# FEASIBILITY STUDY FOR AIR FORCE PLANT 4 VOLUME 2 OF 2 NAS FORT WORTH TX

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RUST GEOTECH

File: 17G
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# NAVAL AIR STATION FORT WORTH JRB CARSWELL FIELD TEXAS

# ADMINISTRATIVE RECORD COVER SHEET

AR File Number 262

GJPO-WMP-86
Vol. 2

Air Force Plant 4

# Feasibility Study

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AERONAUTICAL SYSTEMS CENTER

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# Appendix A

## Potentially Applicable or Relevant and Appropriate Requirements (ARAR's)

# AIR FOR PLANT 4

| ARAR Category | Federal Act | Regulation/ Standard/Code | Description | Comments |
|---|---|---|---|---|
| Location Specific | National Environmental Policy Act (NEPA) | 40 CFR 1500 | Council on environmental quality regulations | Evaluates impacts of remediation on the environment |
| | | 40 CFR 6 | EPA NEPA regulations | Regulations specific to EPA actions |
| | | 32 CFR 989<br><br>32 CFR 265 | DOD-Air Force NEPA regulations<br>DOD-Natural Resources Programs | Regulations specific to DOD-Air Force actions; the Air Force must evaluate and disclose impacts that will occur as a result of remediation |
| | National Historic Preservation Act (1966) | 36 CFR 60, 62, 63, 65, 800 | Cultural resources regulations | Regulations pertaining to the protection of cultural resources. Includes Executive Order 11593 |
| | Archaeological Resources Protection Act (1979) | 36 CFR 296 | Cultural resources regulations | Regulations pertaining to the protection of cultural resources. Includes Executive Order 11593 |
| | Archaeological and Historic Preservation Act (1974) | 40 CFR 6.301 | Cultural resources regulations | Provides for data collection/preservation listing on the National Registry of National Landmarks, etc. If any building and/or other landmarks/resources are considered eligible, compliance must be accomplished prior to remediation. |
| | Floodplains/Wetlands | E.O. 11988<br>E.O. 11990 | | |
| | Migratory Bird Treaty Act | 16 U.S.C. 703-712<br>50 CFR 10, 20, and 21 | Regulates the taking of migratory birds | This act prohibits the "taking" of migratory birds without a permit. Accidental killing of birds by pollution from Plant 4 could be considered "taking". |

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| ARAR Category | Federal Act | Regulation/ Standard/Code | Description | Comments |
|---|---|---|---|---|
| Action Specific | Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) | 40 CFR 300 | National oil and hazardous substances pollution contingency plan | Regulations setting forth the procedures for reporting, responsibilities, and planning actions to remediate releases. OSWER Directive 9355.3-01 is applicable. |
| | Superfund Amendments and Reauthorization Act (SARA) | 40 CFR 355, 370, 372 | Emergency planning and reporting | Pertains to hazardous and toxic chemical reporting and planning requirements. |
| | Fish and Wildlife Coordination Act | 16 USC 661-666 | Requires consultation when federal department or agency proposes or authorizes any modification of any stream or other water body and adequate provision for protection of fish and wildlife resources. | This requirement would be applicable if modification of Meandering Road Creek or Lake Worth may be required. Consultation with the U.S. Fish and Wildlife Service and the appropriate state agency is required. |
| | Endangered Species Act | 50 CFR 200, 402 | Requires action to conserve endangered species within critical habitats upon which endangered species depend; includes consultation with Department of Interior. | This requirement would be most applicable to bird and fish species found in Meandering Road Creek/Lake Worth ecosystems. Consultation with federal and state agencies can be accomplished simultaneously with requirements under the Fish and Wildlife Coordination Act. |
| | Clean Water Act (CWA) | 33 CFR 322 | Structures or work within navigable waters of the United States | May be applicable to Meandering Road Creek and Lake Worth. |
| | | 33 CFR 323 | Discharges of dredge or fill material to waters of the United States | May be applicable to Meandering Road Creek or Lake Worth. |

| ARAR Category | Federal Act | Regulation/ Standard/Code | Description | Comments |
|---|---|---|---|---|
| Action Specific (continued) | Clean Water Act (continued) | 33 CFR 328<br>33 CFR 329 | | |
| | | 40 CFR 109 | Criteria for state, local, and regional oil removal contingency plans | Applicable if oil may be managed or used during remediation due to proximity to Meandering Road Creek and Lake Worth. |
| | | 40 CFR 110 | Oil discharge | May be applicable if determined that oil has contaminated or may contaminate adjacent water bodies. |
| | | 40 CFR 112 | Oil pollution prevention | Applicable to prevent oil spills into adjacent water bodies. Requires that persons who may discharge oil in harmful quantities must prepare a Spill Prevention Control and Countermeasure (SPCC) plan (40 CFR 112.1, [b]). |
| | | Texas Administrative Code (TAC), Title 31, Chapter 343 | Oil and hazardous substances | Provides for immediate cleanup of hazardous substances without obtaining a permit (Texas Water Code, Chapter 26). |
| | | Texas Water Code, Title 2, Chapter 26, Subchapter D | Prohibition against pollution | Prohibits discharge of pollutants into or adjacent to any waters of the state of Texas. |
| | | Texas Water Code, Title 2, Chapter 26, Subchapter G | Oil and hazardous substances spill prevention and control | Also known as Texas Hazardous Substances Spill Prevention and Control Act. Establishes policy to prevent the spill or discharge of hazardous substances into waters of the state of Texas. |

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| ARAR Category | Federal Act | Regulation/ Standard/Code | Description | Comments |
|---|---|---|---|---|
| Action Specific (continued) | Clean Water Act (continued) | Texas Water Code, Title 2, Chapter 26, Subchapter I | Underground and aboveground storage tanks | Refers to state of Texas Solid Waste Law as related to water quality. |
| | | Natural Resources Code, Title 2, Subtitle 6, Chapter 40 | Texas Oil Spill Prevention and Response Act | Established policy for protection of all waters of the state, but focuses on coastal waters. |
| | | TAC, Title 31, Chapter 55 | Pollution/fish kill investigations | May be applicable if a fish kill is suspected or confirmed as a result of the release of hazardous substances. |
| | | TAC, Title 31, Chapter 343 | Texas oil and hazardous substances regulations | Implements regulations under the Texas Water Code (TWC), Chapter 26, Subchapter G. |
| | | 40 CFR 122 | National Pollutant Discharge Elimination System (NPDES) program | Requires permits for the discharge of pollutants from a point source into waters of the United States. |
| | | 40 CFR 125 | Criteria and standards for the NPDES | Includes effluent discharge and stormwater discharge. |
| | | TAC, Title 31, Part IX, Chapter 305 | Texas consolidated NPDES permit rules | Set standards and requirements for applications, permits, and actions by the Texas Water Commission. |
| | | TAC, Title 31, Part IX, Chapters 308 and 315 | Texas criteria and standards for the NPDES; pretreatment regulations | May be applicable depending on selected alternative. |
| | | TAC, Title 31, Part IX, Chapter 319 | General regulations incorporated into permit | Established allowable concentrations of hazardous metals to inland waters. Includes toxic pollutant quality control (319.26) and groundwater protection (319.27). |

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| ARAR Category | Federal Act | Regulation/ Standard/Code | Description | Comments |
|---|---|---|---|---|
| Action Specific (continued) | Clean Water Act (continued) | TAC, Title 31, Part IX, Chapter 323 | Waste disposal approvals | Applies to the collection of waste in floodplains, and groundwater protection requirements. |
| | | TAC, Title 31, Chapter 331 | Underground injection control | Applies to the injection of chemicals into non-potable aquifers to facilitate remediation |
| | Hazardous Materials Transportation Act (HMTA) | 49 CFR 107 | Hazardous materials program procedures | |
| | | 49 CFR 171, 172, 173, 174, 177 | Hazardous materials regulations | Includes general information, communication requirements, emergency response information, and carriage by rail and public highway. Carriage by vessel or aircraft is not anticipated. |
| | Resource Conservation and Recovery Act (RCRA) | 40 CFR 241 | Land disposal of solid waste | May be applicable to four existing landfills if excavation is required. |
| | | 40 CFR 256 | State solid waste management plans | May be applicable if excavation of the four landfills reclassifies the landfill as an "open dump." |
| | | 40 CFR 257 | Classification of disposal facilities and practices | May be applicable to the four landfills if determined that they pose an adverse environmental or health risk. |
| | | 40 CFR 260 | Identification and listing of hazardous wastes | Identifies solid waste subject to regulations as hazardous wastes. |
| | | 40 CFR 262 | Hazardous waste generator standards | Waste will be generated as a result of remediation. |
| | | 40 CFR 263 | Hazardous waste transportation standards | Waste will be transported, including samples, as a result of remediation. Manifests are required. |

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| ARAR Category | Federal Act | Regulation/ Standard/Code | Description | Comments |
|---|---|---|---|---|
| Action Specific (continued) | RCRA (continued) | 40 CFR 264 | Standards for treatment, storage, and disposal (TSD) facilities | Waste may be stored on-site during remediation. |
| | | 40 CFR 265 | Interim status standards | May be applicable if Air Force Plant 4 is required to be a RCRA permitted facility. |
| | | 40 CFR 266 | Management of specific wastes | |
| | | 40 CFR 268 | Land disposal restrictions (LDRs) | Identifies wastes restricted from land disposal unless specific exemptions exist. Applicable to several contaminants of concern. |
| | | 40 CFR 270 | Hazardous waste permit program | Although a permit may not be required due to the designation as an NPL site under CERCLA, specific requirements may still be applicable. |
| | | 40 CFR 280 | Underground storage tank regulations | Applies to owners/operators of underground storage tanks. |
| | | Texas Solid Waste Disposal Act | Texas civil statutes Public Article 4477-7 | Includes implementation of the Federal Resource Conservation and Recovery Act. |
| | | Texas Underground Storage Tanks Act | Texas water code, Title 2, Chapter 26 | Includes underground and aboveground storage tanks. Aboveground tanks pertain only to petroleum products. |
| | | TAC, Title 31, Part IX, Chapter 334 | Underground Storage Tank Rules | Applicable to underground storage tanks storing hazardous or petroleum products, and aboveground storage tanks containing petroleum. |

| ARAR Category | Federal Act | Regulation/ Standard/Code | Description | Comments |
|---|---|---|---|---|
| Action Specific (continued) | RCRA (continued) | TAC, Title 31, Part IX, Chapter 330 | Solid waste management regulations | Includes regulation of both hazardous and non-hazardous waste; however, targets municipal solid waste disposal. |
| | | TAC, Title 31, Chapter 335 | Texas industrial waste management regulations | Regulates the management and control of municipal hazardous waste and industrial wastes. Includes generators, transporters and owners/operators of TSD facilities. |
| | | TAC, Title 31, Chapter 330 | Disposal of lead acid batteries | May be applicable if batteries are disposed in any of the four landfills. |
| | Occupational Safety and Health Act (OSHA) | 29 CFR 1900 | Implementation of OSHA | Address standard safety practices including personal protective equipment. |
| Chemical Specific | Clean Water Act (CWA) | 40 CFR 129 | Toxic pollutant effluent standards | Applicable if any toxic pollutants listed at 129.4 (including PCBs) are discovered. |
| | | TAC, Title 31, Chapter 314 | Texas toxic pollutant effluent standards | Adopts 40 CFR 129, by reference. |
| | | 40 CFR 130 | Water quality planning and management | Water quality planning, management, and program implementation. |
| | | 40 CFR 131 | Water quality standards | Procedures for development, review, and approval of state water quality standards. |
| | | TAC, Title 31, Chapter 307 | Texas surface water quality standards | Standards of the state to maintain the quality of water consistent with public health and enjoyment. |

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| ARAR Category | Federal Act | Regulation/ Standard/Code | Description | Comments |
|---|---|---|---|---|
| Chemical Specific (continued) | CWA (continued) | TAC, Title 31, Chapter 311 | Watershed protection | Includes Lake Worth regarding wastewater disposal and effluent requirements. |
| | Safe Drinking Water Act (SDWA) | 40 CFR 141, 143 | National primary and secondary drinking water standards | Establishes maximum contaminant levels (MCLs) for organics, inorganics, radioactivity, and turbidity. These standards also serve as groundwater cleanup standards at CERCLA sites. Chromium, 1,2-Dichloroethene, and Trichloroethene are the primary contaminants of concern. |
| | | TAC, Title 31, Part IX, Chapter 290 | Texas drinking water standards | Essentially adopts 40 CFR 141, 143, and establishes standards for bacteriological, chemical, and radiological quality. |
| | Clean Air Act (CAA) | 40 CFR 50 | National primary and secondary ambient air quality standards | Establishes standards for sulfur oxides, particulate matter, carbon monoxide, ozone, nitrogen dioxide and lead. |
| | | 40 CFR 52 Subpart 55 | Texas state implementation plan | Incorporates and cites revisions to Texas' 1972 original submittal of a state implementation plan. |
| | | Texas Clean Air Act | Abatement of air pollution and contaminants | Includes dust, smoke, particulate matter, fumes, gas, vapor, odor ... produced by processes other than natural. |
| | | TAC, Title 31, Part III, Chapter 101 | Texas Air Pollution Control regulations: General Provisions | Implements the Texas Clean Air Act |

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| ARAR Category | Federal Act | Regulation/ Standard/Code | Description | Comments |
|---|---|---|---|---|
| Chemical Specific (continued) | CAA (continued) | TAC, Title 31, Part III, Chapter 101 (continued) | Section 101.4 Nuisance | Requires that air pollutants can not be discharged that may be adverse to, or may be injurious to humans, animals, vegetation, and property. |
| | | | Sections 101.20 and 101.21 | Compliance with National Standards |
| | | TAC, Title 31 Part III, Chapter 111 | Visible emissions and particulate matter | Includes incineration of hazardous waste; chromium and lead are included among regulated contaminants. |
| | | | Section 111.145 | Dust control required for land clearing, construction, etc. if more than one acre. |
| | | 40 CFR 61 | National Emission Standards for Hazardous Air Pollutants (NESHAPS). | Possibly applicable due to benzene and vinyl chloride, and if asbestos is remediated in buildings. |
| | | TAC, Title 31 Part III, Chapter 115 | Control of air pollution for volatile organic compounds | a.k.a. "Texas Regulation V"; regulates synthetic organic chemicals including benzene, methylene chloride, and vinyl chloride which are contaminants of concern. |
| | | TAC, Title 31, Part III, Chapter 120 | Control of air pollution from hazardous waste or solid waste sites | Applies to all hazardous waste facilities required to obtain a permit pursuant to the Texas Solid Waste Disposal Act. |
| | Toxic Substances Control Act (TSCA). | 40 CFR 761 | Regulation of PCBs | Applicable if PCBs discovered. |
| | | 40 CFR 763 | Regulation of Asbestos | Applicable if asbestos containing materials are included in remediation. |

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# Appendix B

## Cost Worksheets for Determination of Capital and O&M Costs

**Groundwater Remediation Alternatives**

**Paluxy Aquifer**
**Alternative 2 - Alternate Water Supply**
**Cost Worksheet**

| Capital Costs | Cost* | Quantity | Total |
|---|---|---|---|
| Potable wells | $58,500 | 7 | $409,500 |
| Sampling | $2,000 | 9 | $18,000 |
| Pump/piping | $7,000 | 7 | $49,000 |
| | | | $476,500 |
| | | G&A @21% | $576,565 |
| Total Capital Costs | | Cont.@15% | $663,050 |

* Cost includes labor and materials

**Paluxy Aquifer**
**Alternative 3 - Groundwater Extraction and Treatment**
**Cost Worksheet**

| **Air Stripping Treatment** | **labor** | **material** | **equipment** | **total** |
|---|---|---|---|---|
| Paluxy Upper Sand wells thru treatment | $236,922 | $105,742 | $98,799 | $441,463 |
| Paluxy West wells thru treatment | $37,822 | $7,537 | $54,398 | $99,757 |
| Discharge lines | $230,636 | $333,076 | $42,431 | $606,143 |
| Proj Mgmt | $125,000 | $0 | $0 | $125,000 |
| Subtotal | $630,380 | $ 446,355 | $195,628 | $1,272,363 |
| G&A @21% | $132,380 | $93,735 | $41,082 | $267,197 |
| Subtotal | $762,760 | $540,090 | $236,710 | $1,539,560 |
| Contin. @ 15% | $114,414 | $81,014 | $35,507 | $230,935 |
| Total | $877,174 | $621,104 | $272,217 | $1,770,495 |
| Ann O&M @ 10% of equip costs | | | $27,222 | |
| **UV Oxidation Treatment** | **labor** | **material** | **equipment** | **total** |
| Paluxy Upper Sand wells thru treatment | $236,922 | $105,742 | $213,799 | $556,463 |
| Paluxy West wells thru treatment | $37,822 | $7,537 | $169,698 | $215,057 |
| Discharge lines | $230,636 | $333,076 | $42,431 | $606,143 |
| Proj Mgmt | $125,000 | $0 | $0 | $125,000 |
| Subtotal | $630,380 | $ 446,355 | $425,928 | $1,502,663 |
| G&A @21% | $132,380 | $93,735 | $89,445 | $315,560 |
| Subtotal | $762,760 | $540,090 | $515,373 | $1,818,223 |
| Contin. @ 15% | $114,414 | $81,014 | $77,306 | $272,734 |
| Total | $877,174 | $621,104 | $592,679 | $2,090,957 |
| Ann O&M @ 10% of equip costs | | | $59,268 | |

**East Parking Lot Plume**
**Alternative 2 - DNAPL/Groundwater Extraction and Treatment**
**Cost Worksheet**

| **Air Stripping Treatment** | **labor** | **material** | **equipment** | **total** |
|---|---|---|---|---|
| Wells thru treatment system | $717,218 | $334,872 | $216,692 | $1,268,782 |
| Slurry Wall | $405,761 | $169,067 | $101,440 | $676,268 |
| Discharge lines | $230,636 | $333,076 | $42,431 | $606,143 |
| Proj Mgmt | $375,000 | $0 | $0 | $375,000 |
| Subtotal | $1,728,615 | $ 837,015 | $360,563 | $2,926,193 |
| G&A @ 21% | $363,009 | $175,773 | $75,718 | $614,500 |
| Subtotal | $2,091,624 | $1,012,788 | $436,281 | $3,540,693 |
| Contin. @ 15% | $313,744 | $151,918 | $65,442 | $531,104 |
| Total | $2,405,368 | $1,164,706 | $501,723 | $4,071,797 |
| Ann O&M @ 10% of equip costs | | | $ 50,172 | |
| **UV Oxidation Treatment** | **labor** | **material** | **equipment** | **total** |
| Wells thru treatment system | $717,218 | $334,872 | $331,692 | $1,383,782 |
| Slurry Wall | $405,761 | $169,067 | $101,440 | $676,268 |
| Discharge lines | $230,636 | $333,076 | $42,431 | $606,143 |
| Proj Mgmt | $375,000 | $0 | $0 | $375,000 |
| Subtotal | $1,728,615 | $ 837,015 | $475,563 | $3,041,193 |
| G&A @ 21% | $363,009 | $175,773 | $99,868 | $638,650 |
| Subtotal | $2,091,624 | $1,012,788 | $575,431 | $3,679,843 |
| Contin. @ 15% | $313,744 | $151,918 | $86,315 | $551,977 |
| Total | $2,405,368 | $1,164,706 | $661,746 | $4,231,820 |
| Ann O&M @ 10% of equip costs | | | $ 66,175 | |

**East Parking Lot Plume**
**Alternative 3 - Enhanced DNAPL/Groundwater Extraction and Treatment with Air Stripping**
**Cost Worksheet**

| Air Stripping Treatment | labor | material | equipment | total |
|---|---|---|---|---|
| Pilot test | $217,602 | $411,219 | $102,805 | $731,626 |
| Extract/treat system | $695,218 | $334,872 | $332,442 | $1,362,532 |
| Surfactants, etc | $1,040,450 | $890,848 | $222,712 | $2,154,010 |
| Slurry Wall | $140,742 | $58,642 | $35,186 | $234,570 |
| Discharge lines | $230,636 | $333,076 | $42,431 | $606,143 |
| Proj Mgmt | $375,000 | $0 | $0 | $375,000 |
| Subtotal | $2,699,648 | $ 2,028,657 | $735,576 | $5,463,881 |
| G&A @ 21% | $566,926 | $426,018 | $154,471 | $1,147,415 |
| Subtotal | $3,266,574 | $2,454,675 | $890,047 | $6,611,296 |
| Contin. @ 15% | $489,986 | $368,201 | $133,507 | $991,694 |
| Total | $3,756,560 | $2,822,876 | $1,023,554 | $7,602,990 |
| Ann O&M @ 10% of equip costs | | | $ 102,355 | |

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## Soil Remediation Alternatives

**Landfill No. 4, Landfill No. 3, and Meandering Road Creek**
**Alternative 2a - Capping (addresses only human health risk)**
**Cost Worksheet**

| Item | Labor | Material | Equip. | Other | Total |
|---|---|---|---|---|---|
| **Cap at Landfill No. 4** | | | | | |
| Leveling | $2,640 | | $4,448 | | $7,088 |
| Base | $1,760 | $24,640 | $3,936 | | $30,336 |
| Compaction | $1,778 | | $718 | | $2,496 |
| Asphalt Cap | $9,568 | $102,720 | $8,800 | | $121,088 |
| Fencing | $4,614 | $15,803 | $3,053 | | $23,470 |
| Project Mgmt | $6,488 | | | | $6,488 |
| Subtotal | $26,848 | $143,163 | $20,955 | | $190,966 |
| G&A @ 21% | $5,638 | $30,064 | $4,401 | | $40,103 |
| Subtotal | $32,486 | $173,227 | $25,356 | | $231,069 |
| Contingency @15% | $4,873 | $25,984 | $3,803 | | $34,660 |
| Total | $37,359 | $199,211 | $29,159 | | $265,729 |
| | | | | | |
| **O&M Costs** | | | | | |
| Annual Maintenance | | | | $1,000 | $1,000 |
| Monitoring | | | | $4,000 | $4,000 |
| Total O&M Costs | | | | $5,000 | $5,000 |

**Landfill No. 4, Landfill No. 3, and Meandering Road Creek**
**Alternative 2b - Capping (addresses all risk areas)**
**Cost Worksheet**

| Item | Labor | Material | Equip. | Other | Total |
|---|---|---|---|---|---|
| **Cap at Landfill No. 4** | | | | | |
| Leveling | $2,640 | | $4,448 | | $7,088 |
| Base | $1,760 | $24,640 | $3,936 | | $30,336 |
| Compaction | $1,778 | | $718 | | $2,496 |
| Asphalt Cap | $9,568 | $102,720 | $8,800 | | $121,088 |
| Fencing | $4,614 | $15,803 | $3,053 | | $23,470 |
| Project Mgmt | $6,488 | | | | $6,488 |
| Subtotal | $26,848 | $143,163 | $20,955 | | $190,966 |
| G&A @ 21% | $5,638 | $30,064 | $4,401 | | $40,103 |
| Subtotal | $32,486 | $173,227 | $25,356 | | $231,069 |
| Contingency @15% | $4,873 | $25,984 | $3,803 | | $34,660 |
| Capital Costs for Cap | $37,359 | $199,211 | $29,159 | | $265,729 |
| **Meandering Rd Cr** | | | | | |
| Excavation (92 $yd^3$) | $1,958 | | $296 | | $2,254 |
| TCLP Testing | | | $1,000 | | $1,000 |
| G&A @ 21% | $411 | | $272 | | $683 |
| Subtotal | $2,369 | | $1,568 | | $3,937 |
| Contingency @ 15% | $355 | | $235 | | $591 |
| Total for Excav. | $2,725 | | $1,803 | | $4,528 |
| **Lake Worth** | | | | | |
| Dredging (185 $yd^3$) | $915 | | $1,106 | | $2,021 |
| Mob/demob | $2,590 | | $4,010 | | $6,600 |
| Aquatic Toxicity Testing | | | $11,900 | | $11,900 |
| TCLP testing | | | $1,000 | | $1,000 |
| G&A @ 21% | $736 | | $3,783 | | $4,519 |
| Subtotal | $4,241 | | $21,799 | | $26,040 |
| Contingency @ 15% | $636 | | $3,270 | | $3,906 |
| Total for Excav. | $4,877 | | $25,069 | | $29,946 |

**Landfill No. 4, Landfill No. 3, and Meandering Road Creek**
**Alternative 2b - Capping (addresses all risk areas)**
**Cost Worksheet**

| Item | Labor | Material | Equip. | Other | Total |
|---|---|---|---|---|---|
| **Excavation at LF #3** | | | | | |
| Excavation (185 $yd^3$) | $3,996 | | $596 | | $4,592 |
| TCLP Testing | | | $1,000 | | $1,000 |
| G&A @ 21% | $839 | | $335 | | $1,174 |
| Subtotal | $4,835 | | $1,931 | | $6,766 |
| Contingency @ 15% | $725 | | $290 | | $1,015 |
| Total for Excav. | $5,560 | | $2,221 | | $7,781 |
| **Capital Cost for Alternative** | $50,521 | $199,211 | $58,252 | $0 | $307,985 |
| **O&M Costs** | | | | | |
| Annual Maintenance | | | | $1,000 | $1,000 |
| Monitoring | | | | $4,000 | $4,000 |
| Total O&M Costs | | | | $5,000 | $5,000 |

**Landfill No. 4, Landfill No. 3, and Meandering Road Creek**
**Alternative 3a - Removal/Disposal (addresses only human health risk)**
**Cost Worksheet**

| Item | Labor | Material | Equip. | Other | Total |
|---|---|---|---|---|---|
| **Removal of BAP soil at LF #4** | | | | | |
| Run-on/run-off diversion | $1,000 | | $3,914 | | $4,914 |
| Excavation | $7,128 | | $43,448 | | $50,576 |
| Hauling | | | | $4,480,000 | $4,480,000 |
| Stabilization/Dump | | | | $8,800,000 | $8,800,000 |
| Backfill | $86,432 | $108,800 | $221,664 | | $416,896 |
| Project Mgmt | $10,350 | | | | $10,350 |
| Subtotal | $104,910 | $108,800 | $269,026 | $13,280,000 | $13,762,736 |
| G&A @ 21% | $22,031 | $22,848 | $56,495 | $2,788,800 | $2,890,175 |
| Subtotal | $126,941 | $131,648 | $325,521 | $16,068,800 | $16,652,911 |
| Contingency @15% | $19,041 | $19,747 | $48,828 | $2,410,320 | $2,497,937 |
| Total for alternative | $145,982 | $151,395 | $374,350 | $18,479,120 | $19,150,847 |

**Landfill No. 4, Landfill No. 3, and Meandering Road Creek**
**Alternative 3b - Removal/Disposal (addresses only human health risk)**
**Cost Worksheet**

| Item | Labor | Material | Equip. | Other | Total |
|---|---|---|---|---|---|
| **Removal of BAP soil at LF#4** | | | | | |
| Run-on/run-off diversion | $1,000 | | $3,914 | | $4,914 |
| Excavation | $7,128 | | $43,448 | | $50,576 |
| Hauling | | | | $4,480,000 | $4,480,000 |
| Stabilization/Dump | | | | $8,800,000 | $8,800,000 |
| Backfill | $86,432 | $108,800 | $221,664 | | $416,896 |
| Project Mgmt | $10,350 | | | | $10,350 |
| Subtotal | $104,910 | $108,800 | $269,026 | $13,280,000 | $13,762,736 |
| G&A @ 21% | $22,031 | $22,848 | $56,495 | $2,788,800 | $2,890,175 |
| Subtotal | $126,941 | $131,648 | $325,521 | $16,068,800 | $16,652,911 |
| Contingency @15% | $19,041 | $19,747 | $48,828 | $2,410,320 | $2,497,937 |
| Total for BAP soil at LF #4 | $145,982 | $151,395 | $374,350 | $18,479,120 | $19,150,847 |
| **Meandering Rd Cr** | | | | | |
| Excavation (92 yd³) | $1,958 | | $296 | | $2,254 |
| TCLP Testing | | | $1,000 | | $1,000 |
| G&A @ 21% | $411 | | $272 | | $683 |
| Subtotal | $2,369 | | $1,568 | | $3,937 |
| Contingency @ 15% | $355 | | $235 | | $591 |
| Total for Excav. | $2,725 | | $1,803 | | $4,528 |
| **Lake Worth** | | | | | |
| Dredging (185 yd³) | $915 | | $1,106 | | $2,021 |
| Mob/demob | $2,590 | | $4,010 | | $6,600 |
| Aquatic Toxicity Testing | | | $11,900 | | $11,900 |
| TCLP testing | | | $1,000 | | $1,000 |
| G&A @ 21% | $736 | | $3,783 | | $4,519 |
| Subtotal | $4,241 | | $21,799 | | $26,040 |
| Contingency @ 15% | $636 | | $3,270 | | $3,906 |
| Total for Excav. | $4,877 | | $25,069 | | $29,946 |

**Landfill No. 4, Landfill No. 3, and Meandering Road Creek**
**Alternative 3b - Removal/Disposal (addresses only human health risk)**
**Cost Worksheet**

| Item | Labor | Material | Equip. | Other | Total |
|---|---|---|---|---|---|
| **Excavation at LF #3** | | | | | |
| Excavation (185 $yd^3$) | $3,996 | | $596 | | $4,592 |
| TCLP Testing | | | $1,000 | | $1,000 |
| G&A @ 21% | $839 | | $335 | | $1,174 |
| Subtotal | $4,835 | | $1,931 | | $6,766 |
| Contingency @ 15% | $725 | | $290 | | $1,015 |
| Total for Excav. | $5,560 | | $2,221 | | $7,781 |
| **Disposal of Eco Soil** | | | | | |
| Loading/hauling/unloading | $5,085 | | $10,170 | | $15,255 |
| Disposal | | | $20,340 | | $20,340 |
| TCLP testing of LF #4 soil | | | $1,000 | | $1,000 |
| G&A @ 21% | $1,068 | | $6,617 | | $7,685 |
| Subtotal | $6,153 | | $38,127 | | $44,280 |
| Contingency @ 15% | $923 | | $5,719 | | $6,642 |
| Total for Disposal of Eco Soil | $7,076 | | $43,846 | | $50,922 |
| | | | | | |
| **Total Cost for Alternative** | $150,466 | $151,527 | $376,313 | $18,479,252 | $19,244,025 |

**Building 181**
**Alternative 2 - Soil Vapor Extraction**
**Cost Worksheet**

| Item | Quantity | Cost/Qty | Cost | Other | Total |
|---|---|---|---|---|---|
| **Extraction System** | | | | | |
| Perched wells | 11 | $1,000 | $11,000 | | $11,000 |
| Upper zone wells | 7 | $5,000 | $35,000 | | $35,000 |
| Blower (25 hp) | 1 | $25,000 | $25,000 | | $25,000 |
| Piping (feet) & connections | 1500 | $5 | $7,500 | | $7,500 |
| Subtotal | | | | | $78,500 |
| **Treatment System** | | | | | |
| Carbon canisters (3000 lb) | 4 | $9,000 | $36,000 | | $36,000 |
| Air/water heat exchanger | 1 | $3,000 | $3,000 | | $3,000 |
| 110 gallon tank | 1 | $500 | $500 | | $500 |
| 1000 gallon tank | 1 | $1,000 | $1,000 | | $1,000 |
| Subtotal | | | | | $40,500 |
| **Monitoring System** | | | | | |
| Soil gas probes | 34 | $1,000 | $34,000 | | $34,000 |
| Observation wells | 2 | $5,000 | $10,000 | | $10,000 |
| Subtotal | | | | | $44,000 |
| **Mob/demob** | | | | $25,000 | $25,000 |
| Subtotal | | | | | $188,000 |
| Installation fee (5 %) | | | | $9,400 | $9,400 |
| Engineering (15%) | | | | $28,200 | $28,200 |
| Subtotal | | | | | $225,600 |
| Contingency (15%) | | | | | $33,840 |
| Total Capital Costs | | | | | $259,440 |
| **O&M** | | | | | |
| Carbon canisters (3000 lb) | 10 | $9,000 | $90,000 | | $90,000 |
| Installation fee (5%) | | | | $4,500 | $4,500 |
| Sampling | | | | $10,000 | $10,000 |
| Total O&M Costs | | | | | $104,500 |

# Appendix C

# Engineering Calculations

# Engineering Calculations

Paluxy Aquifer - West Plume: Contaminated Groundwater Volume and Extraction Well Locations

Paluxy Upper Sand Plume: Contaminated Groundwater Volume

Pumping Rates

Air Stripper Calculations

East Parking Lot Plume: TCE DNAPL Dissolution

Mixing Equation: Allowable TCE Concentration in the Upper Zone Groundwater

Paluxy Aquifer: Preliminary Remediation Goals (Paluxy Aquifer and Landfill No. 4)

Landfill No. 4, Landfill No. 3, Meandering Road Creek, Building 181: Estimate of Soil/Sediment Volumes

Time to Cleanup: East Parking Lot Plume

Building 181: Preliminary Remediation Goal

# Technical Task Cover Sheet

262 28

Discipline Groundwater

Number of Sheets 1

**Project:**

Feasibility Study

**Site:**

Air Force Plant 4, Fort Worth, Texas

**Subject:**

Paluxy Aquifer - West Plume: Contaminated Groundwater Volume

**Sources of Data:**

. Plant 4 Database

2. Well logs

3. Air Force Plant 4 RI Report

4. CPS-PC Computer Program, V4.1 by Radian Corporation

5. Groundwater - John Cherry and R. Allen Freeze, Prentice-Hall, 1979

File WESTVOL.CLC  Calc. No. ______  Supersedes Calc. No. ______

| Calculated by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| LP | 4/93 | | | | |

RUST GEOTECH INC.

**Air Force Plant 4 - Feasibility Study**
**Paluxy Aquifer - West Plume Contaminated Groundwater Volume**

## Methodology

1. The area of the plume was estimated using Figures II-19a, II-19b, II-19c, and II-19d from the RI Report. Volume determined by multiplying the area by the average saturated thickness. The average saturated thickness was calculated from wells in the plume showing TCE contamination.

2. Area (determined using AutoCad) = 141,814 $ft^2$.

3. Average saturated thickness = 34 ft.

4. Porosity (from the RI Report) = 0.15 (dimensionless).

5. Volume (not accounting for porosity) = 4,821,676 $ft^3$ (36,066,136 gallons).

6. Volume (accounting for porosity) = 36,066,136 gallons x 0.15
   = 5,409,920 gallons

## Saturated Thickness

| Easting | Northing | Well ID | Water Level Elevation | Bottom of Aquifer Elev. | Saturated Thickness |
|---|---|---|---|---|---|
| 2014407.35 | 401714.48 | P-22U | 576.19 ft | 569.11 ft | 7.08 ft |
| 2014102.64 | 402892.47 | P-27U | 572.74 ft | 559.20 ft | 13.54 ft |
| 2015297.87 | 402253.77 | P-06M | 567.25 ft | 485.40 ft | 81.85 ft |

Average saturated thickness = (7.08 ft + 13.54 ft + 81.85 ft) / 3
= 34.16 ft

# Technical Task Cover Sheet

262 30

**Discipline** Groundwater **Number of Sheets** 1

**Project:**

Feasibility Study

**Site:**

Air Force Plant 4, Fort Worth, Texas

**Subject:**

Paluxy Aquifer - Upper Sand Plume: Contaminated Groundwater Volume

**Sources of Data:**

1. Air Force Plant 4 RI Report
2. EPA DNAPL Workshop, Dallas, Texas, 1991, EPA/600/R-92/030

**File** EASTVOL.CLC **Calc. No.** **Supersedes Calc. No.** E0116900

| Calculated by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| LP | 4/95 | | | | |

RUST GEOTECH INC.

**Air Force Plant 4 - Feasibility Study**
**Paluxy Aquifer - Upper Sand Plume Contaminated Groundwater Volume**

## Methodology

1. The area of the plume was estimated using Figures II-19a, II-19b, II-19c, and II-19d from the RI Report. The portion of the Paluxy Upper Sand with significant saturated thickness is assumed to extend to proposed well EX-3. The determination of area does not extend to well P-19US because there is minimal saturated thickness (varying from 1.7 ft to 2 inches) at P-19US.

   The volume is determined by multiplying the area by the average saturated thickness. The average saturated thickness was calculated from wells in the plume showing TCE contamination.

2. Area (determined using AutoCad) = 1,872,527 $ft^2$.

3. Area increased by 10% because the plume maps do not show a 0 ppb line
   Adjusted area = 1,872,527 $ft^2$ x 1.1
   = 2,059,780 $ft^2$

4. Saturated thickness assumed to be 15 ft on the west side of the plume and 5 ft on the east side of the plume. Average saturated thickness assumed to be 10 ft. An average value for saturated thickness was not used because the saturated thickness varies significantly from the east end of the plume to the west end of the plume.

5. Porosity (from the RI Report) = 0.25 (dimensionless).

6. Volume (not accounting for porosity) = 20,597,800 $ft^3$ (154,071,544 gallons).

7. Volume (accounting for porosity) = 154,071,544 gallons x 0.25
   = 38,517,886 gallons

# Technical Task Cover Sheet

262 32

**Discipline** Groundwater **Number of Sheets** 4

**Project:**

Feasibility Study

**Site:**

Air Force Plant 4, Fort Worth, Texas

**Subject:**

Pumping Rates

**Sources of Data:**

1. Plant 4 Database
2. Well logs
3. Air Force Plant 4 RI Report
4. Groundwater - John Cherry and R. Allen Freeze, Prentice-Hall, 1979

**File** PUMPRATE.CLC **Calc. No.** **Supersedes Calc. No.** E0116600

| Calculated by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| LP | 4/95 | | | | |

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## PUMP RATES

Cooper Jacob method of solution for the Theis equation:

$$s=\frac{2.3*Q}{4*\pi*T}\log\frac{2.25*T*t}{r^2*S}$$

Where:
Q = pump rate (cfd)
s = drawdown (ft)
T = transmissivity (sq. ft per day)
t = duration (days)
S = storativity (unitless)
r = radius (ft)

Substitute "b" for the following:

$$b=\frac{2.3*Q}{4*\pi*T}$$

Substitute "y" for the following:

$$y=\frac{2.25*T*t}{S}$$

Set s = 0 to find the maximum distance from the recovery well that capture will occur.

$$0=b*\log\frac{y}{r^2}$$

$$0=b*(\log y-\log r^2)$$

$$\log y=\log r^2$$

$$y=r^2$$

$$r=\sqrt{y}$$

$$r=\sqrt{\frac{2.25*T*t}{S}}$$

Contamination is in the partially saturated Upper Sand in the Paluxy. Conductivity is assumed to be $10^{-5}$ cm/sec = 0.028 fpd. Some contamination is in the Upper, underneath the Upper Sand. Assume 15 feet saturated thickness for P-9US, P-8US, P-8UN, P-15US, RW-1, RW-2. RW-3 has 5 feet. Calculate transmissivity:

$$T=\frac{K}{b}$$

For Paluxy: b = 15 ft, T = 0.426 $ft^2$/day and for b = 5 ft, T = 0.14 $ft^2$/day.
For Upper Zone, K = 3.26 ft/day, b = 11 ft average, therefore T = 36 $ft^2$/day.

To calculate the maximum radius of influence:
For the Paluxy: T = 0.426 $ft^2$/day, t = 100 days, S = 0.15, s = 0; r = 25 ft
and for T = 0.14 $ft^2$/day, t = 100 days, S = 0.15, s = 0; r = 14 ft

For the Upper Zone: T = 36 $ft^2$/day, t = 100 days, S = 0.27, s = 0; r = 166 ft

To determine the maximum pump rate, determine the maximum drawdown a well is capable of. Use the saturated thickness less 3 feet for sufficient water over the pump to prevent burnout, allow for some particulate trapping at the bottom of the well, etc. Solve the above Theis equation for Q. Use maximum drawdown for "s". Assume r is the radius of the recovery well.

$$Q=\frac{4*\pi*T*s}{2.3}*[\log(\frac{2.25*T*t}{r^2*S})]^{-1}$$

For the East Paluxy, assume wells P-9US, P-8US, P-8UN, P-15US, RW-1, RW-2 have a saturated thickness of 20 feet.

For r = 25 ft, T = 0.426 $ft^2$/day, s = 15 ft, S = 0.15, t = 100 days, therefore Q = 3,630 $ft^3$/day = 19 gpm
For r = 14 ft, s = 5 ft, Q = 723 $ft^3$/day = 1 gpm

For West Paluxy, T = 874 $ft^2$/day, s = 13 ft, S = 0.15, t = 300 days (this area may take longer to reach equilibrium as T is much greater than the other T values), therefore Q = 8,626 $ft^3$/day = 45 gpm

For Upper Zone, saturated thickness is 16 ft., assume s = 13 ft, t = 100 days, S = 0.27, T = 36 $ft^2$/day therefore Q = 3 gpm, but will have injection wells so assume pump rate of 5 gpm.

# EAST PLUME

| EASTING | NORTHING | WELL ID | WATER ELEV | BEDROCK ELEV | SATURATED THICKNESS |
|---|---|---|---|---|---|
| 2015997.63 | 400744.32 | F-218 | 627.00 | 620.00 | 7.00 |
| 2017004.48 | 403181.78 | HM-071 | 618.72 | 600.00 | 18.72 |
| 2016970.77 | 401572.82 | HM-086 | 617.88 | 607.40 | 10.48 |
| 2016665.87 | 400921.90 | HM-087 | 622.30 | 612.00 | 10.30 |
| 2016994.67 | 402042.14 | HM-094 | 614.09 | 590.00 | 24.09 |
| 2017693.59 | 402147.27 | HM-095 | 612.19 | 596.70 | 15.49 |
| 2017699.56 | 402620.67 | HM-099 | 612.19 | 598.20 | 13.99 |
| 2017663.67 | 401380.86 | HM-113 | 612.36 | 589.00 | 23.36 |
| 2016993.48 | 401917.23 | W-149 | 617.76 | 588.22 | 29.54 |
| 2017346.47 | 401531.99 | W-156 | 612.80 | 588.08 | 24.72 |
| 2015603.84 | 400679.14 | W-158 | 628.10 | 619.44 | 8.66 |
| 2015893.52 | 400644.40 | W-159 | 627.32 | 621.30 | 6.02 |
| 2018830.39 | 403105.46 | HM-116 | 611.62 | 602.20 | 9.42 |
| 2018630.46 | 401801.98 | W-153 | 611.28 | 592.40 | 18.88 |
| | | | | AVERAGE | 15.76 |

| PALUXY EAST WELLS | | | | | |
|---|---|---|---|---|---|
| EASTING | NORTHING | WELL ID | WATER ELEVATION (FT) | BEDROCK ELEVATION (FT) | SATURATED THICKNESS (FT) |
| 2017663.58 | 400512.13 | P-19US | 568.95 | 567.28 | 1.67 |
| 2016963.92 | 401568.80 | P-14US | 589.47 | 576.90 | 12.57 |
| 2016994.55 | 402047.08 | P-16US | 607.83 | 577.82 | 30.01 |
| 2016049.28 | 401758.13 | P-09US | 627.41 | 583.00 | 44.41 |
| 2016956.94 | 400972.74 | P-08US | 589.50 | 579.50 | 10.00 |
| 2016997.21 | 402345.04 | P-15US | 593.18 | 578.07 | 15.11 |
| | | | | AVERAGE | 18.96 |
| | | | | | |
| PALUXY WEST WELLS | | | | | |
| | | | | | |
| 2014407.35 | 401714.48 | P-22U | 576.19 | 569.11 | 7.08 |
| 2014102.64 | 402892.47 | P-27U | 572.74 | 559.20 | 13.54 |
| 2015297.87 | 402253.77 | P-06M | 567.25 | 485.40 | 81.85 |
| | | | | AVERAGE | 34.16 |

# Technical Task Cover Sheet

262 37

**Discipline** Groundwater **Number of Sheets** 4

**Project:**

Feasibility Study

**Site:**

Air Force Plant 4, Fort Worth, Texas

**Subject:**

Air Stripper Calculations

**Sources of Data:**

1. Camp, Dresser, and Mcgee, 1988

**File** AIRSTRIP.CLC **Calc. No.** **Supersedes Calc. No.** E0162600

| Calculated by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| LP | 4/95 | | | | |

RUST GEOTECH INC.

Estimated Maximum Emissions per Exemption 68:

Formula:

Emission rate = Q * Concentration * efficiency * conversions

**East Parking Lot Plume (worst case)**

$$ER=\frac{20mg}{L}*\frac{50gal}{\text{min}}*0.99*\frac{3.785L}{1gal}*\frac{2.2lb}{1x10^6}*\frac{60\text{min}}{hr}*\frac{24hr}{day}*\frac{365days}{year}$$

= 4,300 lb/yr = 0.5 lb/hr

This is a WORST CASE scenario as it assumes no decay over time.

1. Emissions shall not exceed 5 tons per year NOR

2. E = L/K where: E - emissions, lb/hr
   L - From table 118A, Exemption 68, for TCE = 135
   K - Value from table as determined by distance

Assume 500 feet as the closest distance to the nearest off-plant receptor. The remediation equipment, to be more centrally located, would necessarily be located in the interior of the plume.

@ D = 500 ft, K = 81

E = L/K = 135/81 = 1.7 lb/hr

Estimated emissions per stack = 4,300 lb/yr = 0.5 lb/hr

Applying this emissions rate to the equation, K and the distance, D, back calculate:

$$E=\frac{L}{K}\rightarrow K=\frac{L}{E}\rightarrow\frac{135}{0.5}=270$$

From the table, K = 270 is between 100 ft and 200 ft, interpolating gives 144 feet. The minimum distance a stack can be is 144 feet away from a receptor. The emissions will meet the maximum of 5 tons per year with 2.1 tons per year.

(g) The transfer of cement from the storage silo(s) shall be handled through closed conveying systems with no visible fugitive emissions.

(h) The cement weigh hopper shall be vented to a control device which eliminates visible emissions, or shall be vented inside the batch mixer.

(i) Good housekeeping measures shall be maintained at all times.

(j) Before construction of the facility begins, written site approval is received from the Executive Director of the TACB and the facility shall be registered with the appropriate Regional Office using Form PI-7, including a current Table 20.

(k) Unless the plant is to be located temporarily in the right-of-way of a public works project, public notice and opportunity for public hearing, as specified in §116.10(a)(3) and (4) and (b), has been published and documentation thereof has been provided to the TACB.

118. Facilities, or physical or operational changes to a facility, provided that all of the following conditions are satisfied:

(a) Exemption 118 shall not be used to authorize construction or any change to a facility specifically authorized in another standard exemption but not meeting the requirements of that exemption. However, once the requirements of a specific exemption are met, Exemption 118(c) and (d) may be used to qualify the use of other chemicals at the facility.

(b) Emission points associated with the facilities or changes shall be located at least 100 feet from any off-plant receptor*.

(c) New or increased emissions, including fugitives, of chemicals shall not be emitted in a quantity greater than 5 tpy nor in a quantity greater than E as determined using the equation E = L/K and the following table.

| D, Feet | K |
|---|---|
| 100 | 326 |
| 200 | 200 |
| 300 | 139 |
| 400 | 104 |
| 500 | 81 |
| 600 | 65 |
| 700 | 54 |
| 800 | 46 |
| 900 | 39 |
| 1,000 | 34 |
| 2,000 | 14 |
| 3,000 or more | 8 |

E = maximum allowable hourly emission, and never to exceed 6 pounds per hour.

L = value as listed or referenced in Table 118A.

K = value from the table on this page. (interpolate intermediate values)

D = distance to the nearest off-plant receptor.

(d) Notification must be provided using Form PI-7 within 10 days following the installation or modification of the facilities. The notification shall include a description of the project, calculations, and data identifying specific chemical names, L values, D values, and a description of pollution control equipment, if any.

TABLE 118A Cont'd.

| Compound | Limit (L) Milligrams Per Cubic Meter |
|---|---|
| Fibrous Glass Dust | 5 |
| Gylcolonitrile | 5 |
| Heptane | 350 |
| Hydrazine | 0.04 |
| Hydrogen Chloride | 1 |
| Hydrogen Sulfide | 1.1 |
| Isoamyl Acetate | 13 |
| Isoamyl Alcohol | 15 |
| Isobutyronitrile | 22 |
| Isophorone Diisocyanate | 0.045 |
| Kepone | 0.001 |
| Kerosene | 100 |
| Malononitrile | 8 |
| Mercury, Inorganic | 0.05 |
| Mesityl Oxide | 40 |
| Methyl Acrylate | 1.7 |
| Methyl Amyl Ketone | 5.8 |
| Methyl Butyl Ketone | 4 |
| Methyl Disulfide | 2.2 |
| Methylenebis (Chloroaniline) MOCA | 0.003 |
| Methylenebis (Phenyl isocyanate) | 0.05 |
| Methylene Chloride | 26 |
| Methylhydrazine | 0.08 |
| Methyl Isoamyl Ketone | 5.8 |
| Methyl Mercaptan | 0.3 |
| Methyl Methacrylate | 34 |
| Methyl Propyl Ketone | 530 |
| Methyl Sulfide | 0.5 |
| Mineral Spirits | 350 |
| Naphtha | 350 |
| Nickel, Inorganic Compounds | 0.015 |
| Nitroglycerine | 0.1 |
| Nitropropane | 36 |
| Octane | 350 |
| Parathion | 0.05 |
| Pentane | 350 |
| Perchloroethylene | 33.5 |
| Petroleum Ether | 350 |
| Phenyl Glycidyl Ether | 5 |
| Phenylhydrazine | 0.6 |
| Phenyl Mercaptan | 0.4 |
| Propionitrile | 14 |
| Propyl Acetate | 281 |
| Propylene Oxide | 5 |
| Propyl Mercaptan | 0.08 |
| Stoddard Solvent | 350 |
| Styrene | 21 |
| Succinonitrile | 20 |
| Tolidine | 0.02 |
| Trichloroethylene | 135 |
| Trimethylamine | 0.1 |

(e) The facilities in which the following chemicals will be handled shall be located at least 300 feet from the nearest property line and 600 feet from any off-plant receptor and the cumulative amount of any of the following chemicals resulting from one or more authorizations under this exemption (but not including permit authorizations) shall not exceed 500 pounds on the plant property and all listed chemicals shall be handled only in unheated containers operated in compliance with U. S. Department of Transportation regulations (49 CFR Parts 171 through 178): acrolein, ammonia, arsine, boron trifluoride, bromine, carbon disulfide, chlorine, chlorine dioxide, chlorine trifluoride, chloroacetaldehyde, chloropicrin, chloroprene, diazomethane, diborane, dimethylhydrazine, ethyl mercaptan, fluorine, formaldehyde, hydrogen bromide, HCl, hydrogen cyanide, hydrogen fluoride, hydrogen selenide, hydrogen sulfide, ketene, methylamine, methyl bromide, methylhydrazine, methyl isocyanate, methyl mercaptan, nickel carbonyl, nitric oxide, $NO_2$, oxygen difluoride, ozone, pentaborane, perchloromethyl mercaptan, perchloryl fluoride, phosgene, phosphine, phosphorus trichloride, selenium hexafluoride, stibine, liquified $SO_2$, sulfur pentafluoride, and tellurium hexafluoride. Containers of these chemicals may not be vented or opened directly to the atmosphere at any time.

(f) For physical changes or modifications to existing facilities, there shall be no changes or additions of air pollution abatement equipment.

(g) Visible emissions, except uncombined water, to the atmosphere from any point or fugitive source shall not exceed 5% opacity in any 5-minute period.

*Off-plant receptor means any recreational area or residence or other structure not occupied or used solely by the owner or operator of the facilities or the owner of the property upon which the facilities are located.

119. Any feed grinding operation which is used only for noncommercial purposes.

120. Sawmills processing no more than 25 million board feet, green lumber tally of wood per year, in which no mechanical drying of lumber is performed and which meet all of the following provisions:

(a) The mill shall be located at least 500 feet from any recreational area, school, residence, or other structure not occupied or used solely by the owner of the facility or the owner of the property upon which the facility is located.

(b) All in-plant roads and vehicle work areas shall be watered, oiled, or paved and cleaned as necessary to achieve maximum control of dust emissions.

(c) All sawmill residues (sawdust, shavings, chips, bark) from debarking, planing, saw areas, etc., shall be removed or contained to minimize fugitive particulate emissions. Spillage of wood residues shall be cleaned up as soon as possible and contained such that dust emissions from wind erosion and/or vehicle traffic are minimized.

# Technical Task Cover Sheet

262 42

**Discipline** Groundwater **Number of Sheets** 1

**Project:**

Feasibility Study

**Site:**

Air Force Plant 4, Fort Worth, Texas

**Subject:**

East Parking Lot Plume: TCE DNAPL Dissolution

**Sources of Data:**

1. Air Force Plant 4 RI Report
2. Johnson, Richard, and Pankow, James, "Dissolution of Dense Chlorinated Solvents into Groundwater, 2. Source Functions for Pools and Solvents," Environmental Science & Technology, Vol. 26, No. 5, 1992

**File** TCEDISLV.CLC **Calc. No.** **Supersedes Calc. No.**

| Calculated by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| LP | 4/95 | | | | |

RUST GEOTECH INC.

ESTIMATE OF TCE DISSOLUTION

$$T_p = \frac{2.48x10^{-5}\rho}{C_{sat}}\sqrt{\frac{L_p^3}{D_v\bar{v}}}$$

Where: $T_p$ = Time to pool dissolution (years)
φ = Solvent density (1.46 E 6 g/m$^3$)
$C_{sat}$ = Saturation concentration (1,100 g/m$^3$)
$L_p$ = Length of a pool in the direction of groundwater flow (10 m)
$D_v$ = vertical dispersion coefficient (m$^2$/s)
v = average groundwater velocity (0.16 - 0.36 m/day)

$$D_v = D_e + v\alpha_v$$

Where:
$D_e$ - aqueous diffusion coefficient from literature (1 E -10 m$^2$/s from literature)
v = groundwater velocity (0.16 m/day - 0.36 m/day)
$\alpha_v$ = vertical dispersivity (0.0002 m - 0.0004 m from literature)

| Estimate of Pool Dissolution | | |
|---|---|---|
| Velocity (m/day) | Vertical Dispersivity (m) | Time (years) |
| 0.16 | 2 E -4 | 464 |
| 0.16 | 4 E -4 | 328 |
| 0.36 | 2 E -4 | 206 |
| 0.36 | 4 E -4 | 146 |

Equation source: "Dissolution of Dense Chlorinated Solvents into Groundwater 2. Source Functions for Pools of Solvent" Environmental Science Technology, Vol. 26, No. 5, 1992. Authors: Richard Johnson and James Pankow.

# Technical Task Cover Sheet

262 44

Discipline Groundwater

Number of Sheets 4

**Project:**

Feasibility Study

**Site:**

Air Force Plant 4, Fort Worth, Texas

**Subject:**

Mixing Equation: Allowable TCE Concentration in the Upper Zone Groundwater (East Parking Lot Plume)

**Sources of Data:**

1. RI Report
2. Hem, J.D., 1970, *Study and Interpretation of the Chemical Characteristics of Natural Water,* 2nd Edition, US Geological Survey Water Supply Paper 1473, pp. 271-275.
3. Metcalf and Eddy, Inc., 1979, *Wastewater Eningeering, Treatment, disposal, Reuse*, 2nd Edition, McGraw-Hill, Inc., pp 839.

File MIXING.CLC Calc. No. Supersedes Calc. No.

| Calculated by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| MK | 7/95 | DD | 8/95 | | |

RUST GEOTECH INC.

Air Force Plant 4
Mixing Calculation to Determine Allowable TCE Concentrations in the Upper Zone Groundwater

**Problem:**

Determine an allowable concentration of trichloroethene (TCE) in the Upper Zone groundwater that will not cause allowable TCE levels in the Paluxy aquifer to be exceeded.

**Methodology:**

*Technical Background*

Figure 1-68 (FS Report, Volume I) is a conceptual site model of how water moves through the Upper Zone and the Paluxy Aquifer. The "Window Area" is illustrated as consisting of a part of the flow system where the Walnut/Goodland Formation aquitard complex is thin or absent.

In this area the vertical discharge through the window area is approximately 54 $ft^3/d$ (pg. 3-43 RI Report). The vertical hydraulic conductivity of the Walnut/Goodland Formation is approximately 7 x $10^{-10}$ cm/s, but in the Window Area the vertical hydraulic conductivity is approximately 7 x $10^{-8}$ cm/s.

The vertical discharge travels through the upper part of the Paluxy Formation, under variably saturated flow conditions, until it enters the Paluxy Aquifer. The upper part of the Paluxy Formation, where variably saturated flow conditions exist, is effectively an aquitard unit; its vertical hydraulic conductivity is approximately 2 x $10^{-8}$ cm/s. The equivalent vertical hydraulic conductivitiy for vertical flow through the Upper Zone flow system, Walnut formation, and Paluxy Upper Sand is estimated to range from $8.0 \times 10^{-8}$ cm/s to 1.0 x $10^{-7}$ cm/s.

Figure 1-69 (FS Report, Volume I) is a sketch that portrays hydrologic conditions within the Window Area. Vertical discharge through the Window Area ($Q_{UZ}$) is assumed to travel through an ellipical zone with an area of approximately 226,000 $ft^2$. The vertical flow table presents a range of estimates for the vertical flow rate, including the estimate that is based on the average Darcy flux of 8.5 $\times 10^{-8}$ cm/s (from page 3-43 of the RI Report).

Within the Paluxy Aquifer the hydraulic conductivity is about 0.006 cm/s, and the hydraulic gradient is between 0.003 and 0.01 (dimensionless). The horizontal discharge through the Paluxy Aquifer ($Q_{P,\ INFLOW}$) that receives TCE-contaminated discharge via leakage from the Paluxy Upper Sand is assumed to pass through a rectangular cross section whose area is 40,000 $ft^2$. The cross sectional area is based on a width of 2,000 ft and a mixing thickness of 20 ft (20 ft was chosen since a domestic well is screened in the upper 20 ft of the aquifer). The width of 2,000 ft is the width of the TCE plume in the Upper Sand, measured in the direction (240° bearing) orthogonal to the hydraulic gradient vector (150° bearing) in the regional Paluxy Aquifer in the vicinity of the Paluxy Upper Sand plume.

For Scenario 1, the final TCE concentration in the Paluxy Aquifer must not exceed the cumulative-risk based TCE concentration of 3 $\mu$g/L. For Scenario 2, the Maximum Concentration Limit for TCE (5 $\mu$g/L) will be used as the maximum allowable concentration in the Paluxy Aquifer. This calculation sheet presents two calculations as the technical basis to support either scenario.

Air Force Plant 4
Mixing Calculation to Determine Allowable TCE Concentrations in the Upper Zone Groundwater

*Example Calculation*

**Vertical Recharge through "Window" Area**

$Q_{UZ} = q_z * A$

*where*

| | | |
|---|---|---|
| $q_z$ | = | Darcy flux = $K_z$ * dh/dz |
| $q_z$ | = | 1.4 x $10^{-7}$ cm/s at well P-15US |
| $q_z$ | = | 3.0 x $10^{-8}$ cm/s at well P-16US (see table 3.8.2-2 in the RI Report) |
| Ave $q_z$ | = | 8.5 x $10^{-8}$cm/s = 2.4 x $10^{-4}$ ft/day |
| A | = | 226,000 $ft^2$ |

$Q_{UZ}$ = (2.4 x $10^{-4}$ ft/day) * (226,000 $ft^2$)
$Q_{UZ}$ = 54 $ft^3$/d.

**Horizontal Flow through Paluxy Aquifer**

$Q_P$ = Kx * dh/dx * A

*where* $K_x$ = 0.006 cm/s,
dh/dx = 0.0065 (dimensionless),
A = 40,000 $ft^2$.

$Q_P$ = (0.006 cm/s) * (2834.6 $ft^2$ * s/cm * d) * (0.0065 ft/ft) * (40,000 $ft^2$)
$Q_P$ = 4,422 $ft^3$/d

Note: assumes that $Q_{P, INFLOW} = Q_{P, OUTFLOW}$

**Mixing of Two Waters to Estimate Cleanup Criteria for Upper Zone**

$C_{P, OUTFLOW} = 1/(Q_{UZ}+Q_P) * [(C_{UZ} * Q_{UZ}) + (C_{P, INFLOW} * Q_P)]$

*where*

| | | |
|---|---|---|
| $Q_{UZ}$ | = | Recharge through Window Area (54 $ft^3$/d). |
| $Q_P$ | = | Horizontal inflow through Paluxy Aquifer (4,422 $ft^3$/d). Assumes that $Q_{P, INFLOW} = Q_{P, OUTFLOW}$ (from Figure II-69). |
| $C_{UZ}$ | = | Residual TCE concentration in Upper Zone following restoration. |
| $C_{P, INFLOW}$ | = | Concentration of TCE in Paluxy Aquifer inflow (0 $\mu$g/L, *assumed*). |
| $C_{P, OUTFLOW}$ | = | Resultant Concentration of TCE in Groundwater *after* mixing is complete (3 $\mu$g/L for Scenario 1, and 5 $\mu$g/L for Scenario 2). |

Air Force Plant 4
Mixing Calculation to Determine Allowable TCE Concentrations in the Upper Zone Groundwater

Rearranging the equation to solve for $C_{UZ}$ yields:

$$C_{UZ} = C_{P,\ OUTFLOW} * (Q_{UZ}+Q_P)/\ Q_{UZ}$$

Using input scenarios 1 and 2 as potential threshold concentrations for the Paluxy Aquifer produces the following result...

Scenario 1:

$C_{P,\ OUTFLOW}$ = {3 $\mu$g/L * (54 $ft^3$/d+ 4,422 $ft^3$/d)} / 54 $ft^3$/d
$C_{P,\ OUTFLOW}$ = 249 $\mu$g/L

Scenario 2:

$C_{P,\ OUTFLOW}$ = {5 $\mu$g/L * (54 $ft^3$/d+ 4,422 $ft^3$/d)} / 54 $ft^3$/d
$C_{P,\ OUTFLOW}$ = 414 $\mu$g/L

**TCE Concentrations for Upper Zone Groundwater that will not Exceed Allowable TCE Concentrations in the Paluxy Aquifer**

| Vertical Flow through Window Area | Horizontal Flow in Paluxy Aquifer | TCE Concentration in Upper Zone Groundwater | |
|---|---|---|---|
| | | 3 $\mu$g/L Allowable in Paluxy Aquifer | 5 $\mu$g/L Allowable in Paluxy Aquifer |
| 32 $ft^3$/day | 4,422 $ft^3$/day | 418 $\mu$g/L | 696 $\mu$g/L |
| 38 $ft^3$/day | 4,422 $ft^3$/day | 352 $\mu$g/L | 587 $\mu$g/L |
| 45 $ft^3$/day | 4,422 $ft^3$/day | 298 $\mu$g/L | 496 $\mu$g/L |
| **54 $ft^3$/day** | **4,422 $ft^3$/day** | **249 $\mu$g/L** | **414 $\mu$g/L** |
| 58 $ft^3$/day | 4,422 $ft^3$/day | 232 $\mu$g/L | 386 $\mu$g/L |
| 64 $ft^3$/day | 4,422 $ft^3$/day | 210 $\mu$g/L | 350 $\mu$g/L |

Air Force Plant 4
Mixing Calculation to Determine Allowable TCE Concentrations in the Upper Zone Groundwater

**Calculation of Vertical Flow Through the Window Area**

| **$q_z$ - Vertical Flux Rate (Darcy Flux in cm/s)** | **Area Perpendicular to Flow ($ft^2$)** | **Vertical Flow ($ft^3$/day)** |
|---|---|---|
| $5.0 \times 10^{-8}$ | 226,000 | 32 |
| $6.0 \times 10^{-8}$ | 226,000 | 38 |
| $7.0 \times 10^{-8}$ | 226,000 | 45 |
| **$8.5 \times 10^{-8}$ *** | **226,000** | **54** |
| $9.0 \times 10^{-8}$ | 226,000 | 58 |
| $1.0 \times 10^{-7}$ | 226,000 | 64 |

* Average Darcy flux is based on data from wells P-15US and P-16US (see pages 3-39 and 3-43 of the RI Report).

**References:**

The equations presented by the EPA in Attachment 1 are also presented in:

Hem, J.D., 1970, Study and Interpretation of the Chemical Characteristics of Natural Water, 2nd Edition, US Geological Survey Water Supply Paper 1473, pp. 271-275.

Metcalf and Eddy, Inc., 1979, Wastewater Engineering, Treatment, Disposal, Reuse., 2nd Edition, McGraw-Hill, Inc., pp. 839.

# Technical Task Cover Sheet

262 49

**Discipline** Groundwater **Number of Sheets** 2

**Project:**

Feasibility Study

**Site:**

Air Force Plant 4, Fort Worth, Texas

**Subject:**

Paluxy Aquifer and Landfill No. 4: Risk-Based Preliminary Remediation Goals

**Sources of Data:**

1. Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), Interim, Publication 9285.7-01B, December 1991.

2. Air Force Plant 4 PA/SI and RI Report, Section 6.0 - Baseline Risk Assessment, Rust Geotech

**File** RISKPRG.CLC **Calc. No.** **Supersedes Calc. No.** E0165600

| Calculated by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| MPP | 10/93 | | | | |

RUST GEOTECH INC.

**Project:** **Air Force Plant 4 - Feasibility Study**
**Subject:** **Risk-based preliminary remediation goal (PRG) for the Paluxy aquifer groundwater and soil at Landfill No. 4.**

**Methodology:**

The threshold values for human health risk above which remedial action may be required are $1.0 \times 1.0^{-6}$ incremental lifetime cancer risk (ILCR) for carcinogens and a hazard index (HI) of 1.0 for non-carcinogens (EPA 1991).

The baseline risk assessment (BRA) determined that benzo(a)pyrene (BAP) in the soil exceeded the $1.0 \times 10^{-6}$ ILCR threshold through the "occupational ingestion of contaminated soil" exposure pathway. In groundwater, trichloroethene (TCE) was determined to exceed the $1.0 \times 10^{-6}$ ILCR threshold for three different exposure pathways and 1,2-dichloroethene (1,2-DCE) was determined to equal the 1.0 HI threshold for ingestion of groundwater.

**Risk Values from the BRA:**

The calculated risk values, concentration and exposure pathways for each of these contaminants are summarized below. Data is from the BRA.

| Contaminant | Concentration* | Exposure Pathway | ILCR | HI |
|---|---|---|---|---|
| BAP | 1.59 mg/kg | Occupational ingestion of soil | $1.6 \times 10^{-6}$ | - |
| TCE | 979.8 ug/L | Ingestion of groundwater | $1.6 \times 10^{-6}$ | - |
| TCE | 979.8 ug/L | Inhalation of VOCs while showering | $1.6 \times 10^{-6}$ | - |
| TCE | 979.8 ug/L | Dermal exposure while showering | $1.6 \times 10^{-6}$ | - |
| 1,2-DCE | 371.1 ug/L | Ingestion of groundwater | - | 1.0 |

* concentration at receptor as determined in the BRA

**Calculation of Risk-Based PRGs:**

Since the mathematical models used for risk calculations are linear with respect to contaminant concentration, the PRGs can be calculated using simple ratios of concentration to risk.

Concentration / Risk = PRG / acceptable risk (where the threshold values for ILCR and HI represent the acceptable risk)

**BAP:** $PRG_{BAP} = (1.59 \text{ mg/kg} / 1.6 \times 10^{-6} \text{ ILCR}) \times (1.0 \times 10^{-6} \text{ ILCR})$
**$PRG_{BAP} = 1.0$ mg/kg**

**TCE:** for TCE the risks for all three exposure pathways must first be combined as a simple sum.
$Risk_{TCE} = 1.3 \times 10^{-4} \text{ ILCR} + 1.6 \times 10^{-4} \text{ ILCR} + 5.0 \times 10^{-5} \text{ ILCR} = 3.4 \times 10^{-4}$
$PRG_{TCE} = (979.8 \text{ ug/L} / 3.4 \times 10^{-4} \text{ ILCR}) \times 1.6 \times 10^{-4} \text{ ILCR}$
**$PRG_{TCE} = 3.0$ ug/L**

**DCE:** The HI for 1,-DCE was calculated to be right at the threshold value of 1.0. Therefore, the risk based PRG would be a concentration less than 371.1 ug/L.

$$\mathbf{PRG_{DCE} = 370\ ug/L}$$

The risk-based PRGs for each contaminant are summarized in the following table.

| Contaminant | Medium | PRG |
|---|---|---|
| BAP | soil | 1.0 mg/kg |
| TCE | groundwater | 3.0 ug/L |
| 1,2-DCE | groundwater | 370 ug/L |

**Notes:**

1. The calculated PRG for TCE of 3.0 ug/L is less than the published MCL for TCE of 5.0 ug/L. This is a result of the influence of the multiple exposure pathways developed in the BRA for exposure to TCE in groundwater. If the MCL of 5.0 ug/L were used as the target cleanup level, it would result in a risk of $1.67 \times 10^{-6}$ [$Risk_{MCL} = (1.0 \times 10^{-6} / 3.0\ ug/L) \times 5.0\ ug/L = 1.67 \times 10^{-6}$]. This is within the acceptable risk range of $1.0 \times 10^{-4}$ to $1.0 \times 10^{-6}$.

2. The published MCLs for the two isomers of 1,2-DCE are 70 ug/L for cis 1,2-DCE and 100 ug/L for trans 1,2-DCE. These are more strict than the risk-based PRG for 1,2-DCE and may be more appropriate for a PRG.

# Technical Task Cover Sheet

262 52

**Discipline** Soil/Sediment **Number of Sheets** 4

**Project:**

Feasibility Study

**Site:**

Air Force Plant 4, Fort Worth, Texas

**Subject:**

Landfill No. 4, Landfill No. 3, Meandering Road Creek, Building 181: Estimate of Soil/Sediment Volumes

**Sources of Data:**

1. Air Force Plant 4 RI Report

**File** SOILVOL.CLC **Calc. No.** **Supersedes Calc. No.**

| Calculated by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| RMJ | 4/95 | | | | |

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**Calculation Sheet**

**Project**: Air Force Plant 4 Feasibility Study
**Subject**: Landfill No. 4, Landfill No. 3, Meandering Road Creek, Building 181: Estimate of Soil/Sediment Volumes

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**Landfill No. 3:**

Problem: Determine the volume of soil with contamination that exceeds ecological risk threshold values.

| | |
|---|---|
| Ecological Risk Threshold Values (based on exposure to mice) | copper - 563 mg/kg<br>lead - 2,000 mg/kg<br>zinc - 1,000 mg/kg |

Soil samples that exceeded threshold values:

| | |
|---|---|
| CS-005 | copper - 5,590 mg/kg<br>lead - 5,800 mg/kg<br>zinc - 2,690 mg/kg |
| CS-007 | copper - 1,580 mg/kg<br>lead - 10,400 mg/kg<br>zinc - 17,400 mg/kg |

Basis for contaminated soil volume determination:

1. Soil samples taken east and west of samples CS-005 and CS-007 do not exceed threshold values.
2. No soil samples were taken immediately north or south of samples CS-005 and CS-007.
3. Samples were taken from the top two feet of soil.
4. Remediation of the top two feet of soil would eliminate the exposure pathway for mice.
6. Assumed a contamination area 50 feet x 50 feet that encompasses both samples.
8. Assumed depth of soil contamination at 2 feet.

Volume of contaminated soil at Landfill No. 3:

CS-005 and CS-007: 50' x 50' x 2' = 5,000 ft3 = 185 yd3

**Calculation Sheet**

**Project**: Air Force Plant 4 Feasibility Study
**Subject**: Landfill No. 4, Landfill No. 3, Meandering Road Creek, Building 181: Estimate of Soil/Sediment Volumes

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**Landfill No. 4:**

Problem: Determine the volume of soil with contamination that exceeds ecological risk threshold values.

Ecological Risk Threshold Values: Arsenic - 29.1 mg/kg
(based on exposure to mice) Cadmium - 132 mg/kg
Copper - 563 mg/kg

Soil Samples that exceeded threshold values:
GMI-01: copper - 850 mg/kg
GMI-04: arsenic - 170 mg/kg
GMI-04: cadmium - 160 mg/kg
GMI-04: copper - 3,000 mg/kg
GMI-05: copper - 1,580 mg/kg
GMI-05: lead - 10,400 mg/kg
GMI-05: zinc - 17,400 mg/kg

Basis for contaminated soil volume determination:
1. Soil samples adjacent to GMI-01, GMI-04, and GMI-05 do not exceed threshold values.
2. Samples were taken from the top five two feet of soil, but the assumption was made that the contamination occurred in the top two feet of the soil.
3. Remediation of the top two feet of soil would eliminate the exposure pathway for mice.
4. Contaminated area around GMI-01 is an area 50 feet by 50 feet
5. Contaminated area around GMI-04 is an area 50 feet by 50 feet
6. Contaminated area around GMI-05 is an area 50 feet by 50 feet
5. Assumed depth of soil contamination at 2 feet.

Volume of contaminated soil at Landfill No. 4:
1. GMI-01: 50 feet x 50 feet x 2 feet = 5,000 ft3 = 185 yd3
2. GMI-04: 50 feet x 50 feet x 2 feet = 5,000 ft3 = 185 yd3
3. GMI-05: 50 feet x 50 feet x 2 feet = 5,000 ft3 = 185 yd3
4. Total volume: 555 yd3

**Calculation Sheet**

**Project**: Air Force Plant 4 Feasibility Study
**Subject**: Landfill No. 4, Landfill No. 3, Meandering Road Creek, Building 181: Estimate of Soil/Sediment Volumes

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**Meandering Road Creek**

Problem: Determine volume of sediment in Meandering Road Creek that has silver contamination exceeding ecological risk threshold values (or back ground levels).

Ecological risk threshold values siver - 1.0 mg/kg
(based on potential toxicity to aquatic organisms)

Upper background level for silver 1.4 mg/kg (Cleanup level assumed to be 1.4 mg/kg)

Sediment samples that exceeded threshold values:
SW-06 silver - 6.9 mg/kg
LW-02 silver - 6.5 mg/kg
LW-03 silver - 13.0 mg/kg

Sediment samples in area of samples that exceeded threshold values:
SW-07 silver - non detect (approximately 600 feet downstream of SW-06)
SW-08 did not analyze for silver
LW-26 did not analyze for silver

Basis of contaminated sediment volume determination:
1. Extent of silver contamination around sample SW-06 is an area of 50 feet long by 25 feet wide, centered on SW-06.
2. Sample LW-26 has concentration of silver that exceed 1.4 mg/kg and the extent of contamination is an area 50 feet long by 25 feet wide, centered on LW-26.
3. Silver contamination in Lake Worth extends up to sample LW-03, approximately 200 feet into the lake. The area of contamination is triangular and varies in width from 0 feet at the inlet to 50 feet wide at LW-03.
4. Contamination depth in all areas assumed to be 1 foot.

Volume of contaminated sediment in Meandering Road Creek:
1. Volume around sample SW-06: 50 feet x 25 feet x 1 foot = 1,250 ft3 = 46 yd3
2. Volume around sample LW-26: 50 feet x 25 feet x 1 foot = 1,250 ft3 = 46 yd3
3. Volume in Lake Worth: 200 feet x 50 feet x 1 foot x 1/2 = 5,000 ft3 = 185 yd3
4. Total volume - 277 yd3

**Calculation Sheet**

**Project**: Air Force Plant 4 Feasibility Study
**Subject**: Landfill No. 4, Landfill No. 3, Meandering Road Creek, Building 181: Estimate of Soil/Sediment Volumes

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**Building 181**

Problem: Determine volume of soil in vadose zone that is contaminated with TCE above action levels.

Action level: 500 ug/l, based on Texas Risk Reduction Standard Number 2, Appendix II, TCE level in soil that is protective of ground water under an industrial land-use scenario.

1. Delineation of TCE contamination in the vadose zone under Building 181 is not well defined and, therefore, estimates of contaminated volume will be rough order of magnitude.
2. The pilot scale soil vapor extraction (SVE) test covered an estimated surface area of approximately 75,000 ft2. This area included most of Building 181. This area is considered a reasonable estimate for the contaminated surface area.
3. Average depth of the vadose zone is approximately 25 feet.

Volume of Contaminated Soil:
75,000 ft2 of surface area x 25 ft average depth = 1,875,000 ft3 = 69,444 yd3

# Technical Task Cover Sheet

262 57

Discipline: Groundwater

Number of Sheets: 4

**Project:**

Feasibility Study

**Site:**

Air Force Plant 4, Fort Worth, Texas

**Subject:**

East Parking Lot Plume: Time to Cleanup Estimate

**Sources of Data:**

1. Air Force Plant 4 RI Report
2. Fountain, J.C., and D.S. Hodge, 1992. "Extraction of Organic Pollutants Using Enhanced Surfactant Flushing--Initial Field Test (Part 1). Project Summary." New York State Center for Hazardous Waste Management, SUNY--Buffalo.

File: SURFLUSH.CLC

Calc. No.: 

Supersedes Calc. No.: 

| Calculated by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| DD | 7/95 | RMJ | 7/95 | | |

RUST GEOTECH INC.

**Project:** **Air Force Plant 4 - Feasibility Study**
**Subject:** **Estimate for the Time to Cleanup, East Parking Lot Plume - Alternative 3**

**Methodology:**

Time to cleanup for the East Parking Lot - Alternative 3 is determined by estimating the time to remove DNAPL with surfactant flushing and then continuing to pump dissolved TCE from the groundwater in the Window Area until dissolved levels are reached.

**Calculations for Time to Remove DNAPL:**

1. DNAPL Plume Area Requiring Cleanup:

   DNAPL Plume Area Requiring Cleanup = 400,000 $ft^2$ (assumed area of approximately 2,000 ft x 200 ft, from Geotech suspected DNAPL zone area calculation via AutoCAD, includes lobe extending to RW-2U area).

2. Pore Volumes Required to Remove DNAPL:

   Removal of DNAPL will be accomplished after flushing 15 pore volumes of surfactant solution. This is based on a residual DNAPL concentration of between 2 and 10 percent and the the work of Fountain (Fountain 1992), where 16 to 18 pore volumes were required to completely remove DNAPL in a zone where residual saturation ranged from 10 to greater than 20 percent (i.e., 10 to 20 percent of the pores were filled with DNAPL trapped by capillary forces).

   The residual DNAPL concentration is estimated to be between 2 and 10 percent based on the length of time that DNAPL has been undergoing natural dissolution by ambient groundwater flow, the length over which DNAPL has likely migrated, and the additional dissolution caused by recent pump and treat operations.

   A residual concentration of between 2 to 10 percent should allow removal of the DNAPL with fewer than the 16 to 18 pore volumes of surfactant required for Fountain's work.

3. Volume of One Pore:

   One pore volume = Area of DNAPL plume * saturated thickness * porosity

   Parameters:

   - Area of DNAPL plume is 400,000 $ft^2$
   - DNAPL assumed to be located in the lowest 10 feet of saturated thickness. Surfactant flushing will occur in this area.
   - Porosity = 0.35

   One pore volume = 400,000 $ft^2$ x 10 ft x 0.35
   = 1,400,000 $ft^3$

4. Number of DNAPL Remediation Zones:

   Assume DNAPL remediation well field consists of 20 zones, with each zone containing 2 injection wells. The size of each zone is assumed to be 200 ft long x 100 ft wide (20,000 $ft^2$).

5. Volume of Each Remediation Zone:

Each of the 20 zones will have a zonal target pore volume of 70,000 $ft^3$

Pore volume of each zone = 1,400,000 $ft^3$ / 20 zones
= 70,000 $ft^3$ per zone

6. Injection Rate into DNAPL Remediation Zone:

Fastest injection rate = 7 gpm

Average injection rate = 3 gpm

Slowest injection rate = 1 pgm

Basis for injection rates:

Injection rates are based interim remedial action wells operated by IT Corporation that have rates ranging from 1 to 7 gpm

7. Effective Injection Rate into DNAPL Remediation Zone:

Effective injection rate = 50% of the injected surfactant reaches the target pore volume.

Fastest effective injection rate = 7 gpm * 0.5 = 3.5 gpm

Average effective injection rate = 3 gpm * 0.5 = 1.5 gpm

Slowest effective injection rate = 1 gpm * 0.5 = 0.5 gpm

Assumptions:

Some injected solution will migrate outside the perimeter through non-NAPL contaminated channels and some solution will migrate above the target pore volume region at the lowest 10 feet of saturated thickness. If more than 1.5 gpm succeeds in flushing the target zone, the cleanup time estimated here will be reduced.

8. Rate of Surfactant Delivery:

Rate of surfactant delivery = rate of delivery per well * number of wells

Fastest rate of delivery = 3.5 gpm * 2 wells
= 7 gpm or 491,909 $ft^3/yr$

Average rate of delivery = 1.5 gpm * 2 wells
= 3 gpm or 210,818 $ft^3/yr$

Slowest rate of delivery = 0.5 gpm * 2 wells
= 1.0 gpm or 70,273 $ft^3/yr$

Assumptions:

Each well delivers from 3.5 to 0.5 gpm of surfactant solution to the target pore volume in each remediation zone

2 injection wells per remediation zone

Conversion of gpm to $ft^3/yr$:

$ft^3/yr$ = gpm * 0.1337 $ft^3/gal$ * 60 min/hr * 24 hrs/day * 365 days/yr
= gpm * 70,273

9. Flushing Time for One Pore Volume (One Remediation Zone):

Flushing time = volume of one remediation zone / rate of surfactant delivery

Fastest flushing time = 70,000 $ft^3$ / 491,909 $ft^3$/year
= 0.142 yrs or 52 days

Average flushing time = 70,000 $ft^3$ / 210,818 $ft^3$/year
= 0.332 yrs or 121 days

Slowest flushing time = 70,000 $ft^3$ / 70,273 $ft^3$/year
= 0.996 yrs or 364 days

10. Time for DNAPL Removal (One Remediation Zone):

Time for DNAPL removal = flushing time for one pore volume * number of pore volumes

Fastest time for DNAPL removal = 0.142 yrs * 15 pore volumes
= 2.1 yrs

Average time for DNAPL removal = 0.332 yrs * 15 pore volumes
= 5 yrs

Slowest time for DNAPL removal = 0.996 yrs * 15 pore volumes
= 15 yrs

Assumption:

15 pore volumes are required to remove all DNAPL from each of the 20 remediation zones was determined in item 2.

11. Time for DNAPL Removal (All Remediation Zones):

Total time for DNAPL removal = time for one remediation zone * remediation phases

Fastest time for DNAPL removal = 2.1 yrs * 1 phase
= 2.1 yrs

Average time for DNAPL removal = 5 yrs * 1 phase
= 5 yrs

Slowest time for DNAPL removal = 15 yrs * 1 phase
= 15 yrs

Assumptions:

There will be one remediation phase and all remediation zones will be done concurrently.

**Summary:**

Some of the DNAPL can be removed within 2 years but most of the DNAPL will take 5 years to remove. Some of the less permeable areas will require up to 15 years to remove DNAPL. A time period of 15 years will be used as the estimate for the time to remove DNAPL from the East Parking Lot.

**References:**

1. Fountain, J.C., and D.S. Hodge, 1992. "Extraction of Organic Pollutants Using Enhanced Surfactant Flushing--Initial Field Test (Part 1). Project Summary." New York State Center for Hazardous Waste Management, SUNY--Buffalo.

# Technical Task Cover Sheet

262 62

**Discipline** Soil/Sediment **Number of Sheets** 3

**Project:**

Feasibility Study

**Site:**

Air Force Plant 4, Fort Worth, Texas

**Subject:**

Building 181: Preliminary Remediation Goal

**Sources of Data:**

1. Air Force Plant 4 RI Report
2. Air Force Plant 4 FS Report
3. Dragun, J, 1988. *The Soil Chemistry of Hazardous Materials*, Hazardous Materials Control Research Institute, Silver Spring, MD.
4. Freeze and Cherry 1979, Equation 8.26
5. Mercer 1988; Jury and others 1983
6. EPA 1986, *Superfund Public Health Evaluation Manual*
7. EPA 1992, *Dense Nonaqueous Phase Liquids*

**File** 181prg.CLC **Calc. No.** **Supersedes Calc. No.**

| Calculated by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| RMJ | 6/95 | | | | |

RUST GEOTECH INC.

**Calculation Sheet**

**Project**: Air Force Plant 4 - Feasibility Study
**Subject**: Building 181: Preliminary Remediation Goal for Soil

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**Subject**

Soil under Building 181

**Problem**

Determine a preliminary remediation goal (PRG) for TCE in the vadose zone under Building 181

**Methodology**

Determine a PRG for soil in the vadose zone using site-specific information in the Remedial Investigation Report and Feasibility Study. The PRG will be determined by calculating an allowable concentration in the soil based the equilibrium soil/water partition equation (Dragun, 1988). The only pathway to be considered for developing the PRG is migration to groundwater.

**Equation:**

**Screening Level in Soil (mg/kg) = $C_w$ x $\{K_d + [(\theta_w + (\theta_a \times H'))/\rho_b]\}$**

$C_w$: Target soil leachate concentration (mg/L)
$K_d$: soil/water partition coefficient (L/kg)
$K_{oc}$: soil organic carbon/water partition coefficient (L/kg)
$f_{oc}$: fraction organic carbon in soil (g/g)
$\rho_b$: dry soil bulk density (kg/L)
n: soil porosity ($L_{pore}/L_{soil}$)
$\rho_s$: soil particle density (kg/L)
$\theta_w$: water-filled soil porosity ($L_{water}/L_{soil}$)
w: average soil moisture content
$\theta_a$: air-filled soil porosity ($L_{air}/L_{soil}$)
H′: Henry's law constant (unitless)
H: Henry's law constant (atm-$m^3$/mol)

**Calculation Sheet**

**Project**: Air Force Plant 4 - Feasibility Study
**Subject**: Building 181: Preliminary Remediation Goal for Soil

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**Derivation of Variables**

**$C_w$**

$C_w$ = groundwater cleanup level for the East Parking Lot Plume x DAF
The cleanup level for the East Parking Lot Plume under Building 181 is removal of DNAPL as shown by dissolved concentrations of less than 10,000 ug/L (10.0 mg/L). However, 10.0 mg/L is the highest allowable level in the groundwater. To assure that peak levels of groundwater contamination are not caused by leachate from TCE in the soil, one-half this level (5.0 mg/L) will be used for $C_w$ in the equation.

DAF is a dilution/attenuation factor. DAF = 1. A DAF value greater than 1 is justified when the point of compliance is downgradient of the point at which the leachate enters the groundwater. However, under Building 181, the point of compliance is at the point where leachate enters the groundwater.

$C_w$ = 5.0 mg/L x 1
$C_w$ = 5.0 mg/L

**$K_d$**

$K_d = K_{oc} \times f_{oc}$
$K_{oc}$ for TCE = 126 mL/g = 126 L/kg (EPA 1986, *Superfund Public Health Evaluation Manual*), value listed on page 1-259 of the FS Report.
$f_{oc}$ = 0.017 g/g (Mercer 1988; Jury and others 1983), value listed on page 1-259 of the FS Report.
$K_d$ = 126 L/kg x 0.017 g/g = 2.14 L/kg

**$\rho_b$**

$\rho_b = (1\text{-}n) \times \rho_s$
$\rho_s$ = 2.65 kg/L
n = 0.3 (dimensionless number presented in Section 1.4.8, page 1-33, Table 1-7), also listed on page 1-259 of the FS Report)
$\rho_b$ = (1 - 0.3) x 2.65 kg/L = 1.86 kg/L

**$\theta_w$**

$\theta_w = \rho_b \times w$, but must be less than n (porosity)
$\theta_w$ = 1.86 kg/L
Maximum w = n / $\rho_b$ = 0.3 / 1.86 = 0.16
Assume a saturation of approximately 85%, w = 0.85 x 0.16 = 0.14
$\theta_w$ = 1.86 kg/L x 0.14
$\theta_w$ = 0.26

**Calculation Sheet**

**Project:** Air Force Plant 4 - Feasibility Study
**Subject:** Building 181: Preliminary Remediation Goal for Soil

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**$\theta_a$**

$\theta_a$ = n - $\theta_w$
$\theta_a$ = 0.30 - 0.26 = 0.04

**H'**

H' = H x 41
H for TCE = 0.00892 atm-$m^3$/mol (EPA 1992, *Dense Nonaqueous Phase Liquids*, Table 1)
H' = 0.00892 atm-$m^3$/mol x 41 = 0.366 (dimensionless)

**Calculation of the PRG for Building 181**

PRG = $C_w$ x {$K_d$ + [($\theta_w$ + ($\theta_a$ x H'))/$\rho_b$]}
PRG = 5.0 mg/L x {2.14 L/kg + [(0.26 L/L + (0.04 L/L x 0.366))/1.86 kg/L]}
PRG = 5.0 mg/L x (2.14 L/kg + 0.15/kg)
PRG = 5.0 mg/L x 2.29 L/kg
**PRG = 11.5 mg/kg**

# Appendix D

## Formal Response Package to the Regulatory Comments on the Draft Feasibility Study Report

GJPO–WMP–94

Air Force Plant 4

# Formal Response Package to the Regulatory Comments on the Feasibility Study Report, May 1995

August 1995

Prepared for
U.S. Department of the Air Force
Headquarters Aeronautical Systems Center
Wright-Patterson Air Force Base, Ohio

Submitted by Rust Geotech, under
DOE Contract No. DE–AC04–94AL96907 for the
**U.S. Department of Energy**

**Response to Comments from**

**U.S. Environmental Protection Agency**

**Region VI**

**EPA (Gary A. Baumgarten) Comments to**
**Draft Final Feasibility Study**
**May 1995**

**Comment 1**

General Comments

EPA disagrees with the methodology used to calculate the PRG for TCE in the window area. Rather than averaging TCE ground water concentrations from the alluvial and the Paluxy aquifer to calculate the PRG, a mixing equation should be used. The use of the mixing equation will take into account the hydrogeologic properties, as well as the PRG of 3 ug/l TCE in the Paluxy aquifer. The attached calculation sheet presents the mixing equation as well as potential PRGs for the alluvial ground water in the window area.

**Response:**

Dilution Factor in the May 1995 FS Report

The Dilution Factor presented in the May 1995 FS is intended to be a simplistic way to consider the effects of attenuation (primarily dilution, sorption, and degradation) as dissolved TCE passes through the Walnut formation into the Paluxy Upper Sand. Attenuation is calculated as a Dilution Factor by considering concentrations in the Upper Zone flow system with those in the Paluxy Upper Sand in the Window Area.

Mixing Equation Proposed by EPA

The mixing equation proposed by EPA was developed for application to the mixing of surface waters (Reference: Study and Interpretation of the Chemical Characteristics of Natural Water). As such, it is very conservative because dilution is the only aspect of attenuation considered in the equation. There is no consideration given to sorption or degradation.

Also, there are errors in the application of the equation as proposed by EPA. The area ($A_{BP}$) used in calculation of the Paluxy Upper Sand horizontal flow is incorrect. The area ($A_{BP}$) should be perpendicular to flow in the Paluxy, not parallel to the flow. This correction makes the calculated horizontal flow in the Paluxy Upper Sand significantly smaller (approximately 2 orders of magnitude smaller) than vertical flow through the Walnut formation. This is consistent with the conceptual model but it results in essentially no mixing and no dilution in the Paluxy Upper Sand.

Therefore, according to the mixing equation, the TCE concentrations in the Paluxy Upper Sand should be the same as those in the Upper Zone flow system. The sampling data do not support this finding. TCE concentrations in the Paluxy Upper Sand have consistently been lower (approximately 1 order of magnitude) than TCE concentrations in the Upper Zone flow system.

Air Force's Proposed Use of the Mixing Equation

Air Force proposes to use the regional Paluxy Aquifer as the point of compliance for application of MCLs or PRGs and to use the mixing equation to determine a concentration level in the Upper Zone flow system that will not cause contaminant concentrations in the regional Paluxy Aquifer that exceeded the cleanup standard. Groundwater in the Paluxy Upper Sand is separated from the water table of the Paluxy Aquifer by an unsaturated zone,leaving the upper sand behaving as a component of the aquitard that is otherwise comprised of the Walnut limestone.

Given the upper sand's aquitard behavior, low permeability, low saturated thickness, and hydraulic disconnection from the regional water table, the upper sand groundwater would be treated the same as groundwater in the Upper Zone flow system. The text throughout the FS will be revised to differentiate between the Paluxy aquifer and groundwater in the Paluxy Formation.

**Comment 2**

General Comments

In evaluating cleanup of TCE in the alluvial system upgradient of the window area, it is unclear why the barrier wall is installed after the surfactant work is finished? In order to sever the migration pathway or DNAPL from upgradient of the window area, the concept of installing a barrier system at the beginning of DNAPL removal should be considered.

In addition to the proposed slurry wall, other techniques that should be evaluated include:

A. Installing a slurry wall around the majority of the upgradient DNAPL area with the installation of recovery well to extract DNAPL.

B. Installing a funnel trapping system (V-shaped slurry wall) and trap (interceptor trench, french drain) to recover DNAPL.

**Response:**

The Air Force disagrees with installing a slurry wall at the beginning of the project but agrees with considering a "V" shaped slurry wall or other shapes, if a slurry wall is required.

Based on the comment received from EPA, it appears the intended function of the slurry wall was not clearly presented in the May 1995 FS Report. Also, the intended function of the slurry wall was not consistently presented throughout the FS Report. Additional and consistent explanation of the proposed function of the slurry wall has been be added to the Final FS and is presented below.

Proposed cleanup levels for the Upper Zone flow system at Building 181 are considerably higher than cleanup levels in the Window Area. Because dissolved concentrations at Building 181 could be in the range of 5,000 ug/L to 10,000 ug/L when remediation is complete, a slurry wall was proposed to stop aqueous phase TCE in the area of Building 181 from migrating to the Window Area. However, groundwater flow in this area is oriented to the southeast and dissolved phase TCE from Building 181 may not affect TCE concentrations in the Window Area. After DNAPL remediation at Building 181 is complete, the flow model and current water level data will be used to determine if the dissolved phase TCE at Building 181 will affect TCE concentrations in the Window Area. If the dissolved TCE at Building 181 will affect the Window Area TCE concentrations, a slurry wall is proposed to divert the dissolved phase TCE around the Window Area.

The Air Force proposes to consider the need for a slurry wall after the DNAPL removal is complete in the Building 181 area. During remediation of DNAPL in the area of Building 181, wells would be extracting groundwater and preventing DNAPL or dissolved phase TCE from going to the Window Area. Most DNAPL in the area has probably already moved to low spots in the base of the Upper Zone or is held as residual DNAPL in the pore spaces. The original purpose of the slurry wall was not to stop DNAPL from moving from Building 181 to the Window Area.

**Comment 3**

General Comments

Monitoring plans are discussed in general terms but very little information is presented in the text of the FS. Although the cost estimates in the Appendix give assumptions for the monitoring cost estimates, the assumptions need to be presented in the body of the FS.

**Response:**

The assumptions for monitoring presented in Appendix B have been included in the main body of the FS. See Section 3.0 and the assumptions for the cost estimates in Section 4.0.

**Comment 4**

General Comments

Through the FS, it is stated that ex-situ bioremediation will be retained as a treatment technology for contaminated ground water. However, a report by ES&E (Draft Report, Supplemental Review of Remedial Alternatives, Air Force Plant 4 and Carswell Air Force Base, June 1994) recommends that biotreatment not be considered further for remediating the TCE plume in the study area. The Air Force needs to reconcile the difference between the two recommendations to determine whether biotreatment should be carried forth in the FS as a treatment technology. Based on the information provided in the Supplemental Review of Alternatives, it is questionable whether biotreatment would lower TCE concentrations to acceptable levels.

**Response:**
Ex-situ bioremediation will not be retained as a treatment alternative in the detailed analysis, and the discussion and evaluation of ex-situ bioremediation have been deleted from Sections 2.0, 3.0, and 4.0.

**Comment 5**
Page 1-1, Section 1.2.2
The statement that CAFB is scheduled for closure is no longer valid. The Site is now referred to as Naval Air Station Fort Worth.

**Response:**
Based on a comment from TNRCC, the first paragraph will be revised to update the current number of employees at Plant 4, and the second paragraph will be reworded to read:

> "Naval Air Station Fort Worth, formerly known as Carswell Air Force Base (CAFB) and hereafter referred to as CAFB in this report, lies directly adjacent to Plant 4 on the east. CAFB occupies about 2,800 acres and is currently in the base realignment and closure list. When the base was active, it employed approximately 1,200 military personnel and 300 civilians."

**Comment 6**
Page 1-219, Section 1.5.5.3, Table 1-100, 1-101
This table shows Paluxy monitoring wells where TCE was detected above CRQLs. However, P-19US is not shown on this table although concentrations in this well exceed 10,000 ug/l.

Table 4.5.3-3 does not list monitoring well P-19US which has a cis-1,2-DCE concentration of 620 ug/1.

**Response:**
The three TCE concentrations for well P-19US presented on page 1-218 have been added to Table 1-100. Also, a change to the maximum concentration of TCE presented in Table 1-99 will be made and P-19US and its corresponding 1,2-DCE concentration will be added to Table 1-101.

**Comment 7**
Page 2-12, Section 2.3.1.2, Paragraph 2
This section of the report should state the basis for the determination that the Upper Zone flow system is not a current or potential source of drinking water.

**Response:**
The paragraph has been rewritten to read:

> "The Upper Zone flow system within the boundaries of Plant 4 and CAFB is not considered a current or potential source of drinking water because of the low yield of the aquifer and readily available drinking water from a municipal source or the regional Paluxy Aquifer. Because the Upper Zone flow system is not a drinking water source, a PRG based on MCLs or risk from using the groundwater is not appropriate."

**Comment 8**
Page 2-12, Section 2.3.1.2, Paragraph 6
The first indicator to determine whether DNAPL has been removed is that dissolved TCE concentration will decrease over time. This by itself is not an acceptable PRG since it does not specifically list a cleanup criteria. There is no information as to the starting point to determine if concentrations decrease over time,nor is there a description of how much of a decrease is necessary to determine that there is no suspected DNAPL.

**Response:**
The following text has been added to Paragraph 6 to quantify how DNAPL removal will be measured.

> "...establish. The indicator that will be used to determine whether DNAPL has been removed is attainment of dissolved phase TCE concentration of less than 10,000 ug/L, one percent of TCE's solubility in water. Recognizing that dissolved TCE concentrations will increase after extraction has stopped, remediation will continue until TCE concentrations drop below 7,500 ug/L. Dissolved phase TCE concentrations will be expected to increase for some time, potentially 5 to 10 years, before they begin to decrease. However, if dissolved TCE concentrations increase to levels above 10,000 ug/L, remediation would begin immediately and continue until levels drop below 7,500 ug/L again."

Also, most of Section 2.3.1.2 has been rewritten to incorporate use of the mixing equation, an additional RAD for the Upper Zone flow system, and other requested information. Monitoring requirements have only briefly been mentioned in this section. More detailed discussions of the monitoring are included in Section 3.0 and the assumptions for the cost estimates in Section 4.0.

**Comment 9**

Page 2-14, Section 2.3.2.1, Landfill 1

This section states that the BRA concluded that BAP concentrations exceeded the human health risk threshold value. However Table ES-1 shows that the contaminants in Landfill 1 do not pose an unacceptable risk to human health or the environment. Clarification is needed as to which statement is correct.

**Response:**

The entry for Landfill No. 1 in Table ES-1, column 2, Findings, has been revised to read "BAP exceeded the human health risk threshold value. However, the BAP is suspected to be from asphalt paving fragments and not from past waste disposal practices." This change will also be made for Table 2-1 on page 2-1.

**Comment 10**

Page 2-14, Section 2.3.2.2, Paragraph 1

The risk associated with the BAP concentrations identified in Landfill 4 needs to be stated. Also, of the 32,000 cubic yards of VOC and Semi-VOC contaminated volume, how many cubic yards are associated with the BAP that exceeds the PRG of 1.0 mg/kg?

**Response:**

The risk associated with BAP has been added to the paragraph and clarification that BAP is assumed to be mixed throughout the 32,000 $yd^3$ of soil is also added. The paragraph now reads "...The RI identified a volume of 32,000 $yd^3$ of VOC and semi-VOC contamination. It is assumed that BAP is mixed throughout this 32,000 $yd^3$ of soil. The risk level calculated for BAP in the Landfill is $1.6 \times 10^{-6}$. An RAO for Landfill No. 4 will be to prevent ingestion of BAP contaminated soils with concentrations exceeding a PRG of 1.0 mg/kg."

**Comment 11**

Page 2-21, Section 2.5

The location of the calculations used to estimate the volume of contaminated ground water and soil should be referenced in this section of the report.

**Response:**

Reference to the location of the calculations has been added to the first paragraph. The first paragraph now reads "...is estimated at $5.4 \times 10^6$ gallons. The calculations estimating the volume of contaminated groundwater are found in Appendix C."

**Comment 12**
Page 2-23, Section 2.6.1, Paragraph 2
In discussing deed restrictions, the property use for Air Force Plant 4 is discussed. It is known that the East Parking Lot TCE plume has migrated to Carswell AFB. Since the TCE plume which has migrated to Carswell AFB is the responsibility of Air Force Plant 4, the discussion on deed restrictions needs to be expanded to include current and future land use on Carswell AFB.

**Response:**

The paragraph has been revised to include discussion of current and future land use on CAFB and now reads "...Also, Plant 4 property is expected to remain under the jurisdiction of the federal government for the indefinite future. CAFB property is currently under the jurisdiction of the federal government, but future land-use is not as well known. Deed restrictions that limit groundwater use could affect future uses on CAFB."

**Comment 13**
Page 2-28 (should be 2-38), Section 2.7.1.1, Institutional Controls
The statement is made that deed restrictions are applicable to all ground water areas on Air Force Plant 4 or Carswell Air Force Base (CAFB), but it is not applicable to off-site contamination. Since CAFB is a Base Realignment and Closure (BRAC) site, there are areas of the base that may not be under the control of the Department of Defense. In those situations where deed restrictions would not be applicable, what remedial action objectives has the Air Force developed since the site wold not be under the control of the US Government.

**Response:**
A paragraph has been added to Section 2.3.1.2 identifying an additional RAO for the East Parking Lot Plume. The RAO will be to keep groundwater contamination above MCLs from migrating off Plant 4 and CAFB property or off private land with deed restrictions on groundwater use that was formerly part of CAFB.

**Comment 14**
Page 3-2, Section 3.1.2, Paragraph 2, 3
The last sentence (Removal of DNAPL does not include extraction and treatment of groundwater once the DNAPL has been removed) as written does not make sense.

What is the area of attainment for meeting the proposed PRG of 30 ug/l in the window area?

**Response:**
The last sentence of the 2nd paragraph has been deleted. The area of attainment for the Upper Zone groundwater cleanup standard is proposed to be 250 feet around well W-149. If the mixing equation suggested in General Comment #1 is used, the area of attainment should be the same as that used in the mixing equation for vertical flow through the Walnut Formation.

**Comment 15**
Page 4-7 through 10, Section 4.2.1.5, Alternative 3
The information in this section that comes after the first paragraph should have been included in the development of alternatives section of the FS. The information after paragraph 1 deals with how the pump and treat remedy will be implemented, not short-term effectiveness.

The text states that RW-2 will be drilled east of P-15US, however, Figure 4-1 shows RW-2 to be east of P-14U not P-15. If Figure 4-1 is incorrect, is the location of RW-3 still accurate?

The concentration in P-19US does not appear to be anomalous since it has been verified by the quarterly ground water sampling. This well has had the following TCE concentrations reported:

| Date | TCE - ug/l |
|---|---|
| 1/92 | 8400 |
| 4/92 | 8900 |
| 7/92 | 8500 |
| 1/93 | 11,000 |
| 10/93 | 7100 |
| 1/94 | 9000 |
| 7/94 | 8400 |
| 7/94 | 9200 |

Under assumptions, it is stated that "P-19US would continue to be dry." Since numerous ground water samples have been taken and analyzed at P-19US, (even though well was purged dry before 3 well volumes were extracted, well recovered within 48 hours for samples to be taken) what is the basis for the preceding statement?

The contaminated ground water volume (3.8 x $10^7$) does not include the entire area of contamination as shown on Figure II-19. Since there is no control points for delineation of the Paluxy south and east of P-19US, the contaminated ground water calculation should at least include the TCE plume as mapped in Figure II-19.

In addition, Figure II-25 (Contour Map of Base of Upper Zone) shows the lowest contour to be in the area of P-19US. Since DNAPL is assumed to be present, the DNAPL will want to migrate to lowest point. Since the Walnut formation is thin in the area of P-19US (less than 10 feet), and the paleochannel migrates towards the southeast in this area, and since there is a potential for DNAPL to migrate to this area, the P-19US data point cannot be excluded.

**Response:**
Information after the 1st paragraph has been moved to Section 3.0 Development of Alternatives.

The text now reads P-14US instead of P-15US.

The statement that "P-19US will continue to be dry" has been deleted and the concentrations at P-19US will be accepted at not being anomalous, but as actual concentrations.

The contaminated groundwater volume did not include the volume at P-19US because there is only a few inches of water in the well and, therefore, there essentially is no significant volume of contaminated groundwater in the area of P-19US. Assuming a significant depth of groundwater for the entire plume area as outlined on Figure II-19 is not supported by the data from P-19US. However, the calculation in Appendix C has been be revised to remove the statement that the higher concentrations at P-19US are not supported.

**Comment 16**
Page 4-14, Alternative 3
Under assumption 15, monitoring of the Paluxy would occur. However, no information is provided as to the potential location of monitor wells and the number of monitor wells required. Will monitoring wells need to be drilled, or will existing wells be modified to become monitoring wells? In addition, what is included in the monitoring costs (frequency of sampling, analyses to be performed, reporting of results)?

**Response:**
A statement has been added as item #27 specifying additional monitoring wells will be installed and located to help define downgradient plume extent and movement. For costing purposes, 3 additional monitoring wells are assumed for the Paluxy Upper Sand Plume and Paluxy aquifer, and no additional monitoring wells will be needed for the Paluxy West Plume. In addition, existing wells will continue to be used as monitoring wells. The assumptions on monitoring costs that are in Appendix B have been added to this section.

**Comment 17**
Page 4-21, Section 4.2.2.5, Paragraph 4
What is the basis for estimating that DNAPL removal by the use of surfactants would last approximately 12-15 years?

**Response:**
A calculation for the estimate of the time for DNAPL removal has been added to Appendix C. If data from the recent tracer tests are available, they will be used to revise this calculation.

**Comment 18**
Page 4-35, Section 4.3.1.3, Alternative 2b
The word "but" should be deleted in the second sentence.

**Response:**
The sentence has been reworded as suggested.

**Comment 19**
Page 4-41, Section 4.3.2.2
The second sentence should be modified to read as follows: "The no action alternative would result in continued contamination of the groundwater that would cause contamination in the Paluxy aquifer above regulatory **and calculated risk-based** levels.

**Response:**
The sentence has been reworded as suggested.

**Comment 20**
Page 4-42, Section 4.3.2.2, Alternative 2
The first sentence is confusing as written. The sentence should be modified to read: The SVE alternative would eliminate a source of contamination which has caused concentration levels of TCE to exceed regulatory levels.

**Response:**
The sentence has been revised to read "The SVE alternative would eliminate a source of contamination which has caused concentration levels of TCE to exceed regulatory levels in the Paluxy aquifer."

**Comment 21**
Page 4-42, Section 4.3.2.3, Alternative 2
Should the first sentence read, "SVE would remove the TCE in the vadose zone resulting **in** permanent removal of contaminants"?

**Response:**
The sentence has been reworded as suggested.

**Comment 22**
Page 4-43, Section 4.3.2.5, Alternative 2
What is the basis for the estimated 5000 gallons of TCE remaining in the vadose zone and the estimated removal rate of 1000 gallons of TCE per year? What is the estimated volume of vadose zone that needs to be remediated. Appendix C does not contain this information.

**Response:**
There are no characterization data that provide and estimate the quantity of TCE in the vadose zone. The estimate of 5,000 gallons is based on the assumption that if 20,000 gallons of TCE were spilled, 25 percent of the TCE will still be in the vadose zone. The estimate of 25 percent is an estimate and is not supported by any reference.

The removal rate of 1,000 gallons per year is based on the 90-day pilot tests where approximately 260 gallons were removed. While this removal rate would not be maintained over the life of the project, the number of extraction wells will be increased. Section 4.3.2.5, Alternative 2, has been rewritten to incorporate these points.

The estimated volume of vadose zone to be remediated is determined in the Appendix C calculation "Landfill No. 4, Landfill No. 3, Meandering Road Creek, and Building 181: Estimate of Soil/Sediment Volumes." The estimate of vadose zone volume is 69,440 $yd^3$ and is presented in the report in Section 2.5.2, page 2-21.

**Comment 23**
Page 4-46, Section 4.4.1.2
In the paragraph discussing "Threshold Criteria", the fourth and fifth sentences need additional wording. The fourth and fifth sentences should read: "Alternative 2, Traditional Pumping, eventually would remove the DNAPL and, therefore, be protective of human **health** and the environment, but it wold take over 100 years. Alternative **2** also would comply with ARARs.

**Response:**
The sentence has been reworded as suggested.

Paluxy Aquifer Dilution Calculation

I. Purpose

Calculate concentration in the upper flow zone that is allowable that will not cause concentrations to exceed 3 ug/l in the Paluxy aquifer.

II. Equation

$$C_R = \frac{C_A Q_A + C_{BP} Q_{BP}}{Q_A + Q_{BP}}$$

with no background solvent concentrations $C_{BP} Q_{BP} = 0$

Solving for $C_A$

$$C_A = C_R \frac{(Q_A + Q_{BP})}{Q_A}$$

Where:

$C_A$ = TCE concentration in upper flow zone (ug/l)

$C_R$ = Resultant TCE concentration after mixing in the Paluxy Aquifer (ug/l)

$Q_A$ = Volume discharge from upper alluvium through eroded aquitard (vertical flow) ($ft^3/d$)

$Q_{BP}$= Volume of flow through Paluxy aquifer crosssection of mixing zone (horizontal flow) ($ft^3/d$)

III. Assumptions

1. $C_R$ = 3 ug/l

2. $Q_A$ = KIA

   K = Hydraulic conductivity of aquitard (ft/d)

   I = Vertical hydraulic gradient

   A = Area of eroded aquitard ($ft^2$)

3. $Q_{BP}$ = KIA

   K = Hydraulic conductivity of Paluxy Aquifer (ft/d)

   I = Horizontal hydraulic gradient

   A = Area of mixing zone in Paluxy Aquifer ($ft^2$)

## Calculation of PRG for Alluvial Ground Water System

| | $Q_A$ Calculations | | | | $Q_{BP}$ Calculations | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $C_R$ ug/l | K ft/d | I ft/ft | A ft2 | $Q_A$ ft3/d | K ft/d | I ft/ft | A ft2 | $Q_{BP}$ ft3/d | $C_A$ ug/l |
| 3 | 0.00028 | 1 | 960000 | 272.126 | 0.02835 | .001 | 18000 | 0.51024 | 3.00563 |
| 3 | 0.0002 | 1 | 196349 | 38.9607 | 0.00003 | .001 | 196349 | 0.00557 | 3.00043 |
| 3 | 0.00003 | 1 | 960000 | 27.2126 | 2.83465 | .001 | 18000 | 51.0236 | 8.625 |
| 3 | 0.00003 | 1 | 196349 | 5.56581 | 0.02835 | .001 | 196349 | 5.56581 | 6 |

262 82

Example of Ecotoxicity Table

| Summary of Toxicity Benchmark Values | | | | | | | |
|---|---|---|---|---|---|---|---|
| Species: Species 1 | | | | | | | |
| Chemical | Test Organism | Exposure Route Duration | Endpoint | Critical Effects | Ecotoxicity Value | Reference | Rationale for Selected Value |
| Chemical 1 | Organism 1<br>Organism 2<br>Organism 3 | Duration 1<br>Duration 2<br>Duration 3 | Endpoint 1<br>Endpoint 2<br>Endpoint 3 | Effects 1<br>Effects 2<br>Effects 3 | Value 1<br>Value 2<br>Value 3 | Reference 1<br>Reference 2<br>Reference 3 | Why you selected the ecotoxicity value. |
| Chemical 2 | Organism 1<br>Organism 2 | | | | | | |

Highlighted value was selected for use in model

**Response to Comments From**

**Texas Natural Resources Conservation Commission**

262 85

**TNRCC (Lel Medford) Comments to**
**Draft Final Feasibility Study Report**
**May 1995**

**Comment 1**
Volume 1, List of Acronyms, Page XV
Add Texas Natural Resource Conservation Commission (TNRCC).

Note: Texas Air Control Board (TACB) has name change to Air Quality (TNRCC).

**Response:**
Texas Natural Resource Conservation Commission (TNRCC) has been added to the list of acronyms.

**Comment 2**
Volume 1, Section 1, Page 1-1
1-1:1.2 Site Description:
1.2.2 industrial Setting.
This data is several years old. Should it be updated?

**Response:**
The current number of employees at Plant 4 will be updated in the first paragraph. Also, based on a comment from EPA, the second paragraph will be reworded to read:

> "Naval Air Station Fort Worth, formerly known as Carswell Air Force Base (CAFB) and hereafter referred to as CAFB in this report, lies directly adjacent to Plant 4 on the east. CAFB occupies about 2,800 acres and is currently in the base realignment and closure list. When the base was active, it employed approximately 1,200 military personnel and 300 civilians."

**Comment 3**
Volume 1, Figure 1-15, Page 1-58
Delete one of the title words "Detected".

**Response:**
The title of the figure has been revised as suggested.

**Comment 4**
Volume 1, Section 4.0, Pages 4-23, 4-24, 4-25
4.2.2.7 Cost
Alternative 2: Source Removal/Window Area Physical, Chemical and Biological Treatments indicate a 50 year Project Life. Clarify this assumption as referenced in Appendix C.

**Response:**
A time period of 50 years for O&M costs was used because when the O&M costs are discounted to a present value, they become insignificant past 50 years. A statement will be added to the assumptions on all the appropriate cost estimates explaining that a time period of 50 years was used for monitoring and O&M costs instead of the estimated project life of greater than 100 years because the present value of costs discounted more than 50 years is insignificant.

4.2.3.2 Compliance with ARARs:
Fifth bullet: "There are no known state regulations against injection of chemicals into ..." This should read: TAC, Title 30, Chapter 331, Underground Injection Control, is a state regulation related to injection of chemicals into non-potable aquifers to facilitate remediation; however, this would be evaluated on a case by case basis.

**Response:**
The bullet has been revised to read:

> "TAC, Title 30, Chapter 331, Underground Injection Control, is a state regulation related to injection of chemicals into non-potable aquifers to facilitate remediation; however, this would be evaluated on a case-by-case basis."

4.3.1.7 Cost:
Alternate 2a and 2b:
Capping Cost for Landfill No. 3, Meandering Road Creek and Landfill No. 4 are identified as one capping cost alternative. Why are they not considered as separate cost alternatives?

**Response:**
Alternative 2a does not include any action for Meandering Road Creek and Landfill No. 3.

Alternative 2b proposed action for Meandering Road Creek and Landfill No. 3 includes placement at Landfill No. 4 and then capping Landfill No. 4. As such, they are not separate actions that can have a separate cost associated with them.

The incremental cost of excavation at Landfill No. 3 and excavation/dredging at Meandering Road and Lake Worth is presented in Appendix B. However, the excavation and dredging actions do not constitute a complete alternative with capping at Landfill No. 4.

4.3.1.7 Cost:
Alternate 3a and 3b:
Excavation Cost for Landfill No. 3, Meandering Road Creek and Landfill No. 4 are identified as one excavation cost alternative. Why are they not considered as three separate cost alternatives?

**Response:**
Alternative 3a does not include any action for Meandering Road Creek and Landfill No. 3.

Alternative 3b proposed actions for Landfill No. 3 and Meandering Road Creek could be costed as separate items because they are assumed to go to a sanitary landfill while the BAP contaminated soil is assumed to go to a hazardous waste landfill. The costs are broken down in Appendix B, but the Air Force prefers to list one cost for Alternative 3b since it would include remediation of all areas.

**Comment 5**
Volume 2, Appendix A, Page A1 thru A9
Add: TAC, Title 31, Chapter 331; Underground Injection Control (see 4.2.3.2 above)

**Response:**
The suggested reference has been added after the first entry on page A-5.

**Comment 6**
Volume 2, Appendix C, Page 45 of 53
Exemption 68 printed at top of page is not legible.

**Response:**
"Exemption 68" will be printed legibly at the top of the page.

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GJPO–WMP–91

Air Force Plant 4

# Formal Response Package to the Regulatory Comments on the Feasibility Study Report

May 1995

Prepared for
U.S. Department of the Air Force
Headquarters Aeronautical Systems Center
Wright-Patterson Air Force Base, Ohio

Submitted by Rust Geotech, under
DOE Contract No. DE–AC04–94AL96907 for the
U. S. Department of Energy

# Response to Comments From

# U.S. Environmental Protection Agency

# Region VI

# U.S. ENVIRONMENTAL PROTECTION AGENCY REVIEW COMMENTS ON THE AIR FORCE PLANT 4 OCTOBER 1993 FEASIBILITY STUDY

The comments provided below correspond to the previous set of comments issued on the May 1993 draft of the Feasibility Study.

## GENERAL COMMENT: ENHANCED DNAPL RECOVERY

One of the changes noted in this document is the initial introduction of a measure involving the introduction of surfactants, cosolvents, alkali, or other medium into source areas to mobilize DNAPL contaminants. The distinction between this measure and other technologies rejected in the screening process such as soil flushing or in-situ soil washing is not made clear, nor is the means of introducing the various reagents through very low transmissivity soils.

**RESPONSE:**
The distinction between measures such as surfactants and soil flushing or in-situ soil washing is that surfactants applies to ground water and soil flushing or in-situ soil washing apply to soils. Soil flushing and in-situ soil washing are applicable for removal of contaminants from the soil. The evaluation of soil flushing and in-situ soil washing will be revised to reflect their potential applicability.

There are problems with introducing reagents (surfactants) through low transmissivity aquifer material. One method used in the oil industry to introduce surfactants into low permeability areas is to inject air into the higher permeability areas causing the surfactant to foam, reducing the flow in the higher permeability areas causing more flow in the low permeability areas. However, it is unlikely that DNAPL will be in areas with low permeabilities because the capillary forces inhibit the DNAPL from entering these areas.

## I. DEFICIENCIES IN RESPONSE TO PRIOR COMMENTS, PARAGRAPH 3:

Regarding the expectation of residuals from treatment processes, the response states that no residuals are expected from either UV/Oxidation or biological treatment of groundwater. This statement fails to acknowledge that, in biological treatment systems, the bacteria are sloughed off by the system as a sludge. Revise the report to account for either (1) a sludge-free biological treatment system, or (2) the management of residuals from biological treatment.

**RESPONSE:**

The text has been modified to reflect disposal of bio-solids.

## III. SPECIFIC COMMENTS - HYDROGEOLOGY

III.1 Regarding a comment requesting revision of the document as to whether or not the results of further modeling would impact the costs to a greater or lesser degree than the target range (-30% to 50%), the response states that more elaborate modeling "could impact" the costs of all alternatives using ground water extraction techniques equally. While true, the response provides no perspective for comparison of alternatives using ground water extraction with the other alternative (alternative water source for the town of White Settlement). If the results of modeling are not available for use in the FS, the comparative analysis should be revised to indicate that the comparison of costs for the various alternatives may be impacted by the results of further modelling of the ground water.

**RESPONSE:**

The text has been revised to include a information stating that further modelling may impact remediation scenarios and therefore project life and cost.

III.3 The statement in the response that the water supply lines are assumed to continue leaking, should be reconciled with the response TWC.4, which states that "the fact that nearly all of Plant 4 is covered by asphalt, concrete, or buildings makes contamination transport from soil to ground water unlikely on a broad scale," and in III.3, that the "leakage should improve the extraction rates and help flush the aquifer."

**RESPONSE:**
For the majority of Plant 4, contamination transport from the soil to the ground water will be retarded by the reduced infiltration caused by the asphalt, concrete, or buildings. In areas where leakage from the water supply lines flows through the soil to recharge the Upper Zone aquifer, contamination transport from the soil to the ground water is a potential concern. The primary area where this could occur is under Building 181, which is suspected of being the source area for TCE in the ground water. Alternatives for soil contamination in this area have been added to the FS.

III.5 In response to a comment calling for estimates of the costs of further well tests (slug tests) as extractions wells are installed, the text of the report (Page 4-25, item 6) has been revised to say that pump tests should be conducted, but no cost for the tests are identified either in the listing or in the supporting cost information in Appendix B.

**RESPONSE:**
Well tests to further characterize the expected aquifer performance has been included in the cost estimate.

III.7 In response to a comment that more discussion was required on the design features of the proposed interceptor trench proposed to be installed in the east parking lot, the statement is made that the interceptor trench can be modeled by three wells, but cannot be physically replaced by three wells, nor can the cost of interceptor trench be replaced with the cost of three wells. No detail has been added to the report to demonstrate the likelihood that the interceptor trench will be a successful measure. With regard to other discussion of the interceptor trench, it is noted that the response in TWC.12, third paragraph contains the statement that the interceptor trench will be backfilled with "sand or gravel" above the saturated water level whereas the response to Air Force comment b. states that soil will be returned to the trench and no excavated material "should" need to be removed from the site. Insufficient detail is provided to allow a determination of whether or not these statements can be made.

**RESPONSE:**

Revisions made to the May 1995 FS Report include eliminating the interceptor trench in favor of a slurry wall. Costs associated with the slurry wall have been included in the cost estimate. The cost estimate assumed the material excavated for the slurry wall would not be hazardous waste and would be disposed off-site.

**III.9** In response to a comment on the lack of discussion of remediation of the "north plume", the text of the document has been modified (page 4-15) with a paragraph which contains the statement that the north plume area show a single well with contamination, and that a single well would be required for remediation, with "negligible" impact on remediation cost estimates. This revision should be reconciled with the findings reported on page 1-206 which include chlorinated organics in two wells listed in Table 1-94 and one well (F-209) discussed in the text, and the findings of up to one foot of LNAPL in six other wells.

**RESPONSE:**
Revisions to the May 1995 FS Report identify the North Plume and West Plume as not requiring cleanup. This is based on the BRA which found that contamination in these plumes did not cause risk to exceed threshold values.

**III.11** Paragraph 3: In response to comments regarding inclusion of costs of field testing of wells, the responses contain a statement that such costs are included as part of the well construction costs. Neither the costing assumptions listed on pages 4-25 and 4-26 nor Appendix B contains any mention of field testing costs.

**RESPONSE:**
The costs of well tests has been included in the assumptions listed in Section 4 and Appendix B.

## IV. SPECIFIC COMMENTS

**Page 2-22, Paragraph 6:**
In response to a comment regarding the disposal of the waste residue from an oil-water separator, the text was revised (page 2-23, paragraph 2) to indicate the reuse or sale of the waste. No consideration was mentioned of the possibility that the waste may be a hazardous waste.

**RESPONSE:**
The discussion of oil-water separators in Section 2.7.1.2 of the May 1995 FS Report has been revised to mention that if the product were disposed of as a waste it would probably be considered a hazardous waste.

**Page 2-22, Paragraphs 7 & 8:**
In response to a comment regarding a statement that UV and biological treatments were flow-limited, the report was revised to state that, "It may be offset by upscaling the equipment..". (Page 2-23, paragraphs 3 and 4). This revision does not explain how UV/Oxidation and biological treatments are limited by flow rate.

**RESPONSE:**

The discussion on page 2-23 was incorrect to imply that use of UV oxidation and biological treatment are limited by flow-rate. Section 2.7.1.2 of the May 1995 FS Report has been revised to state that higher flow rates can be attained by adding more treatment units.

**Page 4-6, Paragraph 6:**

A comment regarding the clarification of conditions of discharge of treated ground water received no identifiable response. The document still indicates discharge of treated ground water to surface waters (page 4-7, paragraph 1), to the local sewer system (page 4-8, paragraph 1), or to surface waters (page 4-8, paragraph 1).

**RESPONSE:**

The document has been revised to consistently refer to discharge to surface waters as the preferred method.

**Page 4-11, Paragraph 4 (Capping):**

$1000 per year has been added for O&M costs in Appendix B so that capping costs change from $266,000 to $267,000. It is stated that the amount is also considered a present worth cost since all work is expected to be completed within one year. Is it assumed that the cap O&M will only occur for one year? If cap O&M is to occur for a number of years, the report should be revised to present the future costs and present worth values.

**RESPONSE:**

The report was in error to assume that all O&M costs occur only in the first year. The cost estimate has been revised to reflect the present value of annual maintenance costs. Annual monitoring costs have been added to the O&M costs.

**Page 4-11, Paragraph 7:**

On page 4-13 and Table 4-3 of the revised report, it is noted that capping and removal/disposal reduce the mobility of the contaminated soil. While this is true, a qualifying statement should be made that the above remediation techniques do not meet the requirements of the NCP for reduction of toxicity, mobility or volume through <u>treatment</u>.

**RESPONSE:**

A qualifying statement has been added to Section 4.4.2.1 of the May 1995 FS Report that states capping does not reduce mobility, toxicity, or volume through treatment.

**Page 4-21, 4-24, and 4-25:**

The previous comment requested a discussion on the likelihood of achieving reductions of 99.89% and 99.96%. The only response given is that "careful design and testing would be required to achieve the desired results". No revision to the text of the report on the above pages was noted nor was there additional discussion on performance levels > than 99% provided in the report.

**RESPONSE:**

The reductions of 99.89% and 99.96% were supplied from vendor information, however specific removal efficiencies are inappropriate for the scope of the FS. The units will perform within the operating limits as specified by the vendor, provided the design flow rates and initial concentration are not exceeded or the required final concentration is not lowered.

# Response to Comments From

# Texas Water Commission

# TEXAS WATER COMMISSION
# COMMENTS ON THE
# AIR FORCE PLANT 4
# OCTOBER 1993 FEASIBILITY STUDY REPORT

## Part I

**Comment #1,** Executive Summary

I very much like the form of Table ES-1, however, it should contain the same sites presented in Tables ES-1 of the RI report as this could confuse the general public who do not know nearly as much about the site. Please change Table ES-1 in the FS to reflect Table ES-1 in the current RI (3rd draft).

**RESPONSE:**

The tables in the executive summary for the RI and the FS have been revised to be consistent.

**Comment #2,** Regarding the response for comment #12 from the 2nd draft TNRCC comments

Has a cost comparison been performed between the excavation and disposition of soils from the trench as proposed and shoring which could substantially reduce the amount of excavation?

**RESPONSE:**

A cost comparison of excavation versus shoring will probably be done as part of the remedial design but is not anticipated to be performed as part of the FS.

**Comment #3,** Regarding the response for comment #14 from the 2nd draft TNRCC comments

You state the text was modified to reflect TCA and DCA as degradation products of TCE. However, TCA and DCA are not degradation products of TCE. Please revise.

**RESPONSE:**

The text has been revised (Section 4.2.1.4 of the May 1995 FS Report) and no longer refers to TCA and DCA as degradation products of TCE.

**Comment #4,** Appendix C

Under treatment costing notes you do not mention trenching. Please include trenching as you have in the cost estimates.

**RESPONSE:**

Trenching is no longer included in the alternative. The FS has been revised and now includes a slurry wall over trenching as means of containment. However, the cost of the slurry wall is included in the cost estimate.

## Part II

5. **Section 2.4.1.4 Treatment:**

   Soil washing:

   Clarify:

   Who or what established the "effectiveness" in the category of contaminants for BAP?

**RESPONSE:**
The discussion of soil washing was incorrect in its listing of contaminants that can be effectively treated. The write-up has been revised to state that soil washing has been proven effective on SVOCs, fuels, inorganics, and selected VOC and pesticides. Soil washing will still be eliminated from further consideration because of the likelihood that additional treatment of the residuals would be required.

6. **Section 2.4.1.4 Treatment:**
Thermal:
DISAGREE;
Metals are not a significant problem, and thermal desorption in an oxygen deprived atmosphere only removes the organics, it does not volatilize the metals.

**RESPONSE:**
The write-up is not suggesting that metals would be volatilized but that metals will be retained in the residuals, soil remaining the thermal desorption unit, and would likely require additional treatment, such as stabilization, before disposal. Thermal desorption was eliminated from further consideration because additional treatment would likely be required.

7. **Section 4.3.1 Groundwater:**
Physical Treatment (air stripping):
DISAGREE:
Air stripping is followed by catalytic oxidation and does not put organics into the air.

**RESPONSE:**
Air stripping followed by catalytic oxidation does not put organics into the air, or very low amounts, but catalytic oxidation is not considered part of the air stripping system because emissions are anticipated to be within allowable limits.

8. **Section 4.3.2 Soil:**
COMMENTS:
a. Soil contamination leads to groundwater contamination.
b. Sampling is an inexact science, if some contamination is known which exceeds the $10^{-6}$ threshold, then addition (more thorough investigation) can only make this situation worse.
c. Residential exposure is more stringent and $10^{-6}$ has exceeded the occupational exposure.

**RESPONSE:**
a. Soil contamination does lead to ground water contamination, but the soil contamination at Landfill No. 4 is not contributing to ground water contamination that exceeds risk threshold values, as calculated by the BRA.
b. More sampling may or may not result in contamination levels different than those used in the baseline risk assessment (BRA). However, it is not appropriate for the FS to determine the adequacy of the sampling effort used in the BRA.
c. The text gave the impression that the occupational exposure scenario is more stringent than the residential exposure scenario. This is incorrect and has been revised.

**STATEMENT OF RECORD:**

The Texas Natural Resource Conservation Commission (TNRCC) accepts only the following Groundwater Remedial Actions proposed:

Alternative 3 — Physical Groundwater Treatment
Alternative 4 — Chemical Groundwater Treatment
Alternative 5 — Biological Groundwater Treatment

The TNRCC rejects all Soil Remedial Actions proposed. As stated in previous comments, The TNRCC rejects any technology which does not either remove or destroy the contaminants.

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GJPO-WMP-91

Air Force Plant 4

# Formal Response Package to the Regulatory Comments on the Draft Final Feasibility Study Report

October 1993

Prepared for
U.S. Department of the Air Force
Headquarters Aeronautical Systems Center
Wright-Patterson Air Force Base, Ohio

Submitted by RUST Geotech Inc., under
DOE Contract No. DE-AC04-86ID12584 for the
**U. S. Department of Energy**

262100

# Response to Comments From

# U.S. Environmental Protection Agency

# Region VI

262101

# U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE AIR FORCE PLANT 4 MAY 1993 DRAFT FINAL FEASIBILITY STUDY

The comments in this document are organized into four categories. The first group deals with deficiencies in responses to comments on the Draft Feasibility Study dated December 1992; the second group consists of general comments on the current Draft Final Feasibility Study; the third group of comments consists of specific comments relating solely to hydrogeological aspects; and the fourth group contains specific comments on other aspects. These latter two groups relate specifically to identified sections or portions of the text of the current Draft Final Feasibility Study.

## I. DEFICIENCIES IN RESPONSES TO PRIOR COMMENTS

Some of the prior EPA comments on the Draft Feasibility Study of December 1992 have been responded to either specifically or in terms of extensive revisions of many of the subsections of the Introduction. The following items are concerned only with prior comments to which no response was apparent during review. Further comments are given below under Specific Comments - Hydrogeology.

Revise the designation of the storm sewer outfall shown on Figure 1-19, -20, and -22 through -26 to include a number as appropriate. Label the unlabeled pipe adjacent to the pipes labeled "French Drain #2" on Figure 1-21 and on any other similar drawings.

Identify the likelihood of the presence or absence of any residuals from the processes projected to be used to treat groundwater.

RESPONSES:

The designation for the unnumbered storm sewer outfall could not be changed. This outfall has historically been referenced without a number. To create a number for it at this time would confuse the storm sewer outfall references that have been used in the numerous documents and reports that have preceded the FS.

The unlabeled pipe has been labeled as French Drain #2. French Drain #2 has several pipes, three of which appear in this particular cross-section.

Treatment residuals would not be expected from either the Chemical or Biological treatment alternatives since these two methods should destroy the contaminants. The physical treatment alternative does not destroy the contaminants but transfers them from one medium (groundwater) to another (air, in this case). No treatment residuals are expected because the discharge rates to the air are not expected to exceed discharge limits, therefore no filter units would be employed. Some residuals would result from the necessary periodic cleaning of an air stripper.

## II. GENERAL COMMENTS

It is noted that the current Draft Final Feasibility Study document differs from the prior Draft (December 1992) document in terms of constituents of concern and concentrations discussed as target cleanup levels or Preliminary Remediation Goals (PRGs). The prior document discussed a level of chromium of 2.8 mg/kg in soil, while the current Draft Final sets a PRG for a chromium in soils at 82 mg/kg and adds BAP (benzo-a-pyrene?) as a constituent of concern. Additionally, the prior draft identified chromium (as well as TCE and 1,2-DCE) as a constituent which presented an unacceptable health risk in groundwater, as well as including treatment to remove chromium from groundwater among the alternatives and process options. None of these prior aspects of chromium in groundwater appear in the current Draft Final document.

RESPONSE:

Comment acknowledged. The changes in the Constituents of Concern (COCs) and the Preliminary Remediation Goals (PRGs) are due to revisions of the Baseline Risk Assessment (BRA).

III. SPECIFIC COMMENTS - HYDROGEOLOGY

1. Of the General Comments made with respect to the earlier draft of the subject document, some have been addressed in the present draft, but some have not been. The prior comments called for a more comprehensive description of the hydrologic system and this has been provided in the current draft. However, several of the more critical questions have not been addressed.

   Page 3-1, Paragraph 4: It is noted that further modeling of the groundwater is indicated by the statements (page 1-252, paragraph 5), "...analysis is in progress..." and (page 3-1, paragraph 3), "A detailed analysis of the modeling is forthcoming." No statement is made as to whether or not the further work on modeling of the groundwater will be taken into account in the Final Feasibility Study. This is of particular note in view of the level of estimated costs for the groundwater extraction systems and the lack of detail in relating the results of the current modeling to the proposed extraction systems. That is, the modeling results shown indicate, for example, that the East Parking Lot plume could be captured with 27 wells with drawdowns indicated for that number of wells. The proposed extraction system for that plume calls for 200 wells in order to achieve treatment of the plume within a reasonable time (12 years). Further, the groundwater remediation costs show a relatively moderate variation with different treatment technologies, but no indication is given of possible variation of the groundwater remediation costs if more elaborate modeling were to significantly affect the number of extraction wells projected, particularly for the East Parking Lot plume (currently estimated at 200 wells).

   To correct these apparent deficiencies, provide a discussion in Section Three under the description of the extraction system of whether or not more detailed modeling may affect groundwater remediation costs to an extent more than the target accuracy of the cost estimates (-30% to +50%).

   Also, provide a description in the text (in Section Three, in the description of the groundwater extraction system) that indicates that the extraction well system for the East Parking Lot extends into Carswell Air Force Base. This feature is currently only indicated by the location of wells shown in Plate 6.

   RESPONSE:

   More elaborate modeling could impact the cost estimates. However, all alternatives employing groundwater extraction would be impacted equally, therefore the relative costs should remain the same. Without actually having the results of the model, it is not possible to state whether the absolute costs would increase or decrease, but the accuracy would be expected to improve.

A description of the extraction well system as it extends on to Carswell Air Force Base (CAFB) is now included in Section Three.

2. Page 1-26, Paragraph 4 (Upper Zone Hydraulics): Requested was an explanation of how transmissivity values were determined in modeling the upper zone and how the number and placement of the 200 wells and their common pumping rate, said to be required to remediate the East Parking Lot plume, were determined. Although this draft of the feasibility study (FS) does contain information about upper zone hydraulic characteristics, taken from the RI, no answers to prior specific questions are given.

   The upper zone is defined as the unconsolidated deposits, consisting largely of silt, clay, and fill, with some silty sand and gravel, extending from the water table to the top of the competent bedrock (pp. 1-24 to 1-26). The thickness of the deposits, though not given in the FS, varies over a wide range, from zero or near zero, where competent bedrock is near to the surface, to several feet in channels eroded into the bedrock before the unconsolidated materials were deposited.

   The hydraulic conductivity of these materials also varies widely, as shown by the results of slug testing of monitor wells presented in pp. 1-27 and 1-30. Transmissivity, the product of the hydraulic conductivity and saturated thickness, must, of course, also vary widely from well to well.

   These widely varying factors prompted the prior request for an explanation of how the modeling was conducted and how a uniform pumping rate of 5 gal/min for each well was derived.

   With respect to pumping rates, a statement appearing as item 6, p. 4-24, reads, "Pumping rates have been estimated based upon information from the RI. They are estimates only. Pump(ing) tests should be conducted in each of the 4 areas to determine actual pumping rates for design purposes." The next item on p. 4-24, item 7, states that for the East Parking Lot plume 200 wells will be installed to pump at 5 gal/min (each).

   RESPONSE:

   A reasonable average value is adopted to facilitate the conceptual analysis of the extraction scenario.

   The word "each" has been inserted in the appropriate position in the text.

3. Page 1-25, Paragraph 4: No explanation is offered relative to prior comment 3, regarding the effect on the flow system of leaking water supply lines, reported to be leaking at a rate of at least 316,000 gal/day. Questions whether this leakage is assumed to go on for the duration of the project and how leakage might affect extraction rates and contaminant retrieval are unanswered.

   RESPONSE:

   The water supply lines are assumed to continue leaking for the duration of the project. The leakage should improve the extraction rates and help flush the aquifer.

4. Page 4-24 (Well Sizes): Items 8 and 9 indicate that upper zone wells will be 8 inches in diameter and equipped with 1/2 HP pumps. No justification is given for incurring the extra cost

of 8-inch wells when ordinary domestic wells are typically 4-1/2 to 6 inches in diameter and yield 5 to 10 gal/min. In Ground Water and Wells (Edward E. Johnson, Inc., 1966, p. 186), an 8-inch diameter well is recommended for pumps yielding 75 to 175 gal/min.

RESPONSE:

The larger diameter wells are used because there is typically more downhole equipment required for a contaminant extraction system than with an ordinary domestic well and the increased cross-sectional area facilitates required maintenance. In this case, the estimated flow rate is not the constraining parameter.

5. Appendix C (Groundwater Modeling): In Appendix C, Section E0116600, are listed the assumptions used in calculating (modeling) upper zone parameters. Hydraulic conductivity is selected as 3.26 ft/d, roughly the average of the logarithmic mean values of the slug test results in wells in the third principal groundwater flow areas (see p. 1-27). Upper zone aquifer thickness is assumed to average 11 feet (though nowhere else in the report is the average thickness estimated), and the transmissivity, therefore, is 35.9 ft2/d. Storativity is assumed to be 27%, typical of an unconfined aquifer.

In the accompanying calculation sheets, hypothetical yield for one 12-inch diameter well (not 8-inch) is given for various pumping times from 10 days to 6 years assuming a constant drawdown of 11 feet. The calculated yield ranges from 2.75 gal/min after 10 days to 1.75 gal/min after 6 years (2190 days). The estimated yield is significantly less than the previously stated anticipated yield of 5 gal/min for 200 wells said to be required in remediating the East Parking Lot plume. Not considered are other factors, including well losses, well interference effects, dewatering of the aquifer, and recharge from leaking pipes, of which the latter might tend to offset somewhat the effects of the first three factors.

The FS document should discuss the likely need for further tests as the drilling of the extraction wells proceeds and to include estimated time and costs in the forecast of the remedial action.

RESPONSE:

The possible need for further tests is noted in Section 4.2.5 and possible cost impacts are mentioned in Section 4.2.7.

6. Page 2-6, Paragraph 5 (Groundwater Volumes): The report states, "The East Parking Lot plume is the largest contaminated groundwater plume at Plant 4. The estimated volume of dissolved TCE is 2,300 gallons within an estimated 1.7 X 1010 gallons of water. The areal extent of this plume is 940 acres." Elsewhere (p. 4-24, item 7), the report states that 200 wells will pump at 5 gal/min, with 10 air strippers to remove an average of 2.7 mg/l to 3 µg/l TCE.

If 1.7 X 1010 gallons of contaminated water were pumped from the ground only once by the 200 extraction wells, pumping would take 32 years. Considering recharge to the aquifer, by rainfall (p. 1-41, 1-42) and from the leaking pipes, it is evident that much more than the initial volume of water will have to be pumped in the process of treatment.

However, in Appendix C, calculation sheet no. E0116700, the volume of contaminated ground water in the East Parking Lot plume is estimated as 1.6 X 109 gallons, about a factor of 10 less than estimated on p. 2-6.1 To pump this much water would take only 3 years. In the calculations it is assumed that 4 times this volume would need to be pumped through the air strippers and the total remediation time would be 12 years. No explanation is given for how the estimate of the required 4 pore volumes was determined. This is of considerable importance and should be explained, as it is a measure of the time required for remediation.

How the estimates of water volume to be remediated were arrived at also is not clear. The figure of 1.7 X 1010 gallons given in Section 2, p. 2-6, is obviously wrong as it would require an aquifer thickness of about 200 feet over the 940 acres said to be contaminated.

$$\text{Thickness} = \frac{1.7 \text{ X } 1010}{940 \text{ X } 325828.8 \text{ X } .27} = 206 \text{ ft}$$

The estimate given in the calculation sheets, 6.3 X 109 gallons of contaminated water is also questionable. This would require an average aquifer thickness of, 76 feet, which is significantly greater than the estimated average thickness of 11 feet used in the calculations of the pumping rate (see calculation sheet no. E0116600).

<u>RESPONSE:</u>

The discrepancies in the mentioned groundwater volumes have been rectified.

The four aquifer volumes was extrapolated from the well development requirement of three to five well volumes. This volume requirement, though not developed for this application, should provide a conceptual basis for alternative evaluation, in the absence of more elaborate modeling.

7. <u>Page 3-1, Paragraph 4 (Interceptor Trench)</u>: Another remediation option for the East Parking Lot plume is the installation of an interceptor trench, as explained in Section 3.1.2, p. 3-1, as follows: "The plumes would be controlled by pumping wells placed throughout and by an interceptor trench placed in the East Parking Lot, ahead of the 'window area' that communicates with the Paluxy Formation aquifer."

   The purpose of the interceptor trench is to control an "estimated 20,000 gallons of TCE released in June 1991. Most of this is expected to be a DNAPL that will follow a paleochannel into the East Parking Lot, although the precise location.....is not presently known." (Sec. 2.3.1, p. 2-6)

   In Sec. 3.1.2, p. 3-1, the report states that, "Water removed from the wells and trench would be sent to treatment systems...." The trench, as proposed, would be a significant construction project. On p. 3-1 it is stated, "At its current location (Figure 3-1) it would be approximately 375 feet long...." It states further that the trench would be excavated to bedrock and would be 10 feet wide and 50 feet deep.

   Section 4.2.5.1.2, p. 4-14, states that the "impact of the interceptor trench has been estimated by placing 3 extraction wells in the area." (Presumably in the model.) If a trench of the size indicated will only take the place of three wells, it seems completely unjustified based on cost. More discussion of the design features of the trench is needed.

**RESPONSE:**

The function of the interceptor trench is to intercept DNAPL. The trench extraction flow rate can be modeled by three extraction wells. However, the extraction wells cannot replace the DNAPL interception function of the trench. Therefore, it is not appropriate to compare the trench to three extraction wells on a cost basis as stated in the comment.

8. Page 1-195, Paragraph 1 (West Plume): Other plumes are the west and north plumes, described in Sec. 1, pp. 1-195 and 1-202. The west plume "is an estimated 80 acres containing approximately 1.3 X 10 8 gallons of water. 670 gallons of dissolved TCE is estimated...." (p. 2-6). For 1.3 X 108 gallons, aquifer thickness is about 18 feet:

$$\text{Thickness} = \frac{1.3 \times 108}{80 \times 325828.8 \times .27} = 18.4 \text{ ft}$$

In the calculation sheets (no. E0116700) however, the volume of water in the aquifer is given as 3.6 X 107 gallons, making aquifer thickness about 5 feet. Which is right? Remediating the west plume will require an estimated 15 wells, pumping 2 gallons each. Clean-up time is estimated at 9 years, based on the extraction and treatment of four pore volumes.

**RESPONSE:**

The 80 acre plume area does not directly correspond to the volumetric "slices" used to calculate the water volume. The volumes should not be "backed out" using the 80 acre value. The acreage value has been deleted from the text to avoid confusion.

9. Page 1-202, Paragraph 2 (North Plume): The size, water volume, and dissolved TCE content are not given for the north plume and no calculations are presented relative to pumping rates and remediation time. The approach to remediation of the north plume, or the lack of need for remediation, should be discussed.

**RESPONSE:**

Discussion has been added to Section 4.2.5 regarding the remediation aspects of the North Plume. Essentially, since only one well revealed contamination in the area, a single extraction well could be added to the system at this point. However, this would have negligible impact on the overall project approach and cost.

10 Page 4-16, Paragraph 1: The Paluxy east and west plumes evidently underlie the respective upper zone east and west plumes, though this is not stated, and it should be, if true. Consider identifying these features in a revised, coherent description of alternatives at an earlier point in the document, e.g., Section 3.

The Paluxy East plume stems from leakage from the upper zone through a "window area" underlying the East Parking Lot where the aquitard separating the upper zone from the Paluxy aquifer has been removed or significantly thinned by erosion (p. 1-26). The amount of leakage into the Paluxy is estimated as about 375 gallons per day, assuming a window area equivalent in size to a 500-foot diameter circle (p. 1-41).

The amount of contaminated water in the Paluxy East plume is estimated at 2.5 X 108 gallons (E0116900). Average TCE concentration is estimated at 7.5 mg/l (p. 4-24).

Remediation over a 3-year period will require seven 8-inch diameter wells 120 feet deep, screened in the lower 40 feet. Pumping rates will be 80 gal/min each. The calculations in Appendix C (E0116600) are based on hydraulic conductivity of 19 ft/d (from slug test and pumping test values, as stated on p. 1-47) and a saturated thickness of 46 feet, giving a transmissivity of 874 ft2/d. The Paluxy Formation ranges in saturated thickness from 119 to 168 feet in the monitor wells drilled on-site (Table 1-12). Why 46 feet was selected for the saturated thickness used in the calculations is not explained. Also in the calculations, the storativity is assumed to be 0.15, typical of an unconfined aquifer, based on the values from the literature (p. 1-42). However, the report states (p. 1-42), "The high frequency of the interbedded shale and siltstone/claystone units can be expected to cause the aquifer to behave in a semi-confined manner in the immediate vicinity of Plant 4." These statements should be reconciled and the assumptions used in the model should be clearly identified. Reference is made to a "site-scale" model, evidently still to be developed after "further calibration of the regional-scale model" (pp. 1-46, 1-47). The implications of future modeling on the content of the FS should be discussed.

RESPONSE:

Section 3.1.3 now mentions that the Upper-Zone lies above the Paluxy Formation. It is also noted in Section 4.2.5.1 under the extraction discussion.

The future modeling discussed will not have any impact on the material as presented in the FS as it will not be completed until after the FS is completed. However, the results of the future modeling are expected to be used in the remedial design phase to assist in developing an optimal extraction scheme.

11. Page 4-14, Paragraph 2: It must be kept in mind in evaluating this FS report that pumping rates, number and placement of wells, aquifer hydraulic properties, and the amount of water that must be pumped and treated in remediating the identified plumes, are largely estimates. They may not reflect accurately the respective field installation and facilities required in remediation of this site. Costs may deviate markedly from those presented in the estimates. As the report states (p. 4-14), "The simplified extraction scenarios presented are a test of the feasibility, not a rigorous design model....The extraction scenarios merely present information on whether extraction will contain the plume. They are not a final design and do not present the total number or placement of the extraction wells. The quantity of remediation systems is an approximation to estimate a maximum acceptable total project life of 10-12 years." It may well be appropriate to have included this statement in the Introduction and Executive Summary.

    The references to additional pumping tests and a site-scale model, required for final design, will significantly increase the final cost of this project and should be estimated. The cost of field testing the final well installations also should be estimated.

    RESPONSE:

    A statement has been added to the Executive Summary to remind the reader of the conceptual nature of material presented in CERCLA Feasibility Studies.

The "site-scale model" has already been funded and nearly completed; therefore, it will not add further costs to the remedial action alternatives.

The field testing of final installed wells is included as part of the well construction costs.

12. Page 1-26, Paragraph 4: The upper zone flow system is bounded by the water table and the top of the competent bedrock (p. 1-26). The report contains computer-generated maps of the top bedrock (Fig. 1-7) and of the water table (Fig. 1-9). No doubt a map could have been developed from these data showing the saturated thickness of the upper zones in the vicinity of the plumes. Consider the use of existing data to develop more refined estimates of the upper zone characteristics or to develop an estimate of effort required for field testing of wells.

RESPONSE:

Cost and schedule considerations precluded the development of further maps for use in this Feasibility Study.

## IV. OTHER SPECIFIC COMMENTS

1. Page 2-4, Paragraph 2: Since this paragraph focuses primarily on the soils in the area of Building 181 and Landfill No. 3, it should be identified at the beginning of the paragraph, i.e. "With respect to soil contamination being a source of ground-water contamination in the vicinity of Building 181 and Landfill No. 3..." Also, the rationale and assumptions presented in this paragraph need to be revised in order to be reflective of the actually site conditions and on-going activities. For instance, the rationale presented involving TCE in the groundwater and the soil no longer being a source, is totally incorrect. One cannot conclude that the saturated zone (that is contaminated with TCE) will no longer contribute to the contaminated groundwater, especially if the same paragraph states "the primary suspected DNAPL source areas under the assemply building..." However, if additional details are provided such as the spill that occurred in this area, the corrective actions that were taken, and the on-going interim measures that are being pursued, then one could possible conclude that the soil is not a continuous source impacting the groundwater. The use of terms such as "it is understood" and "already attempting" should be avoided. If interim measures are being pursued in order to achieve an objective, they sould be confirmed and stated so in the text.

RESPONSE:

The specific areas targeted for interim measures are noted in Section 2.2.2 along with who to contact to obtain more information.

2. Page 2-4, Paragraph 5: Is the 5,300 cubic yards of metal contaminated soil part of the 32,000 cubic yards of VOC and semi-VOC contamination, or is it a separated amount of contaminated soil? Clarification should be made.

RESPONSE:

The 5,300 cubic yards were included in the 32,000 cubic yards. This is no longer an issue since the results of the final revision of the BRA do not show health risks due to metals contamination in the soil to exceed the threshold values for remedial action.

3. Page 2-7, Paragraph 3: Reconcile the value of 39,600 cubic yards given here with the value of 32,700 cubic yards given elsewhere.

**RESPONSE:**

The cited paragraph was in error. Corrections of been made.

4. Page 2-8, Table 2-4 (On-Site Discharge): The entry regarding discharge of untreated effluent to Lake Worth should be revised to agree with the alternative of discharging treated water to Meandering Road Creek, as identified later in the document (page 4-16),

**RESPONSE:**

The revision has been made.

5. Page 2-11 (Slurry Walls): Replace "is" with "are" in the phrase "Slurry walls is..."

**RESPONSE:**

The correction has been made.

6. Page 2-12, Paragraph 3 (Deep Well Injection): The Paluxy Formation consists of three zones which are identified as being the upper, middle, and lower zones. To state that "...the Upper Sand and the Paluxy Formation, are contaminated" leads the reader to believe the entire Paluxy is contaminated and this is not the case. Care should be used in distinguishing the zones where communication exists, especially if a sector of the aquifer is used as a drinking water source. It is believed that in the "Window Area" communication possibly exists between the upper aquifer which is contaminated and the upper Paluxy zone. The distinction of the zone that is possibly being impacted should be specified.

**RESPONSE:**

The conceptual model of the Paluxy Formation Aquifer has been modified. One result of this modification was the elimination of the concept of "zones." Ref. Chem-Nuclear Geotech, Inc., June 1992. "A Modification in the Former Conceptual Model of the Paluxy Aquifer Flow System."

7. Page 2-12, Paragraph 4 (Local Stream): Reconcile the statement that discharge to a local stream is not retained here, but is part of the alternative discussed later (page 4-16, paragraph 6). Distinguish between discharges of treated and untreated water.

**RESPONSE:**

Correction made, the approach is retained.

All discharges would be from the treatment system(s); therefore, discharges would be treated water only.

8. Page 2-16, Table 2-5 (Capping): The table entry should reflect the retention of capping as an alternative, to agree with the text.

**RESPONSE:**

The referenced table states that capping is potentially applicable. Potentially applicable process options are retained for further consideration.

9. Page 2-20, Table 2-6 (Ion Exchange): Reconcile the evaluations given with the previous elimination (page 2-9, Table 2-4) of this treatment technology.

**RESPONSE:**

Ion exchange has been removed from the referenced table.

10. Page 2-22, Paragraph 5 (Treatment): Reconsider the statement that "airstripper design rests on aquifer parameters"; Change to "influent characteristics" if that is what is meant; also change "construction oriented" to "construction on site."

**RESPONSE:**

The noted changes have been made.

11. Page 2-22, Paragraph 6: Discuss what will be done with the separated product collected in a holding tank.

**RESPONSE:**

Discussion regarding separated product has been added to the referenced paragraph.

12. Page 2-22, Paragraphs 7 and 8: Explain how the UV/oxidation and biological treatments are limited by flow rate and how any such limitations may be offset.

**RESPONSE:**

Appropriate discussion has been added to the referenced paragraphs.

13. Page 2-23, Paragraphs 2 and 4: The assignment of relative cost rating of "high" for an interceptor trench and the rating of the cost of the discharge system should be revised to agree with the cost values given in Appendix B; the trench and discharge system appear to be moderate cost elements compared to the extraction well systems.

**RESPONSE:**

The text has been modified to more accurately reflect the relative cost ratings.

14. Page 2-26, Table 2-8: Carbon adsorption does not appear in this table, but its elimination was not discussed. Revise the text and tables to show either the elimination or retention of carbon adsorption as a process alternative.

**RESPONSE:**

The text has been revised accordingly.

15. Page 3-6, Section 3.2.5, Paragraph 3: The logic of this particular paragraph is hard to follow. For instance, if the washed soil is rendered clean, why would off-site disposal be required? The text states it must "satisfy the delisting requirements", what are the requirements? If Land Disposal Restrictions (LDR) are a concern, an evaluation must first be made in order to determine if LDR apply. Was an evaluation made? If it was, it should be described in the text. Several scenarios exists where remediated soil can be used as backfill. Also, excavation of contaminated soil does not necessary constitute new waste generation.

**RESPONSE:**

This paragraph has been eliminated from the text.

16. Page 4-5, Paragraph 1: The information referenced in Appendix C regarding emissions of TCE from the air stripper shows an estimated total of 13,677 pounds per year; reconcile this estimate with the limit of "not more than 5 tons per year" shown in the Texas regulations (also in Appendix C).

**RESPONSE:**

It was assumed from previous work that the "5 tons per year" is per stack. The 13,677 pounds per year is cumulative for all stacks.

17. Page 4-6, Paragraph 6: Clarify the statements here and on page 4-7 (paragraph 4) and page 4-8 (paragraph 1) regarding discharge of treated groundwater; reconcile these statements with the statement on page 4-16 (paragraph 6) that treated storm water will be discharged to a storm drain discharging to Meandering Road Creek. Add the revision to the description of the Extraction/Discharge Alternative in Section Three.

**RESPONSE:**

The statements have been revised accordingly.

18. Page 4-11, Paragraph 4 (Capping): Reconcile the statement that the cap would require periodic maintenance with the lack of any O&M costs in Appendix C or any indication of continuing costs for capping.

**RESPONSE:**

An annual maintenance cost of $1,000 has been added to the cost estimate.

19. Page 4-12, Paragraph 1: Revise the text to acknowledge that TCA, DCE, and DCA are possible degradation products and may continue to appear throughout any natural attenuation process.

**RESPONSE:**

The text has been revised accordingly.

20. Page 4-12, Paragraph 5 (Biological Treatment): Discuss the possible generation of residuals (sludge) by the biological treatment process and any requirement for management of these residuals.

262111A

**RESPONSE:**

This process is an irreversible treatment that is expected to have no residuals. This statement has been added to the text.

21. Page 4-11, Paragraph 7: Note that the evaluation should consider reduction of toxicity, mobility, or volume through treatment. In this sense, alternatives that do not include treatment cannot achieve such reductions. Revise the evaluations accordingly.

**RESPONSE:**

The text has been amended accordingly.

22. Page 4-14: The information on the groundwater extraction system given here should be added to the initial description of the alternative given in Section 3 (Development Alternatives), Subsection 3.1.2.

**RESPONSE:**

The text has been amended to help the reader locate the section where further information can be found.

23. Page 4-14, Paragraph 5: Provide an explanation here (and in paragraph 6) for the rationale for the selection of numbers of extraction wells versus the capture requirements shown for the East Parking Lot plume (200 wells versus 27) and the West plume (15 wells versus 7).

**RESPONSE:**

The smaller number of extraction wells represents how many are required to capture the plume. The larger number of wells represents how many are required to obtain a faster contaminant recovery rate that should ensure a reasonable project lifetime. This is stated in the subject paragraphs.

24. Page 4-16, Paragraph 1: Reconcile the value associated with a 7-year project life with the values for other time periods given elsewhere.

**RESPONSE:**

The East Parking Lot Plume is the driving force behind the total remediation. Other plumes, due to lower volumes, will take less time.

25. Pages 4-21, 4-24, and 4-25: The performance of the UV/oxidation and biological treatment systems for groundwater are reported as >99% removal; the performance levels called for in the projected systems are given as reductions from 2.7 mg/l or 7.5 mg/l to 3 µg/l, reductions of 99.89% and 99.96%, respectively. The likelihood of achieving such performance (or attainable effluent concentrations) should be discussed.

**RESPONSE:**

Careful design and testing would be required to achieve the desired results.

26. Page 4-27, Paragraph 2: The discussions of costs of soil remediation alternatives should identify that the capping alternative includes only the capping of Landfill No. 4, while the other alternatives (In-Place Stabilization or Removal/Treatment/Disposal) include Landfill No. 4, Landfill No. 1, and FDTA-2. The differences in volumes associated with the various alternatives should be identified to allow better comparison of costs.

**RESPONSE:**

Revisions to the BRA have significantly altered the soils contamination discussions in the FS. The concerns expressed in this comment are no longer an issue as a result of the updated soil contamination discussions.

262113

# Response to Comments From

# Texas Water Commission

262114

# TEXAS WATER COMMISSION
# COMMENTS ON THE
# AIR FORCE PLANT 4
# MAY 1993 DRAFT FINAL FEASIBILITY STUDY REPORT

**TWC Project Manager (Peter A. Waterreus)**

1. Although TCE is the primary contaminant in the plumes, do the proposed remedial methods remove all contaminant concentrations (e.g., Chromium, other COC's) to acceptable discharge criteria?

   **RESPONSE:**

   None of the contaminants are expected to be present in the effluent in concentrations exceeding MCLs.

2. The PRG's shown in Appendix C of the FS are based upon risk calculations developed in the second draft of the BRA, however, I do not find the calculation sheets used to determine the chronic daily intake or risk which the PRG's are based upon. These calculation sheets should be include in the RI to back up the BRA. In addition, please explain how the 2.8 mg/kg determined in the 1st draft of the FS is so much less than the 82 mg/kg determined in the 2nd draft of the FS.

   **RESPONSE:**

   The referenced calculation sheets have been provided to the TWC as attachments to a letter dated September 7, 1993 to Mr. Peter A. Watterreus from Sam. J. Marutzsky.

   The reason for the large change in the PRG for chromium was a revision to the BRA. The earlier version of the BRA incorrectly applied a value for the chromium slope factor. Correction of this error significantly reduced the calculated health risk presented in the BRA. (It should be noted that the BRA results for chromium and several other COCs have been revised again and these revisions are reflected in the current version of the FS.)

3. Include BAP and Cr in the list of acronyms.

   **RESPONSE:**

   The acronym list has been amended.

4. Has the effect of leachate from contaminated soils on ground water been looked into? This could drive the cleanup of soils. You mention interim measures are underway in some of the contaminated areas, however, to what concentration should the soil be cleaned up to in order to prevent additional contamination of the aquifer?

**RESPONSE:**

Leachate from contaminated soils has not been explicitly evaluated. The fact that nearly all of Plant 4 is covered by asphalt, concrete, or buildings makes contaminant transport from soil to groundwater unlikely on a broad scale.

Section 2.2.2 now identifies the sites subject to interim measures and who to contact to obtain specifics about the interim measures. The interim measure in Building 181 is understood to be a soil vapor extraction process targeting a suspected source area for the TCE entering the groundwater. A target cleanup concentration for the soil has not been determined by Geotech and it is not known if the contractor performing the interim measure has calculated target concentrations. Typically, however, such systems are operated as long as a significant contaminant mass continues to be recovered. When little or no contaminant is recovered, operation is suspended, samples are collected and analyzed, and a decision on how to proceed is made at that point. The decision could be to resume operations or to discontinue operations or to wait for some time period and then resume operations.

5. Section 1.3, page 1-3

   Lockheed now operates the facility. State when the operation switched from GD to Lockheed.

   **RESPONSE:**

   The text has been amended accordingly.

6. Section 1.3, page 1-3

   State when AFP4 was included on the NPL.

   **RESPONSE:**

   Section 1.3 now includes this date.

7. Section 1.4.2.2, page 1-4

   Lockheed now operates the facility. State when the operation switched from GD to Lockheed.

   **RESPONSE:**

   The text has been amended accordingly.

8. Section 1.5, page 1-49

   Please provide a table showing the total number of sites, a table showing the sites which require no further action and provide a brief statement why no further action is required, and a table showing the remaining sites under consideration for remedial action.

**RESPONSE:**

A table has been included in the Executive Summary.

9. Section 2.2.2.1, page 2-4

   3rd sentence - BAP present in shallow depths "is" suspected, not "in".

   **RESPONSE:**

   The text has been corrected.

10. Section 2.4.1.1, page 2-11

    Comment #16 from the 1st set of FS comments was not addressed in the text as mentioned in your response. Please revise the text.

    **RESPONSE:**

    The text has been revised.

11. Section 2.4.1.1, page 2-15

    Comment #20 from the 1st set of FS comments was not addressed in the text as mentioned in your response. Please revise the text.

    **RESPONSE:**

    The text has been revised.

12. Section 3.1.2, page 3-1

    I have never heard of a 1:1.5 percent slope. "allowing for a slope of 1:1.5 and a 10-foot-wide trench".

    You mention in your response to TWC comment #46 from the 1st draft comments that the trench design is conceptual. Why did you select a conceptual design that would require the removal of so much earthen material? Is there a means of construction whereby the walls of the trench can remain vertical? In addition, what type of material will be backfilled into the trench and how will the piping be arranged to remove water from the trench?

    **RESPONSE:**

    The word "percent" has been removed from the sentence.

    There are trench designs that allow vertical walls, however, they are more complicated, expensive, and potentially more dangerous to workers. Vertical walls would require elaborate internal shoring to comply with OSHA construction standards, but it can be done.

Sand or gravel will be backfilled into the trench above the saturated water level to facilitate movement into the trench. As far as piping in the trench, slotted pipe would be placed on the bottom with an estimated three extraction pipes connected to the slotted pipe.

13. Section 4.2.1.1.3, page 4-5

Exemption #68 should be listed in the references.

**RESPONSE:**

The Texas Air Control Board Standard Exemption list has been added to the reference list.

14. Section 4.2.4.1.1, page 4-12

TCA and DCA are not by-products of TCE. Please revise the text.

**RESPONSE:**

The text has been modified to refer to these constituents as degradation products.

15. Section 4.2.5.1.2, page 4-14

Please provide a reference and justification for the estimated remediation quantity of 4 aquifer volumes. Mark Plessinger did state that he felt 4 volumes would be insufficient for cleanup of the DNAPL. This should also be stated in the text. In addition, what would it take to estimate the number of pore volumes required to remediate the aquifer?

**RESPONSE:**

Please note that the four subject aquifer volumes refer to the dissolved portion of the contaminants. Four aquifer volumes would not be expected to remove all DNAPL.

The basis for choosing four pore volumes is the common well development practice of purging three to five volumes prior to use. We understand that this represents a significant extrapolation going from a well to an aquifer, but it is hoped that four pore volumes will provide a useful conceptual benchmark to gain a "feel" for the situation and provide a useful starting point for an actual design for remedial action.

Presently, it is not possible to predict the number of pore volumes necessary to remove a DNAPL mass from an aquifer. In recognition of the difficulties presented by DNAPL aquifer contamination, the FS has been expanded to include the use of innovative technologies to enhance the DNAPL recovery rate. The extraction and treatment scenarios have been modified to accommodate this approach.

16. Section 4.2.5.1.2, page 4-14

5th paragraph - which three wells were used to simulate the effects of the trench. Also, I do not find the trench depicted on Plate 6 as stated in the text.

If the trench was simulated using three wells why can we not expect more than 5 gpm from the trench?

RESPONSE:

The reference to Plate 6 was incorrect and has been deleted from the text.

The text was not clear. The three wells would pump 5 gpm each for a total of 15 gpm. The text has been clarified.

17. Table 4-1, page 4-16

Two of the exponents are of a size that is easy to read, the remaining 6 are difficult to read. Could you please make all the exponents legible?

RESPONSE:

The exponents have been made larger in Table 4-1.

18. Section 4.2.6.1.2, page 4-20

Last paragraph - Although I agree further delays may arise if CAFB and AFP4 do not cooperate, I do not believe it is necessary to state it in the FS. Please delete this sentence.

RESPONSE:

The Geotech field experience at the site was such that implementation considerations for activities on CAFB property presented significant administrative challenges as well as health and safety issues. Because of this experience we felt that this statement should remain as part of the implementability evaluation.

19. Section 4.2.6.1.5, page 4-21

Sections prior to this mention the use of bioreactors as a means of treatment. Why has it been omitted here?

RESPONSE:

Bioreactors were not intended to be eliminated. They are part of the Biological treatment alternative.

20. Section 4.2.6.2.4, page 4-23

Transportation of contaminated materials should follow DOT regulations rather than DDT regulations.

RESPONSE:

The text has been corrected.

**TWC Pollution Cleanup Division (Lel Medford, SES)**

## I. FINAL GROUNDWATER REMEDIATION OPTIONS

1. Treatment options acceptable.

   **RESPONSE:**

   Comment acknowledged.

## II. FINAL SOIL REMEDIATION OPTIONS

1. Soil mixing not acceptable as an option. The TWC does not consider this remediation a permanent solution.

   **RESPONSE:**

   Soil mixing has been eliminated from the FS as a treatment alternative.

2. Capping not acceptable as an option. The TWC does not consider this remediation a permanent solution.

   **RESPONSE:**

   Comment noted. This option is still retained as an alternative since it does control the exposure pathway.

**TWC Pollution Cleanup Division (Louis Rogers, TSS)**

## I. REVIEW OF METAL CONTAMINATION

I have evaluated the information you provided which is presented in Table 1-18 of the May 1993 Draft Final Feasibility Study Report for the Air Force Plant #4 Site. Because this data is being used by the authors of the report as a basis for evaluating future remediation at the facility, some general observations are appropriate.

1. The need for remediation is based on the assumption that a metals concentration in the soil must be greater than a calculated background concentration.

   **RESPONSE:**

   The response to comments 1 through 4 are combined in the response for comment 4.

2. The background concentrations for the various metals are calculated from the mean and deviation of approximately 778 soil samples from the Western United States (west of the 96th meridian) as presented in Table 2 of U.S.G.S. Professional Paper 1270, by Shacklette and Boerngen.

RESPONSE:

The response to comments 1 through 4 are combined in the response for comment 4.

3. Air Force Plant #4 lies approximately 85 miles west of the 96th meridian. The 96th meridian was chosen by Shacklette and Boerngen as an artificial division between the Eastern United States and the Western United States because of the general change in precipitation, climatology, and soil type.

RESPONSE:

The response to comments 1 through 4 are combined in the response for comment 4.

4. The background concentrations calculated from the mean and deviation of approximately 540 soil samples from the Eastern United States are slightly different, and might be just as appropriate to use as a basis for remediation.

RESPONSE:

Remediation of metals contamination in soils at Plant 4 is based on health risk and not background. Background information is presented to assist the reader in assessing the relative levels of metals contamination at the site. The background concentrations for the western United States (US) were presented because Plant 4 lies within that portion of the US based on Shacklette and Boerngen. We realize that some discrepancies exist between the levels presented for the eastern and westerns sections of the US, however, those discrepancies do not affect the selected remediation alternatives.

5. The background for the elements cadmium and silver are reported as "Not Available", when in fact the U.S.G.S. Report specifically states that neither element exists at background levels within the conterminous United States.

RESPONSE:

According to Shacklette and Boerngen, silver and cadmium "were determined too uncommonly for reliable mean concentrations to be calculated." This statement does not mean that neither element exists at background levels, but rather, that a mean concentration cannot be reliably determined based on the data presented. Consequently, an "NA" is used in the table to indicate that the data is not available.

6. A background for the element thallium (an extremely toxic element at low concentrations, estimated lethal dose in humans of 8 to 12 mg/kg per Casarett and Doull) is incorrectly reported in Table 1-18. Thallium was never quantified in the U.S.G.S. Report. Thorium (Th), which is reported, was mistaken for thallium (Tl). As with cadmium and silver, the background for thallium at this site should be assumed to be zero.

RESPONSE:

The background concentration for thallium was improperly reported in the table. According to Shacklette and Boerngen, thallium was analyzed for, but never found, in a concentration greater than 50 parts per million (the approximate lower detection limit) in any of the samples. To be consistent within the table, this lower detection limit is presented in parentheses to indicate that the element was not found at that level. Within the other tables where thallium data is presented, a concentration of twice the levels found in the four background samples was used for reference.

7. No evidence is presented to support the assumption that the site has been fairly characterized for the extent of metals contamination due to industrial or commercial activity. The only data which I have seen appears to have been collected at random.

   <u>RESPONSE</u>:

   The data collected and presented in this document was not collected at random, but results from comprehensive investigations of the known or suspected hazardous waste sites at Plant 4. These investigations follow procedures outlined in the *Final Work Plan* and *Final Sampling and Analysis Plan*. Both planning documents were reviewed and approved by representatives of the US Environmental Protection Agency Region VI and the Texas Water Commission.

8. Table 1-72 of the May 1993 Draft Final Feasibility Study Report summarizes the sediment sampling from Lake Worth, the major drinking water supply for the City of Ft. Worth. The PRP did not test for thallium. This appears to be a major oversight.

   <u>RESPONSE</u>:

   Eighteen samples collected from Lake Worth sediments at nine locations were analyzed for thallium. Thallium was not detected in 16 of the 18 samples (instrument detection limits ranged from 0.54 - 1.00 mg/kg). Thallium was detected in the other two samples at 0.72 mg/kg and 0.61 mg/kg, respectively; however, in both cases it was also detected in the laboratory method blank. Thallium was not reported in the referenced table because it was not identified by the US Fish and Wildlife Service as an aquatic chemical of concern, nor was it identified in the Baseline Risk Assessment as chemical of concern for human health.

## II. COMMENTS ON DRAFT FS

I have examined the response to the TWC's comments from the PRP's on the Draft FS Report, and offer the following suggestions.

<u>Soil Mixing</u>

1. I consulted the Handbook on In Situ Treatment of Hazardous Waste-Contaminated Soils, EPA/540/2-90/002, (note the EPA reference no.) and found that only thermoplastic microencapsulation of fine particles of contamination using melted asphalt indicated any similarity to the PRP's response. Experimental work is referenced taking advantage of the characteristics of quaternary ammonium ions as spacers in clay matrices.

   <u>RESPONSE</u>:

   Soil mixing has been deleted from consideration as a remedial action alternative.

2. The response to thermal desorption as a technology to explore states chromium, the COC according to the BRA will still be a problem. However, in the response to TWC's first comment, chromium is not "a COC for health-based reasons according to the Draft Final BRA."

<u>RESPONSE</u>:

The statement regarding chromium not being a COC was referring to chromium as a groundwater contaminant.

262123

# Response to Comments From

# U.S. Air Force/Aeronautical Systems Center

262124

# HQ AFMC
# COMMENTS ON THE
# AIR FORCE PLANT 4
# MAY 1993 DRAFT FINAL FEASIBILITY STUDY REPORT

**HQ AFMC/SGBP Comments**

## I. GENERAL COMMENTS

1. Page 1-94

Will a study continue to identify the probability of migration of contaminants into the groundwater system or the surface waters of Meandering Creek? Examine the possibility of children playing in or on the banks of Meandering Creek.

**RESPONSE:**

A more rigorous groundwater model has been developed. The results are expected to be available in the Spring of 1994. The scenario of children playing at the creek was examined in the Baseline Risk Assessment. No significant health risks were found.

2. Page 1-109

Were any surface soil samples near public access of Lake Worth taken and examined for contaminants?

**RESPONSE:**

No

**Environmental Issues Division**
**Office of Public Affairs (Michael L. Martino)**

## I. GENERAL COMMENTS

The Office of Public Affairs has no significant comments on subject document. I would, however, suggest that Chapter 1, section 1.2.2 be modified to reflect the current status of CAFB, and that sections 1.3 and 1.4.2.2 be updated to reflect the transition from GD to Lockheed.

**RESPONSE:**

The text has been revised.

**Directorate of Environmental Law (Frank E. Steele)**

## I. GENERAL COMMENTS

1. I have reviewed the subject document and offer the following comments and observations:

   a. Note the references in the cover page and elsewhere to Aeronautics System Division need to be updated to Aeronautical Systems Center.

   **RESPONSE:**

   The noted update has been made.

   b. Executive Summary, page xiii, paragraph 6, - Since the term "window area" first appears here, a brief description, such as the area between two geologic formations, may be helpful.

   **RESPONSE:**

   This comment was inadvertently overlooked.

   c. Section 1.3, page 1-3, paragraph 1 - This history should be updated to reveal that in 1993, Lockheed Forth Worth Company took over operations from GD.

   **RESPONSE:**

   GD references have been changed to Lockheed as appropriate.

   d. Section 1.5.3.4, page 1-89, conclusion paragraph regarding landfill no. 3 - Although this conclusion states that landfill 3 had some of the highest concentrations of metals in soil, and VOCs at levels indicating pure product, this landfill was not identified as requiring remediation in other areas of this study. If there is a good reason, such as conclusions from the baseline risk assessment, a short discussion would be helpful.

   **RESPONSE:**

   The referenced section is verbatim from the RI and really cannot be modified. However, the FS, in later sections, defines the target contaminants, preliminary remediation goals, and areas under consideration for remedial action, along with the rationale for targeting certain areas and not others. This information is primarily located in Section 2. Additionally, reference is made to the interim measures being applied at Landfill No. 3.

   e. Section 1.5.3.10, page 1-125, conclusion paragraph regarding die yard chemical pits - Although this conclusion states that significant contamination is still present and TCE is a major concern, this site was not specifically identified as requiring remediation in other areas of this study. If there is a good reason, such as any contamination from this site being captured in remediating a common plume in the area, a short discussion would be helpful.

RESPONSE:

The Executive Summary now includes a table citing the 24 sites as defined in the RI/FS Work Plan. Mention is made that contamination contributions from specific sites are in some cases addressed through the various groundwater plume remedies.

f. Section 2.2.1, page 2-2, paragraph 2 - This paragraph correctly sets forth that when groundwater is an actual or potential source of drinking water, the MCLs specified in the Safe Drinking Water Act (SDWA) are generally the applicable or relevant and appropriate standard; however, rather than citing the authority for this as "EPA 1987," the reference should be to the National Contingency Plan at 40 C.F.R. 300.430(e)(2)(i)(A). However, in this study, the cleanup level proposed for TCE is 3 ppb rather than the SDWA MCL of 5 ppb. Although the risk assessment may have found the 3 level to be protective of human health, it seems that the numbers summarized at the end of section 1 for the risk assessment may still fall within the 1 in 10,000 to 1 in 1,000,000 range, rather than using 1 in 1,000,000 only. I realize that the NCP suggests that numbers other than MCL may be appropriate where multiple pathways of exposure may exist. However, I recommend that the numbers in the risk assessment be re-worked to see if they indeed fall within the acceptable range of 1 in 10,000 to 1 in 1,000,000. In any event, SAF MIQ has expressed a policy of not cleaning TCE below 5 ppb. This policy should be especially followed at a site like this where the aquifer is only a potential drinking water aquifer.

RESPONSE:

The final remediation goals will be defined in the Record of Decision (ROD). The issue of 3 ppb vs. 5 ppb as a TCE cleanup target should be negotiated between the Air Force and the regulators as part of developing the ROD.

g. Section 2.4.1.1, page 2-10, access restrictions and deed restrictions - The assumptions here of long-term Federal government ownership are not correct as the Air Force is attempting to divest itself of these industrial-owned sites.

RESPONSE:

One of the premises of the Baseline Risk Assessment is that Plant 4 and CAFB will continue to be used for industrial purposes. The FS must be consistent with the assumed future scenario developed in the risk assessment.

h. Section 3.1.2, page 3-1, paragraph 3 - Where is the tremendous amount of soil from this trench going to be deposited? Have the removal, sampling, deposit, run-off, and concomitant problems and costs associated with this action been calculated and considered?

RESPONSE:

The soil would be returned to the trench as soon as the piping in the trench is in place. None of the excavated material should need to be removed from the site.

262127

GJPO–WMP–91

Air Force Plant 4

# Formal Response Package to the Regulatory Comments on the Draft Feasibility Study Report

May 1993

Prepared for
U.S. Department of the Air Force
Headquarters Aeronautical Systems Center
Wright-Patterson Air Force Base, Ohio

Submitted by RUST Geotech Inc., under
DOE Contract No. DE–AC04–86ID12584 for the
**U. S. Department of Energy**

262128

# Response to Comments From

# U.S. Environmental Protection Agency

# Region VI

262129

# U.S. ENVIRONMENTAL PROTECTION AGENCY
# REVIEW COMMENTS ON THE
# AIR FORCE PLANT 4
# DRAFT FEASIBILITY STUDY REPORT

**Report Prepared for U.S. Department of the Air Force**
**Headquarters Aeronautics Systems Division**
**Wright-Patterson Air Force Base, Ohio**
**by**
**Chem-Nuclear Geotech, Inc.**
**Report Issued December 1992**

The U.S. Environmental Protection Agency (EPA) has reviewed and herein reports comments on the Draft Feasibility Study for Air Force Plant 4, prepared by Chem-Nuclear Geotech, Inc. for the U.S Department of the Air Force, dated December 1992.

The comments on this document are organized into two categories; I. General Comments dealing with overall aspects of the document and II. Specific Comments which relate to specifically identified sections or portions of the text.

## I. GENERAL COMMENTS

(1) The statement in the executive summary that the Draft Feasibility Study (FS) is subject to revision to account for revisions of the Draft Remedial Investigation Report (RI) is noted. Future drafts of the FS are expected to incorporate appropriate changes corresponding to revisions of the RI.

RESPONSE: Comment Acknowledged.

(2) The authors of the FS obviously expect the reader to refer to the RI for details of the hydrologic system. Other than a brief description in the Executive Summary which states that "the facility is situated on complex geologic formations involving two distinct aquifers separated by an aquitard, " there is no further description of the hydrologic system.

Reports such as the RI and the FS need to "stand alone". The FS should include a comprehensive description of the hydrologic system, with all its complications, and explanation of how the modeling strategy was developed, how well placement was determined, and how the model was constructed and programmed. Provide a discussion of the basis for transmissivity values used in modelling the upper zone sediments (in the RI, it was said to vary by four orders of magnitude) and the Paluxy aquifer, how vertical flow through the aquitard was handled in the modeling, and what was done in the "window area" where the aquitard may be missing. Describe the method used to select the number and locations of the 200 wells for the East Parking Lot plume (see page 4-23), and a pumping rate for each of 5 gal/min. Evidently the "complex" system was greatly simplified in the model. A brief explanation of why 150 of these wells will be constructed of PVC, and 50 of stainless steel (Item 8) should be provided. Item 15, page 4-23, states that the pumping rate for the Paluxy wells will be 80 gal/min. One assumes that in the computer simulation of the drawdown in these wells programmed factors included not only transmissivity and storativity but also well losses, well interference, boundary effects, and amount of leakage through the aquitard. These parameters should all be matched to the total available drawdown in the aquifer and included in appropriate discussions.

RESPONSE: Section 1 of the FS has been substantially augmented with material from the RI to enable the FS to better "stand alone." More detail has been included in the text to explain the rationale and assumptions behind the pumping scenarios.

(3) No discussion is given about the effect on extraction rates caused by the leaking water-supply lines described in the RI. State if this leaking is assumed to go on for the duration of the project. Discuss how this might affect the extraction rates and contaminant retrieval.

RESPONSE: The leaking is assumed to continue for the duration of the project.

(4) On page 1-16, in the description of Landfill No. 4, investigations by Hargis and Montgomery and by Radian are cited. These names are not listed in the References. The same comment applies to Intellus, cited in page 1-19. Supply appropriate reference

RESPONSE: The Bibliography has been modified.

(5) In the next to last paragraph (page 1-16) there is a statement about the attitude of the Goodland Limestone, shown in Figure 1-14 (page 1-18). Provide data and discussion for the basis for extending this sequence of interbedded shale and limestone layers approximately 250 feet from well HM-43 (where data presumably exist) to the edge of the clay unit especially with the beds dipping as shown.

RESPONSE: Section 1 of the FS has been substantially augmented with material from the RI.

(6) The Draft Feasibility Study presents discussions of a large number of areas of contamination defined during the Remedial Investigation. However, the remedial actions developed for consideration in the FS include treatment of soils at only three of the areas. The selection of the areas for remediation of soils is based on contamination levels which exceed acceptable risk levels. The FS also includes approaches to the remediation of contaminated groundwater using pump-and-treat techniques. The FS does present some brief discussions of probable relationships among areas of contaminated soils and contaminated groundwater. The FS presents no discussion of the feasibility (or infeasibility) of treating contaminated soils so as to remove sources of contamination which may continue to affect the groundwater. The FS should be revised to include a discussion of the feasibility or infeasibility of treating sources of groundwater contamination (i.e., contaminated soils) as well as treatment of affected groundwater.

RESPONSE: Section 2 has been substantially augmented to provide a clearer basis for the approaches taken to develop remedial actions.

(7) A site wide map that lists all of the areas that have been investigated is needed.

RESPONSE: A map has been included.

## II. SPECIFIC COMMENTS

**Page 1-1, Section 1.1, Paragraph 2, fourth line:**

Replace "alternates" with "alternatives".

RESPONSE: Correction made.

**Section 1.2.3 Nature and Extent of Contamination:**

The summary descriptions of specific areas studied during the RI are considered subject to modification in response to the review comments directed to the RI. This comment applies to summary conclusions and the figures relating to subsurface geology, as well as prior comments on the RI which pointed out uncertainties in definitions of limits of affected sites. The summary descriptions of the various areas contain no quantitative data, do not relate the findings at the areas to any applicable standard or risk level, and do not provide any conclusion regarding possible future remedial action, applicable technology, or relate to any other portion of the Draft Feasibility Report.

For example, the selection of soil areas to be remediated, based on health-based risk-assessment criteria, are defined on page 2-5 under the category of "2.3 General Response Actions", i.e., not related to the "Nature and Extent of Contamination" (Section 1.2.3), nor to the "Remedial Action Objectives" (Section 2.2.2), nor to the "Baseline Risk Assessment" (Section 1.2.4).

If risk levels are to be used as criteria for remedial action, then the description of the "nature" of contamination at the described areas should include the quantitative results of the risk assessment of that area, as well as the identification of the major quantitative components in the risk level such as chemicals and concentrations. Similarly there is no way to relate the volumes of soil "targeted for possible remedial action" on page 2-4 to the "health risk based target cleanup concentration" of 2.8 mg/kg of chromium given on page 2-2 (paragraph 5, 2.2.2 - Soil) or to the data in Figures 1-11 (soil analyses) or the area of extent given in Figure 1-12. For example, the data in Figure 1-11 show 23.1 mg/kg of Cr at SB-016, but SB-016 is not included in the area diagram of Figure 1-12, Extent of Inorganic Contamination. There is no connection shown between the nature and extent of contamination, the target cleanup levels (referred to as Remedial Action Objectives and also Preliminary Remediation Goals, pages 2-1 and 2-2), and the calculation of volumes of soil or groundwater.

No concentration values for background soils are listed in the Draft Feasibility Study, although "background" is referred to frequently.

The discussion on page 1-50 under the heading "Meandering Road Creek" contains undefined combinations of numbers and types of samples (sediment and surface water); the figure referred to (Figure 1-42) contains indications of "Lake Worth Sampling Locations" considerable distances from Lake Worth. This discussion, like the others describing "nature and extent of contamination" does not relate the area or media to any cleanup level or remedial action, or "no action" determination. Review comments on this specific section are to revise the text to clearly distinguish between sediment and surface-water samples, to summarize contaminants in quantitative terms, and to relate the contaminants to clearly stated cleanup levels.

RESPONSE: Section 2 has been revised to more thoroughly link health-based risk assessment criteria to the contamination zones described in Section 1, Remedial Action Objectives and General Response Actions.

As stated under general comments, Section 1 has been substantially augmented with material from the RI. This should improve the accuracy of the descriptions of the nature and extent of contamination contained in the FS.

**Page 1-7, Figure 1-4:**

Does the notation "STORM SEWER OUTFALL" represent "STORM SEWER 5 OUTFALL"? If so, please note it on the figure.

The legend does not describe the symbol ____ __ ____ __ ____, is this a property line?

RESPONSE: This section and figure have been revised.

**Page 1-9, Figure 1-6:**

An extra drain appears on this figure near French Drain #2, please provide appropriate label.

RESPONSE: This section and figure have been revised.

**Page 1-16, Paragraph 1:**

French Drain No. 1 and No. 2 (see Landfill No. 1). Be consistent in references, refer to the specific figure(s) not "(see Landfill No. 1)".

RESPONSE: This section has been revised.

**Paragraph 2, Last Sentence:**

Replace "See figures listed in Landfill No. 1" with "See Figures 1-4 through 1-12 for areal.."

RESPONSE: This section has been revised.

**Page 1-19, (FDTA-5), Paragraph 3:**

"Metals were found to be within background levels (Figure 1-19)". Why is Figure 1-19 referenced? This figure depicts the "Extent of VOCs and Semi VOCs Detected at FDTA-5.

RESPONSE: This section has been revised.

**Page 1-24, Figure 1-19:**

Where are the markers that indicated the locations for FDTA #5 and the DYCP?

RESPONSE: This figure and section have been revised.

**Page 1-25, Figure 1-20:**

Should not Figures 1-20 and 1-24 be identical since their symbolic of the same cross section? Please provide an explanation as to why they are different.

RESPONSE: These figures and section have been revised.

**Page 1-38, Paragraph 8:**

The text refers to Figures 1-32, 1-33, and 1-34 as showing the areal extent of contamination around Fuel Saturation Area No. 3 and UST-30; the referenced figures are geological cross-sections. Provide figures supporting the statement in the text.

RESPONSE: These figures and section have been revised.

**Page 1-53, Section 1.2.3.3, Paragraph 4:**

"Other areas cited in the RI as a possible sources...", delete "a".

RESPONSE: This section has been revised.

**Page 1-53 to 1-55:**

The estimates of plume volumes are subject to the comments made in the review of the IR. The estimates given here lack sufficient supporting detail to be accepted with confidence. In turn, the lack of credible detail in the estimates of plume volume affect the credibility of the design for groundwater extraction and, in turn, the cost estimates. The extent of the plumes should be supported with diagrams or figures given in this document. Specifically, the extent of the extraction activity for the "East Parking Lot Plume" should be defined in terms of the relationship to the groundwater under Carswell Air Force Base.

RESPONSE: The Draft Final FS has been revised accordingly to reflect the Draft Final RI. Section 1 has been extensively revised. More information regarding the rationale behind contaminant extraction scenarios has also been included.

**Page 1-54, Paragraph 8:**

"Seven priority pollutants, antimony, arsenic,...", only six priority pollutants are listed, please correct.

RESPONSE: This section has been revised.

**Page 2-1, Paragraph 6:**

Identify the specific formation which is identified as a Class I aquifer.

RESPONSE: The Paluxy formation has been identified.

**Page 2-2, Paragraph 3:**

See Comments on Appendix C relative to the use of a "PRG" of 3.0 ≤g/l for TCE.

RESPONSE: Comment noted.

**Page 2-2, Paragraph 4:**

Revise the paragraph to provide a clear statement of the Remedial Action Objective or Preliminary Remediation Goal to be used for the purpose of the Feasibility Study. Item 10 on page 4-13 indicates treatment to 1 ≤g/l of chromium but does not reference a rationale for the use of that concentration as a treatment goal.

RESPONSE: RAOs and PRGs have been clarified in Section 2. Also, chromium is no longer a COC in ground water.

**Page 2-2, Paragraph 5:**

Although soils may not prove to be a risk, it can still be a source of groundwater contamination, therefore, treatment would be justified.

RESPONSE: Comment acknowledged. The COCs for ground water are TCE and 1,2-DCE (a TCE degradation product). A DNAPL such as TCE is not expected to reside in the unsaturated zone for very long. Therefore, locating and removing TCE as a soil contaminant is not considered to have a high chance of success. Also, it is understood that a soil vapor extraction system is being employed in the area of the highest known soil TCE concentrations (under the parts plant) as an interim measure separate from this feasibility study.

**Page 2-3, Paragraph 1:**

Expand the discussion of surface water to include the quantitative results which define the absence of risk from the possible effects of groundwater on surface water quality.

RESPONSE: Section 2.2.4 has been expanded to include direct reference to the BRA results for health risk and reference to the ambient water quality criteria for surface water.

**Page 2-7, Paragraph 3 (Deed Restrictions):**

This is not true for the State of Texas, only Deed "Notice" can be imposed on property in the State of Texas.

RESPONSE: Text has been amended.

**Page 2-9, Paragraphs 2 and 3:**

The local stream and publicly-owned treatment works are both eliminated as options for discharge of treated groundwater. Later discussion (e.g., page 4-20) identifies discharges to a sanitary sewer and to a storm sewer without identifying ownership of the sewers or the actual destination of the discharge. Clarify the discussion at both places in the report.

RESPONSE: Text has been amended.

**Page 2-9, Paragraph 1 (Deep Well Injection):**

Expand the discussion to include the feasibility or infeasibility of deep well injection into formations below the Paluxy.

RESPONSE: Deep well injection would entail injection into a potable aquifer. This is not a desirable practice.

**Page 2-10, Paragraph 5 (Reverse Osmosis):**

State whether RO is retained or screened out, in both the text and Table 2-1.

RESPONSE: RO is screened out. The text has been amended.

**Page 2-10, Paragraph 7:**

State whether or not evaporation ponds are retained or rejected. (Refer to Table 2-1 also.)

RESPONSE: Evaporation ponds are rejected. The text has been amended.

**Page 2-11, Paragraph 1:**

Provide citations here or in the later description of UV/peroxide treatment (page 3-3) of sites where the technology has been applied and quantitative data on the effectiveness of TCE removals by this process.

RESPONSE: Information concerning the effectiveness of UV/Oxidation was provided by the vendors of the equipment.

**Page 2-11, Paragraph 4:**

Expand the discussion of ion-exchange processes to include consideration of the management of spent resin or regenerant/back-wash solutions.

RESPONSE: Ion-exchange has been eliminated as an option since inorganic ground-water contamination is no longer a risk driver.

**Page 2-11, Paragraphs 4 and 6:**

Reconcile the elimination of Precipitation as technology in paragraph 6 with the statement in paragraph 4 of its possible use as a method of treating ion-exchange backwash.

RESPONSE: Error has been corrected. Both technologies were eliminated as inappropriate for the COCs.

**Page 2-11, Paragraph 8:**

Discuss here or in a later section (e.g., page 2-19, page 3-4, or page 4-5) some existing applications of biological treatment for the removal of TCE from wastewaters, especially in the presence of chromium as intended here.

RESPONSE: Information concerning the effectiveness of bioremediation was provided by vendors of the equipment. Also, chromium is no longer a COC in ground water.

**Page 2-12, Paragraph 6 (Deed Restrictions):**

Same comment as cited for page 2-7.

RESPONSE: Text has been amended.

**Page 2-12, Paragraph 8 (Containment):**

Reconcile this discussion of containment with the entries in Table 2-2, page 2-13, where Capping is retained as an option. Note that the reference to Section 2.4.1.3 for details of containment systems is erroneous, since there is no such section.

RESPONSE: The text has been corrected. Containment is retained as an option.

**Pages 2-13 and 2-14, Paragraph 4:**

The table entries and discussion for Soil Mixing fail to correlate what is apparently an in-situ soil stabilization/immobilization process with a later discussion of Immobilization. Revise the report to identify in-situ immobilization techniques using augers or excavation equipment as a variation of immobilization/stabilization treatment. Expand the discussion of the applicability of augers in the materials likely to be found in Landfills 1 and 4, as discussed on page 3-5. Revise other portions of the report as appropriate.

RESPONSE: The text has been revised and expanded appropriately.

**Page 2-16, Paragraph 6 (Containment):**

Clarify the paragraph as to whether containment or capping is being discussed.

RESPONSE: Paragraph has been clarified. Capping is a technology type under the general response action of containment.

**Page 2-16, Paragraph 9:**

The entry for Carbon Adsorption should contain a discussion of the regeneration or disposal of spent carbon, as was given on page 2-9.

RESPONSE: Carbon adsorption has been eliminated from consideration. Comment on regeneration is not necessary.

**Page 2-17, Table 2-3:**

The relative ratings of high capital cost for Capping and low capital cost for UV/Oxidation treatment should be reconciled with the cost estimates given later in the report.

RESPONSE: The relative cost ratings have been revised appropriately.

**Page 2-17, Table 2-3:**

Provide a discussion of the evaluation of an alternative water supply as entered in the table. Discuss how this alternative would be implemented, what water supply it would replace, what existing supply would be used, the indicated difficulty of implementation, and whether the cost would be rated high, moderate, or low, relative to alternative technology.

RESPONSE: Alternate water supply was removed from consideration.

**Page 2-18, Paragraph 2:**

Revise the discussion of the effectiveness of UV/Oxidation treatment to include quantitative descriptions of past or existing applications in terms of concentration levels of TCE removed, and concentrations achieved in treated effluents. Expand the discussion of the technology's relative "newness" for remediation.

RESPONSE: The vendors of UV/Oxidation treatment systems are confident that the effluent limits can be achieved.

**Page 2-18, Paragraph 3:**

Revise the discussion of the effectiveness of biological treatment to provide quantitative information on the effectiveness of the treatment in removing TCE from water including citations of existing groundwater treatment facilities, concentrations of contaminants in influent and effluent streams, the management of any residuals (e.g., sludge) produced by the treatment, the sensitivity of the treatment to the expected chromium concentrations in the water, and the compatibility of this treatment technology with the ion-exchange treatment proposed for the removal of chromium.

RESPONSE: Ion exchange is no longer being considered because chromium is not a COC for ground water according to the Draft Final BRA. The vendors consulted are confident that bioremediation can accomplish the objectives.

**Page 2-18, Paragraph 9:**

Identify the concept of an interceptor trench; discuss the concept in terms of extraction or containment technology options, or, as it is identified on page 2-19 paragraph 1, as a treatment technology.

RESPONSE: The discussion of the interceptor trench has been augmented.

**Page 2-19, Paragraphs 8 and 9:**

Reconcile the relative ratings of Capping as "a high initial investment" and extraction as having "a moderate capital cost" with the differences in cost as developed in later sections of the report. Revise the third sentence of the paragraph on Containment to clarify the concept of replacement of a cap; provide a range of estimated life for a cap.

RESPONSE: Text has been clarified and revised.

**Page 2-20, Paragraph 2:**

Provide clarification of "median" and "moderate" as used in the sentence, "A median approach will put costs at a moderate level." Provide a rationale for the inclusion of the interceptor trench in a discussion of "Treatment".

RESPONSE: Text has been clarified.

**Page 2-20, Paragraph 7:**

The entries under the heading of "Containment" do not provide an indication of effectiveness. The third sentence introduces the concept of wind-borne contamination which is not considered elsewhere. The third sentence has no proper subject (i.e., "This...") and should be deleted.

RESPONSE: The text has been revised.

**Page 2-20, Paragraph 8:**

The first sentence should be deleted as it indicates physical, chemical and biological treatments for soil and is not coherent with any other discussion of remedial actions for soil. Revise the last sentence of the paragraph to identify what is being discussed: "in-situ version..." of what technology.

RESPONSE: The text has been revised accordingly.

**Page 2-21, Table 2-4:**

Reconsider the assignment of the same "moderate" relative cost to both capping and "soil mixing".

RESPONSE: The table has been amended.

**Page 2-22, Paragraph 3:**

Delete the statement that identifies capping as an institutional control, or provide a rationale for capping as an institutional control and apply that rationale to the balance of the technology screening process.

RESPONSE: The text has been amended to remove capping as an institutional control.

**Page 2-23, Table 2-5:**

Reconcile the listing of institutional actions in the table of final groundwater remediation options with the statement in the second sentence of the following paragraph which states that no institutional controls "passed the assessment". It is further noted that ion-exchange for removal of chromium is not discussed in this summary, although it is discussed and retained for application in earlier and later sections of the report.

RESPONSE: The table has been corrected.

**Page 3-1, Paragraph 1:**

Provide a discussion of why the first paragraph refers to a later description of the groundwater extraction system (in Section 3.1.2 on physical treatment) which is not as informative as the subsequent portions of additional description given on pages 4-14 under biological treatment and on page 4-22 under the topic of costs of physical treatment. Revise the report to present a coherent description of the groundwater extraction system used as the basis for the Feasibility Study.

RESPONSE: This information is now included in Section 4.2.5.1.

**Page 3-1, Paragraph 3:**

Note that the modelling of groundwater flow and contamination referred to in Appendix J of the RI is subject to revision to respond to review comments.

RESPONSE: Comment noted.

**Page 3-1, Paragraph 6:**

Expand the discussion of air stripping to remove TCE from groundwater to provide an estimate of the rate of emissions of TCE to the atmosphere. Discuss the likelihood of a need for emissions control and the management of residuals from the control process.

RESPONSE: The estimated air emissions and the regulated levels are included in Section 4.2.1.1.3, "Alternative 2 - Physical Treatment."

**Page 3-1, Paragraph 5:**

Move the discussion of oil-water separation from a section discussing extraction to a section discussing treatment. This also applies to the repetitive sections on pages 3-3 and 3-4.

RESPONSE: The discussion of the extraction scenario has been separated from the treatment discussions.

**Page 3-1, Paragraph 6:**

Provide discussion of specific operating histories of existing air-stripping units to support the achievement of performance levels stated on page 4-23, items 7, 10, and 13.

RESPONSE: The stated performance levels were provided by vendors working with estimated influent rates and concentrations.

**Page 3-3, Paragraph 7:**

Provide discussions of specific operating histories of UV/Oxidation treatment units to support the achievement of performance levels as given on pages 4-24 and 4-25.

<u>RESPONSE</u>: Performance levels were provided by vendors given estimated influent rates and concentrations.

**Page 3-4, Paragraphs 4 and 5:**

Expand the discussion of biological treatment processes for the removal of TCE to include the same factors as given in the two preceding comments as well as a discussion of the presence or absence of residuals, the compatibility of this treatment process with the presence of chromium in the groundwater, and the compatibility with an ion-exchange process for chromium removal, as discussed in prior sections and indicated in the cost estimates.

<u>RESPONSE</u>: Chromium removal is no longer a remedial action objective for ground water since the risk assessment results no longer specify chromium as a COC for ground water. Also, projected chromium levels do not exceed the MCL at the receptor wells. Treatment process performance data is provided by vendors.

**Page 3-5, Paragraph 5:**

Why was not a combination synthetic/clay/asphalt cap considered?

<u>RESPONSE</u>: If capping is the chosen alternative, then cap optimization would be part of the remedial design process. An asphalt cap is considered as a process option for comparison to other alternatives on a conceptual level.

**Page 3-5, Paragraph 6:**

The discussion of in-situ soil stabilization should be expanded to include a discussion of how the process of using "mixing augers" will be applied in landfill areas.

<u>RESPONSE</u>: Discussion was added to the text regarding the difficulties encountered operating mixing augers in mixed debris media.

**Page 3-6, Paragraphs 4 and 7:**

Discuss the special considerations "possible" at Landfill 4 because of its proximity to Meandering Road Creek. Identify the significance of the rainfall data provided; show its relationship to cleanup operations.

<u>RESPONSE</u>: The special considerations include wetland proximity and the need for run-on and run-off controls capable of handling the 24-hour, 25-year rainfall event.

**Page 3-6, Paragraph 5:** 262142

"Selection of a landfill will be based on the possession of the..." replace with "Selection of a landfill will be based on compliance with EPA's Off-site Policy, the possession of..."

RESPONSE: The text has been amended.

**Page 4-1, Paragraph 2:**

"...after the public comment period on the RI/FS document is completed". This sentence should read "...after the public comment period on the RI/FS document and the Proposed Plan are completed" (see page 4-3).

RESPONSE: The text has been amended.

**Page 4-5, Paragraphs 2 and 3:**

Reconcile the statement of a project life of "less than 10 years" with the 12 years used in cost estimates, e.g., page 4-24.

RESPONSE: The text has been corrected.

**Page 4-6, Paragraphs 2 and 3:**

Following the second paragraph "...both human health and the environment.", add this sentence - Capping will also reduce potential rainfall infiltration and future groundwater contamination.

Delete the word "be" in the third paragraph "The material will be become an inert block..." Also, the material will not be an inert block since it will still contain contaminants. Instead, words like stable, fixed, solid, dense, compact, etc., should be used.

RESPONSE: The text has been amended.

**Page 4-6:**

In the discussion of compliance with ARARs, the possible need for permits for the discharge of treated groundwater is discussed relative only to water treated by biological treatment (page 4-7). Discuss the possible need for such permits for other treat-and-discharge options.

RESPONSE: The text has been augmented. See Section 4.2.2.

**Page 4-8, Paragraph 4:**

Keep in mind that this will not be an issue if conducted in the "RCRA Unit", i.e. on the facility.

RESPONSE: Comment noted.

**Page 4-11, Paragraph 3:**

Add the sentence "The potential would still exists for creating or adding to groundwater contamination.

RESPONSE: The text has been amended.

**Page 4-12, Paragraphs 3 and 5:**

In paragraph 3, would any air issues developed from volatilizing TCE?

In paragraph 5, discuss examples of the use of biological treatment which support the expectation of no residuals.

RESPONSE: Air emissions are discussed in Section 4.2.1.1.3 with supporting calculations in Appendix C. Vendor data supports the position that the organics would be destroyed.

**Page 4-13, Paragraph 5:**

Reconcile the use of the term "several years" with the estimate given elsewhere of sixty years for contaminants to reach nearby wells. Also, the potential exists for downward migration of contaminants to a usable zone.

RESPONSE: The text has been corrected.

**Page 4-14, Paragraph 2,3,4, and 6:**

As commented previously, the information discussed here on plume volumes, pumping rates and other aspects of the extraction system should be combined with other information and presented in a coherent discussion of the extraction system. The remarks about an extraction system which would require 1,000 years for remediation should be deleted.

It should be noted in paragraph 6 that care must be taken to ensure cones of depression overlap to avoid incomplete treatment.

RESPONSE: The extraction system has been developed separately in the text in Section 4.2.5.1.2. The cones of depression overlap.

**Page 4-18, Section 4.2.5.2.2:**

If a synthetic, clay or asphalt cap is used, it may require some excavation activities.

RESPONSE: Comment noted.

**Paragraph 1 of Section 4.2.5.2.3:**

Add to the sentence "...risks to the community during remedial action", "although this can be controlled with typical dust suppression techniques such as water spray".

RESPONSE: The text has been amended.

**Page 4-19, Paragraph 1:**

"...storage, transportation to a RCRA landfill...", after "landfill" add "in compliance with the Superfund Off-Site Policy...."

RESPONSE: The text has been amended.

**Page 4-20, Paragraph 3:**

Clarify or delete the last sentence.

RESPONSE: Sentence was deleted.

**Page 4-20, Paragraph 2 and 5:**

Clarify and present distinct discussions for discharge of treated groundwater, the receiving facility, and clear discussion of required permits.

RESPONSE: See Sections 4.2.5.1.2 and 4.2.2 for discussion.

**Page 4-22, Paragraph 1:**

"...Plant 4 site or at the RCRA landfill...", after "landfill" add "in compliance with the Superfund Off-Site Policy...."

RESPONSE: The text has been amended.

**Page 4-22, Paragraph 4:**

The discussion of costs of various alternatives which extends from page 4-22 to page 4-26 contains numerous details of the alternatives discussed which should be presented in earlier sections of the report, as previously commented.

The numbers and locations wells described are apparently based on the groundwater model. The attributes of the model should be described in English in an appropriate section of the report rather than as given in this draft, i.e., only in computer language in an appendix to the report.

The details of the cost estimates given in the appendix rely on many factors common to construction cost estimating. Additional discussion should be given on the details of the basis for estimating costs for well installation, groundwater treatment processes, O&M costs, and a sample calculation of present worth of O&M, including the use of a discount rate of 5% as provided in EPA Guidance for RI/FS processes.

The discussions of costs for wells and treatment processes should cite sources for costs and indicate the method by which the variation of costs for treatment units sized for various flow rates were computed.

RESPONSE: See Section 4.2.5.1.2 for the discussion of the extraction scenario. Additional costing details have been left in the Cost Section for costing purposes. The explanation of the modeling has been included in more detail in Appendix C. The costs have been amended to follow EPA's format. The costs used are from vendor quotes. Listing the vendors who supplied the information would not be in good faith as they are only estimates and not based on design data.

**Page 4-27, Table 4-2, Alternative 1 column:**

"Compliance Status Not Clear", needs to be clarified.

RESPONSE: Status has been clarified.

**Page 4-26, Paragraph 5 (Comparative Analysis):**

Expand the (one paragraph) discussion of the comparative analysis to include a detailed discussion of the relative balance of advantages and disadvantages of the alternatives, including considerations of cost. Provide a discussion of differences between the protectiveness expected from the three pump-and-treat alternatives, identifying any differences in performance relative to differences in costs. Provide a similar discussion of the differences or similarities of protectiveness of the three action alternatives evaluated for remediation of soils, discussing the protectiveness relative to the three widely different costs.

RESPONSE: The comparative analysis has been expanded.

**Appendix B: Detailed Cost Estimates:**

Provide a rationale for the use of a value of $60,000 for annual costs of parts and materials for all three variations of treatment systems applied to the groundwater. Identify the sources and details of the vendor quotes obtained for wells and water treatment units. Revise or justify the use of costs for domestic water wells for the costing of the extraction wells. Verify the proper use of costs for treatment systems; the cost used for the 100 gpm air-stripper appears to exceed the cost used for units with higher flow ratings.

RESPONSE: The presentation of costs has been modified to better parallel the format used in the EPA guidance documents. Costs have been reverified.

**Appendix C: Calculation of Preliminary Remedial Goals:** **262146**

The development of preliminary remedial goals (PRGs) for the Air Force Plant 4 site were based on exposure pathways and calculations evaluated in the Baseline Risk Assessment (August 1992, Draft). The equations utilized for calculation of the PRGs appear to follow appropriate guidelines for the derivation of PRGs. Yet, the exact equations provided in the U.S. EPA Human Health Evaluation Manual, Part B: "Development of Risk-based Preliminary Remediation Goals" (OSWER Directive 9285.7-01B) were not utilized in Appendix C. Rather, the equations developed in the Baseline Risk Assessment were employed. An example would be the equations derived for inhalation exposure during showering (Groundwater Contamination, Sheets 2 and 3). It is noted that the equations employed in Appendix C provide a different method for modeling or predicting air concentrations of the chemicals of concern compared to the U.S. EPA Part B equations (page 21) for deriving PRGs for inhalation during showering. However, it is also noted that the equations used provide a more conservative estimate of PRGs than the EPA Part B equations for showing exposure.

RESPONSE: Comments acknowledged. The PRG calculations were modified significantly to reflect revisions to the BRA.

**Appendix C: Carcinogenic Risk, Soil Contamination, Sheet 1 and Groundwater Contamination, Sheet 4.**

For both the soil and groundwater contamination scenarios, the inhalation cancer slope factor for hexavalent chromium was utilized as the oral cancer slope factor (SFo). Such an approach may be unacceptable unless it can be demonstrated that the inhalation toxicity factor provides a reasonable approximation of an appropriate toxicity value for the oral route.

In addition, the PRGs derived for ingestion of chromium in soil and groundwater are developed using an absorption coefficient (AB) or index of bioavailability. Such a factor is not included in equations for soil and groundwater ingestion recommended in the U.S. EPA Human Health Evaluation Manual, Part A (Baseline Risk Assessment) or Part B. Use of an absorption factor results in an absorbed dose estimate of exposure. If such an absorption factor is utilized, then the associated toxicity factor (SFo) should also be a adjusted to an absorbed dose value. The source of the absorption coefficient for chromium has not been adequately documented in the equations in Appendix C.

RESPONSE: The BRA was revised and no longer uses the inhalation slope factor for chromium as the oral slope factor. The FS was revised accordingly.

PRG calculations were revised.

**Appendix C: Aquifer-Related Calculations:**

Provide detailed discussions describing the assumptions used, the methodology or approach to the estimates addressed, and descriptions of the computer programs used, including any simplifying assumptions, and discussion and summaries of the results generated.

RESPONSE: The methodology has been included.

Appendix C: Net Present Worth Calculations: **262147**

Provide a discussion of the method of calculation, the values used for interest rate and periods of payment; provide a complete sample calculation related to a specific alternative and specific cost data as developed in the cost estimation process and as reported in the document.

RESPONSE: The method of calculation is the standard equation. The source has been cited on the calculation cover page. A sample calculation has been included.

# Response to Comments From

# Texas Water Commission

262149

RE: DRAFT FEASIBILITY STUDY REPORT

The report was generated by Chem-Nuclear Geotech, Inc.

TWC received the report on 12/22/92

TWC comments sent 2/11/93 to George Walters of the Air Force and to Ursula Lennox of the EPA Region 6 office.

TWC project Manager (Peter A. Waterreus)

1. **Page iv (contents):**

Check the page numbers associated with the figures. I found at least one error (e.g., Fig 1-16 is on page 1-21, not page 1-20).

RESPONSE: The Table of Contents has been revised.

2. Contents:

Please provide a list of acronyms.

RESPONSE: An acronym list has been provided.

3. **Page 1-1, Section 1.2.1:**

According to the RI, AFP4 occupies 605 acres. Which is correct?

RESPONSE: Section 1 of the FS has been substantially revised.

4. **Page 1-1, Section 1.2.1:**

State when AFP4 was included on the NPL.

RESPONSE: This comment was overlooked; it will be included in the Final FS.

5. **Page 1-3, Section 1.2.3.1:**

Provide a figure and legend depicting all of the individual sites. In the text, state the original number of sites under review and why some were deleted.

RESPONSE: Plate 1 depicts all the sites. Section 1 has been substantially revised to be more complete.

**6. Page 1-53, Section 1.2.3.3:**

Provide a space between the text and "UPPER ZONE GROUNDWATER: ORGANIC CONTAMINATION".

RESPONSE: The text has been revised.

**7. Page 1-56, Tables 1-1 thru 1-5:**

Values in this table do not correspond to values in the 2nd draft of the RI. Are the values in the FS incorrect? Also, there are more chemicals of concern (COC) listed in the text than shown on the tables.

Have all these COC's been evaluated?

RESPONSE: The Draft FS was based on information presented in the Draft RI, so discrepancies with the Draft Final RI were anticipated (as noted in the executive summary of the Draft FS). The Draft Final FS is based on the Draft Final RI.

COCs exceeding levels specified in chemical-specific ARARs and COCs exceeding threshold values for human health risk were evaluated.

**8. Page 1-56, Tables 1-2 & 1-4:**

Why is ingestion of soil contaminated with chromium not a concern in the future?

RESPONSE: This exposure pathway was not identified by the BRA.

**9. General:**

Has the effect of leachate from contaminated soils on ground water been looked into? This could drive the cleanup of soils.

RESPONSE: The primary COC for ground water is TCE. Soil samples with high levels of TCE have all come from the saturated zone, indicating the TCE is already in the ground water. However, it is noted that interim measures are underway in the suspected TCE source areas (inside the parts plant and Landfill No. 3).

**10. Page 1-59, Section 1.2.5.1:**

The flow direction should be stated (i.e, eastward from AFP4 to Carswell AFB). State that landfill No. 5 is on Carswell AFB.

RESPONSE: The text has been revised.

**11. Page 1-61, Section 1.2.5.1:**

When will the maximum concentration of chromium reach the supply wells? This may be important considering the remedial action objectives.

RESPONSE: Chromium is no longer a COC in ground water according to the latest revision of the BRA.

**12. General:**

Provide a synopsis of the 24 sites and the various plumes, table form may be appropriate, listing the chemicals of concern and stating whether or not there is a hazard associated with a particular site and why (e.g., soils, ground water, etc.).

RESPONSE: This synopsis will be developed for the final revision of the FS.

**13. Page 2-2, Section 2.2.1:**

More emphasis should be given to the removal of LNAPL and its constituents at AFP4.

Also state the MCL for the 1,2-DCE trans isomer.

RESPONSE: LNAPLs were not identified as exceeding chemical-specific ARARs or as presenting unacceptable health risks at Plant 4. Therefore, LNAPLs are not addressed by the FS alternatives.

The MCLs for both isomers of 1,2-DCE are now listed in the text.

**14. Page 2-2, Section 2.2.2:**

Why is TPH in soils not considered a problem at AFP4?

RESPONSE: No chemical-specific ARARs for TPH were discovered. Also, there is no way of calculating health risks for TPH.

**15. Page 2-6, Table 2-1:**

It is very difficult to read this table. Please enlarge it.

RESPONSE: This table has been modified accordingly.

**16. Page 2-8, Section 2.4.1.1:**

Is sheet piling an option that will be retained or not?

RESPONSE: Sheet piling is not retained, the text has been clarified.

**17. Page 2-9, Section 2.4.1.1:**

Was the Paluxy the only Formation considered for deep well injection?

RESPONSE: The Paluxy was not considered for deep well injection; it is a potable aquifer.

**18. Page 2-10, Section 2.4.1.1:**

Is reverse osmosis an option that will be retained or not?

RESPONSE: Reverse osmosis will not be retained.

**19. Page 2-10, Section 2.4.1.1:**

Are evaporation ponds an option that will be retained or not?

RESPONSE: Evaporation ponds will not be retained.

**20. Page 2-11, Section 2.4.1.1:**

Is biological treatment an option that will be retained or not?

RESPONSE: Biological treatment will be retained as an option.

**21. Page 2-14, Section 2.4.1.1:**

Is immobilization an option that will be retained or not?

RESPONSE: Immobilization will be retained as an option.

**22. Page 2-16, Section 2.4.2:**

Although barriers are a temporary measure, they can be quite effective in conjunction with pump and treat systems in deterring migration of contaminants.

RESPONSE: Comment acknowledged. The plume in this case is too large to be effectively contained with a barrier.

**23. Page 2-18, Section 2.4.2:**

Why is ion exchange not included under treatment?

RESPONSE: Ion exchange has been removed from consideration since chromium is no longer a COC in ground water, according to the Draft Final BRA.

**24. Page 2-19, Section 2.4.2:**

Regarding physical treatment - Why is ion exchange not included?

RESPONSE: Ion exchange has been removed from consideration since chromium is no longer a COC in ground water, according to the Draft Final BRA.

**25. Page 2-20, Section 2.4.2:**

Why is ion exchange not included under treatment?

RESPONSE: Ion exchange has been removed from consideration since chromium is no longer a COC in ground water, according to the Draft Final BRA.

**26. Page 2-20, Section 2.4.2:**

Regarding the soil effectiveness evaluation - What about above ground soil washing?

RESPONSE: Consideration of soil washing has been added to the text.

**27. Page 2-22, Section 2.4.2:**

Regarding treatment - Why are you comparing soil mixing to incineration, since incineration was never discussed as an option?

Why is soil washing not included?

RESPONSE: The text has been amended accordingly.

**28. Page 2-23, Table 2-5:**

**Which one of these process options if any will remove the chromium from ground water?**

RESPONSE: Chromium is no longer a COC for ground water according to the results of the Draft Final BRA.

**29. Page 2-23, Table 2-6:**

Why is soil mixing preferred over soil washing? What if the subsurface conditions at AFP4 are not suitable for in-situ stabilization.

Soil washing will remove the problem whereas stabilization may not be completely effective.

RESPONSE: The discussions regarding soil mixing and soil washing have been expanded in the text.

**30. Page 3-1, Section 3.1.2:**

Is extraction not a consideration for the other plumes or for the Paluxy?

RESPONSE: Extraction is a consideration for all plumes. The extraction scenario has been separated within the text to improve clarity.

**31. Page 3-3, Section 3.1.3:**

Is extraction not a consideration for the other plumes or for the Paluxy?

RESPONSE: Extraction is a consideration for all plumes. The extraction scenario has been separated within the text to improve clarity.

**32. Page 3-4, Section 3.1.4:**

Is extraction not a consideration for the other plumes or for the Paluxy?

RESPONSE: Extraction is a consideration for all plumes. The extraction scenario has been separated within the text to improve clarity.

**33. Page 3-5, Section 3.2.2:**

Asphalt caps will also degrade with time due to the weather elements. So why is asphalt the cap of choice?

RESPONSE: Asphalt was chosen as a representative process option for comparison with other technologies at the conceptual level appropriate for an FS. Should capping become the chosen alternative, part of the remedial design process would be cap optimization.

**34. Page 3-6, Sections 3.2.3 & 3.2.4:**

What is the reason behind the rainfall rate. Are you implying that consideration be given to the removal and treatment of precipitation entering the excavation?

RESPONSE: The rainfall rate is cited to emphasize the need for run-on and run-off control to be part of the site preparation.

**35. Page 4-5, Section 4.2.1.1.2:**

How many years is several? Alternatives 3 & 4 state that the duration of the project should be less than 10 years.

RESPONSE: The text has been corrected.

**36. Page 4-5, Sections 4.2.1.1.3 & 4.2.1.1.4:**

How was the project life of less than 10 years determined?

RESPONSE: Project life is determined by the quantity of water to be removed (4 aquifer volumes) divided by the cumulative flow rate of the extraction wells in that plume. The larger the number of wells, the smaller the project life. See Appendix C.

**37. Section 4.2.1.1:**

Is chromium in ground water not considered to be a problem at AFP4?

RESPONSE: According to the Draft Final BRA, chromium in ground water is not a health problem.

**38. Page 4-9, Section 4.2.3.1.2:**

You elude to removal of chromium to comply with clean up standards, however, none of the treatment methods (i.e., air stripping, UV/oxidation, or aerobic biological) appear to remove chromium. How will chromium be removed from ground water?

RESPONSE: According to the Draft Final BRA, chromium in ground water is not a health problem.

**39. Page 4-14, Section 4.2.5.1.2:**

In order to achieve the clean up goal in 12 years each well would have to pump approximately 50 gpm. At a 5 gpm rate it would require approximately 120 years. Is the 50 gpm rate feasible for this area?

Why is the remediation time 12 years in this section and less than 10 years on page 4-5?

How were these numbers developed? Was a model used? Could the impact of 200 wells pumping at 5 gpm deplete the aquifer?

Has reinjection of treated water been looked into as a means of flushing the aquifer at a faster rate?

RESPONSE: See #36. The remediation time has been corrected. See Appendix C for an explanation of how the extraction scenarios were developed. Re-injection of water would provide an unnecessary risk to the aquifer if contaminants were accidently re-injected.

**40. Page 4-14, Section 4.2.5.1.2:**

Why is there no mention of the trench in this section?

What is the impact on remediation time if the trench is included?

What is the anticipated pumping rate of the trench?

RESPONSE: The trench has been added to the section that addresses the extraction scenario. The trench will not affect the remediation time and the pump rate would be the same as the other wells in the East Parking Lot (5 gpm). See Section 4.2.5.1.2.

**41. Page 4-14, Section 4.2.5.1.2:**

Have the effects of degradation been accounted for?

RESPONSE: The effects of degradation have not been accounted for. This results in a more conservative estimate.

**42. Page 4-14, Section 4.2.5.1.2:**

2nd paragraph - State upfront that this paragraph deals with the east plume. Plate 1 provides the only indication that this paragraph addresses the east plume. The first sentence indicates that we may be addressing all plumes in this paragraph.

RESPONSE: The text has been amended accordingly.

**43. Page 4-14, Section 4.2.5.1.2:** 26215

4th paragraph - Why are estimated plume volumes in this section different from quantities stated in section 1.2.3.3? Example - West plume in the Paluxy on page 1-55 states 2.5 x $10^8$ gallons, whereas, page 4-14 states 2.2 x $10^7$ gallons.

A table showing the estimated quantities of contaminated ground water for each plume and estimated quantities of ground water to be extracted in order to remediate the aquifers would be beneficial.

RESPONSE: The text has been clarified. A table (Table 4-1) has been included.

**44. Page 4-14, Section 4.2.5.1.3:**

Specify the cells/sectors mentioned here in section 4.2.5.1.2.

RESPONSE: See revised text Section 4.2.5.1.2.

**45. Page 4-19, Section 4.2.6.1.2:**

last paragraph - Figure 4-1 does not indicate a trench.

RESPONSE: The text has been corrected.

**46. Page 4-20, Section 4.2.6.1.2:**

Is there another trench design that will not require as much width?

Why is there no mention of the implementability of wells?

RESPONSE: The trench configuration is conceptual. If a trench were employed, the configuration would be optimized as part of the remedial design process.

**47. Page 4-21, Section 4.2.6.2.1:**

Implementability for soils and ground water should follow similar formats.

RESPONSE: The ground-water implementability section has been revised accordingly.

**48. Page 4-22, Section 4.2.7.1.2:** 262150

Point 8 - Why are some of the wells PVC and others stainless steel? Also what is the criteria for determining the well construction material?

What is the proposed slot size?

RESPONSE: Amended. The criteria used are based upon materials compatibility sheets and contaminant concentration. Slot size will be determined during the design phase when a sieve analysis can be done.

**49. Page 4-22, Section 4.2.7.1.2:**

Point 12 - see aforementioned comment.

RESPONSE: Amended. The criteria used are based upon materials compatibility sheets and contaminant concentration. Slot size will be determined during the design phase when a sieve analysis can be done.

**50. Page 4-22, Section 4.2.7.1.2:**

Point 14 - What is the expected composition of the casing material?

What is the thickness of the casing?

RESPONSE: Amended. Casing is Schedule 40 PVC. This is a standard pipe designation and as such has a nominal wall thickness of 0.332 inches, according to the ASTM standards.

**51. Page 4-24, Section 4.2.7.1.2:**

State that details of the cost estimates can be found in appendix B.

RESPONSE: The text has been amended accordingly.

**52. Page 4-27, Table 4-1:**

What happened to long term effectiveness and permanence?

Why doesn't the cost analysis include present worth of O&M over the anticipated life of the project?

RESPONSE: The text has been amended. See Appendix C for present worth calculations.

**53. Appendix C, Calculation No. EO1166AA:**

The introductory page needs to be presented in a neater fashion. Shouldn't the value for drawdown be less than the average saturated thickness? Depletion of the aquifer may be a problem regarding ground water remediation.

RESPONSE: Yes the drawdown should be less than the average saturated thickness but, for the purposes of this conceptual level model, setting them equal is sufficient.

**54. Appendix C, Calculation No. EO1167AA:**

The introductory sheet should have all assumptions and input values stated clearly (type it) with the appropriate justification. This should be provided for all portions of the subject matter. The reams of data presented are not very meaningful without clearly stating the objectives and input values necessary to run the program. Output values should also be tabulated.

In addition, why were these programs selected?

RESPONSE: The text has been amended accordingly. The programs employed were selected on the basis of availability, ease of running on local PC and are deemed appropriate for conceptual level design as is normally the focus of an FS.

**55. Appendix C, Calculation No. E01168AA:**

See above comment.

RESPONSE: The text has been amended accordingly. The programs employed were selected on the basis of availability, ease of running on local PC and are deemed appropriate for conceptual level design as is normally the focus of an FS.

**56. Appendix C, Calculation No. E01169AA:**

See above comment.

RESPONSE: The text has been amended accordingly. The programs employed were selected on the basis of availability, ease of running on local PC and are deemed appropriate for conceptual level design as is normally the focus of an FS.

**57. Appendix C, Calculation No. E01170AA:**

See above comment.

RESPONSE: The text has been amended accordingly. The programs employed were selected on the basis of availability, ease of running on local PC and are deemed appropriate for conceptual level design as is normally the focus of an FS.

**58. Appendix C, Calculation No. E01171AA:**

See above comment.

RESPONSE: The text has been amended accordingly. The programs employed were selected on the basis of availability, ease of running on local PC and are deemed appropriate for conceptual level design as is normally the focus of an FS.

**59. Appendix C, Calculation No. E01172AA:**

See above comment.

RESPONSE: The text has been amended accordingly. The programs employed were selected on the basis of availability, ease of running on local PC and are deemed appropriate for conceptual level design as is normally the focus of an FS.

**60. Appendix C, Calculation No. E01173AA:**

Why have E01174AA but no E01173AA.

RESPONSE: Calculation numbers are not necessarily sequential as the numbers are assigned on an as-needed basis for all active projects at Geotech.

**61. Appendix C, Calculation No. EO1174AA:**

This sheet is terrible. Please submit a clean, new, and complete version.

RESPONSE: The calculation has been revised and now is Calculation Number E0162100 of Appendix C.

262161

COMMENTS TO:

DRAFT: FEASIBILITY STUDY
Air Force Plant No. 4
December 1992

Lel L. Medford
2/11/93

Technology Types and Process Options for Groundwater:

1. Treatment Alternatives acceptable, however, if chromium is encountered above MCL's, what treatment method(s) would be considered. Any treatment method will need to meet all MCL's or proposed MCL's. If the effluent is discharged thru reinjection, then the treatment standards will potentially be stricter than the MCL's

RESPONSE: Chromium is not projected to exceed MCLs at the receptor wells, nor is it a COC for health-based reasons according to the Draft Final BRA. Presently, reinjection is not being considered.

Technology Types and Process Options for Soil:

We reject technology which does not either remove or destroy organics. The proximity of the site to a major metro water supply indicates a more conservative solution is warrented.

RESPONSE: The results of the Baseline Risk Assessment did not demonstrate organic soil contamination as having a credible pathway to a major metro water supply. Consequently soil remedies were not developed to control that exposure pathway.

1. REJECT Soil Mixing: No proven data that organics will not leach out.

   Too many variables in soil that will cause problems with this solution, i.e., assorted mixtures of sands, gravels, silts, clay, and organic debris. Other areas contain concrete, asphalt, metals, wood, plastic and trash.

RESPONSE: Some of the recent information on soil mixing (e.g., Handbook on In Situ Treatment of Hazardous Waste-Contaminated Soils, EPA/540/2-90/001) suggest that mixed debris and some organics (such as benzo(a)pyrene, the organic COC in soil at Plant 4) actually increase the durability of the stabilized mass. The problem of adequate mixing still remains, however. The text has been expanded on this subject. This approach will be retained in the FS. If it is to be rejected it can be rejected in the ROD.

2. REJECT Capping: This is only delaying the clean-up process.

RESPONSE: Capping should control the exposure pathways and satisfy ARARs. Therefore, capping shall be retained as an alternative in the FS. If capping is to be rejected it can be rejected in the ROD.

Thermal Desorption is another method of removing the organics from the soil, this technique was not reviewed in the FS process.

a. Easy to implement.
b. A service base operation.
c. High cost, no O & M.

Of the options considered, Soil Washing appears to be a better choice than Soil Mixing because of the following reasons:

a. Removes the source.
b. Constrains the contaminants for effective destruction.

RESPONSE: Thermal Desorption will not solve the metal (chromium) contamination problem. Chromium was shown to present greater health risk than organics for the soils at Plant 4, according to the BRA. Soil washing is discussed in greater detail in the Draft Final FS. However, soil washing is ultimately rejected since it entails excavation and then "placement" of washed soil. This "placement" invokes RCRA which leads to either delisting the washed soil before it can be backfilled or transportation of the washed soil to an off-site RCRA landfill, an option that has already been retained, without first washing the soil.

262160

# Response to Comments From

# U.S. Air Force/Aeronautical Systems Center

Greg Harvey
AF/ASC

26216

I have several questions about the physical and biological treatments being proposed in this draft feasibility study they are as follows:

1) Are there any microorganisms capable of reducing TCE levels of 3ppb currently available ( I have been told the 5ppb is about the best that bugs are capable of at this time due to enzyme kinetic considerations). Please provide some references if you are aware of any bugs that can routinely acheive clean up levels of 3ppb under field conditions. Also provide the environmental conditions and flow rates.

RESPONSE: The vendors contacted say they can achieve the effluent limits. The actual flow rates would be developed as part of the remedial design, if bioremediation is the chosen alternative. Keep in mind this in an "above-ground" process taking place in bioreactors. The residence time can be whatever is required.

2) If we assume removal efficiencies of only 99% water with 7500ppb of TCE into the air stripper will result in water with TCE 75 ppb levels leaving the air stripper not 3ppb.

RESPONSE: Air strippers are capable of efficiencies greater than 99%. Also, if necessary, the stripping can be accomplished in two or more stages. The precise configuration of stripping units would be determined as part of optimizing the remedial design, should air stripping be the chosen alternative.

3) How often will these air strippers have to be cleaned due to iron deposition. Iron deposition is probab;y the most underestimated problem with groundwater treatment systems and especially with air strippers Depending on the iron concentration present in the water the packing may have to be cleaned as often as every month. As a very rough rule of thumb the following guideslines can be used:

<1 mg/l Fe -low maintenance
2-5 mg/l Fe -clean tower every 3-6 months
>10 mg/l Fe -Clean tower every 1-2 months

RESPONSE: Comment acknowledged. If air stripping is the chosen alternative, part of the remedial design process would be to obtain conventional water quality analyses and develop the appropriate maintenance/cleaning schedule based on that data.

4) What about bioremediation of soil? The target for this technology are subsurface soils and the vadose zone above the water table. In this technology various microbes, nutrients and an oxygen source through injection wells into the soil. Air strippers will clean up the groundwater but I think it is rebutable to state that air stripping is a long term and permanent solution. As soon as air stripping is terminated the contamination in the subsurface soils in time degrades the groundwater. A long term permanent solution to AFP 4 groundwater problems must address subsurface soil contamination as well as the groundwater contaminants Chromium is ubiquitous in the environment and an understanding of its toxicological, physical and chemical properties is a prerequite to make environmentally sound and cost

effective decisions about the risks associated with chromium at Air Force Plant 4 To date it is my understanding that only total chromium levels have been determined in the groundwater and soil. and conservatively assumed to be 100% hexavalent. There is a marked difference in the toxicity of hexavalent and trivalvent chromium. Hexavalvent chromium crosses biological membranes, is mobile in the environment, and is a human carcinogen by inhaltion. Trivalvent chromium however does not readily cross biological membranes and is an essential nutrient that is needed for glucose metabolism. Hexavalvent chromium is reduced to the trivalvent when organic matter, iron, sulfur, or anaerobic conditions are present. Why are we assuming the chromium at AFP4 is hexavalvent when we readily determine the valency. We must resist the temptation to overstate or understate the potential risk of the chromium present at this plant. Simply measuring the amount of hexavalvent chromium in the soil and groundwater will certainly be more cost effective than assuming extremely conservative assumptions and plugging them into models that lead to estimates that may be diametrically opposed to the actual reality of the situation. There are only two basic requirements for the long-term isolation of chromium waste: a permanent reducing environment and permanent immobilization of reduced chromium. As long as all hexavalvent chromium has been reduced and the trivalvent chromium is tied up by decay-resistant organic polymers the chromium will remain inert and immobile, as long as oxygen is excluded. Composting chromium contaminated soil with decay resistant material and capping makes more sense than digging this soil up and transporting to a hazardous land fill or mixing concrete to immobilize it.

RESPONSE: TCE is the COC for ground water. It is understood that interim measures are currently addressing the two areas suspected of being TCE source areas (under the parts plant and Landfill No. 3).

The assumption of all chromium being in the hexavalent state is a health-risk assessment practice, not the choice of the FS authors. Chromium is not a COC in the ground water according to the Draft Final BRA; therefore, it is not addressed as a ground-water COC in the Draft Final FS.

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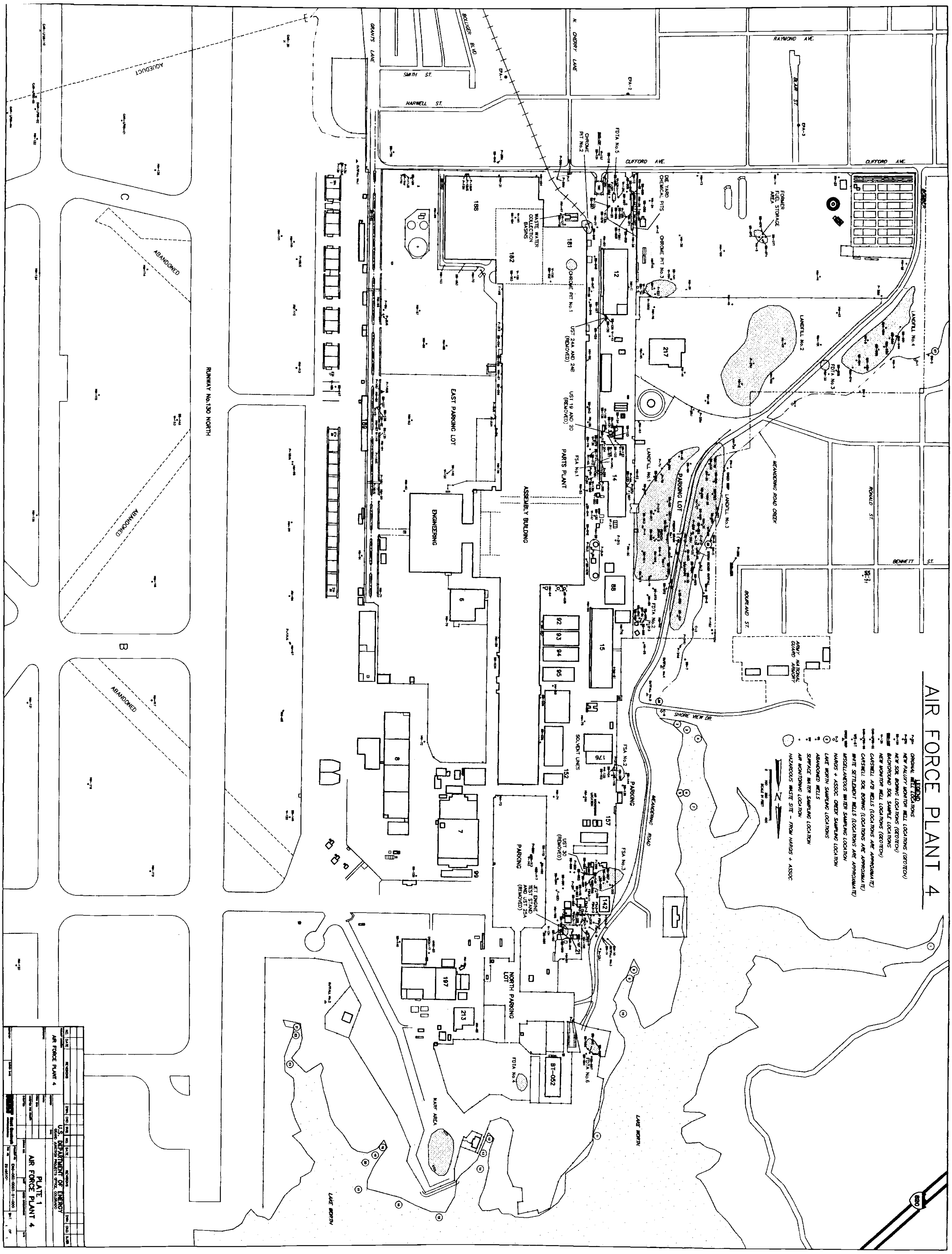
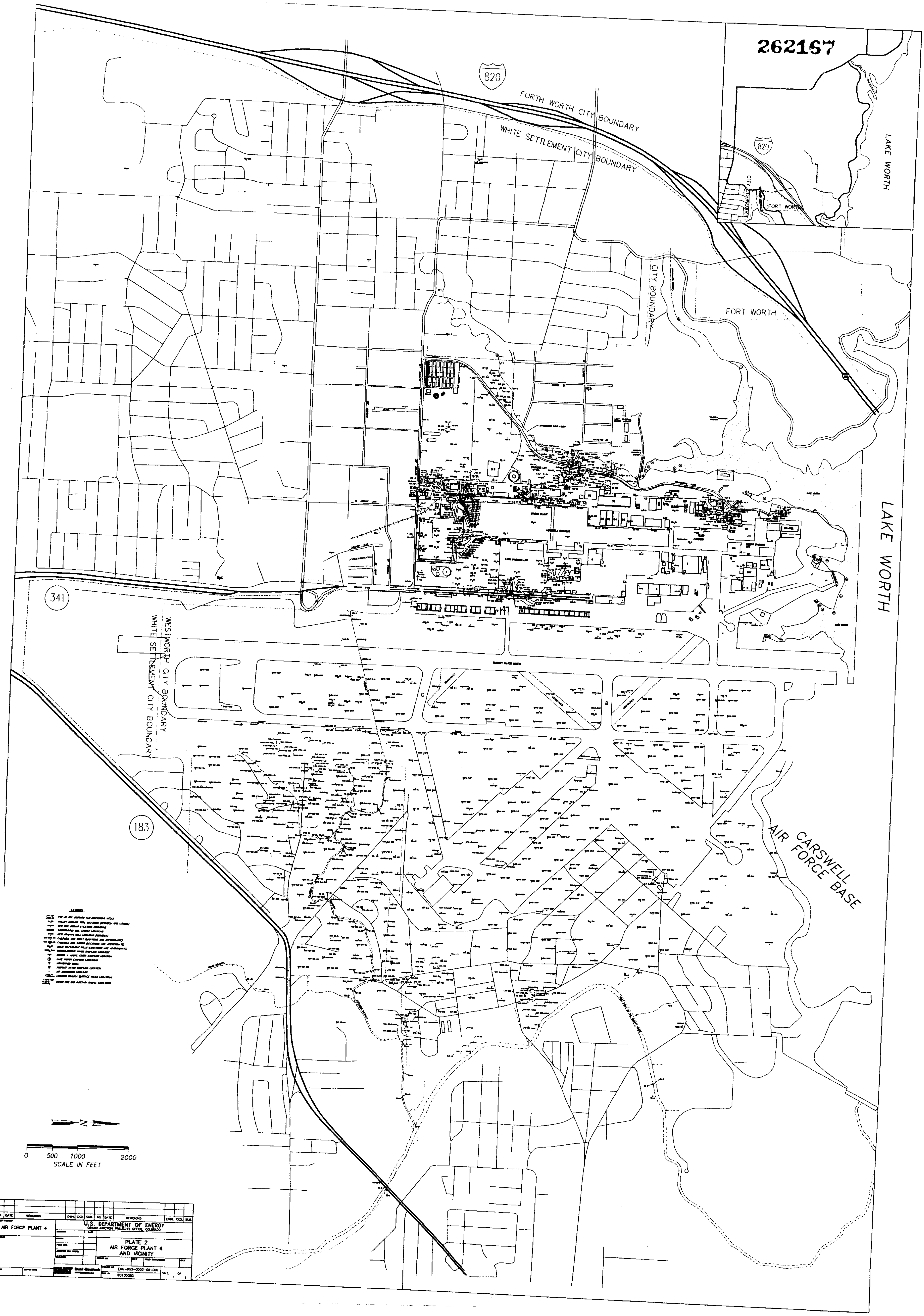


AIR FORCE PLANT 4
LEGEND
RUNWAY No.130 NORTH
ABANDONED
AQUEDUCT
CLIFFORD AVE.
RAYMOND AVE.
HARWELL ST.
SMITH ST.
GRANTS LANE
BOULDER BLVD
CHERRY LANE
BLAIR ST.
RONALD ST.
BENNETT ST.
BOURLAND ST.
SHORE VIEW DR.
MEANDERING ROAD
MEANDERING ROAD CREEK
LAKE WORTH
EAST PARKING LOT
ASSEMBLY BUILDING
ENGINEERING
PARTS PLANT
PARKING LOT
NORTH PARKING LOT
PARKING
SOLVENT LINES
WASTE WATER COLLECTION BASINS
CHROME PIT No.1
CHROME PIT No.2
CHROME PIT No.3
DIE YARD CHEMICAL PITS
FORMER FUEL STORAGE AREA
LANDFILL No.1
LANDFILL No.2
LANDFILL No.3
LANDFILL No.4
FDTA No.2
FDTA No.3
FDTA No.4
FDTA No.5
FDTA No.6
FSA No.1
FSA No.2
FSA No.3
UST 24A AND 24B (REMOVED)
UST 19 AND 20 (REMOVED)
UST 30 (REMOVED)
JET ENGINE TEST STAND AND UST 25A (REMOVED)
ARMY NATIONAL GUARD ARMORY
NAVY AREA
PLATE 1
AIR FORCE PLANT 4
U.S. DEPARTMENT OF ENERGY


262167
820
FORTH WORTH CITY BOUNDARY
WHITE SETTLEMENT CITY BOUNDARY
CITY BOUNDARY
FORT WORTH
LAKE WORTH
341
WESTWORTH CITY BOUNDARY
WHITE SETTLEMENT CITY BOUNDARY
183
CARSWELL AIR FORCE BASE
N
0 500 1000 2000
SCALE IN FEET
DATE
REVISIONS
DWN. CKD. SUB. NO. DATE
REVISIONS
DWN. CKD. SUB.
AIR FORCE PLANT 4
U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION PROJECTS OFFICE, COLORADO
PLATE 2
AIR FORCE PLANT 4
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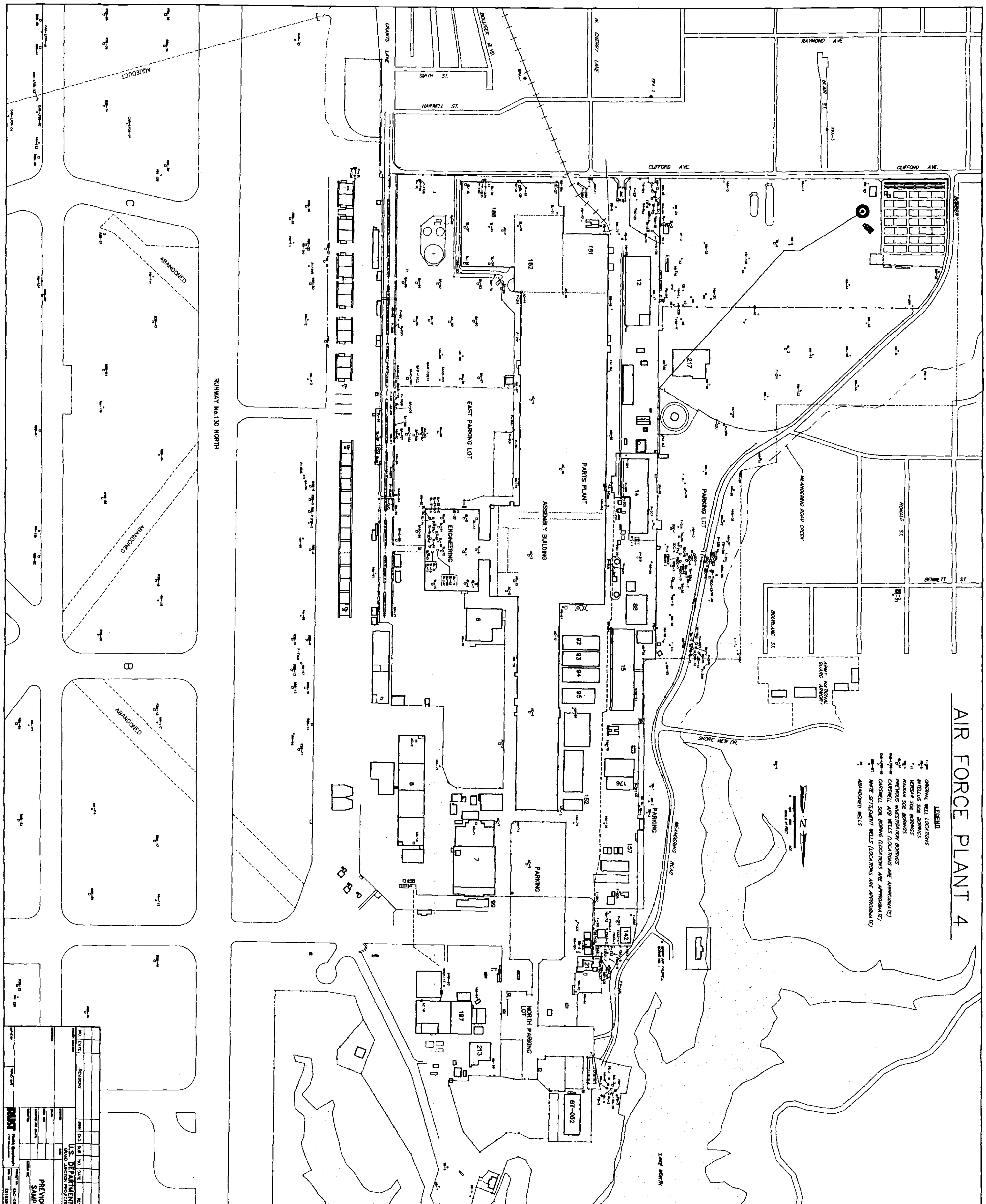
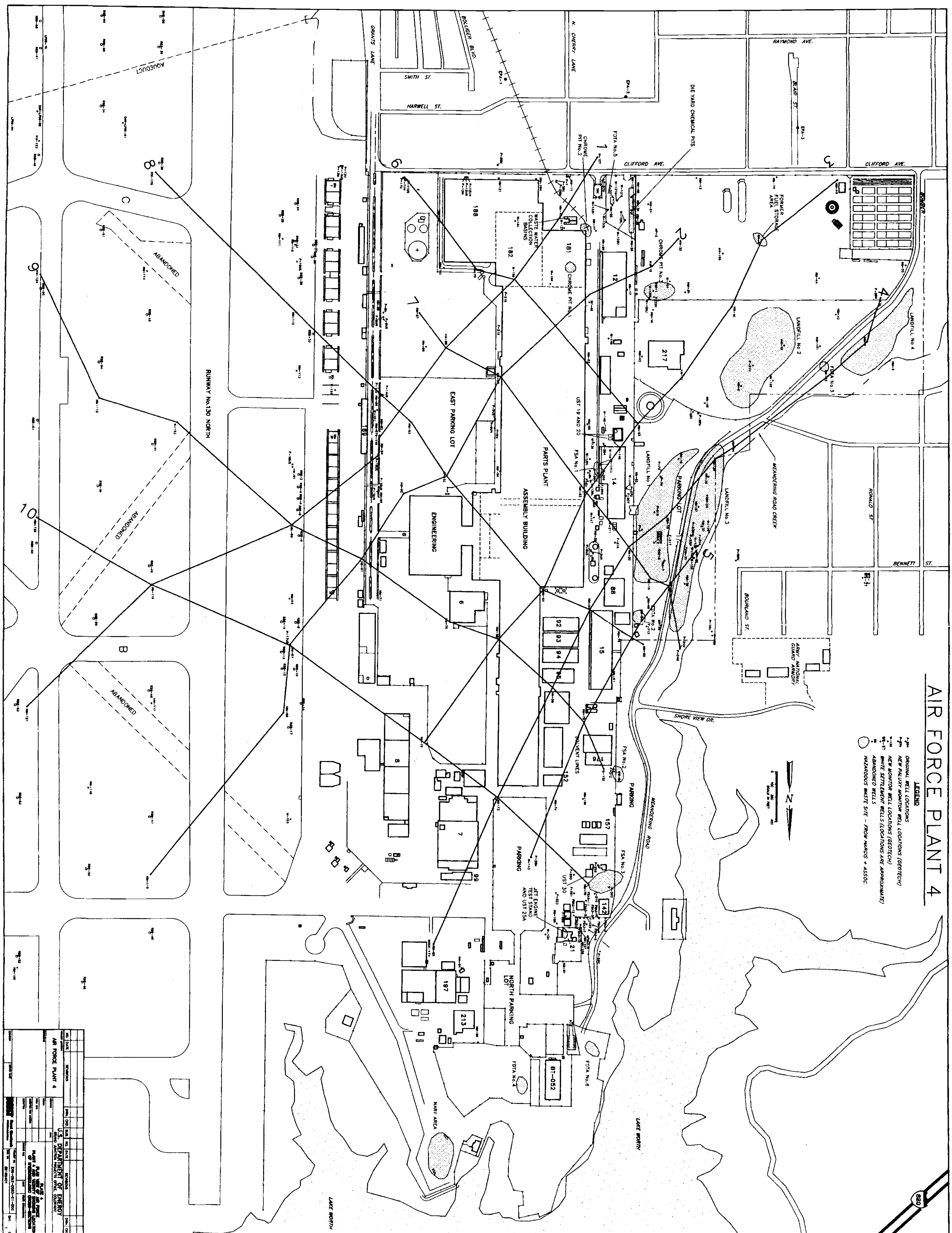

AIR FORCE PLANT 4
LEGEND
RUNWAY No.130 NORTH
ABANDONED
AQUEDUCT
CLIFFORD AVE.
RAYMOND AVE.
SMITH ST.
HARRELL ST.
GRANTS LANE
CHERRY LANE
EAST PARKING LOT
PARTS PLANT
ASSEMBLY BUILDING
ENGINEERING
PARKING LOT
PARKING
NORTH PARKING LOT
MEANDERING ROAD CREEK
MEANDERING ROAD
SHORE VIEW DR.
RONALD ST.
BENNETT ST.
BOURLAND ST.
ARMY NATIONAL GUARD ARMORY
LAKE WORTH
U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION PROJECTS OFFICE, COLORADO
PLATE 3
PREVIOUS INVESTIGATION
SAMPLING LOCATIONS

26216



AIR FORCE PLANT 4
LEGEND
ORIGINAL WELL LOCATIONS
NEW PALUXY MONITOR WELL LOCATIONS (GEOTECH)
NEW MONITOR WELL LOCATIONS (GEOTECH)
WHITE SETTLEMENT WELLS (LOCATIONS ARE APPROXIMATE)
ABANDONED WELLS
HAZARDOUS WASTE SITE - FROM HARGIS + ASSOC.
RUNWAY No.130 NORTH
ABANDONED
AQUEDUCT
EAST PARKING LOT
PARTS PLANT
ASSEMBLY BUILDING
ENGINEERING
NORTH PARKING LOT
PARKING
LANDFILL No. 1
LANDFILL No. 2
LANDFILL No. 3
LANDFILL No. 4
MEANDERING ROAD CREEK
MEANDERING ROAD
SHORE VIEW DR.
CLIFFORD AVE.
RAYMOND AVE.
GRANTS LANE
SMITH ST.
HARWELL ST.
N. CHERRY LANE
BOLLEGER BLVD.
BENNETT ST.
RONALD ST.
BOURLAND ST.
LAKE WORTH
NARI AREA
DIE YARD CHEMICAL PITS
FORMER FUEL STORAGE AREA
CHROME PIT No. 1
CHROME PIT No. 3
WASTE WATER COLLECTION BASINS
FDTA No. 2
FDTA No. 4
FDTA No. 5
FDTA No. 6
FSA No. 1
FSA No. 2
FSA No. 3
UST 19 AND 20
UST 30
JET ENGINE TEST STAND AND UST 25A
SOLVENT LINES
PARKING LOT
ARMY NATIONAL GUARD ARMORY
U.S. DEPARTMENT OF ENERGY
AIR FORCE PLANT 4

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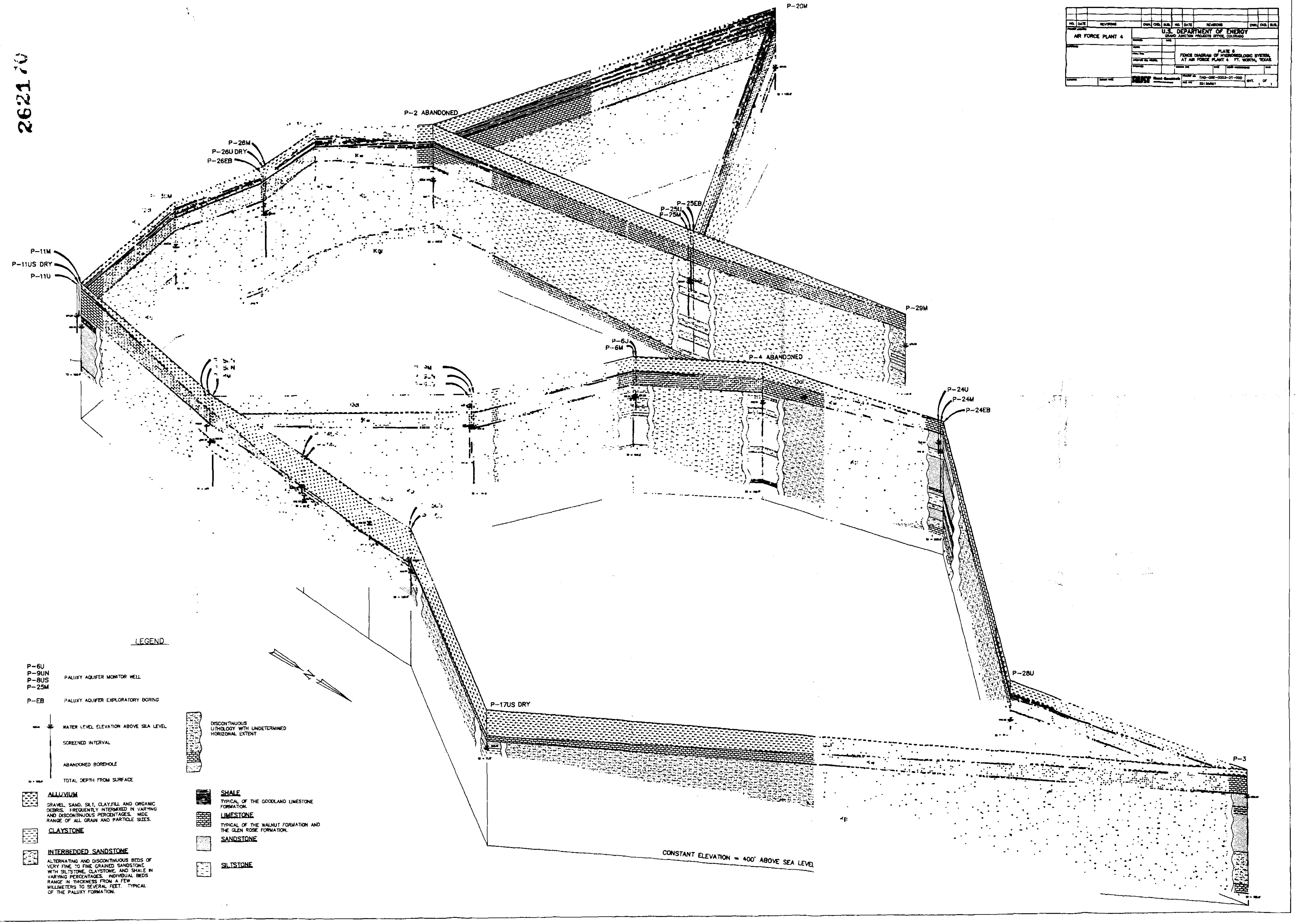


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AIR FORCE PLANT 4

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION PROJECTS OFFICE, COLORADO

PLATE 8
FENCE DIAGRAM OF HYDROGEOLOGIC SYSTEM,
AT AIR FORCE PLANT 4 FT. WORTH, TEXAS

RUST Geotech

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