1]	Explosives[1]	Appendix IX Metals[1] Total	Appendix IX Metals[1] Dissolved	Cyanide	TOC	TOX
06C02	A	A	A, D	A, D	•	•	•
06C03	A	A	A, D	A, D	•	•	•
06C03P2	A	A	A, D	A, D	•	•	•
06C04	A	A	A, D	A, D	•	•	•
06C04P2	A	A	A, D	A, D	•	•	•
06C05	A	A	A, D	A, D	•	•	•
06C06	A	A	A, D	A, D	•	•	•
06C06P2	A	A	A, D	A, D	•	•	•
06C07	A	A	A, D	A, D	•	•	•
06C08[2]	A	A	A, D	A, D	•	•	•
06C08P2	A	A	A, D	A, D	•	•	•

1 The letters A, B, C, etc. indicate subsets of the parameter group shown in the column headings. Specific parameters included in each subset are listed in Appendix D of this approved FSP.

2 Monitoring well 06C08 is also an upgradient well for the ORR. Analyses are also included in Table 4-6.

Monitoring well 06C08 is slated for sampling under both the ORR and the DR because of its upgradient proximity to both sites. Thus, only one ground water sample taken from this well is sufficient for the requirements at both the ORR and the DR.

Section 9 of the approved Ground Water Monitoring Plan contains details on the purposes for which ground water monitoring is being conducted at the DR and the use of the data.

4.1.4 Old Jeep Trail

At the time of printing of this approved FSP, monitoring wells that will be sampled at the OJT area have not been selected. Further investigative activities must be performed to determine a proper monitoring network to meet the objectives of this investigation. Once a monitoring well network is determined, the wells selected for ground water sampling will be included as an addendum to this report under corrective action.

4.2 FIELD SAMPLING AND ANALYSIS PROCEDURES

This section describes the field sampling and analysis procedures for ground water, surface water, and spring water monitoring at the ABG, and ground water monitoring at the ORR and DR. The NSWC Crane Environmental Protection Department (EPD) must approve any deviations from these procedures before implementation.

4.2.1 Inspection of Existing Monitoring Wells

Before each monitoring well is sampled, a brief inspection will be conducted. SOP 1 contains a description of the inspection procedure. Appendix B contains a copy of this SOP.

4.2.2 Water-Level Measurements

Water-level measurements will be obtained for each well at each unit (ABG, ORR, and DR) during every sampling event, before purging and sampling activities are conducted. Each unit-specific set of water-level measurements will be obtained within a 24-hour period. SOP 2 contains a description of the water-level measurement procedures. Appendix B contains a copy of SOP 2.

4.2.3 Low-Flow Pump Installation

Dedicated 1.66-inch-diameter, low-flow, bladder pumps (Teflon-lined PVC) were installed in all the monitoring wells prior to ground water sampling. Each pump was placed at the midpoint of the saturated well screen and, if possible, no less than 2 feet above the bottom of the well in order not to disturb any sediment that was located at the bottom of the well. Prior to pump installation, all the wells were developed using a surge block and a submersible purge pump capable of reaching depths of 60 feet. In cases where well depths exceeded 60 feet, a bailer was used instead of the submersible pump. The pumps were certified contaminant free; this certification, as well as lot numbers, was provided in an appendix of the initial ground water monitoring report. SOP 3 contains procedures for the installation/replacement of dedicated pumps, if necessary. This SOP also describes procedures for removal and reinstallation of pumps for well maintenance procedures, if necessary. A copy of SOP 3 is contained in Appendix B.

4.2.4 Well Purging

Purging will be accomplished by using low-flow techniques in accordance with SOP 4. A copy of this SOP is included in Appendix B. Low-flow purging and sampling are being implemented because this method will provide the least disturbance to the surrounding formation (i.e., less turbulence in sampling and hence less turbidity) and will allow for a more representative sample to be collected.

4.2.5 Low-Flow Sampling of Monitoring Wells

Low-flow sampling procedures will be used. The low-flow procedures are based on procedures described in the U.S. EPA ground water flow paper, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (EPA/540/S-95/504). SOP 5, contained in Appendix B, describes the low-flow sampling procedures for ground water wells. Table 4-10 contains a summary of sample analyses and associated container types and volumes, preservation requirements, and holding times.

4.2.6 Sampling of Springs and Little Sulphur Creek at the ABG

Springs A and C will be sampled by extracting a sample from the first surface water pool into which each spring discharges. Two samples will be obtained from Little Sulphur Creek. One sample will be collected

TABLE 4-10

SUMMARY OF SAMPLE ANALYSES, CONTAINER TYPES AND VOLUMES, PRESERVATION REQUIREMENTS, AND HOLDING TIMES
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA
PAGE 1 OF 3

Parameter	Sample Container	Container Volume	Preservation[1]	Maximum Holding Time[2]	Analytical Methodology
Explosives (all explosives except nitrocellulose, picric acid, picramic acid)	Amber glass, Teflon-lined cap	(2) 1,000 mL[3]	Cool to 4°C, dark	Extraction 7 days; analysis within 40 days of extraction	SW-846[4] Method 8330
Nitrocellulose	Amber glass, Teflon-lined cap	(2) 500 mL	Cool to 4°C	Filtration 7 days; analysis within 40 days of filtration	Modified Army Corps Method[5]
Picric acid, Picramic Acid	Amber glass, Teflon-lined cap	(2) 1,000 mL[3]	Cool to 4°C, dark	Extraction 7 days; analysis within 40 days of extraction	Laucks HPLC Method[6]
Appendix IX Metals (total and dissolved)	Polyethylene bottle, plastic cap, plastic liner	1,000 mL[7, 8]	HNO_3 to pH < 2	Within 180 days; mercury within 28 days	SW-846 Method 6020; mercury - SW-846 Method 7470A
Calcium, Iron, Magnesium, Manganese, Sodium, and Potassium (total and dissolved)	Polyethylene bottle, plastic cap, plastic liner	1,000 mL[7]	HNO_3 to pH < 2	180 days	SW-846 Method 6010B
Appendix IX Volatile Organic Compounds	Glass, black phenolic plastic screw cap, Teflon-lined septum	(6) 40 mL[9]	Cool to 4°C, dark, zero headspace, HCl to pH < 2	14 days	SW-846 Method 8260B[10] (plus SW-846 Method 8015B for 1,4-dioxane, acetonitrile, isobutyl alcohol, and propionitrile)
TCE and Degradation Products	Glass, black phenolic plastic screw cap, Teflon-lined septum	(3) 40 mL[11, 12]	Cool to 4°C, dark, zero headspace, HCl to pH < 2	14 days	SW-846 Method 8260B[10]
Aromatic and Chlorinated Hydrocarbons	Glass, black phenolic plastic screw cap, Teflon-lined septum	(3) 40 mL[11, 12]	Cool to 4°C, dark, zero headspace, HCl to pH < 2	14 days	SW-846 Method 8260B[10]
Appendix IX Semivolatile Organic Compounds	Amber glass, Teflon-lined cap	(4) 1000 mL[13]	Cool to 4°C, dark	Extraction 7 days; analysis within 40 days of extraction	SW-846 Method 8270C (plus SW-846 Method 8270C with Selective Ion Monitoring for polynuclear aromatic hydrocarbons [PAHs])

TABLE 4-10

SUMMARY OF SAMPLE ANALYSIS, BOTTLE REQUIREMENTS, PRESERVATION REQUIREMENTS, AND HOLDING TIMES
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA
PAGE 2 OF 3

Parameter	Sample Container	Container Volume	Preservation[1]	Maximum Holding Time[2]	Analytical Methodology
Appendix IX Organochlorine Pesticides/Polychlorinated biphenyls (PCBs)	Amber glass, Teflon-lined cap	(2) 1000 mL[3]	Cool to 4°C, dark	Extraction 7 days; analysis within 40 days of extraction	SW-846 Method 8081
Appendix IX Herbicides	Amber glass, Teflon-lined cap	(2) 1000 mL[3]	Cool to 4°C, dark	Extraction 7 days; analysis within 40 days of extraction	SW-846 Method 8151A
Dioxins/Furans	Amber glass, Teflon-lined cap	(2) 1000 mL[3]	Cool to 4°C, dark	Extraction 30 days; analysis within 45 days of extraction	SW-846 Method 8290
Ammonia	Polyethylene bottle, plastic cap, plastic liner	500 mL[14]	Cool to 4°C, H_2SO_4 to pH <2	28 days	EPA Method [15] 350.1
Chloride	Polyethylene bottle, plastic cap, plastic liner	500 mL[16]	Cool to 4°C	28 days	SW-846 Method 9056
Cyanide	Polyethylene bottle, plastic cap, plastic liner	500 mL	Cool to 4°C, NaOH to pH > 12	Within 14 days	SW-846 Method 9012A
Dissolved Methane, Ethene, and Ethane	Amber glass, plastic cap Mylar-faced silicon septum	(2) 40 mL	Cool to 4°C, dark, zero headspace	14 days	Microseeps Method AM18.01[17]
Phosphorus (Total and Dissolved)	Polyethylene bottle, plastic cap, plastic liner	500 mL[14]	Cool to 4°C, H_2SO_4 to pH <2	28 days	EPA Method 365.2
Sulfate	Polyethylene bottle, plastic cap, plastic liner	500 mL[16]	Cool to 4°C	28 days	SW-846 Method 9056
Sulfide	Polyethylene bottle, plastic cap, plastic liner	500 mL	Cool to 4°C, zinc acetate, NaOH to pH >9	7 days	SW-846 Method 9030B/9034
Total Organic Carbon (TOC)	Amber glass, septa cap	125 mL	Cool to 4°C, H_2SO_4 to pH <2	28 days	SW-846 Method 9060
Total Organic Halides (TOX)	Amber glass, Teflon-lined cap	1000 mL	Cool to 4°C, H_2SO_4 to pH <2	28 days	SW-846 Method 9020B

TABLE 4-10

SUMMARY OF SAMPLE ANALYSIS, BOTTLE REQUIREMENTS, PRESERVATION REQUIREMENTS, AND HOLDING TIMES
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA
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1 HCl = Hydrochloric acid, H_2SO_4 = Sulfuric Acid, NaOH = Sodium Hydroxide, HNO_3 = Nitric Acid

2 All holding times are from date of collection.

3 Two additional 1,000-mL bottles are required for samples designated for matrix spike/matrix spike duplicate analysis (minimum 1 in 20 samples).

4 U.S. EPA, 1986. Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods. SW-846, 3rd ed, including updates.

5 Based on Indiana Army Ammunition Plant Contamination Survey. "Nitrocellulose in Water". Aqualab, Inc., 1983.

6 Laucks SOP LTL-8308, included in Appendix B of the QAPP.

7 One 1,000-mL bottle of unfiltered ground water will provide sufficient sample volume for the analysis for Appendix IX metals (total) and/or any additional total metals analyses. Likewise, one 1,000-mL bottle of filtered ground water will provide sufficient sample volume for the analysis for Appendix IX metals (dissolved) and/or any additional dissolved metals analyses.

8 One additional 1,000-mL bottle is required for samples designated for matrix spike/duplicate analysis (minimum 1 in 20 samples).

9 Eight additional 40-mL vials are required for samples designated for matrix spike/matrix spike duplicate analysis (minimum 1 in 20 samples).

10 Analysis will be performed using a 25-mL sample volume in order to achieve lower quantitation limits for ground water samples.

11 Three 40-mL vials will provide sufficient sample volume for the analysis of trichloroethene and its degradation products (volatile subset B) and aromatic and chlorinated hydrocarbons (volatile subset C). In addition, when samples are collected for analysis of the Appendix IX volatile list (six 40-mL vials), it is not necessary to collect any additional vials for volatile subsets B and C because the analytes included in volatile subsets B and C are completely contained within the Appendix IX volatile list.

12 Four additional 40-mL vials are required for samples designated for matrix spike/matrix spike duplicate analysis (minimum 1 in 20 samples).

13 Four additional 1,000-mL bottles are required for samples designated for matrix spike/matrix spike duplicate analysis (minimum 1 in 20 samples).

14 Ammonia and total phosphorus samples will be provided for analysis in the same 500-mL bottle.

15 U.S. EPA, 1983. Methods for Chemical Analysis of Water and Wastes.

16 Chloride and sulfate samples will be provided for analysis in the same 500-mL bottle.

17 Microseeps Method AM18.01, included in Appendix B of the QAPP.

effective on certain chemicals of interest. The sample preservatives required for each of the chemicals of interest are provided in Table 4-10. SOP 10, attached in Appendix B, provides a detailed description of sample preservation and handling procedures required for this sampling plan.

4.2.12 Chain-of-Custody/Documentation

Sample custody procedures are designed to provide documentation of preparation, handling, storage, and shipping of all samples collected. Integrity of the samples collected during the site investigation will be the responsibility of identified persons from the time they are collected until they, or their derived data, are incorporated into the final report. Stringent chain-of-custody procedures will be followed to document sample possession. An example of the chain-of-custody form, which will be used to document this procedure, is included in SOP 11. The chain-of-custody procedure will be followed in accordance with SOP 11 included in Appendix B.

All samples taken at NSWC Crane will be properly labeled with a sample label affixed to the sample container and a sample tag secured by a wire tie around the neck of the sample container. Detailed information regarding completion of sample labels and tags, as well as all field record keeping and documentation activities, is also provided in SOP 11.

4.3 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

The purpose of this section is to address the data quality objectives of field-quality QA/QC samples such as field blanks, field duplicates, rinsate blanks, trip blanks, ambient blanks, and matrix spikes/matrix spike duplicates. The following tables contain a summary of water sample analyses and field QC samples for each unit (ABG, ORR, and DR) and for each type of sampling event frequency (quarterly, semiannual, annual).

Table 4-11 - ABG quarterly sampling (quarters 1 through 8)
Table 4-12 - ABG quarterly and semiannual sampling (after quarter 8)
Table 4-13 - ABG annual sampling
Table 4-14 - ORR quarterly sampling
Table 4-15 - ORR annual sampling
Table 4-16 - DR semiannual sampling

TABLE 4-11

SUMMARY OF SAMPLE ANALYSIS AND QUALITY CONTROL SAMPLES
QUARTERLY MONITORING-QUARTERS 1 THROUGH 8
AMMUNITION BURNING GROUNDS
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA
PAGE 1 OF 2

Parameter[1]	Samples	Field Duplicates [2]	Trip Blanks[3]	Ambient Blanks[4]	Matrix Spike/Duplicates[5]	Total[6]
Laboratory:						
TCE & degradation products/volatiles	22	3	TBD	TBD	2/2	29+
Dissolved methane/ethane/ethene	12	2	NA	TBD	NA	14+
Explosives – subset A	22	3	NA	TBD	2/2	29+
Explosives – subset B	12	2	NA	TBD	1/1	16+
Metals (total)	22	3	NA	TBD	2/2	29+
Metals (dissolved)	22	3	NA	TBD	2/2	29+
Cyanide	22	3	NA	TBD	2/2	29+
Sulfate	22	3	NA	TBD	2/2	29+
Phosphorus (total)	22	3	NA	TBD	2/2	29+
Phosphorus (dissolved)	22	3	NA	TBD	2/2	29+
TOC	22	3	NA	TBD	2/2	29+
TOX	22	3	NA	TBD	2/2	29+
Sulfide	12	2	NA	TBD	1/1	16+
Chloride	22	3	NA	TBD	2/2	29+
Field:						
Dissolved oxygen[7]	22	NA	NA	NA	NA	22
PH	22	NA	NA	NA	NA	22
Specific conductance	22	NA	NA	NA	NA	22
Temperature	22	NA	NA	NA	NA	22
Turbidity	22	NA	NA	NA	NA	22
ORP	22	NA	NA	NA	NA	22
Alkalinity	22	3	NA	NA	NA	25
Carbon Dioxide	12	2	NA	NA	NA	14
Dissolved oxygen[8]	12	2	NA	NA	NA	14
Ferrous Iron	12	2	NA	NA	NA	14

TABLE 4-11

SUMMARY OF SAMPLE ANALYSIS AND QUALITY CONTROL SAMPLES
QUARTERLY MONITORING-QUARTERS 1 THROUGH 8
AMMUNITION BURNING GROUNDS
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA
PAGE 2 OF 2

Parameter[1]	Samples	Field Duplicates[2]	Trip Blanks[3]	Ambient Blanks[4]	Matrix Spike/Duplicates[5]	Total[6]
Hydrogen sulfide	12	2	NA	NA	NA	14
Nitrate	12	2	NA	NA	NA	14
Nitrite	12	2	NA	NA	NA	14
Water level	18	NA	NA	NA	NA	18

1 See Table 4-2 of this approved FSP in conjunction with Table 1-3 of the approved QAPP for ABG-specific analysis requirements.
2 Field duplicates will be collected at a minimum frequency of 1 per 10 samples. Field duplicates are not applicable (NA) for field measurements obtained by using a flow-through meter or a water-level meter.
3 Trip blanks will be submitted for analysis at a frequency of one per cooler containing samples for volatile organics analysis. Because the number of sample coolers shipped varies, totals are to be determined (TBD).
4 Ambient blanks will be collected at the discretion of the FOL, to delineate site conditions. Because site conditions vary, totals are to be determined (TBD). Ambient blanks are not applicable for field analyses (NA).
5 Matrix spike (MS) and duplicate samples will be collected at a frequency of 1 per 20 samples. For inorganics, an MS and a sample duplicate will be collected and, for organics, an MS and a matrix spike duplicate (MSD) will be collected. MS/MSDs and sample duplicates are not applicable for field analyses (NA).
6 Plus sign (+) indicates potential for the total number of samples to increase, due to TBD variables.
7 Dissolved oxygen is measured by a flow-through meter for determination of stabilization conditions.
8 Dissolved oxygen is analyzed by field kit for monitoring of natural attenuation.

NA Not Applicable
TBD To be determined
TCE Trichloroethene
TOC Total organic carbon
TOX Total organic halogens
ORP Oxidation-reduction potential

TABLE 4-12

SUMMARY OF SAMPLE ANALYSIS AND QUALITY CONTROL SAMPLES
QUARTERLY AND SEMIANNUAL MONITORING AFTER QUARTER 8
AMMUNITION BURNING GROUNDS
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA
PAGE 1 OF 2

Parameter[1]	Samples	Field Duplicates[2]	Trip Blanks[3]	Ambient Blanks[4]	Matrix Spike/Duplicates[5]	Total[6]
Laboratory:						
TCE and degradation products	15	2	TBD	TBD	1/1	19+
Explosives - subset A	15	2	NA	TBD	1/1	19+
Metals (total)	15	2	NA	TBD	1/1	19+
Metals (dissolved)	15	2	NA	TBD	1/1	19+
Cyanide	15	2	NA	TBD	1/1	19+
Sulfate	15	2	NA	TBD	1/1	19+
Phosphorus (total)	15	2	NA	TBD	1/1	19+
Phosphorus (dissolved)	15	2	NA	TBD	1/1	19+
Chloride	15	2	NA	TBD	1/1	19+
TOC	15	2	NA	TBD	1/1	19+
TOX	15	2	NA	TBD	1/1	19+
Field:						
Dissolved oxygen	15	NA	NA	NA	NA	15
PH	15	NA	NA	NA	NA	15
Specific conductivity	15	NA	NA	NA	NA	15
Temperature	15	NA	NA	NA	NA	15
Turbidity	15	NA	NA	NA	NA	15
ORP	15	NA	NA	NA	NA	15
Alkalinity	15	2	NA	NA	NA	17
Water level	15	NA	NA	NA	NA	15

1 See Table 4-3 of this approved FSP in conjunction with Table 1-3 of the approved QAPP for the ABG-specific analysis requirements.
2 Field duplicates will be collected at a minimum frequency of 1 per 10 samples. Field duplicates are not applicable (NA) for field analyses obtained using a flow-through meter.
3 Trip blanks will be submitted for analysis at a frequency of one per cooler containing samples for volatile organics analysis. Because the number of sample coolers shipped varies, totals are to be determined (TBD).

TABLE 4-12

SUMMARY OF SAMPLE ANALYSIS AND QUALITY CONTROL SAMPLES
QUARTERLY AND SEMIANNUAL MONITORING AFTER QUARTER 8
AMMUNITION BURNING GROUNDS
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA
PAGE 2 OF 2

4 Ambient blanks will be collected at the discretion of the FOL, to delineate site conditions. Because site conditions vary, totals are TBD. Ambient blanks are not applicable for field analyses (NA).

5 MS and duplicate samples will be collected at a frequency of 1 per 20 samples. For inorganics, an MS and a sample duplicate will be collected, and for organics, an MS and an MSD will be collected. MS/MSDs and sample duplicates are not applicable for field analyses (NA).

6 Plus sign (+) indicates potential for the total number of samples to increase, due to TBD variables.

NA Not Applicable
TBD To be determined
TOC Total organic carbon
TOX Total organic halogens
ORP Oxidation-reduction potential

TABLE 4-13

SUMMARY OF ANNUAL SAMPLE ANALYSIS AND QUALITY CONTROL SAMPLES
AMMUNITION BURNING GROUNDS
ANNUAL APPENDIX IX MONITORING
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Parameter[1]	Samples	Field Duplicates[2]	Trip Blanks[3]	Ambient Blanks[4]	Matrix Spike/Duplicates[5]	Total[7]
Laboratory:						
VOCs	15	2	TBD	TBD	1/1	19+
SVOCs	15	2	NA	TBD	1/1	19+
Organochlorine pesticides/PCBs	15	2	NA	TBD	1/1	19+
Herbicides	15	2	NA	TBD	1/1	19+
Dioxins/furans	15	2	NA	TBD	1/1	19+
Sulfide	15	2	NA	TBD	1/1	19+

1 See Table 4-4 of this approved FSP in conjunction with Table 1-3 of the approved QAPP for the ABG-specific analysis requirements.
2 Field duplicates will be collected at a minimum frequency of 1 per 10 samples.
3 Trip blanks will be submitted for analysis at a frequency of one per cooler containing samples for volatile organics analysis. Because the number of sample coolers shipped varies, totals are TBD.
4 Ambient blanks will be collected at the discretion of the FOL, to delineate site conditions. Because site conditions vary, totals are TBD.
5 MS and duplicate samples will be collected at a frequency of 1 per 20 samples. For inorganics, an MS and a sample duplicate will be collected, and for organics, an MS and an MSD will be collected.
6 Plus sign (+) indicates potential for the total number of samples to increase, due to TBD variables.

NA Not Applicable
TBD To be determined
PCBs Polychlorinated biphenyls
VOCs Volatile organic compounds
SVOCs Semivolatile organic compounds

Note: Annual Appendix IX sampling is to be performed in conjunction with quarterly sampling.

TABLE 4-16

SUMMARY OF SEMIANNUAL SAMPLE ANALYSIS AND QUALITY CONTROL SAMPLES
DEMOLITION RANGE
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Parameter[1]	Samples	Field Duplicates [2]	Trip Blanks [3]	Ambient Blanks[4]	Matrix Spike/Duplicates[5]	Total[6]
Laboratory:						
Explosives - subset A	10	1	NA	TBD	1/1	13+
Metals (total)	10	1	NA	TBD	1/1	13+
Metals (dissolved)	10	1	NA	TBD	1/1	13+
Cyanide	10	1	NA	TBD	1/1	13+
TOC	10	1	NA	TBD	1/1	13+
TOX	10	1	NA	TBD	1/1	13+
Field:						
Dissolved oxygen	10	NA	NA	NA	NA	10
pH	10	NA	NA	NA	NA	10
Specific conductivity	10	NA	NA	NA	NA	10
Temperature	10	NA	NA	NA	NA	10
Turbidity	10	NA	NA	NA	NA	10
ORP	10	NA	NA	NA	NA	10
Water level	10	NA	NA	NA	NA	10

1 See Table 4-9 of this approved FSP and Table 1-3 of the approved QAPP for the specific analysis requirements and constituents for the Demolition Range.
2 Field duplicates will be collected at a minimum frequency of 1 per 10 samples. Field duplicates are not applicable (NA) for field analyses obtained using a flow-through meter or water level meter.
3 Trip blanks are submitted for analysis at a frequency of one per cooler containing samples for volatile organics analysis. Volatile organics are not analyzed for the Demolition Range. Therefore trip blanks are not applicable (NA).
4 Ambient blanks will be collected at the discretion of the Field Operations Leader, to delineate site conditions. Because site conditions vary, totals are to be determined (TBD). Ambient blanks are not applicable for field analyses (NA).
5 MS and duplicate samples will be collected at a frequency of 1 per 20 samples. For inorganics, an MS and a sample duplicate will be collected, and for organics, an MS and an MSD will be collected. MS/MSDs and sample duplicates are not applicable for field analyses (NA).
6 Plus sign (+) indicates potential for the total number of samples to increase, due to TBD variables.

NA Not applicable
TOX Total organic halogens
TBD To be determined
VOCs Volatile organic compounds
TOC Total organic carbon
ORP Oxidation-reduction potential

4.3.1 Source Water Blanks

Source water blanks are obtained by sampling the analyte-free water and/or potable water source(s) used for decontamination of sampling equipment. If applicable, source water blanks are used to determine whether the analyte-free water or the potable water (used for steam cleaning) may be contributing to sample contamination. The collection of source water blanks is not anticipated since source water blanks are only applicable if decontamination procedures are used in the field for sampling equipment. The use of decontamination procedures is not anticipated because dedicated equipment has been installed and will be used for sampling monitoring wells and the installation of new wells is not anticipated. If non-dedicated sampling equipment is used or if new wells are installed, one source water blank will be collected for each source of water used for decontamination.

4.3.2 Field Duplicates

Field duplicates are two samples from a single sampling location collected into two identical sets of sample bottles in the same order as described in SOPs 5 and 6 and analyzed for the same parameters. Field duplicates are obtained during a single act of sampling and are used to assess the overall precision of the sampling and analysis methods employed. Field duplicates will be collected at a minimum frequency of 1 per every 10 samples. Field duplicates are not applicable for field measurements obtained using a meter but are applicable for field measurements obtained using field test kits. Field duplicates will be analyzed for the same parameters in the laboratory and will be labeled in order to make the identity of the duplicate unknown to the laboratory (see SOP 9).

4.3.3 Rinsate Blanks

Dedicated equipment will be used for this monitoring program. Therefore, the collection of equipment rinsate blanks is not anticipated unless it becomes necessary to install new monitoring wells or unless the use of non-dedicated equipment (e.g., bailers) for sampling becomes necessary due to unexpected circumstances. Equipment rinsate blanks are obtained under representative field conditions by running analyte-free water through sample collection equipment (bailer, split-spoon, corer, etc.) after decontamination and then placing the water in the appropriate sample containers for analysis. Equipment rinsate blanks are used to assess the effectiveness of decontamination procedures. Equipment rinsate blanks are collected at a frequency of 1 per every 10 samples, with a minimum of one per day of sampling per non-dedicated sampling device/instrument. Rinsate blanks are not required for wells in which dedicated sampling equipment is installed. This includes all the wells at the ABG, ORR, and DR,

as listed in Tables 4-1, 4-5, and 4-8. Rinsate blanks will not be collected for spring and surface water samples because a direct-fill method will be used for collection of spring and surface water samples. Therefore, collection of rinsate blanks will not take place. Rinsate blanks are not applicable for field analyses.

4.3.4 Trip Blanks

Trip blanks are used to assess the potential for contamination resulting from contaminant migration into sample bottles/jars during sample shipment and storage. Trip blanks pertain to VOCs only. Trip blanks are prepared by the laboratory prior to the sampling event, shipped to the site with the sample containers, and kept with the investigative samples throughout the sampling event. They are then packaged for shipment with other VOC samples and sent for analysis. One trip blank will be included in each sample shipping container (i.e., cooler) that contains samples for VOC analysis. At no time after trip blank preparation are trip blank sample containers opened before they reach the laboratory. Because the number of sample coolers shipped varies, totals are to be determined in the field.

4.3.5 Ambient Blanks

Ambient blanks are collected in the field and analyzed to check for interfering contaminants that could potentially be present in ambient air at the sampling site (e.g., VOCs in an area where fumes are typically present or metal particulates on a windy day in a dry, dusty area). Ambient blanks are collected at the sampling location(s) by placing analyte-free water directly into the same types of containers, preserved, and stored in the same manner as field samples. The exposure of ambient blanks to ambient conditions should be similar to the ambient exposure of field samples. Ambient blanks will be collected based on conditions at the time of sampling, at the discretion of the FOL, as needed to delineate site conditions. Because site conditions vary, totals are to be determined. Ambient blanks are not applicable for field analyses.

4.3.6 Matrix Spikes/Duplicates

Matrix spikes are investigative samples analyzed to provide information about the effect of the sample matrix on the digestion and measurement methodology. Matrix spike (MS) and matrix spike or sample duplicate samples will be collected at a frequency of 1 per every 20 samples; for inorganics, an MS and a sample duplicate will be collected; and for organics, an MS and a matrix spike duplicate (MSD) will be collected. Extra sample volume must be collected for samples designated for MS/MSD analyses for VOCs and extractable organics. Specific details regarding extra sample volume required for MS/MSD

samples are provided for each applicable analytical fraction in Table 4-10. MS/MSDs and sample duplicates are not applicable for field analyses.

4.4 ANALYTICAL LABORATORY CAPACITY

Careful coordination with the analytical laboratory will be required throughout the project in order not to exceed the capacity of the laboratory to perform the analysis. The schedule for analysis will be developed jointly with the laboratory at the time the bottle request is made for a sampling round.

4.5 CALIBRATION PROCEDURES AND FREQUENCY

Instruments used in the field will be calibrated according to the procedures described in the SOPs and equipment manuals appended to this approved FSP. Calibration will be documented on an Equipment Calibration Log (SOP 11). 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.

Calibration of equipment at the analytical laboratory is addressed in the approved QAPP.

4.6 PERFORMANCE AND SYSTEM AUDITS

System audits will be performed, as appropriate, to ensure that the work is being implemented in accordance with the approved project SOPs and in an overall satisfactory manner.

- The FOL will supervise, and check on a daily basis, that field measurements are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and the field work is accurately and neatly documented.

- A formal audit of the field sampling procedures will be conducted in accordance with the approved QAPP.

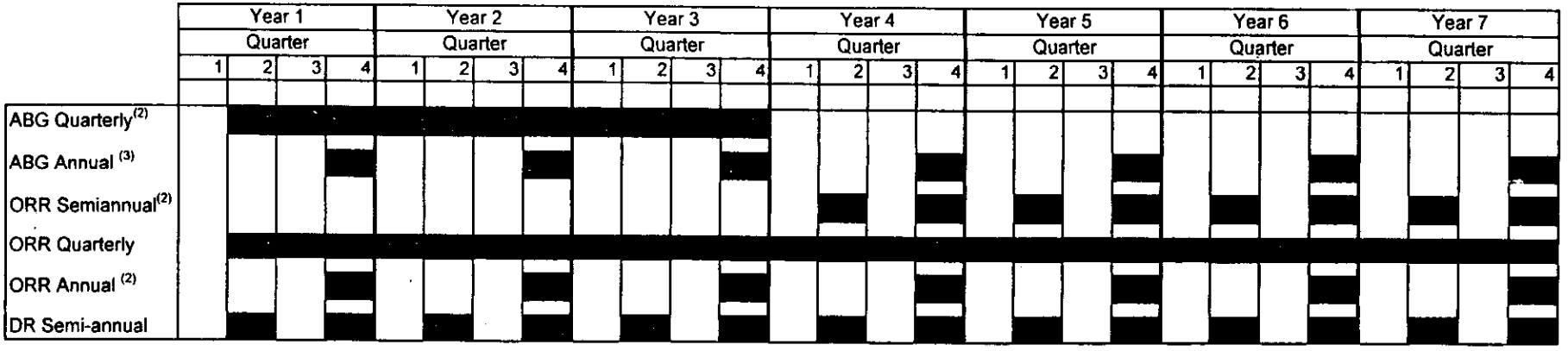
- U.S. EPA, IDEM, and the Navy may perform an audit of field procedures at any time.

5.0 PROJECT SCHEDULE

This section provides a project schedule for the implementation of the long-term ground water monitoring at the ABG, including the Surface Impoundments and Waste Pile (both currently in the closure process), ORR, DR, and OJT to be performed at the NSWC-Crane, Indiana. The ground water monitoring plan will be performed during the operating life of the unit and any closure and post-closure periods. Within this period, quarterly, semiannual and annual ground water sampling events will take place for the ABG, quarterly and annual sampling will take place for the ORR and semiannual sampling will take place for the DR. Figure 5-1 shows the milestone sampling events. Dedicated well pumps will be installed during the first quarterly sampling event.

FIGURE 5-1

MONITORING SCHEDULE[1]
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA



1 Monitoring will continue throughout the operating life of the units and the closure and post-closure periods.
2 Quarterly monitoring will take place for a minimum of three years or one year after soil removal and cleanup is complete, whichever is later. Seminannual monitoring will then begin.
3 NSWC Crane will request a modified suite of Annual Appendix IX analytes after the first year of monitoring.

U.S. EPA, 1995. Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM04.0. Office of Emergency and Remedial Response, Washington, D.C.

U.S. EPA Region 5, Apirl 1998. Region 5 QAPP Policy. Waste, Pesticides, and Toxics Division, Chicago, IL.

U.S. EPA Region 5, August 1993a. Region 5 Standard Operating Procedure for Validation of CLP Organic Data. Environmental Sciences Division, Central Regional Laboratory, Chicago, IL.

U.S. EPA Region 5, September 1993b. Region 5 Standard Operating Procedure for Validation of CLP Inorganic Data. Environmental Sciences Division, Central Regional Laboratory, Chicago, IL.

U.S. EPA Region 5, September 1995. EDQL, PQL Values for All Media. Environmental Sciences Division, Central Regional Laboratory, Chicago, IL.

U.S. EPA Region 5, December 1995. USEPA Region 5 Waste Management Branch RCRA Data Quality Levels. Environmental Sciences Division, Central Regional Laboratory, Chicago, IL.

STANDARD OPERATING PROCEDURE NUMBER 5

MONITORING WELL SAMPLING

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish the procedure for monitoring well sampling. Low-flow sampling techniques are used for ground water sampling at the Ammunition Burning Grounds (ABG), Old Rifle Range (ORR), and Demolition Range (DR). Each monitoring well sampled at the ABG, ORR, and DR is equipped with a dedicated, 1.66-inch-diameter bladder pump and dedicated Teflon®-lined polyethylene tubing. Therefore, this procedure is designed for sampling using dedicated sampling equipment.

The NSWC Crane Environmental Protection Department must approve any deviations from this procedure.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

The following field forms and equipment are required for low-flow sampling of monitoring wells.

Numbered Ground Water Sample Log Sheet: A copy of this form along with instructions for its completion are included in SOP 11.

Bound Field Logbook

Labeled sample containers: See SOP 9 for sample identification procedures and SOP 11 for contents of labels.

Numbered tag for each sample container

0.45 micron filter assembly: These are single-use filters used to filter samples scheduled for dissolved metals or dissolved phosphorus analysis. The filters are discarded after one use.

Electronic Programmable Controller, Model 400: The programmable controller regulates the dedicated bladder pump. The manual for the operation of the controller is found in Appendix C of this approved Field Sampling Plan.

Cylinder of compressed nitrogen with regulator: Compressed gas is the power source for the dedicated bladder pump.

Plastic storage bags

Shipping containers

3.0 MONITORING WELL SAMPLING PROCEDURES

3.1 Before the well is sampled, the inspection procedures described in SOP 1, the water-level measurements described in SOP 2, and the well-purging procedures described in SOP 4 must be completed. Initiate sampling when the well is stabilized in accordance with SOP 4.

3.2 Record the sample start time (using military time) on the Ground Water Sample Log Sheet.

3.3 With the pump continuing to run, disconnect the flow-through cell from the pump discharge tube and immediately start filling sample bottles directly from the pump discharge. Allow the pump discharge to flow gently down the inside of the container with minimal turbulence when filling sample containers. Avoid immersing the discharge tube into the sample as the sample container is being filled.

3.4 Cap each container immediately after filling.

3.5 Record the time that the sample container was filled on the numbered Ground Water Sample Log Sheet and on the numbered sample tag.

3.6 Using a wire tie, secure the associated numbered tag to each sample container.

3.7 Place the tagged sample container into a plastic storage bag and then into a cooler containing ice.

3.8 Repeat steps 3.1 through 3.8 for each sample container collected.

STANDARD OPERATING PROCEDURE NUMBER 6

SURFACE AND SPRING WATER SAMPLING

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish the procedure for surface and spring water sampling.

The NSWC Crane Environmental Protection Department must approve any deviations from this procedure.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

The following field forms and equipment are required for surface and spring sampling.

Numbered Surface Water Sample Log Sheet: A copy of this form is included in SOP 11.

Bound Field Logbook

Numbered tags for each sample container

Multi-parameter water-quality meter: The water-quality meter is used for the measurement of dissolved oxygen, pH, specific conductance, temperature, turbidity, and oxidation-reduction potential. The manual for the operation and calibration of this meter is found in Appendix C.

Dedicated/disposable sample containers: Dedicated/disposable sample containers are used to fill sample containers and transport sample(s) to a pump for filtering.

Labeled sample containers: See SOP 9 for sample identification procedures and SOP 11 for contents of labels.

0.45 micron filter assembly: These are single-use filters used to filter samples scheduled for dissolved metals or dissolved phosphorus analysis. The filters are discarded after one use.

Silicon tubing

Plastic storage bags

Shipping containers

3.0 SURFACE AND SPRING WATER SAMPLING PROCEDURES

3.1 The same methods will be used to collect surface water and spring water samples. Sampling will start at the downstream location and proceed to the farthest upstream location. Reference figures for all four locations are included in this SOP for exact sample locations. The sampling sequence will be as follows:

LOCATION	LOCATION ID
Little Sulphur Creek at site Boundary	A CRB
Little Sulphur Creek Below Spring A	A CRA
SPRING A	A SPRA
SPRING C	A SPC

3.2 Gently remove any leaves or twigs that have accumulated in the sample pool area since the last sampling event in a manner that will not disturb the sediment but will allow for sample volumes to be taken.

3.3 Estimate the flow rate of the stream or spring in gallons per minute (gpm). This is an estimate only. Round the flow rate to the nearest 5 gallons and record this number on the Surface Water Sample Log Sheet.

3.4 Record the sample time (using military time) on the Surface Water Sample Log Sheet and sample container labels.

3.5 Obtain measurements of dissolved oxygen, pH, specific conductance, temperature, turbidity, and oxidation-reduction potential using the multi-parameter water-quality meter. Suspend the meter into the sample pool. After the meter has stabilized (approximately 1 to 2 minutes), record the readings on the Surface Water Sample Log Sheet.

STANDARD OPERATING PROCEDURE NUMBER 7
FIELD TEST KIT ANALYSIS

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish the procedure for the field chemical analysis of parameters in groundwater, spring water, and surface water using field test kits. The following parameters are included in this SOP:

- Alkalinity
- Dissolved Carbon Dioxide
- Dissolved Oxygen
- Ferrous Iron
- Nitrite
- Nitrate
- Hydrogen Sulfide

The NSWC Crane Environmental Protection Department must approve any deviations from this procedure.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Field Chemical Analytical Log Form: A copy of the Field Chemical Analytical Log Form, along with instructions for completing this form, can be found in SOP 11.

Field analytical test kits, methods, and reagents: The following table presents the required analytical test kits to be used for field analysis. Specific reagents and bottle requirements are included in each procedure (copies of procedures are attached in Appendix C).

Parameter	Make	Model	Method Number	Equipment/ Method Chemistry
Alkalinity	HACH	AL-DT	HACH 8203 SM 2320	Digital Titration / Sulfuric Acid, Phenolphthalein
Carbon Dioxide	HACH	CA-DT	HACH 8205	Digital Titration / Sodium Hydroxide, Phenolphthalein
Dissolved Oxygen	HACH	OX-DT	HACH 8215 EPA 360.1	Digital Titration/ Azide modification to Winkler

Parameter	Make	Model	Method Number	Equipment/ Method Chemistry
Ferrous Iron	HACH	DR-850	HACH 8146	Colorimeter / 1,10 Phenanthrolein
Nitrite	HACH	DR-850	HACH 8507 Mod EPA 354.1	Colorimeter / Diazotization
Nitrate	HACH	DR-850	HACH 8192 Mod EPA 353.2	Colorimeter / Cadmium Reduction
Hydrogen Sulfide	HACH	DR-850	HACH 8131 EPA 376.2	Colorimeter / Methylene Blue

3.0 FIELD ANALYTICAL PROCEDURES

3.1 GENERAL

For specific analytical procedures, the procedures for each of the individual analyses are attached in Appendix C. The procedures give a detailed explanation on how to perform each particular method, and include information on sampling/storage, accuracy checks, standard additions methods, interference, reagents, and apparatus.

Prior to analysis, ground water samples will be collected in accordance with SOP 5. Surface and spring water samples will be collected in accordance with SOP 6.

3.2 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Accuracy checks shall be performed to check the performance of the reagents, the apparatus, and the analytical procedure. These accuracy checks include standard additions, standard solutions, field duplicates, and reagent blank correction. The procedures attached in Appendix C detail how to perform each of the accuracy checks for each parameter.

Prior to analysis, the expiration dates of reagents will be checked. If the reagents have exceeded their shelf life, the reagents will be replaced. If standard additions accuracy checks do not fall within 5 percent of the expected range, the apparatus and procedures will be evaluated. If the apparatus is found faulty, the apparatus will be replaced and the associated data will be flagged as estimated. If new apparatus is immediately available, the samples will be reanalyzed. If deviations from the applicable analytical procedure are identified, the deviations will be corrected and the associated samples re-analyzed. If no problems are identified with the reagents, apparatus, or procedures, interference may be present. Associated data will be qualified as estimated in the 'notes' section on the sample logsheet. Field

duplicate results will be evaluated for relative percent difference (RPD). If the RPD exceeds 30 percent, the associated data will be qualified as estimated.

The following table describes the type and frequency of accuracy checks required for each parameter.

Parameter	Standard Addition	Standard Solution	Field Duplicate	Reagent Blank Correction
Alkalinity	1 per round	None	1 per 10	None
Carbon Dioxide	1 per round	None	1 per 10	None
Dissolved Oxygen	None	None	1 per 10	None
Ferrous Iron	None	None	1 per 10	None
Nitrite	None	1 per round	1 per 10	1 per lot
Nitrate	1 per round	1 per round	1 per 10	1 per lot
Hydrogen Sulfide	None	None	1 per 10	None

3.3 Sample Handling and Storage

Each of the field parameters requires slightly different sampling procedures and storage limitations. In order to compile these procedures and limitations into one location for reference in the field, the following table has been prepared that presents parameter-specific requirements for sampling and storage.

Parameter	Handling	Storage
Alkalinity	Avoid agitation and exposure to air	May hold for 1 hr. at 4°C with zero headspace; warm to room temperature before analysis.
Carbon Dioxide	Avoid agitation and exposure to air	May hold for 24 hr. at 4°C with zero headspace; warm to room temperature before analysis.
Dissolved Oxygen	Avoid agitation and exposure to air	Analyze immediately.
Ferrous Iron	Avoid agitation and exposure to air; filter if visibly turbid	Analyze immediately; keep out of sunlight.
Nitrite	Utilize standard sampling techniques	May hold for 24 hr. at 4°C; warm to room temperature before analysis.
Nitrate	Utilize standard sampling techniques; filter if visibly turbid	May hold for 48 hr. at 4°C; warm to room temperature before analysis.
Hydrogen Sulfide	Avoid agitation and exposure to air	Analyze immediately.

- Book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). At the completion of each day's entries, the site logbook must be signed and dated by the Field Operations Leader (FOL).

Upon completion of the fieldwork or when completely filled, the Site Logbook is stored in the NSWC Crane records repository. Attachment 1 contains an example of typical entries found in a Site Logbook.

3.2 Field Logbooks

The Field Logbook is a separate dedicated notebook used by field personnel to document his or her activities in the field. This notebook is hardbound and paginated.

Upon completion of the fieldwork or when completely filled, Field Logbooks are stored in the NSWC Crane records repository. Attachment 2 contains an example of typical entries found in a Field Logbook.

3.3 Document Tracking Logbook

The Document Tracking Logbook is used to record the numbers of each chain-of-custody (COC) and field form(s) associated with a particular monitoring point. This logbook is hardbound and paginated. The FOL (or designee) is responsible for entry of information into the Document Tracking Logbook.

Upon completion of the field work or when completely filled, Field Logbooks are stored in the NSWC Crane records repository. Attachment 3 contains an example page from the Document Tracking Logbook and instructions for completing the entries for a monitoring point.

3.4 Sample Label and Tag

Adhesive sample container labels must be completed and applied to every sample container. Each adhesive label is numbered. A second, identical (including number) adhesive sample label will be completed and affixed onto a tag that will be attached to the neck of the sample container with string.

Once the laboratory receives the sample, the tag will be removed from the sample container and returned to the task manager.

Sample tags will be stored in the NSWC Crane records repository. Attachment 4 contains an example label and tag, along with instructions for entering information on the label and tag.

3.5 Chain-of-Custody Form

The Chain-of-Custody form (COC) is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as it is transferred from person to person. Each COC is numbered. This form must be used for any samples collected for laboratory chemical analysis.

The FOL must include the name of the laboratory in the "Remarks" section to ensure that the samples are forwarded to the correct location. If more than one COC is necessary for any cooler, the FOL will indicate "Page __ of __" on each COC. The original (top) signed copy 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, a separate COC must be included with each cooler and must reflect the sample containers in that particular cooler. Once the samples are received at the laboratory, the sample custodian checks the contents of the cooler against the enclosed COC. Any problems are noted on the enclosed COC form (bottle breakage, discrepancies between the sample labels, tags, COC form, etc.) and will be resolved through communication between the laboratory point-of-contact and the task manager. The COC form is signed and retained by the laboratory and becomes part of the sample's corresponding analytical data package.

The number of each COC associated with a monitoring point is recorded in the Document Tracking Logbook. Each COC is placed into a binder and stored in the NSWC Crane records repository. Attachment 5 contains an example COC, along with instructions on completing the COC.

3.6 Custody Seal

The Custody Seal is an adhesive-backed label with a number on each seal. It is part of the 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 Custody Seals are signed and dated by the samplers and affixed across the opening edges of each cooler (four seals per medium to larger coolers; two seals per small cooler) containing environmental samples. The laboratory sample custodian will examine the Custody Seal for evidence of tampering and will notify the task manager if evidence of tampering is observed. The number of each custody seal is recorded on the COC.

ATTACHMENT 4

SAMPLE LABEL AND TAG

INSTRUCTIONS FOR COMPLETION OF SAMPLE LABELS AND TAGS

Sample labels and tags are used to document sample ID, date, time, tag number, analysis, preservative, matrix, sampler, and laboratory. For each sample, a label and a tag will be completed and attached to the sample container. The label and tag for each sample container are identical.

1 Enter the sample date.
2 Enter the time that the sample container was filled, in military time.
3 Enter the sampler's initials.

A pre-printed set of labels will be made for each sampling event having the following established:

(A) Tag numbers (sequential)
(B) Laboratory Name (matched to specific analyses)
(C) Sample numbers (based on established set of samples per well location or SW locatoin)
(D) Preservative (based on specific analyses)
(E) Analyses (established analysis per well or SW location based on QAPP parameter list)
(F) Sample matrix (aqueous in all sampling performed under this plan)
(G) Project Number: Stays the same throughout the contracting period
(H) Location: NSWC Crane, Indiana
(I) Contractor

Pre-established tags will reduce the field writing time, but the sampler must be cautious in placing the correct label associated with the taken sample.

(I) Tetra Tech NUS, Inc. 661 Andersen Drive Pittsburgh, 15220 (412)921-7090		Project: CTO 038 (G) Location: NSWC CRANE (H)	
Sample No: AC172A99 (C)			Tag #: A0001 (A)
Date: (1)	Time: (2)	Preserve: H2SO4 (D)	
Analysis: TOC (E)		Matrix: AQUEOUS (F)	
Sampled by: (3)		Laboratory: LAUCKS (B)	

(I) Tetra Tech NUS, Inc. 661 Andersen Drive Pittsburgh, 15220 (412)921-7090		Project: CTO 038 Location: NSWC CRANE	
Sample No: AC172A99 (C)			Tag #: A0001 (A)
Date: (1)	Time: (2)	Preserve: H2SO4 (D)	
Analysis: TOC (E)		Matrix: AQUEOUS (F)	
Sampled by: (3)		Laboratory: LAUCKS (B)	

ATTACHMENT 5

CHAIN-OF-CUSTODY

INSTRUCTIONS FOR COMPLETION OF THE CHAIN OF CUSTODY RECORD

The Chain-of-Custody Record (COC) is a multi-part, standardized form designed to summarize and document pertinent sample information such as sample identification and type, matrix, date and time of collection, preservation, and requested analyses. Furthermore, through the sequential signatures of various sample custodians (e.g., sampler, airbill number, laboratory sample custodian), the COC report documents sample custody and tracking.

1 Enter the signature of the person(s) that sampled this monitoring point.
2 Enter the date that the sample was collected.
3 Enter the time (in military time) that the sample was collected.
4 Enter the sample's alphanumeric identification.
5 Enter the number of containers associated with the corresponding date and time.
6 Enter the letter (A,B,C, etc.) of the subset associated with the parameter that the sample will be analyzed for. If this parameter does not require analysis, leave this space blank. The list of subsets for all parameters that have subsets can be found in Appendix D of this approved Field Sampling Plan.
7 Enter a check mark if the laboratory is to test for this parameter. If this parameter does not require analysis, leave this space blank.
8 If additional analyses are required that differ from the preprinted analyses, these spaces will serve as a place for that additional analysis.
9 A check mark will be placed here to indicate to the laboratory that this parameter is to be analyzed.
10 Enter the number from the corresponding sample tag that is tied to the neck of the sample container.
11 Enter any remarks (duplicate, MS/MSD, low sample volume, etc.) that relate to anything out of the ordinary with a particular sample. This remarks column is for field personnel comments only.
12 Enter the signature of the person who relinquishes the sample cooler to another person. The first "relinquished by" space should be that of the sampler(s).
13 Enter the date that the sample cooler was relinquished.
14 Enter the time (using military time) that the sample cooler was relinquished.
15 Enter the signature of the person receiving the sample cooler from the relinquisher.
16 Enter the signature of the person receiving the sample cooler for the laboratory.
17 Enter the date that the laboratory received the sample cooler.
18 Enter the time (in military time) that the laboratory received the sample cooler.
19 Enter the airbill number from the courier's shipping label.
20 Enter the temperature of the Temperature Blank (in degrees Celsius) at shipping.
21 Enter the temperature of the Temperature Blank (in degrees Celsius) upon arrival of the sample cooler at the laboratory.
22 Enter the numbers of the cooler custody seals used to ship that cooler.
23 This space is for remarks.
24 Enter project number unless pre-printed.

Pre-printed information on the COC:

(A) COC Form number: sequential
(B) Location: NSWC Crane, Indiana
(C) Contractor used for contracting period

TETRA TECH NUS, INC.
661 Andersen Drive • Pittsburgh, PA 15220

(C)

0001 (A)

NSWC CRANE, INDIANA

(B)

CHAIN OF CUSTODY RECORD

PROJECT NO.: (24)

SAMPLERS (SIGNATURE): (1)

DATE	TIME	SAMPLE ID	CONTAINERS NO.	VOLATILES	DISSOLVED GASES	SULFIDE	TOX	SEMIVOLATILES	EXPLOSIVES	METALS	CYANIDE	PESTICIDES/PCBS	HERBICIDES	DIOXINS/FURANS	TOC	SULFATE	AMMONIA	CHLORIDE	PHOSPHORUS	(8)	(8)	TAG NO.	REMARKS
(2)	(3)	(4)	(5)	(6)	(6)	(7)	(7)	(6)	(6)	(6)	(7)	(6)	(6)	(6)	(7)	(7)	(7)	(7)	(7)	(9)	(9)	(10)	(11)

RELINQUISHED BY (SIGNATURE):	DATE/TIME		RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME		AIR BILL NO.: (19)
(12)	(13)	(14)	(15)	(12)	(13)	(14)	TEMP. BLANK: AT SHIPMENT (20) °C AT LAB (21) °C

RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME		RECEIVED FOR LAB BY (SIGNATURE):	DATE/TIME		COOLER CUSTODY SEAL NOS: (22)
(15)	(12)	(13)	(14)	(16)	(17)	(18)	REMARKS: (23)

ATTACHMENT 6

CUSTODY SEAL

INSTRUCTIONS FOR COMPLETION OF CUSTODY SEALS

Custody seals are tamper-evident self-sticking labels. The seals are used in conjunction with strapping tape to seal coolers containing samples and COC(s) for shipment to the laboratory.

1 Enter date cooler is sealed.

2 Enter signature.

Note: Four custody seals will be used on a medium size cooler.

Pre-printed on Seal:

(A) Seal tag number: sequential

ATTACHMENT 7

EQUIPMENT CALIBRATION LOG

INSTRUCTIONS FOR COMPLETION OF THE EQUIPMENT CALIBRATION LOG

This field form is used to document equipment calibration. One equipment calibration log will be completed for each piece of equipment calibrated. The calibration log is to be used for all on-site equipment calibration (all columns on the form may not apply to each instrument).

1 Enter instrument make and model.
2 Enter instrument serial number.
3 Enter name of instrument manufacturer.
4 Use this column to enter instrument calibration date.
5 Use this column to enter instrument initial settings.
6 Use this column to enter standards used during calibration.
7 Use this column to enter procedures used during calibration, i.e. as per instrument manual.
8 Use this column to enter any adjustments made to the instruments.
9 Use this column to enter instruments final settings.
10 Enter personnel signature.
11 Enter comments pertaining to the calibration of the instrument.
12 Enter the name of the rental company that the instrument was rented from.
13 Enter project number unless pre-printed.

Pre-printed Equipment Calibration Log information:

(A) Project Name: NSWC Crane

NSWC Crane
Field Form
Revison: 3
September 1999

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : _____(1)_____ PROJECT NAME : NSWC Crane (A)

SERIAL NUMBER: _____(2)_____ PROJECT NUMBER : _____(13)_____

MANUFACTURER : _____(3)_____

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

Instrument Rented From: _____(12)_____

ATTACHMENT 8

MONITORING WELL INSPECTION FORM

INSTRUCTIONS FOR COMPLETION OF THE MONITORING WELL INSPECTION FORM

This field form is used to document the condition, prior to sampling, of monitoring wells.

1	Enter the well ID number.
2	Enter the time inspection was performed, using military time.
3	Enter the date of inspection.
4	Print the inspector's name.
5 and 6	Enter a check mark in the appropriate status box: S = satisfactory, U = unsatisfactory; if U, explain.
7	Enter any observations pertaining to that inspection item.
8	Enter any comments pertaining to the well inspection.
9	Enter the sampler's signature(s).

Pre-printed information on Monitoring Well Inspection form:

(A) Monitoring well inspection form number: sequential

Sequential Number ___(A)___ NSWC Crane
Field Form
Revision: 3
September 1999

NSWC CRANE
MONITORING WELL INSPECTION FORM

Well ID: _____(1)_____

Time: _____(2)_____ **Date:** ___(3)_____ **Inspector's Name:** _____(4)_____

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	(5)	(6)	(7)
Well security	Condition protective case, cap, lock			
Well pad	Concrete or gravel & condition			
Well seal	Condition of...			
Area Immediately around well pad	Record any evidence of/or standing water in area of well			
Dedicated sampling equipment	Condition of...			
PVC Riser	Condition of riser & survey reference point			

Comments: **(8)**

Signature(s)_____(9)_____

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

ATTACHMENT 9

WATER-LEVEL MEASUREMENT FORM

INSTRUCTIONS FOR COMPLETION OF THE WATER LEVEL MEASURMENT FORM

This field form is used to document monitoring well water levels and associated data. Refer to SOP 2 for water level measurement procedures.

1	Enter the weather conditions at the time of measurements.
2	Print personnel name(s).
3	Enter make, model, and serial number of the instrument.
4	Enter any pertinent remarks.
5	Enter the well ID number.
6	Enter the date measurement was taken.
7	Enter the time measurement was taken, using military time.
8	Enter static water level of the well, to the nearest 0.01 foot.
9	Enter, if applicable, thickness of free product, to the nearest 0.01 foot.
10 and 11	Enter the PID reading in the riser pipe (2-inch PVC) and in the breathing zone, in ppm.
12	Enter comments pertaining to water-level measurements and record readings from the interface probe, if used.
13	Enter personnel signature(s).
14	Enter proejct number, unless pre-printed.

Pre-printed information on the Water Level Measurement form:

(A)	Project Name: NSWC Crane
(B)	Project Location: Crane, Indiana
(C)	Water level measurement form number: sequential

Sequential No. ____(C)_____

NSWC Crane
Field Form
Revision: 3
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WATER LEVEL MEASUREMENT FORM

Project Name: NSWC Crane (A)
Location: Crane, IN (B)
Weather Conditions: _____(1)_____

Project No.: _____(14)_____
Personnel: _____(2)_____
Measuring Device: _____(3)_____
Remarks: _____(4)_____

Well ID	Date	Time	Water Level *	Thickness of Free Product *	PID Reading ppm		Comments
					RP	BZ	
(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

* All measurements to the nearest 0.01 foot

Signature(s): _____(13)_____

ATTACHMENT 10

LOW-FLOW PURGE DATA FORM

INSTRUCTIONS FOR COMPLETION OF THE LOW-FLOW PURGE DATA FORM

This field form is used to document date, times, and data during purging of wells. This form is used in conjunction with the Ground Water Sample Log Form.

1	Enter the well ID number.
2	Enter the date purged.
3	Enter the time that stabilization parameters are taken, typically at 5- to 10-minute intervals, using military time.
4	Enter water-level reading, measured to the nearest 0.01 foot.
5	Enter pump rate, in milliliters per minute.
6 through 11	Record field parameters from Multiple-Parameter Water-Quality meter.
12	Enter comments (i.e. adjustments/maintenance preformed on meters/equipment, moved off well due to Navy activities, etc.)
13	Enter sampler's signature(s).
14	Enter page two and total pages used for sampling and purging, per well. The Ground Water Sample Log Form will always be page one, and the Low-Flow Purge Data Form(s) will be the following page(s).
15	Enter project number, unless pre-printed.

Pre-printed information on the Low-Flow Purge Data form:

(A)	Project Name: NSWC Crane
(B)	Low-flow purge data form number: sequential

Pre-printed Sequential No. ____(B)_____

NSWC Crane
Field Form
Revision: 3
September 1999

LOW FLOW PURGE DATA FORM

PROJECT SITE NAME: NSWC CRANE (A)

PROJECT NUMBER: (15)

WELL ID.: (1)

DATE: (2)

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

SIGNATURE(S): _____(13)_____

PAGE___OF___ (14)

ATTACHMENT 11

GROUND WATER SAMPLE LOG FORM

INSTRUCTIONS FOR COMPLETION OF THE GROUND WATER SAMPLE LOG FORM

This field form is used to document date, times, and additional data at ground water sampling locations. This form is used in conjunction with the Low-Flow Purge Data Form.

1	Enter page one and total pages used for sampling and purging, per well. The Ground Water Sample Log Form will always be page one, and the Low-Flow Purge Data Form(s) will be the following page(s).
2	Enter the sample ID number.
3	Enter the sample location (i.e. ABG, ORR, DR).
4	Print the name of the sampler(s).
5	Enter the COC number associated with samples taken on this form.
6	Enter date sampled.
7	Enter start sample time, using military time.
8	Enter end sample time, using military time.
9	Enter color of sample (i.e. clear, cloudy, light tan, etc.).
10 through 15	Enter final set of field parameters from associated Low-Flow Purge Data Form.
16	Enter odor of sample, if any (i.e. none, light sulfur, etc.).
17	Enter date purged. Note: sample and purge date may be different dates.
18	Enter one casing volume, calculated.
19	Enter total depth of the well to the nearest 0.01 foot.
20	Enter static water level of the well to the nearest 0.01 foot.
21	Enter start purge time, using military time.
22	Enter end purge time, using military time.
23	Enter total purge time.
24	Enter total volume purged, in gallons.
25	Enter, for each sample container, time of collection, using military time.
26	Observations, notes (i.e. changes in site conditions from last sampling event, adjustments/maintenance preformed on meters/equipment, etc.).
27	Enter riser pipe and breathing zone PID readings, in ppm.
28	Enter reaction of sample water to preservative; if no reaction, enter None.
29	Enter Yes or No.
30	Enter, if taken, Duplicate ID number; if none was taken, enter No.
31	Enter sampler's signature(s).
32	Enter project number, unless pre-printed.

Note: Analysis will vary (site-to-site, quarterly, annually, etc.) and will be reflected in the Sample Collection Information section of this form. These variations will not change the instructions for completion of this sample log form.

Pre-printed information on the Ground Water Sample Log form:

(A) Project Site Name: NSWC Crane

NSWC Crane
Field Form
Revision: 3
September 1999

GROUND WATER SAMPLE LOG FORM

(1)
Page___ of ___

Project Site Name:	NSWC CRANE, IN (A)	Sample ID No.:	(2)
Project No.:	_____(32)_____	Sample Location:	(3)
		Sampled By:	(4)
		C.O.C. No.:	(5)

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date: (6)								
Time-Start: (7) End: (8)	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method: Dedicated Bladder Pump	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)

PURGE DATA:

Date: (17)	Total Well Depth (TD): (19)	End Purge (hrs): (22)
Method: Dedicated Bladder Pump	Static Water Level (WL): (20)	Total Purge Time (min): (23)
Well Casing: 2" PVC	Start Purge (hrs): (21)	Total Vol. Purged (gal): (24)
One Casing Volume(gal): (18)		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Time Collected
Volatiles (Subsets B&C)	HCl/4°C	(3) 40 mL Glass Vials	(25)
Dissolved Methane/Ethane/Ethene	4°C/Dark	(2) 40 mL Amber Glass Vials	
Sulfide	4°C/Zn($C_2H_3O_2$),NaOH	(1) 500 mL Polyethylene	
TOX	H_2SO_4/4°C	(1) 1000 mL Amber Glass	
Explosives (Subsets A)	4°C/Dark	(2) 1000 mL Amber Glass	
Explosives (Subsets B)	4°C/Dark	(2) 500 mL Amber Glass	
Total Metals (Subsets A & B)	HNO_3/4°C	(1) 1000 mL Polyethylene	
Cyanide	NaOH/4°C	(1) 500 mL Polyethylene	
TOC	H_2SO_4/4°C	(1) 125 mL Amber Glass	
Chloride & Sulfate	4°C	(1) 500 mL Polyethylene	
Total Phosphorus	H_2SO_4/4°C	(1) 500 mL Polyethylene	
Dissolved Phosphorus	H_2SO_4/4°C/Filtered	(1) 500 mL Polyethylene	
Dissolved Metals (Subsets A, C & D)	HNO_3/4°C/Filtered	(1) 1000 mL Polyethylene	
Natural Attenuation (field test)	Various Parameters & Containers, see SOP 7		

OBSERVATIONS / NOTES: (26)

PID reading in PVC riser pipe = (27) (ppm)
PID reading in Breathing Zone = (ppm)

Reaction of sample to preservative: (28)

QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):
(29)	(30)	(31)

ATTACHMENT 12

SURFACE WATER SAMPLE LOG FORM

INSTRUCTIONS FOR COMPLETION OF THE SURFACE WATER SAMPLE LOG FORM

This field form is used to document date, times, and additional data at spring and surface water sampling locations.

1	Enter the sample ID number.
2	Enter the sample location (i.e. ABG, ORR, DR).
3	Print the name of the sampler(s).
4	Enter the COC number associated with samples taken on this form.
5	Check spring or stream.
6	Enter date sampled.
7	Enter start sample time, using military time.
8	Enter end sample time, using military time.
9	Enter depth sample was taken, in inches.
10	Enter color of sample (i.e. clear, cloudy, light tan, etc.).
11 through 16	Enter field parameters recorded from the Multiple-Parameter Water-Quality meter.
17	Enter odor of sample, if any (i.e. none, light sulfur, etc.).
18	Enter, for each sample container, time of collection, using military time.
19 and 20	Enter any comments, observations, or notes (i.e. changes in sample point from last sampling event, rain, etc.).
21	Enter reaction of sample water to preservative; if no reaction, enter None.
	Enter estimated flow rate of stream or spring at sample location, in gallons per minute (gpm).
22	Enter Yes or No.
23	Enter, if taken, Duplicate ID number; if none was taken, enter No.
24	Enter sampler's signature(s).
25	Enter project number, unless pre-printed.

Note: Analysis will vary (quarterly, annually, etc.) and will be reflected in the Sample Collection Information section of this form. These variations will not change the instructions for completion of this sample log form.

Pre-printed information on the Surface Water Sample Log form:

(A) Project Site Name: NSWC Crane, IN

NSWC Crane
Field Form
Revision: 3
September 1999

SURFACE WATER SAMPLE LOG FORM

Project Site Name: NSWC CRANE, IN (A)
Project No.: _____(25)_____

[] Stream (5)
[] Spring

Sample ID No.: (1)
Sample Location: (2)
Sampled By: (3)
C.O.C. No.: (4)

SAMPLING DATA:

Date: (6)	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start: (7) End: (8)	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Depth: (9)								
Method: Direct Fill	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Time Collected
Volatiles (Subsets B&C)	HCl/4°C	(3) 40 mL Glass Vials	(18)
Dissolved Methane/Ethane/Ethene	4°C/Dark	(2) 40 mL Amber Glass Vials	
Sulfide	4°C/Zn($C_2H_3O_2$),NaOH	(1) 500 mL Polyethylene	
TOX	H_2SO_4/4°C	(1) 1000 mL Amber Glass	
Explosives (Subsets A)	4°C/Dark	(2) 1000 mL Amber Glass	
Explosives (Subsets B)	4°C/Dark	(2) 500 mL Amber Glass	
Total Metals (Subsets A & B)	HNO_3/4°C	(1) 1000 mL Polyethylene	
Cyanide	NaOH/4°C	(1) 500 mL Polyethylene	
TOC	H_2SO_4/4°C	(1) 125 mL Amber Glass	
Chloride & Sulfate	4°C	(1) 500 mL Polyethylene	
Total Phosphorus	H_2SO_4/4°C	(1) 500 mL Polyethylene	
Dissolved Phosphorus	H_2SO_4/4°C/Filtered	(1) 500 mL Polyethylene	
Dissolved Metals (Subsets A, C & D)	HNO_3/4°C/Filtered	(1) 1000 mL Polyethylene	
Natural Attenuation (field test)	Various Parameters & Containers, see SOP 7		

OBSERVATIONS / NOTES: (19)

Reaction of sample to preservative: (21)

Estimated Flow Rate: (22)

Comments: (20)

QA Samples Collected:

MS/MSD	Duplicate ID No.:
(23)	(24)

Signature(s):

(25)

APPENDIX D

LIST OF FIELD PARAMETER AND ANALYTICAL SUBSETS

FIELD PARAMETERS SUBSET A

Measured by meter:
Dissolved oxygen (DO)
pH
Specific conductance (SC)
Temperature (T)
Turbidity
Oxidation-reduction potential (ORP)
Water level (by water level meter)

FIELD PARAMETERS SUBSET B

Measured by test kit:
Alkalinity (carbonate, bicarbonate, hydroxide)

FIELD PARAMETERS SUBSET C

Measured by test kit:
Carbon dioxide
Dissolved oxygen
Ferrous iron
Hydrogen sulfide
Nitrite
Nitrate

VOLATILES SUBSET A

Appendix IX volatiles listed in Table 1-3 of the approved QAPP

VOLATILES SUBSET B

Trichloroethene (TCE)
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
Vinyl chloride

VOLATILES SUBSET C

Benzene
Toluene
Ethylbenzene
Total xylenes
Tetrachloroethene
1,1,1-Trichloroethane
1,1-Dichloroethane
1,2-Dichloroethane
Carbon tetrachloride
Chloroethane
Chloroform
Methylene chloride

DISSOLVED GASES SUBSET A

Methane
Ethane
Ethene

SEMIVOLATILES SUBSET A

Appendix IX semivolatile organic compounds listed in Table 1-3 of the approved QAPP.

PESTICIDES/PCBs SUBSET A

Appendix IX pesticide/PCB compounds listed in Table 1-3 of the approved QAPP.

HERBICIDES SUBSET A

Appendix IX herbicides listed in Table 1-3 of the approved QAPP.

METALS SUBSET A

Appendix IX metals listed in Table 1-3 of the approved QAPP.

METALS SUBSET B

Iron

METALS SUBSET C

Potassium
Sodium
Calcium
Magnesium

METALS SUBSET D

Manganese

DIOXINS/FURANS SUBSET A

Appendix IX dioxins/furans listed in Table 1-3 of the approved QAPP.

EXPLOSIVES SUBSET A

1,3,5-Trinitrobenzene
1,3-Dinitrobenzene
TNT
2,4-Dinitrotoluene
2,6-Dinitrotoluene
HMX
2-Nitrotoluene
3-Nitrotoluene
4-Nitrotoluene
4-Amino-2,6-dinitrotoluene
2-Amino-4,6-dinitrotoluene
Tetryl
Nitrobenzene
RDX
Nitroglycerin
PETN
Nitrocellulose

EXPLOSIVES SUBSET B

2,4-Diamino-6-nitrotoluene
2,6-Diamino-4-nitrotoluene
2,2',6,6'-Tetranitro-4,4'-azoxytoluene
3,5-Dinitroaniline
TNX
MNX
Picric acid

EXPLOSIVES SUBSET C

Picric acid
Picramic acid

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

James Hunsinke
SIGNATURE

ENV. PROT. Dept. Mgr.
TITLE

10/20/93
DATE

Enclosure (2)