TWIN CITIES ARMY AMMUNITION PLANT
NEW BRIGHTON/ARDEN HILLS
SUPERFUND SITE

OPERABLE UNIT 2
RECORD OF DECISION

October 1997

Prepared for:

Commander
Twin Cities Army Ammunition Plant
ATTN: SIOTC-CO
Arden Hills, Minnesota

Prepared under contract to:

U.S. Army Environmental Center
Environmental Restoration Division
ATTN: SFIM-AEC-ERO
Aberdeen Proving Ground, Maryland

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ARDEN HILLS, MINNESOTA

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In accordance with 40 CFR 1500, this document is intended to comply with NEPA of 1969.

OPERABLE UNIT 2 RECORD OF DECISION
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APPENDICES

I. DECLARATION FOR THE RECORD OF DECISION

A. Site Name and Location

The site is known as Operable Unit 2 (OU-2) within the New Brighton/Arden Hills (NB/AH) Superfund Site, also known as Twin Cities Army Ammunition Plant (TCAAP), Ramsey County, Minnesota (Figure 1).

B. Statement of Basis and Purpose

This decision document explains the factual and legal basis for selecting the remedy for OU-2. The information supporting this remedial action decision is contained in the Administrative Record for this site.

This decision document presents the selected remedial action for addressing soil and groundwater contamination within OU-2 of the New Brighton/Arden Hills Superfund Site in Ramsey County, Minnesota, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), the Minnesota Environmental Response and Liability Act (MERLA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The remedial actions were selected by the United States Environmental Protection Agency (EPA) and the Minnesota Pollution Control Agency (MPCA), together with the United States Army (Army) pursuant to the Federal Facilities Agreement (FFA) among the three parties.

C. Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

D. Description of the Selected Remedies

The NB/AH site has been divided into three operable units (Figure 2). The first operable unit, OU-1, consists of the North Plume of off-TCAAP contaminated groundwater. A ROD has already been issued for OU-1, for which the selected remedy is to contain the North Plume by extracting groundwater using municipal wells, treating the extracted groundwater, and utilizing the treated water for municipal supply. The second operable unit, OU-2, addressed by the remedies selected in this ROD, consists of the on-TCAAP soils and groundwater that have been impacted by waste materials such as volatile organic compounds (VOCs), heavy metals, corrosive materials, and explosives that were disposed of within OU-2. The third operable unit, OU-3, consists of the South Plume of off-TCAAP contaminated groundwater. A ROD has already been issued for OU-3, for which the selected remedy is to contain the South Plume by groundwater extraction with a municipal well from the leading edge of the plume, thus preventing further contaminant migration into areas that have not been impacted. The extracted water is treated and used for municipal supply.

The principal threats posed by the NB/AH site include the exposure of local residents to groundwater contaminated by organic compounds in excess of allowable concentrations and site workers coming into contact with soil contaminants at concentrations above acceptable exposure levels. Selected remedies for OU-2 address both of these principal threats. Remedy costs are summarized in Table 14.

For OU-2, the impacted soils and groundwater sites (Figure 3) have been organized for the purpose of remedial alternative development and selection based on similarities in media and contaminants. The grouping of sites within OU-2 and the major components of the selected remedy can be described as follows:

<u>Shallow Soil Sites:</u> Sites A, C, E, H, 129-3, and 129-5, have inorganic and organic contaminants above site cleanup goals (Table 1). No contamination was found to exist at Site B. Unpermitted landfills, or dumps, exist within Sites A, B, E, H, and 129-15. Sites B and 129-15 are included solely as dumps. The selected remedy for the shallow soil sites will attain the site cleanup levels specified in this ROD and includes the following activities:

- Identification/characterization of contaminated soil boundaries, surface and subsurface debris for Sites A, C, E, H, 129-3, and 129-5;
- Excavation and sorting of hazardous and nonhazardous materials, debris and ordnance for Sites A, C, E, H, 129-3 and 129-5;
- Removal and disposal of ordnance, debris and oversized material for Sites A, C, E, H, 129-3 and 129-5;
- On-site stabilization of hazardous soils from Sites A, C, E, H, 129-3 and 129-5;
- Off-site disposal of contaminated soils above site specific cleanup goals from Sites A, C, E, H, 129-3 and 129-5;
- Backfill/regrade excavations on Sites A, C, E, H, 129-3 and 129-5;
- Restrict site access and use during remedy implementation;
- Five-year period of groundwater monitoring to verify no adverse remedy impacts at Sites A, C, E, H, 129-3 and 129-5; and
- Characterization of dumps at Sites B and 129-15 to determine their contents. If contents are found to be toxic, hazardous, or contaminated, then a remedy for the landfill will be utilized and documented through a post-ROD amendment. If the contents are not toxic, hazardous or contaminated, a no further action remedy would be employed.

<u>Deep Soil Sites:</u> Sites D and G have been impacted primarily by VOC contaminants at depths of 50 to 170 feet. Some additional shallow soil contaminants may exist at Site D. Site G also contains a dump. The selected remedy for these sites will attain the site cleanup levels specified in this ROD (Table 1) and includes the following activities:

- Groundwater monitoring;
- Restrict site access and use during remedy implementation;
- Install and operate deep soil vapor extraction (SVE) systems with modified shallow SVE;

- Evaluate and potentially use enhancements to the SVE systems;
- Maintain existing site caps;
- Maintain surface controls; and
- Following completion of SVE remediation of deep soils, characterize Site D shallow soils and Site G dump to determine appropriate action.

Shallow Groundwater Sites: Includes Sites A, I and K, which have been primarily impacted by VOC contaminants. The selected remedy for Site A shallow groundwater will attain the site cleanup levels specified in this ROD (Table 1) and includes the following activities:

- Groundwater monitoring to track plume migration and remedy performance;
- Use of existing gradient control wells to contain the contaminant plume and remove mass;
- Institutional controls to restrict new well installations and provide alternate water supplies and well abandonment as necessary;
- Discharge of extracted groundwater to a publicly owned treatment works (POTW); and
- Source characterization/remediation.

The selected remedy for Site I shallow groundwater will attain the site cleanup levels specified in this ROD (Table 1) and includes the following activities:

- Groundwater monitoring to track remedy performance;
- Use of an existing well to remove impacted Unit 1 groundwater;
- POTW discharge of extracted groundwater; and
- Additional characterization of the Unit 1 and Unit 2 soil and groundwater.

The selected remedy for Site K shallow groundwater will attain the site cleanup levels specified in this ROD (Table 1) and includes the following activities:

- Groundwater monitoring to track remedy performance;
- Installation of sentinel wells at the bottom of Unit 1 and the top of Unit 3;
- Use of existing interceptor/recovery trench to contain plume and remove impacted groundwater;
- Treatment of extracted groundwater using air stripping;
- Discharge of treated groundwater to Rice Creek;
- Monitoring to track compliance with discharge requirements; and
- Additional characterization of the unsaturated Unit 1 soil.

Deep Groundwater: Includes the deep groundwater plume that underlies the southwestern portion of OU-2 and originated primarily from Sites D, G and I. The selected remedy for Deep Groundwater will attain the site cleanup levels specified in this ROD (Table 1) and includes the following activities:

- Groundwater extraction to hydraulically contain the contaminated groundwater source area to the 5 ug/L trichloroethene (TCE) concentration contour and optimize the removal of contaminants from the source area through pumping of select wells;
- Groundwater treatment using air stripping;
- Discharge of treated groundwater to the on-site gravel pit;

- Institutional controls to restrict access to contaminated aquifers and prevent exposure to contaminated groundwater;
- Reviews of new and emerging technologies that have the potential to cost-effectively accelerate the timeframe for aquifer restoration. Reviews shall be performed by Army and reported on annually in accordance with the consistency provisions of the TCAAP FFA; and
- Groundwater monitoring to track remedy performance.

Other Sites: Includes Site F and Site J. Site F was a former disposal area within OU-2. Site J is a portion of the TCAAP sanitary sewer located in the southwestern portion of the facility.

- Site F was remediated and is being closed under Resource Conservation and Recovery Act (RCRA). Site F is not included in this decision document.
- The Final Site J Closure Report (1994) was approved by the regulatory agencies, and documented the absence of contaminants above background levels and recommended no further action was necessary for site remediation.

E. Statutory Determinations

The selected remedies are protective of human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost-effective. These remedies utilize permanent solutions and alternative treatment (or resource recovery technologies) to the maximum extent practicable, and satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because the selected remedies for Sites D and G soils, A, I, and K shallow groundwater, and deep groundwater will result in hazardous substances remaining on site above health-based levels for a number of years, a review of these remedies will be conducted within five years after commencement of the remedial actions to ensure that the remedies continue to provide adequate protection of human health and the environment. The remedies for Sites A (shallow soils), B (exclusive of the dump), C, E, H, J, 129-3, and 129-5 will not result in hazardous substances remaining on site above health-based levels, therefore the five year review will not apply to these actions.

Wm. E. Muno — 11/24/97

WILLIAM E. MUNO — Date
Director, Superfund Division
U.S. Environmental Protection Agency
Region V

PEDER LARSON — Date
Commissioner
Minnesota Pollution Control Agency

JAMES P. FAIRALL, Jr. — Date
Colonel, GS
Commander, Twin Cities
Army Ammunition Plant

MAJOR GENERAL DAVID A. WHALEY — Date
Assistant Chief of Staff for Installation Management

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WILLIAM E. MUNO
Director, Superfund Division
U.S. Environmental Protection Agency
Region V

Date

Lisa J. Thorvig, Deputy Commissioner

for PEDER LARSON
Commissioner
Minnesota Pollution Control Agency

10/28/97
Date

JAMES P. FAIRALL, Jr.
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Commander, Twin Cities
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Date

MAJOR GENERAL DAVID A. WHALEY
Assistant Chief of Staff for Installation Management

Date

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WILLIAM E. MUNO
Director, Superfund Division
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MAJOR GENERAL DAVID A. WHALEY
Assistant Chief of Staff for Installation Management

12/11/97
Date

J.C. MENIG, SES V
Dep Asst C of S
Installation Mgt

II. DECISION SUMMARY

A. Site Name, Location, and Description

The NB/AH site consists of a 25-square-mile area located in Ramsey County and Hennepin County, Minnesota just north of the Minneapolis-St. Paul metropolitan area. This includes the 4-square-mile TCAAP facility and portions of seven nearby communities: New Brighton, Arden Hills, St. Anthony, Shoreview, Mounds View, Columbia Heights, and Minneapolis (Figure 1). Land use in this generally suburban area is mixed residential, commercial, and industrial. As presently defined, the site covers much of the U.S. Geological Survey's New Brighton, Minnesota 7.5-minute quadrangle.

This decision document deals specifically with Operable Unit 2 (OU-2), a portion of the NB/AH site (Figure 2). OU-2 encompasses 14 identified sites designated as Sites A, B, C, D, E, F, G, H, I, J, K, 129-3, 129-5 and 129-15 as shown on Figure 3.

The site consists of gently rolling, postglacial terrain with several hills and surface water bodies, including lakes and streams, but no extreme relief. The site is located within the Rice Creek watershed. Rice Creek and its surrounding marshes and woodlands provide cover for a variety of vegetation and wildlife. Much of the lowland area adjacent to Rice Creek has lush and vigorous vegetation creating a wildlife habitat well suited to small animals. The site is underlain by both shallow and deep groundwater that is used for potable supply to both local residents and municipalities (deep groundwater only).

OU-2 of the NB/AH site consists of the TCAAP facility, an inactive small arms ammunition manufacturing plant surrounded by residential communities It is currently in modified caretaker status, and operated by the installation services contractor, Alliant Techsystems Inc. (Alliant). Alliant also operates manufacturing facilities at TCAAP. Several occupants, including the Minnesota Army National Guard and the Army Reserves, utilize facilities within OU-2 for training and administrative operations. Approximately 300 people are currently employed at TCAAP.

B. Site History and Enforcement Activities

TCAAP has been used to manufacture, store, and test small arms ammunition and related materials since 1941. Information from past studies indicates that between 1941 and 1981, waste materials such as VOCs, heavy metals, corrosive materials, and explosives were disposed of at a number of locations defined as source areas within TCAAP. In 1981, the MPCA and Minnesota Department of Health (MDH) began groundwater sampling and analysis. Samples were collected from wells in the TCAAP area. The analytical results from these samples indicated that municipal and private drinking water wells and wells at TCAAP were contaminated by VOCs.

The NB/AH site was proposed for inclusion on the National Priorities List (NPL) in July 1982 and finalized in September 1983, with a Hazard Ranking System (HRS) score of 59 and a ranking of 43 on the NPL. In 1981, the Army began a Phase I investigation at TCAAP which involved a significant quantity of monitoring wells and sampling efforts designed to identify the overall contribution of TCAAP to the groundwater contamination.

The NB/AH site, as currently defined, consists of contaminated soils and groundwater within the confines of the TCAAP facility (OU-2), and portions of several regional aquifers off post that are contaminated to differing degrees with VOCs (OU-1 and OU-3). Contaminant levels on site in both soils and groundwater exceed current health-based criteria.

Soil and groundwater contamination at TCAAP pose a potential health hazard. This hazard potentially results from direct human contact (dermal contact, inhalation, or ingestion) of soil or groundwater contaminated with heavy metals and industrial solvents. Studies concerning contaminants in soil and groundwater within the study area have been undertaken primarily by the Army, Alliant Techsystems, MPCA, and EPA. The objectives and results of the studies are summarized as follows.

B.1) Previous Studies

In 1978, the U.S. Army Toxic Hazardous Materials Agency (USATHAMA) issued a report detailing waste disposal activities and uses of potential toxic or hazardous chemicals and radioactive materials at TCAAP. This report, Installation Assessment of the Twin Cities Army Ammunition Plant, Report No. 129, identified a number of sites at TCAAP possibly used in the past for disposal of waste solvents, acids, caustics, heavy metals, and other production and solid wastes. Subsequent to the 1978 USATHAMA report, numerous investigations were performed at TCAAP. As a result of these investigations, attention focused on 14 source areas at TCAAP that were used as burial or open-burning areas in disposal-related activities or were industrial sources of contamination. These sites were identified from a search of records and analytical data for TCAAP, and they have been designated by the Army and EPA as potential source areas.

Army reports of investigations and studies at TCAAP in 1983 and 1984 identified major and minor disposal areas on the facility that were sources of release or threatened release of hazardous substances. In their review of these reports, EPA and MPCA noted that additional information was needed to address the extent and magnitude of contaminated groundwater, to fill data gaps relative to off-site contamination, and to complete an assessment of the disposal areas identified on TCAAP.

In 1984 and 1985, the Army submitted investigative reports addressing VOC contamination at Alliant-operated buildings 502 and 103 (Sites I and K respectively). The reports indicated that the buildings' operations were a source of VOC-contaminated groundwater migrating towards Rice Creek from Building 103, and also to the west or southwest from the Building 502 area. As a result of these findings, Alliant announced a three-phase off-TCAAP investigation on July 28, 1984, to supplement work being conducted by MPCA to identify off-TCAAP sources of release.

In 1985, MPCA released the Phase I Final Report, New Brighton/Arden Hills, Minnesota Multi-Point Source Remedial Investigation. The report identified four potential source areas of VOC release in the study area that had possibly contaminated the groundwater. The source areas included two areas at TCAAP and two areas adjacent to TCAAP. A second phase of the off-TCAAP RI, Phase IA, was initiated in July 1986 and completed in February, 1991. The purpose of the Phase IA RI was to further define the nature and extent of groundwater contamination in off-TCAAP areas.

Disposal activities at the sites are discussed in detail in the Preliminary Assessment for the Twin Cities Army Ammunition Plant (PA) (1988) and in the Supplement to the Preliminary Assessment of the Twin Cities Army Ammunition Plant (PA Supplement) (1988). The PA and PA Supplement presented the results of an extensive records search for documents related to the history of production and waste disposal activities at TCAAP prior to December, 1981. The geohydrological conditions of the site and response actions associated with the 14 disposal sites at TCAAP were also identified in the PA and PA Supplement.

In 1988, the Army initiated an on-TCAAP RI designed to characterize the nature and extent of contamination within the facility boundary, addressing soils, sediments, surface waters and groundwater. The on-TCAAP RI was completed in April, 1991. Additional characterization of the nature and extent of contamination within TCAAP was conducted in the late 1992 as part of the feasibility study process for remedy development.

Additionally, in 1991, EPA completed the Human Health Risk Assessment and the Army completed the Terrestrial Ecological Risk Assessment. The completion of these studies and documents led to the development of the feasibility study for final remedial actions within OU-2.

In 1994, the Division of Health Assessment and Consultation (DHAC), Agency for Toxic Substances and Disease Registry (ATSDR) completed a Public Health Assessment of the NB/AH site. The data and information in the NB/AH Public Health Assessment was evaluated, and ATSDR placed the site in the category of a public health hazard because people were exposed in the past to groundwater contaminants from TCAAP at concentrations that may result in adverse health effects.

B.2) Interim Remedial and Removal Actions

The interim remedial actions (IRAs) taken at TCAAP have been implemented under the Army Installation Restoration Program (IRP). These actions have been coordinated with federal and state regulatory agencies prior to implementation. Alliant Techsystems entered into an agreement with the Army in 1985 to investigate and pursue the cleanup of sites at TCAAP associated with Alliant operations. Industrial operations at TCAAP have generated most of the contamination currently identified at the site. The IRAs conducted by the Army and Alliant have concentrated on contaminant source control, with a focus on individual site cleanups and groundwater (aquifer) remediation. Actions that have already been taken can be divided into the categories of: a) unilateral actions by the Army, b) actions with EPA and state concurrence, and c) other actions initiated by EPA, MPCA, and/or Army/Alliant Techsystems.

a) Unilateral Actions by the Army

Unilateral removal actions have been taken by the Army using its own delegated removal authorities under CERCLA section 104. These actions have included:

- In-situ soil vapor extraction (SVE) systems for the remediation of contaminated soils at Sites D and G within OU-2. The SVE systems were implemented in 1986 and, since then, have removed over 110 tons of VOCs from site soils.

- A groundwater pump-and-treat system at Site A, where the surficial aquifer is contaminated with VOCs. The initial system, installed by the Army in 1988, utilized liquid-phase granular activated carbon (GAC) to treat extracted groundwater, which was then surface-discharged.

- In 1988, Alliant installed a groundwater pump-and-treat system at Site K. Groundwater underneath the site is contaminated with VOCs with the likely source identified as leaks from floor drains and sewer lines. The extracted groundwater is treated by air stripping. The treated groundwater from Site K is discharged to Rice Creek.

b) Actions with EPA and State Concurrence

- In 1987, the Army implemented the Boundary Groundwater Recovery System (BGRS), for which the EPA signed a ROD in September 1987. This system initially consisted of a series of six groundwater extraction wells located along the southwest boundary of TCAAP and designed to prevent any further migration of contaminated groundwater off of TCAAP. After a period of performance monitoring, the system was expanded in 1989 to twelve wells. Eight of the BGRS wells draw water from the Hillside Sand aquifer with the other four drawing from the Prairie du Chien aquifer. In 1996, one well (B-12) was removed from the system because it was having minimal impact on plume cleanup.

- Water extracted from the BGRS is pumped to an air stripping facility for the removal of VOCs. From there the treated water is pumped to the Arsenal Sand and Gravel Pit in the north-central portion of TCAAP, where it is discharged and allowed to infiltrate back into the ground.

- In addition to the implementation of the BGRS, the Army subsequently installed five source control (SC) wells downgradient of Sites D, G and I. The BGRS and SC wells together comprise the TCAAP Groundwater Recovery System (TGRS). The TGRS is designed to provide regional groundwater remediation at TCAAP and prevent additional contamination from migrating beyond the facility boundaries. Over 10 billion gallons of water have been treated and 72 tons of VOCs have been removed by this system. In 1996, one of the SC wells (SC-4) was removed from the system because it was having minimal impact on plume cleanup.

- In 1993, remedial action was implemented at Site F as a RCRA cleanup within TCAAP. Soil contaminated by heavy metals were remediated utilizing soil washing/soil leaching technologies. Final closure of Site F is anticipated in 1997.

- The Site A groundwater remediation system was modified in 1994 to include eight boundary extraction wells that were pumped to hydraulically contain the plume on site. Extracted groundwater is then discharged directly into an off-site sanitary sewer for subsequent treatment at a publicly owned treatment works (POTW).

c) Other Actions Initiated by EPA, MPCA, and/or Army/Alliant

- Site J, the sanitary sewer system at TCAAP, has been investigated in several studies. In 1983, integrity testing was conducted on part of the upper plant sewer and on the 18-inch and 24-inch force mains. During 1984, approximately 50 percent of the sanitary sewer system (over 42,000 linear feet) was inspected, cleaned, and tested. By July 1986, cleaning of all sewer lines was completed. This material was containerized in drums and stored in Building 576 and in a building called the Retrievable Monitored Containment Structure (RMCS). In 1992, verification sampling of soils around the Site J sewers was conducted to document the absence of contamination at levels above health-risk based criteria. Site J was closed per the regulatory agency-approved closure plan in 1994.

- In 1985, Alliant excavated PCB-contaminated soils around Building 502 and placed them in the RMCS. These soils were removed from the RMCS in 1996 and disposed of off site in a permitted facility.

- About 1,400 cubic yards of PCB-contaminated soil at Site D were thermally treated in 1989. EPA prepared the ROD and the risk assessment report for this action.

- The Army completed a two-phase water management study to evaluate feasible alternatives for the disposal of treated groundwater anticipated from future remedial measures.

B.3) CERCLA Enforcement Activities

Pursuant to Section 120 of the Superfund Amendments and Reauthorization Act of 1986 (SARA), the Army entered into a Federal Facilities Agreement (FFA) with EPA and the State of Minnesota. The TCAAP FFA, which became effective on December 31, 1987, was the first to be negotiated between EPA and any federal agency since the enactment of SARA. The general purposes of the FFA are to:

1. Ensure that the environmental impacts associated with past and present activities at TCAAP are thoroughly investigated and that appropriate remedial actions are taken to protect the public health, welfare, and the environment.

2. Establish a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions in accordance with CERCLA/SARA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Superfund guidance and policy, the Resource Conservation and Recovery Act (RCRA), and RCRA guidance and policy.

3. Ensure cooperation, information exchange, and participation of the parties in such actions.

The specific purposes of the agreement are to:

1. Identify interim remedial action alternatives appropriate for preventing further migration of contaminated groundwater prior to the implementation of final remedial actions for the site.

2. Establish requirements for conducting the on-TCAAP RI to determine fully the nature and extent of the threat to the public health, welfare, or the environment caused by the release and threatened release of hazardous substances, pollutants, or contaminants at TCAAP.

3. Establish requirements for conducting an FS for the site to identify, evaluate, and select alternatives for the appropriate remedial action(s) to prevent, mitigate, or abate the release or threatened release of hazardous substances, pollutants, or contaminants at the site in accordance with CERCLA and SARA.

4. Identify the nature, objectives, and schedule of response actions to be taken at the site. Response actions at the site shall attain a degree of cleanup of hazardous substances, pollutants, or contaminants mandated by CERCLA and SARA.

5. Implement the selected interim and final remedial action(s).

6. Assure compliance with federal and state hazardous waste laws and regulations for matters covered by the agreement.

C. Highlights of Community Participation

The community near TCAAP has been involved in site activities since the environmental problems related to the TCAAP facility were identified. Most citizens want to know about and participate in decisions that may affect their community. As a result, TCAAP prepared a Community Relations Plan in 1991 (updated in 1997) for the purpose establishing avenues for sharing knowledge and encouraging community participation regarding the hazardous waste remediation activities both underway and planned for at TCAAP. The Community Relations Plan outlines specific community relations strategies for addressing these goals and for maintaining the Plan as a flexible, "living" document that can adjust to evolving community needs and concerns.

Over the years TCAAP has prepared and distributed numerous fact sheets to a large number of local and interested residents to keep the community apprised of the various remedial activities at the site. TCAAP sponsors various tours of the facility and accompanying wildlife areas, in addition to providing monthly Technical Review Committee (TRC) meetings open to the public to review the status of restoration activities at the site.

The TCAAP Restoration Advisory Board (RAB) was established in January 1996 to provide citizen input into the cleanup of TCAAP. The RAB provides an opportunity for community representatives to review and analyze issues concerning the contamination and remediation of TCAAP soils and groundwater; provide comments and recommendations regarding remediation of contaminated areas at TCAAP; and to provide advice on decisions that affect the quality of the environment of the communities that are impacted by the contamination at TCAAP.

For the remedy selection for OU-2, the public participation requirements of CERCLA Sections 113 (k) (a) (B) (i-v) and 117 were met through the issuance of a fact sheet and Proposed Plan, notification of the availability of the Proposed Plan by newspaper, and the holding of a Public Meeting on April 22, 1997. The public comment period for the Proposed Plan began on April 8, 1997, and ended on May 7, 1997.

D. Scope and Role of Operable Units Within the Overall Cleanup Strategy

The NB/AH site has been divided into three operable units (Figure 2). The first operable unit, OU-1, consists of the North Plume of off-TCAAP contaminated groundwater. The second operable unit, OU-2, addressed by the remedies selected in this ROD, consists of the on-TCAAP soils and groundwater and the shallow (Unit 1) groundwater northwest and west of Site A to Rice Creek. The third operable unit, OU-3, consists of the South Plume of off-TCAAP contaminated groundwater. A conceptual illustration of the three operable units is presented in Figure 2.

The main role of OU-2 and this ROD is the removal of soil contaminants, the containment and control of groundwater contamination and restoration of aquifers to selected cleanup levels. Implementation of the remedies for OU-2 will provide overall protection of human health and the environment. Removal of soil contaminants will protect those workers at TCAAP that may come into contact with contaminated soils through site activities, and protect underlying groundwater from further contamination. Extraction of groundwater contaminants and hydraulic control of contaminant migration will contain the most contaminated portions of the aquifers and remove contaminant mass from the systems. Restoration of aquifers to concentrations below selected cleanup levels is a remedial action objective for groundwater. The Army will annually report to the regulatory agencies on its review and evaluation of new and emerging technologies that may provide a more cost-effective approach to deep groundwater cleanup.

E. Summary of Site Characteristics

All known or suspected sources of contamination have been identified. Contamination of soil within OU-2 has been separated amongst the source areas between shallow (less than 12 feet) soil sites (which includes Sites A, C, E, H, 129-3, and 129-5), deep (greater than 12 feet) soil sites (Sites D and G), shallow (Unit 1) groundwater (Sites A, I and K), and deep (Units 3 and 4) groundwater. Site locations are shown on Figure 3.

Unpermitted landfills, or dumps, also exist within OU-2. Several sites are considered solely as dumps and require further characterization before a final remedy can be determined. One dump is partially located within Site B-3; the second dump site is Site 129-15. Dump materials could span a wide range of wastes, from rubble, concrete, wood, and soil, to rags, sewage sludge, burn pit residuals and metal slag. There is no clear indication of groundwater contamination resulting from either of these dumps. While it is not evident that the environment or human health is at risk from the conditions or impacts of these dumps, there is a lack of comprehensive data on the materials and contents within each dump. Detailed characterization of dump contents was not included in previous remedial investigations. These dumps will be characterized and a response action chosen.

Shallow soil sites are generally contaminated by heavy metals and minor amounts of VOCs in the upper 5 to 10 feet of soil (Table 1). Contaminated soil volumes range from as little as 15 cubic yards (CY) at Site 129-5 to as much as 2600 CY at Site C (Table 2). Dumps exist within the boundaries of Sites A, E, and H. Dermal contact, ingestion, and leaching to groundwater are the principal routes of migration of the contaminants in the shallow soils of OU-2.

Sites D and G make up the deep soil sites and contain VOC contaminants dispersed in the soil potentially down to the water table, a distance of 130 to 170 feet. These sites are considered two of the three primary source areas for VOC contamination of the deep groundwater aquifers. Each site contains an SVE system that has removed significant volumes of VOC contaminants from the soil. Some additional shallow soil contaminants may exist at Site D based on past disposal practices. Site G is underlain by a dump which will be characterized after completion of the deep soil cleanup.

Within OU-2, groundwater is found in both bedrock and glacial deposit aquifers. On top of the irregular bedrock surface, a series of unconsolidated glacial sediments has been deposited. Several of these units are water-bearing and have been affected by contaminants originating from source areas within OU-2. Figure 4 provides a schematic of the geologic and water-bearing units underlying OU-2.

The Prairie du Chien/Jordan Sandstone aquifer is the principal aquifer in the Twin Cities Basin. This aquifer is referred to as Unit 4. Permeability in the Prairie du Chein/Jordan Sandstone aquifer is controlled by the extent of fractures and joints in the Prairie du Chien unit and the porosity of the Jordan Sandstone unit. Groundwater flow through this aquifer is generally in a west-southwest to south-southwest direction toward the Mississippi River. Recharge to the Prairie du Chien/Jordan Sandstone aquifer occurs by infiltration through the overlying glacial units.

The Hillside Sand and the Arsenal Sand are referred to as Unit 3. Except for an exposure in Minneapolis, the Hillside/Arsenal Sand directly overlies the Prairie du Chien/Jordan Sandstone aquifer and provides direct recharge to both underlying units. The groundwater in Unit 3 flows predominantly southwest.

The Twin Cities Till overlies the Hillside Sand in much of the area and is referred to as Unit 2. The Twin Cities Till acts as an aquitard, i.e., a confining layer that prevents direct hydraulic communication between the overlying Lacustrine Deposits and the Hillside Sand below.

The Lacustrine Deposits, referred to as Unit 1, are predominantly fine to medium sands with interbedded silt layers and occasional minor peat and clay layers. These units form the shallow surface aquifer within OU-2. The Unit 1 aquifer is of sufficient permeability and extent to support the installation and use of shallow private wells for domestic supply and irrigation needs. Groundwater in this unit is perched and discontinuous. Any groundwater flow is localized and usually toward the closest small lake or stream.

Groundwater in aquifer Units 1, 3 and 4 has been contaminated by chemicals coming from one or more of the source areas identified within OU-2. At Sites A and K, groundwater contaminants (Table 3) are generally contained within the shallow Unit 1 aquifer. Groundwater contamination at Site I has affected both the shallow Unit 1 aquifer and the deep Units 3 and 4 aquifers. In the deep Units 3 and 4 aquifers, VOCs (specified in Table 4) migrate horizontally and vertically downward in response to corresponding hydraulic gradients. The plume is divided amongst the three operable units within the NB/AH site. Off site, the contaminant plume is categorized as the North Plume (OU-1), which migrates in a southwesterly direction in both the Hillside Sand and Prairie du Chien aquifers, and the South Plume (OU-3) which moves in a more southerly direction. Exposure to contaminated groundwater from the site is through wells or as discharge of groundwater to surface waters.

F. Summary of Site Risks

A human health risk assessment for the Site was performed by EPA in 1991. The risk assessment evaluated the potential health risks associated with exposure to the source areas on TCAAP as well as the contaminated groundwater both on and off TCAAP. This involved calculating the potential increase in the risk of cancer and the potential risk of noncancer effects, such as liver damage and reproductive abnormalities. It also evaluated the ways by which people could be exposed to contaminants.

The current land use, which is a military industrial facility, will be the future land use at TCAAP. The risk evaluation developed for the site assumed a use scenario that is consistent with continued industrial use of the site. The following assumptions relative to receptors and exposure are considered reasonable to the industrial use scenario:

- People who might be at risk from exposure to contaminated soil include TCAAP workers or occupants. Incidental ingestion and dermal contact are the only significant routes for receptors exposed to contaminants in surface soils at the site. If future activities require excavation, however, workers may be exposed to contaminants by inhaling vapors or dust, as well as through incidental ingestion and dermal contact.

- People who might be at risk from exposure to contaminated groundwater include TCAAP workers and local residents who rely on private drinking wells that extract contaminated groundwater. The potential pathways by which these receptors might be exposed include ingestion, inhalation during showering, and adsorption through the skin (dermal contact) during showering or bathing with contaminated groundwater.

The conclusions in the risk assessment are based upon the chemicals of concern (COCs); that is, the hazardous chemicals found in the groundwater and soils on TCAAP. The chemicals of concern in OU-2 were developed on a site specific basis, and are summarized in Table 1. The risk characterization developed in the risk assessment performed by the EPA was updated in the OU-2 Feasibility Study to accommodate the additional COCs identified at the site during investigations performed following the completion of the risk assessment. Exposure assessment equations, contaminant toxicity equations, and quantitative site-specific risk evaluations are summarized in Appendix C-1 in Tables 1 through 6 (exposure assessment and toxicity data) and Tables I-1 through I-12 (quantitative site-specific risk evaluations per contaminant and totals for each site).

- Cancer Risk - Based upon the risk assessment, it was estimated that maximum exposure to the chemicals at the site could result in an increased cancer risk greater than the amount the EPA and MPCA consider acceptable (see Appendix C-1, Tables I-1 through I-12). This projected increase was based upon the assumption that those exposed would either use untreated contaminated groundwater for an exposure period equal to an average lifetime, or be exposed to contaminated soils via dermal contact and ingestion over an exposure period equal to 25 years. Federal and State regulations often require action when the increased cancer risk reaches the range of one in ten thousand to one in one million.

- Non-Cancer Risk - The potential risk of non-cancer effects, such as liver damage or reproductive abnormalities, is evaluated through the calculation of a hazard quotient (HQ) for each chemical of concern. The HQ also takes into account the potential exposure through ingestion, inhalation, and dermal contact. Non-cancer risk for a given contaminant exists when the sum of the HQs, known as the Hazard Index (HI) is greater than one. The HIs for the chemicals of concern exceed 1.0 at most of the sites in OU-2 (see Appendix C-1, Tables I-1 through I-12).

To date, EPA has generally selected from between 5 ppb and 20 ppb as a cleanup level for dioxin in commercial/industrial soils for sites where dioxin is driving the remedy. Based on presently available information, and using standard default exposure assumptions, the cancer risk associated with a lifetime exposure to 5 ppb, or the lower end of the range recommended for industrial soils, is approximately 1.3×10^{-4}. This is within the range of cancer risks generally considered acceptable at Superfund sites. Since concentrations of dioxin in TCAAP soils are below 5 ppb, it has been determined that dioxin does not pose an unacceptable risk at the site.

EPA is presently completing work on a comprehensive reassessment of the toxicity of dioxin, to be embodied in the documents titled "Health Assessment Document for 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds" and "Estimating Exposure to Dioxin-like Compounds." The reassessment report, which is scheduled to be issued in 1998, will represent the culmination of 7 years of EPA effort to collect, analyze and synthesize all of the available information about dioxin. It is one of the most comprehensive evaluations of toxicity of a chemical ever performed by EPA. Following release of the report, EPA's Superfund program will participate in a cross-program review of the implications of the report for the regulation and management of dioxin by EPA. It is anticipated that this review will culminate in guidance addressing the management of dioxin at Superfund sites.

We do not believe it is prudent to establish new, and possibly varying, precedents for dioxin remediation goals just prior to the release of EPA's reassessment report. As with any other pollutant, it is important to ensure appropriate national consistency in remediation efforts. The EPA has used from between 5 ppb and 20 ppb as an industrial remediation goal for dioxin in the past; it will be issuing guidance, informed by the reassessment effort, that is expected to provide a basis for the selection of dioxin remediation goals in the future. In the interim, for sites that require the establishment of final dioxin cleanup levels prior to the release of the report, it is appropriate to use 5 ppb as an industrial preliminary remediation goal. Since all dioxin soil concentrations are below 5 ppb, dioxin is not a contaminant of concern at the site. Consistent with 40 CFR §300.430(f)(5)(iii)(D), the decision for this operable unit in reference to the presence of dioxin will be reviewed promptly following the release and EPA's analysis of the reassessment report, and changes will be made to this ROD based on the information contained in the report, if necessary.

At the request of the EPA, the Army conducted an ecological risk assessment for terrestrial habitats at TCAAP. This risk assessment addressed on-TCAAP risks to plants and animals, and concluded that no significant risks exist. The Army is currently evaluating potential chemical risks to the aquatic ecosystems associated with the installation. This aquatic risk assessment is scheduled for completion in 1997, with recommendations for additional assessment if it concludes that unacceptable ecological risks may exist.

In summary, actual or threatened releases of hazardous substances from this site, if not addressed by implementing the remedial actions selected in this ROD, may present imminent and substantial endangerment to public health, welfare, or the environment.

G. Description of Alternatives

The Feasibility Study for OU-2 was performed in accordance with EPA guidance for Superfund Remedial Investigations and Feasibility Studies. Table 5 presents a tabular summary of the technology screening for OU-2. The potentially feasible remedial technologies retained from the screening are listed in Table 6. These technologies were combined into various remedial alternatives, which were then developed and screened. The following remedial alternatives were retained for each site or group of sites for detailed analysis:

Shallow Soil Sites

The shallow soil sites include Sites A, C, E, H, 129-3, and 129-5, which have been impacted primarily by inorganic and organic contaminants. No contamination was found to exist at Site B, therefore no remedial action is necessary for this site. Maps showing the estimated boundaries of contaminated soils and dump materials within each of the shallow soil sites are presented as Figures 5 through 12. Present-worth cost estimates for each alternative on a site by site basis are summarized in Table 7. Detailed cost estimates are presented in Appendix D.

Alternative 1: No Action

The No Action alternative serves as a baseline for comparison with other alternatives. No remedial actions would be performed at a site to eliminate future potential exposure pathways, so there would be no reduction in risks to human health or the environment under the current and most probable land use (industrial) scenario, nor would this alternative comply with ARARs or TBCs. The only activity included in this alternative is groundwater monitoring to track the fate of soil contaminants should they migrate to the water table and disperse in groundwater.

Alternative 2: In Situ Fixation and Capping

Remedial design would be initiated with a field characterization/screening effort to establish the exact boundaries of contaminated soils (area of concern or AOC) and dump materials at each site. This activity would pay special attention to locating ordnance, buried drums, and subsurface debris, so that these materials are removed prior to any stabilization activities at a site. If found, these materials would be categorized, tested, and disposed of in an appropriate manner that is approved by the regulatory agencies. All contaminated soil that is removed during characterization activities would be retained on site for subsequent inclusion in the remedial action. In addition, characterization activities would take into account other to-be-evaluated (TBE) contaminants denoted for each site so that appropriate field and analytical screening measures are included. Best management practices (BMPs) for the protection of marshlands or wetlands in or around a site would be incorporated into this and all subsequent site activities.

An *in situ* solidification/stabilization process involving a solidifying/stabilizing agent and a unique mixing system was evaluated for the TCAAP soil sites. The chemical additive would be injected into the soil using a hollow drill with an injection point at the bottom of the shaft. The drill would be advanced into the ground to the desired depth and the chemical additive injected at low pressure to prevent excessive spreading and would be blended with the soil as the drill rotates. The treated soil forms a solid vertical column. Soil columns are created to overlap to ensure that all the soil is adequately treated.

Although very few volatile organic COCs exist within the shallow soil sites, the TBE compounds addressed during remedial design activities may result in the identification of additional organic contaminants that require remediation. The organic contaminants that have been identified, specifically at Site 129-3 (TCE and nitroglycerine), are of limited distribution and volume and at relatively low concentrations. Because of the limited nature and extent and low concentration levels of these contaminants, it is expected that *in situ* fixation would be a reliable technology for contaminant immobilization and eliminating them from exposure pathways that impact human health and the environment. Bench scale testing of fixating the organic contaminants would be conducted to verify the reliability of this technology. If high levels of volatile organics are encountered during remedy design efforts, then it is anticipated that SVE would be utilized to reduce the contaminant concentrations to levels amenable to remediation through *in situ* fixation.

The stabilized soils would be left in place and capped. Alternative 2 assumes a mixed solid waste (MSW) cap is constructed. The cap would consist of three layers: a barrier layer, a drainage layer, and a top layer. When using soils or amended soils for the barrier layer, it should be a minimum of 24 inches thick and have a permeability of less than 1×10^{-6} cm/sec. A synthetic membrane of 30/1000 of an inch can be used if it meets the physical property standards for the material type developed by the National Sanitation Foundation and reproduced in the EPA Manual, "Lining of Waste Impoundment and Disposal Facilities", SW-870, March 1993. The drainage layer should be at least six inches thick. The top layer should be 18 inches thick including at least six inches of topsoil which is capable of promoting vegetative cover. The vegetative cover should consist of shallow rooted perennial grasses or other suitable vegetation that will not penetrate the barrier layer. The final cover should have between a 3 to 20 percent grade to maximize runoff and prevent ponding. All layers should be put in with six inch lifts and compacted within zero to five percent of optimum moisture content to achieve 95 percent Standard Proctor of maximum density. The layer of topsoil should not be compacted to these specifications.

Since Alternative 2 would not result in clean closure, long-term monitoring would be required using monitoring wells immediately downgradient of the treatment sites. Performance monitoring data obtained from these wells would be used to evaluate this remedy on an annual basis and as part of the five-year review periods. For those sites without existing monitoring wells in a downgradient location, the installation of additional wells would be required.

Upon completion of the remedial action, access and use restrictions would be instituted to restrict the site activities to those consistent with the site conditions and level of cleanup. Any activities that would disturb the integrity of the surface cap or the underlying stabilized soils would be deemed inappropriate and prohibited. Short and long term maintenance and monitoring of site conditions, especially with respect to the condition of the surface cap, would be established and maintained.

Costs for Alternative 2 have been developed on a site by site basis. Each site specific estimate considers the volume of contaminated soil that requires stabilization and the aerial extent of the contaminated soils for capping. Long term monitoring (and additional wells as necessary) and cap maintenance are included in the estimates.

The remedial cost estimate for Sites A, E and H includes removal activities focused solely on dump materials within each site. Removal costs for each individual dump have been estimated separate from the contaminated soils alternative and are presented as a range that bracket the costs for disposal of dump materials to either a demolition landfill or to a Subtitle D landfill following stabilization. Although visual observation indicate some percentage of the dump materials are construction debris, the dump cost estimate assumes all dump materials are soils. Non-soil materials encountered during removal may impact eventual material disposition and the overall cost for this remedy.

<u>**Alternative 3: Soil Washing/Soil Leaching**</u>

This remedy would be initiated in much the same way as Alternative 2 in terms of defining the limits of site dumps and locating site debris and ordnance. Site debris, ordnance, dump and oversized materials would be segregated, characterized, and removed from the site in the AOC as previously described.

Following characterization, remediation for the dumps present within the shallow soil sites would involve complete excavation and off-site disposal. The results of the characterization activities will determine the disposal requirements for the dump materials.

Soil would be excavated to the boundaries of the contaminated zone (as determined from characterization sampling and field screening) and would then be temporarily staged on-site. It is assumed that remedial activities will take place during seasonally low groundwater levels (mid to late summer), therefore high moisture content soils are not anticipated during excavation. Representative samples would be collected for treatability studies based on the composite characteristics of the soil mass requiring remediation. The results of the treatability studies would be used to refine the treatment system design.

Soil washing/soil leaching is not an appropriate technology for the treatment of organic contaminants, therefore pretreatment of organic compounds may be required at Site 129-3 prior to soil washing/soil leaching. Some trichloroethene may volatilize as a result of excavation, screening, and the soil washing/leaching process, but the remainder would be bound to the soil matrix. Additional measures to protect workers from organic contaminants would be necessary if the organics are detected above remediation goals and allowed to pass through the treatment system unabated. Soils containing volatile organic contaminants above remediation goals would be staged separately from the rest of the soils and pretreated prior to soil washing/soil leaching using soil vapor extraction techniques.

Ordnance screening before and during soil excavation is necessary to protect workers. Buried ordnance retrieved during excavation must be segregated, sampled and properly disposed of. The screening of soil prior to treatment and disposal of materials buried in the soil will significantly affect the cost.

Toxic heavy metal alloys are the primary inorganic contaminants in the shallow soils. Soil washing/soil leaching is a proven treatment technology for these types of contaminants. Soil washing involves a density separation step which removes the coarse grained soil fraction and particulate metals or alloys. Based on Site F experience, the metal contamination at TCAAP is in both the particulate and ionic (bound to the soil matrix) forms. Soil leaching, an additional process step, is added to the treatment train to remove the inorganic contamination bound to the soil matrix. Because the inorganics typically bind to the finer fraction of the soil matrix, a high percent of non-particulate inorganics and a high percentage of fines will increase treatment costs. In addition, treating soil to extremely low cleanup levels may involve reprocessing.

Following treatment, the clean soils would be backfilled into the site excavations. It is anticipated that additional imported (clean) soil would be necessary to complete the backfilling of the excavations back to their original grade. Treatment residuals would be disposed of in accordance with their contaminant concentrations and regulatory requirements. It is anticipated that wastewater resulting from the soil washing/soil leaching process would be acceptable for

POTW discharge based on the experience with this technology at Site F. Metals recovered from the treated soils would be sent off-site for recycling. Those soils not passing TCLP after treatment would be stabilized on-site, and transported to a permitted off-site disposal facility.

Upon completion of site remediation, surface grading and revegetation would be conducted to restore the site to conditions similar to that prior to remedial activities. Groundwater monitoring would be performed for a limited period of time to monitor remedy effectiveness and insure that site contaminants have been removed from the soil column and are not leaching into the underlying groundwater.

Use and access restrictions would be commensurate with those industrial activities and restrictions to public access that TCAAP currently employs as a federal facility. No additional restrictions would be necessary for site use for Alternative 3.

Each site specific cost estimate assumes that the total volume of contaminated soil (as determined by the existing COCs and site specific cleanup goals) is excavated, and buried and surface hazardous debris (assumed 1 percent of excavated soil weight) are removed from the soil mass and disposed of off-site. Organic contaminant pretreatment using SVE is included for Site 129-3, and bench scale testing and ordnance screening are included for all sites prior to treatment. Based on the availability of funding, it is anticipated that implementation of this remedy would take three to six months per site, Groundwater monitoring is included to verify no adverse impacts from remedy implementation.

For treatment, it was assumed that 17 percent of the soil volume washed would be removed as coarse material (cobbles, rocks, etc.) and require no further treatment; of the 83 percent remaining that is treated with soil leaching, it was assumed that 20 percent would not meet the site remediation goals, and would therefore require stabilization and off-site disposal.

The remedial cost estimate for Sites A, E and H would include removal activities focused solely on dump materials within each site. Removal costs for each individual dump have been estimated separate from the contaminated soils alternative and are provided as separate estimates.

Alternative 4: Excavation, Stabilization, and Off-Site Disposal

This remedy would be initiated in much the same way as the previously described alternatives in terms of summarily defining the limits of contaminated soils, contents of site dumps, and locating site debris and ordnance. The dump and debris materials would be segregated, characterized, and removed from the site as previously described.

A clear understanding of the range and extent of contaminants in the shallow soils would be possible once the soils are out of the ground. Soil would be excavated to the boundaries of the contaminated zone (as determined from confirmation sampling and field screening) and would then be temporarily staged on-site. It is assumed that remedial actions will take place during seasonally low groundwater levels (mid to late summer), therefore high moisture content soils are not anticipated during excavation. Representative samples would be collected for analytical and TCLP evaluation based on the characteristics of the soil mass requiring remediation. The results of the evaluation would be used to refine the disposal requirements for the soil mass.

Any additional debris and ordnance would be selectively removed from the excavated soil, characterized, and disposed of in a manner commensurate with applicable regulations. For all sites with the possible exception of Site C, the hazardous and/or contaminated soils would be stabilized on-site prior to off-site transport and disposal. This pretreatment option was chosen to reduce the overall cost of disposal of these materials. Following on-site pretreatment, the stabilized soils that pass TCLP would be transported to a Subtitle D landfill for disposal. Subtitle D landfills can only accept this material if the stabilized soils pass the TCLP test, the landfill agrees to accept the soil and modifies its waste plan to include handling of the soils.

For Site C, the excavated soils may need to be transported to an off-site incinerator for thermal treatment/destruction of contaminants. Following incineration, the resulting ash would be disposed of in a permitted and licensed landfill. If, during excavation, only metal contaminated soils are identified, they will be segregated and transported for off-site stabilization and disposal at a local Subtitle D landfill.

The on-site excavation would be backfilled and regraded to resemble site conditions prior to the remedial action. Groundwater monitoring would be performed for a limited period of time following site closure to verify that no adverse affects resulted from remedy implementation. Use and access restrictions would be employed during remedy implementation.

Each site specific cost estimate assumes that the total volume of contaminated soil (as determined by the existing COCs and site specific cleanup goals) is excavated, and buried and surface hazardous debris (assumed 1 percent of excavated soil by weight) are removed from the soil mass and disposed of off site in a Subtitle D landfill. The Site C cost estimate assumes that thermal treatment/destruction will be required. For pre-treatment of soils from Sites A, E, H, 129-3 and 129-5, it was assumed that 99 percent of the total contaminated soil volume would require stabilization prior to off-site disposal. A 10 percent bulking factor was applied to the stabilized mass to account for the increase in volume following stabilization. Based on the availability of funding, it is anticipated that implementation of this remedy would take approximately three to six months per site. Groundwater monitoring is also included to verify no adverse impacts from remedy implementation.

The remedial cost estimate for Sites A, E and H include removal of dump materials. Removal costs for each individual dump have been estimated separate from the contaminated soils alternative and are provided as separate estimates.

Dumps

Dumps adjacent to Site B and within Site 129-15 will be characterized to determine their contents. If contents are found to be toxic, hazardous, or contaminated, then a remedy for the landfill will be utilized and documented through a post-ROD amendment. If the contents are not toxic, hazardous or contaminated, a no further action remedy would be employed. This approach for Sites B and 129-15 is retained regardless of the alternative selected for the remaining shallow soil sites.

Deep Soil Sites D and G

The deep soil sites include Sites D and G, which have been impacted primarily by VOC contaminants at depths of 50 to 150 feet. Site D may contain contaminants in shallow soils not affected by SVE efforts that will require characterization following removal of the SVE system. Site G also contains a dump which will require further characterization to determine the final remedial action necessary to close the site. Maps of each of the deep soil sites are presented as Figures 13 and 14. Present-worth cost estimates for each alternative on a site by site basis are summarized in Table 9. Detailed cost estimates are presented in Appendix D.

Alternative 1: No Action

The No Action alternative serves as a baseline for comparison with other alternatives. Under this option, the SVE system at Sites D and G would be shut down and no additional remedial activities would occur at the site. The SVE systems would be dismantled and the and vents abandoned according to Minnesota codes. A groundwater monitoring program would remain in effect to ensure changes in the VOC plume are detected. Site use restrictions would remain in effect due to the presence of the Site G dump and VOC contamination). Costs for the No Action alternative for Sites D is $166,200 and for Site G is $229,300 as summarized in Table 9.

Alternative 2: No Further Action

Under Alternative 2, the SVE system at Sites D and G would be maintained as they currently exist. The existing caps would be maintained and surface controls for drainage kept in place. A groundwater monitoring program would remain in effect to ensure changes in the VOC plume are detected. Site use restrictions would remain in effect due to the presence of the Site G dump and VOC contamination.

Since the SVE systems are currently in place, costs for Alternative 2 are based on operation and maintenance. For Site D, the present worth cost of this alternative is $353,700; for G it is $392,300.

Alternative 3: Expand SVE System Vertically

Alternative 3 includes expanding the SVE system vertically to remove contamination located in the deep soils with the possibility of enhancement options (hot air stripping, steam enhanced extraction, radio frequency heating and bioventing). These enhancements are included as options with Alternative 3 and would be evaluated during remedial design. No enhancement options were included in the cost estimates because it is unknown which ones, if any, would be needed. Access and use restrictions that are already in place would be maintained and groundwater monitoring would continue. Routine maintenance of the pre-existing cap at Sites D and G would be conducted and surface controls would be left in place.

Field activities for expanding the SVE system would begin with predesign characterization activities to establish preliminary design considerations for the installation of deep soil vents at each site. Based upon this characterization, a pilot study would be performed as necessary. Following the pilot study, a deep SVE system would be installed as appropriate. It is anticipated that remedy implementation at each site would take approximately one year.

Use of any enhancements to the deep vent system would be determined after the characterization and pilot tests results have been evaluated. For costing purposes, it was assumed that an SVE system without enhancements would be installed and utilized at Sites D and G. It was also assumed that by minimizing the use of shallow vents in the existing SVE system, the current blower system can be used for both the shallow and deep SVE systems. Decisions on the use of the blower system will be made during the remedial design phase of the project.

An SVE system was conceptualized for Site D with a final system design of 18 additional deep vents (in nests of two) as a basis for further evaluation of Alternative 3 (Figure 15). For the purposes of cost development, it was assumed that the additional soil vents would be constructed in and around the existing system at two different screen depths. Actual vent screen depths would likely encompass more horizons. The two groups of soil vents would be manifolded into separate vacuum blowers so the shallow and deep vents can be operated independently. The detailed cost estimates for this alternative assume the existing SVE system blower and housing would be suitable for the new vent layout. The detailed cost estimates also assume that off-gas treatment would not be required because the estimated average discharge would be below permit requirements. If initial concentrations exceed emissions standards and require some type of treatment, additional costs would be incurred.

An SVE system was conceptualized for Site G with a total of 22 additional deep vents (in nests of two) as a basis for further evaluating the alternative (Figure 16). The detailed cost estimates for this alternative again assumed the existing SVE system blower and housing would be suitable for the new vent layout. The detailed cost estimates also assume that off-gas treatment would not be required because the estimated average discharge would be below permit requirements. If initial concentrations exceed emissions standards and require some type of treatment, additional costs would be incurred.

SVE systems at both Sites D and G would be monitored for contaminant removal throughout their operational period. Air samples would be collected from the discharge of each SVE system within twelve hours of initial system startup and again after seven to fourteen days. From this initial systems startup program, the necessity for any additional air treatment would be evaluated. Performance and system modifications over time will be addressed based on site specific soil and contaminant conditions as determined during performance monitoring.

Permanent shutdown would occur when it has been determined that the systems are no longer effectively removing additional contaminant mass. When the systems have reached asymptotic levels of contaminant mass removal, a series of rebound tests would be conducted to assess if vapor concentrations increase during a shutdown period. Soil samples would need to be collected and analyzed to determine if the SVE systems or portions thereof can be permanently shut down. It is anticipated that deep soil remediation would not take longer than thirty years to reach site cleanup goals.

The existing Site G surface cap would require long-term maintenance at least during the life of the SVE system. Cap maintenance would include mowing, revegetation and filling eroded areas as required. Groundwater monitoring and restricted site access would continue through the life of the remedial action.

Costs for Expanding the SVE System Vertically have been developed for both sites. For Site D, the cost is $670,800; for G the cost is $727,200.

Site A Shallow Groundwater

Site A shallow groundwater is contaminated primarily by dissolved VOCs, most notably 1,2-dichloroethene (1,2-DCE). A map showing the boundaries of the 1,2-DCE plume is presented as Figure 17. Table 10 presents a summary of the costs developed for each of the Site A shallow groundwater alternatives. Detailed cost estimates are provided in Appendix D.

Alternative 1: No Action

The No Action alternative serves as the baseline for comparison with the other three alternatives. Under the No Action alternative, current actions associated with remediating Site A Unit 1 groundwater will be discontinued. Groundwater monitoring would continue under this alternative, but no efforts would be made to identify and remediate the source of the VOC contamination or remediate the groundwater VOC plume. The No Action alternative cost is $525,000.

Alternative 2: Boundary Containment

The boundary containment pumping system would continue to operate as currently designed. The boundary pumping system consists of eight Unit 1 groundwater extraction wells pumping at a combined flow rate of approximately 40 gpm. The locations of these wells and the projected capture zones developed through pumping are shown on Figure 18. The collected groundwater is discharged directly to the sanitary sewer system without any pretreatment.

Institutional controls including special area well advisories, alternate water supplies and well abandonment at the expense of Army are a part of this alternative. However, it may not be necessary to abandon residential wells if none are affected above ARARs by the off-site portion of the plume and continued monitoring indicates decreasing contaminant levels over time. Off-site private well drilling is restricted during the remedial action.

A groundwater performance monitoring program would be included with this alternative. Recommendations for operational changes to the boundary pumping system or changes in the monitoring plan would be reviewed annually. Five year reviews would also be a part of this alternative until the remedial action is completed. Army may need to evaluate supplemental remedial actions or technologies during the RD/RA phase, should system performance require such an action.

Demolition of the indoor firing range at Site A was completed to facilitate characterization and removal of possible groundwater VOC plume sources. Investigation would be carried out by excavating trenches through suspect areas of contamination. Probable remedial alternatives for the affected soils may include treating excavated materials or possibly utilizing an *in situ* treatment process. The remedial options selected would be consistent with the overall remedial alternatives for Unit 1 groundwater and the shallow soils. Materials encountered which are typical of the inorganics contamination previously identified at the site would be addressed as part of the RD/RA activities for Site A soils.

An option to be retained in Alternative 2 is disposal to Rice Creek rather than using the current POTW discharge. This option would require reevaluation of treatment requirements for discharge to Rice Creek once effluent contaminant concentration data are available. Treatment for inorganics (if necessary) would likely make this option more costly in the long term than direct discharge to the POTW. Cost estimates for Alternative 2 assume continued discharge to the POTW.

The boundary containment system, as noted previously, has proven effective in preventing the further migration of the VOC plume. Since implementation of the boundary containment system, the plume contaminant concentrations have significantly decreased. The length of time required to complete remedial actions at Site A is anticipated to be 10 years. Therefore, present worth values for this alternative were calculated based on a 10-year project life.

The cost of Alternative 2 is $2,294,100. This cost reflects the additional capital expenditures pertaining to the source delineation and remediation efforts.

Alternative 3: Boundary Containment with Air Sparging

Alternative 3 uses air sparging to strip VOCs from the groundwater and increase groundwater oxygen concentrations to promote aerobic biodegradation of organic contaminants. The implementability of air sparging shallow groundwater at Site A is dependent on the site-specific soil conditions. An air sparging field pilot test would be conducted to provide essential information about optimal air delivery pressure and rate and the effective radius of aeration from a single air sparge point.

Field testing to optimize the system for bioremediation would likely involve conducting a respirometry test over the course of several days immediately following an air sparge pilot test to observe oxygen decay and carbon dioxide production. To complement bioremediation field testing, chemical analysis of Site A groundwater samples for available oxygen and nutrients along with a microcosm or bench test using Site A groundwater samples would be conducted to provide design requirements for nutrient and substrate addition.

The air sparging/soil vapor extraction (AS/SVE) system would be expected to meet cleanup goals because of its aggressive approach to VOC removal along with source remediation to remove any long-term risks of groundwater recontamination. Optimizing air sparging to promote biodegradation of contaminants may significantly reduce the cleanup time.

The boundary containment system, groundwater monitoring, institutional controls and source characterization/remediation actions as presented in the boundary containment alternative are included in Alternative 3. Continued operation of the boundary containment system would prevent the plume from spreading downgradient and continue to remove contaminant mass. Water disposal to the POTW from the groundwater containment system in this alternative would be the most economical option. It is anticipated that implementation of this remedy would take approximately one year.

The cost of Alternative 3 is $3,076,100. This estimate assumes a ten year lifespan for the remedy. The basis for this time frame estimate was derived from experience at other sites with air sparging and the general nature of the application of this technology and its effectiveness in remediating contaminants.

Alternative 4: Boundary Containment with Infiltration

Alternative 4 uses infiltrated water to increase groundwater oxygen concentrations to promote aerobic biodegradation of organic contaminants. Given that the existing groundwater containment system is providing complete capture of the VOC plume, an infiltration gallery would require little or no extra containment wells to provide a closed system

The feasibility of reinfiltrating pumped groundwater is dependent on water treatment requirements, percolation rates and the ability to maintain groundwater containment. Similar to surface water discharge, infiltration may require removal of contaminants from the boundary containment system discharge water. Conceptual design and costs developed for this alternative assume that organics treatment would consist of air stripping and inorganics treatment would not be required.

Bench scale or microcosm testing and a laboratory analysis of Site A groundwater nutrient concentrations would be conducted as described for the air sparging system bench tests. Percolation tests to determine the required size for an infiltration gallery along with groundwater modeling to determine the effects on the containment system performance would also be required. These treatability tests would be completed during the remedial design phase for Site A. Should the infiltration gallery not be able to accept the entire volume of extracted groundwater, POTW discharge would be retained for the excess water.

The boundary containment with infiltration system is assumed to meet cleanup goals in at least ten years. Actual cleanup times would be more adequately determined during the treatability testing. It is anticipated that implementation of this remedy would take approximately one year.

The boundary containment system, groundwater monitoring, institutional controls and source characterization/remediation actions as presented in the previous boundary containment alternatives are included in this alternative. Continued operation of the boundary containment system would be required to maintain VOC plume capture.

The cost of Alternative 4 is $2,240,200. The cost of Alternative 4 is a direct result of the reduced cost incurred by reducing or eliminating POTW discharge of extracted groundwater (assuming treatment for metals is not required).

Site I Shallow Groundwater

Site I shallow groundwater is perched and discontinuous across the site. Groundwater is contaminated primarily by VOCs. A map showing the estimated configuration and concentration levels of trichloroethene (TCE) in groundwater at Site I is presented as Figure 19. Table 11 summarizes the alternative costs developed for Site I shallow groundwater. Detailed cost estimates are provided in Appendix D.

Alternative 1: No Action

The No Action alternative reflects the present condition at Site I and does not consider any action to remediate the site. A 30 year groundwater monitoring program utilizing existing wells would be conducted under the No Action alternative. The monitoring program would be consistent with the requirements of the annual monitoring plan.

The total estimated present worth cost of the No Action alternative is $142,000. The only costs for this alternative are groundwater monitoring costs. No capital expenditures are required.

Alternative 2: Extraction with POTW Discharge

The Extraction with POTW Discharge alternative consists of pumping contaminated Unit 1 groundwater to the sanitary sewer. An existing monitoring well already in place outside the outer west wall of Building 502 would be converted to an extraction well. A pump would be installed in that well and groundwater would be pumped from the well through a discharge pipe into a sanitary sewer manhole approximately 80-feet south of the extraction well.

The extraction well would be pumped at an estimated rate of 2 gpm and the pump would run intermittently. The groundwater would discharge to the TCAAP sanitary sewer system which empties into the Metropolitan Council Environmental Service's (MCES) sanitary sewer system. The extracted groundwater would eventually discharge to the POTW. Additional characterization of shallow soil and groundwater would also be conducted.

A 30-year groundwater monitoring program utilizing existing wells would be conducted under Alternative 2. It is anticipated this remedy would be operational for 30 years. The discharge to the POTW would be sampled in accordance with MCES requirements. The total estimated present worth cost of Alternative 2 is $393,000.

Alternative 3: Extraction with Air Stripping

The Extraction with Air Stripping alternative utilizes the existing air stripping towers next to Building 960 (located west of Building 502). Unit 1 groundwater would be pumped from the in-place extraction well on the west edge of Building 502 to the air stripping towers. A sequestering agent would be added to the groundwater prior to the air stripping towers in order to keep iron in the groundwater from precipitating in the air stripping towers.

The treated groundwater would then be discharged to the storm sewer which eventually flows to Round Lake. The treatment system would only operate during months when the discharge would not freeze in the storm sewer system.

A 30-year groundwater monitoring program would be conducted under Alternative 3. The treatment system would also be monitored to evaluate the efficiency of the air stripping towers and monitor discharge reporting requirements.

It is anticipated this remedy would be operational for 30 years. The total estimated present worth cost of Alternative 3 is $775,000.

Alternative 4: Air Sparging

The goal of Alternative 4 is in situ remediation of the Unit 1 aquifer through air sparging. Both horizontal and vertical air sparging wells are evaluated for this alternative because of the ongoing manufacturing operations in Building 502. Horizontal wells would be installed from the side of Building 502.

Soil vapor extraction wells would be installed to collect the VOCs driven out of the groundwater into the vadose zone. Collected vapors may require off-gas treatment before being vented to the atmosphere. Groundwater and off-gas monitoring would be conducted to ensure remediation of the aquifer. A groundwater monitoring program would be conducted until the shallow aquifer achieves the RAOs. It is anticipated this remedy would be operational for 30 years.

Cost estimates for both vertical sparging wells and for horizontal sparging wells are provided for Alternative 4. The total estimated present worth cost is $482,000 for vertical sparging wells and $1,418,000 for horizontal sparging wells.

Site K Shallow Groundwater

Site K shallow groundwater is contaminated primarily by VOCs. A map showing the estimated configuration and concentration levels of TCE in groundwater at Site K is presented as Figure

20. Table 12 summarizes the costs for each of the alternatives developed for Site K shallow groundwater. Detailed cost estimates are provided in Appendix D.

.**Alternative 1: No Action**

The No Action alternative does not consider any action to remediate Site K. The groundwater treatment system installed as an interim remedial action (IRA) would be shut off and no effort would be made to contain or treat the groundwater. A 30-year groundwater monitoring program utilizing existing wells would be conducted under the No Action alternative.

The cost estimate for the No Action alternative is $163,000. The only costs for this alternative are groundwater monitoring costs.

Alternative 2: Containment/Extraction with Air Stripping

Alternative 2 consists of the groundwater recovery and treatment system implemented through the IRA. Currently, the groundwater is pumped from the interceptor trench to air stripping towers where the VOCs are removed. The groundwater is then discharged to Rice Creek.

In Alternative 2, the air stripping towers are replaced by a shallow tray air stripping system. Shallow tray strippers are easier to maintain than towers. The iron and bacteria deposits that would build up on the trays can be removed much easier and at a lower cost than they are removed from the current tower packing.

A 30-year groundwater monitoring program would be conducted as part of Alternative 2. In addition to the existing wells, some sentinel wells would be installed at Site K in the bottom of the Unit 1 aquifer and the top of the Unit 3 aquifer. These wells would be used to monitor for potential migration of VOCs through the Unit 2 aquitard. Additional characterization of the unsaturated Unit 1 soil would be conducted during remedial design.

In addition, the treatment system would be monitored to evaluate the efficiency of the air stripper and to monitor discharge reporting requirements. This program consists of collecting samples from the air stripper influent and effluent.

It is anticipated this remedy would be operational for 30 years. The total estimated present worth cost of Alternative 2 is $734,000.

Alternative 3: Containment/Extraction with Air Sparging

The goal of Alternative 3 is in situ remediation of the Unit 1 aquifer through air sparging. Both horizontal and vertical air sparging wells are evaluated for Alternative 3 because of the ongoing manufacturing operations in Building 103. Horizontal wells would be installed from the side of Building 103.

Soil vapor extraction wells would be installed to collect the VOCs driven out of the groundwater into the vadose zone. Collected vapors may require off gas treatment before being vented to the atmosphere. Groundwater and vapor monitoring will be conducted to measure remediation progress of the aquifer.

In addition, the IRA, consisting of the interceptor/recovery trench and air stripping tower, would continue to operate until the Unit 1 aquifer has been remediated to ARARs. A groundwater monitoring program would be conducted until the Unit 1 aquifer is remediated to ARARs. It is anticipated this remedy would be operational for 30 years.

Cost estimates for both vertical sparging wells and horizontal sparging wells are provided for Alternative 3. The total estimated present worth cost is $2,237,000 for vertical sparging wells and $3,559,000 for horizontal sparging wells.

Deep Groundwater

VOC contamination of deep groundwater is primarily attributed to source area Sites D, G and I. Maps showing the estimated distribution of TCE in Units 3 and 4 are presented as Figures 21 through 23. Table 13 summarizes the cost estimates for the deep groundwater alternatives. Detailed cost estimates are provided in Appendix D.

Alternative 1: No Action

The No Action alternative serves as a baseline for comparison with the other alternatives. The no action alternative assumes that the TGRS IRA is not operational. This alternative also considers that no institutional controls on groundwater usage have been initiated. Groundwater monitoring would continue under the No Action alternative, but no efforts would be made to remediate the groundwater VOC plume.

Groundwater modeling indicates that relative to current containment conditions, an increased volume of contaminants migrate downward from the Unit 3 aquifer into the Jordan aquifer if the TGRS were to stop pumping. In addition, modeling results indicate that significant concentrations of plume contaminants bypass the down-gradient OU-1 containment system in the Jordan aquifer. Containment is further impacted by the increased volume of flow that occurs as a result of eliminating extraction at the TGRS.

Groundwater monitoring of plume migration patterns and remedy performance is included throughout the duration of the No Action alternative. Annual reviews of performance data would be conducted, and the adequacy of the overall remedy would be reviewed every 5 years.

The No Action alternative has a 30 year present worth of $2,315,577.

Alternative 2: No Further Action

Alternative 2 involves the continued use of the TGRS as a pump and treat system (Figure 24). In this alternative, the TGRS continues to operate in a manner similar to existing operations.

Treatment and disposal of TGRS effluent would continue as current operations dictate, using air stripping to remove VOCs and discharging to the gravel pit as the principal disposal option. Additional treatment using carbon adsorption would continue for that part of the extracted water that is to be used for potable supply to TCAAP residents.

Alternative 2 was simulated by computer modeling. The results of modeling indicate that approximately 75 to 80 percent of the modeled plume mass within OU-2 is removed after 100 years of model simulation, with 7 to 12 percent escaping the site boundaries and roughly 13 percent remaining inside the fenceline.

Similar to the institutional controls addressed in the OU-1 and OU-3 remedies for eliminating potential points of exposure to contaminated groundwater by abandoning wells, providing alternate water supplies, and establishing drilling and well use advisories, these types of institutional controls would be included with Alternative 2. Groundwater monitoring in accordance with a performance monitoring plan would be included to monitor the migration of the groundwater contaminants. It is anticipated this remedy would be operational for more than 30 years.

The costs associated with Alternative 2 were developed based on the operation and maintenance of the TGRS pump and treat system, and monitoring of the remedy performance. The 30-year present worth for Alternative 2 is $9,441,000.

Alternative 3: Source Containment

Alternative 3 involves the use of existing TGRS extraction wells as a pump and treat system to hydraulically contain and extract contaminants from the deep groundwater plume source area. Extracted groundwater would be treated using air stripping to remove VOCs that exceed ARARs. Treated water would be discharged to the on-site gravel pit. Institutional controls would be implemented utilizing special well construction areas (to manage new well installations), provisions for alternate water supplies (to prevent exposure to contaminated groundwater), and the sealing of wells in the impacted aquifers (to eliminate pathways for exposure).

In addition, Alternative 3 would include the review and evaluation of new and emerging technologies that have the potential to cost-effectively accelerate the timeframe to achieve aquifer restoration. Those technologies which have been determined to have the ability to cost-effectively accelerate cleanup shall be further evaluated as potential enhancements to the pump and treat system.

Alternative 3 is consistent with the phased approach to plume management and remediation in that it recognizes and acknowledges the importance of source control through hydraulic containment and the reduction of contaminant levels through mass removal in light of the current limitations and constraints to source area (saturated zone) remediation in the presence of DNAPLs. This alternative provides a phased approach in the consideration of future developments in plume and aquifer restoration technologies that may cost-effectively reduce the timeframe for restoration.

Implementation of Alternative 3 would expedite removal of dissolved contaminants from the source area and provide hydraulic containment of the contaminant plume. Source containment pumping would result in a shift of the existing line of hydraulic capture established by the boundary wells of the TGRS, as shown in Figure 25. Initially, this alternative would involve the use of the TGRS as it currently operates. During the remedial design stage, groundwater modeling would be utilized to evaluate, design, and support implementation of specific changes to the TGRS. For example, this may include modifying the number and location of extraction wells used and the pumping rates maintained in the extraction wells to focus the hydraulic capture zone on the deep groundwater plume source area. Capture of the source area to the 5 ug/L TCE concentration contour would be maintained and occur upgradient of the TCAAP fenceline. Capture of the highest contaminant concentrations would continue to occur at or near the TCAAP south fenceline.

Shifting the line of capture away from the fenceline will result in some contaminated groundwater in the fringes of the OU-2 plume to move downgradient of the line of capture. The contaminated groundwater that would no longer be contained within OU-2 would be expected to have no measurable effect on downgradient contaminant concentrations nor impact local wells that have already been affected by the plume. Moreover, shifting capture back away from the fenceline will allow considerably more operational flexibility to effectively control the source area and maximize mass removal within the current treatment system capacity.

Groundwater modeling scenarios were evaluated as part of the feasibility process to assess potential variations in mass removal rates over time with several different pumping schemes using both existing TGRS wells and potential new source control wells. All scenarios evaluated had mass removal rates which approach asymptotic levels after 30 to 40 years of system operation. The best of these scenarios projected approximately 82 to 89 percent of the modeled plume mass would be removed within 100 years (Figure 26). In comparison, the existing TGRS is projected to remove between 75 and 80 percent of the plume mass in the same time period. All scenarios generally control the source area contaminants through hydraulic containment. Variations in mass removal rates are a function of either increasing or decreasing individual well pumping rates dependent upon local plume concentration levels, or by adding additional wells in high concentration areas. Modifying the pumping rates in individual wells may require changes in existing pumping hardware and/or well design, but the maximum treatment system throughput of 2,700 gpm will not be exceeded.

Treatment and discharge of TGRS effluent would continue using air stripping to remove VOCs and discharging the treated water to the gravel pit to conserve the groundwater resource and enhance groundwater recharge and flushing of the contaminated aquifer. A better use of this treated water will continue to be explored by the Army. Additional treatment using carbon adsorption would continue for that part of the extracted water that is to be used for the potable supply by TCAAP.

Alternative 3 would provide the capability for the Army and the regulatory agencies, in coordination with the RAB and community, to engage in reviews of promising new or innovative technologies. This phased approach to identifying and evaluating technologies could lead to faster, more cost effective cleanup and potentially accelerate the timeframe to achieve RAOs. As an example, Army is currently participating in the evaluation of natural attenuation as a potentially promising technology.

Institutional controls for eliminating potential points of exposure to contaminated groundwater by abandoning wells, providing alternate water supplies, and establishing drilling and well use advisories are included with Alternative 3. Groundwater monitoring in accordance with a performance monitoring plan would be included to track the migration and removal of the groundwater contaminants and assess the performance of the remedy. Annual performance monitoring reports would be prepared documenting the results of the monitoring program and comparing the remedy performance with the RAOs established for deep groundwater. In addition, the annual report would discuss and summarize evaluations of new or emerging technologies.

The costs associated with Alternative 3 were developed based on the operation and maintenance of the existing TGRS pump and treat system, monitoring of the remedy performance, and evaluations of new and emerging technologies that could potentially expedite site remediation. No additional wells (and associated capital costs) were included with this cost estimate. More detailed computer modeling and system evaluation are necessary during remedial design before such modifications can be addressed. The requirements and additional costs for installing new wells and/or abandoning existing wells are not included and will be developed, if necessary. It is anticipated this remedy would be operational for more than 30 years. The 30-year present worth for Alternative 3 is $ 9,494,900.

Alternative 4: DNAPL Characterization/Remediation, Plume Containment, and Aquifer Restoration

For Alternative 4, the TGRS extraction, treatment, and disposal system would be operated with an emphasis on hydraulic containment. This emphasis on containment would be required to insure that the impacts or effects of any subsequent *in situ* remediation efforts are confined to OU-2. Institutional controls such as special area well advisories, alternate water supplies, and well abandonments would also be included on an as-needed basis.

In order for aquifer restoration to take place, DNAPLs must be located and removed from the subsurface environment. Objectives of a DNAPL characterization program would include determination of mobile and residual DNAPL distributions, DNAPL volumes, DNAPL composition and fluid properties, and stratigraphic controls on DNAPL movement (Cohen and Mercer 1993). Unfortunately, the subsurface DNAPL distribution may defy definition, particularly at a site like TCAAP that has heterogeneous strata, a relatively large source area, fractured bedrock, multiple DNAPL release locations, and unknown DNAPL mixtures (Figure 27).

For Alternative 4, a characterization program would be approached in phases. The characterization data would be utilized to define the nature and extent of subsurface DNAPLs in both the vadose and saturated zones, and ultimately be used to evaluate the design and operation of DNAPL remedial measures. It cannot be concluded that this effort would be successful in identifying and characterizing all subsurface DNAPL occurrences at the site, given the complex geologic conditions and potential widespread distribution of DNAPL contaminants.

Technologies for DNAPL recovery are generally unproven under field-scale conditions; and there are no methods available, or series of methods, which have been demonstrated to completely remove DNAPL from the subsurface (Cohen and Mercer 1993). Furthermore, DNAPL recovery operations are ongoing at relatively few sites. There are, however, many DNAPL recovery and treatment technologies being developed which have undergone limited laboratory and pilot-scale field testing (Cohen and Mercer 1993). The physical and chemical characteristics of the media and DNAPL need to be determined to assess their feasibility.

Similar to the necessity to implement the DNAPL characterization efforts in a phased approach, DNAPL remediation would also require a phased approach of removal actions for free or residual-phase DNAPL followed by remedial actions for treatment of the dissolved-phase contaminant plume in groundwater. Without a removal action for addressing residual DNAPL, any attempts to remediate the dissolved-phase groundwater plume below ARARs would fail as contaminant sources would continue to release dissolved contaminants within treatment areas. A successful cleanup would likely require a combination of technologies ranging from pump and treat to innovative DNAPL recovery and treatment technologies. The lack of specific data on the exact location or locations and chemical characteristics of residual and free phase DNAPL and the physical parameters of the media in which it resides prevents the development of a detailed approach to remediate these contaminants.

Technologies for dissolved-phase contaminant treatment have been successfully demonstrated at sites such as the Savannah River Site (USDOE 1995). While these experiences are limited in application, the Savannah River Integrated Demonstration Project characterization and pilot-scale testing efforts were extensive and clearly showed the cost effectiveness of bioremediation relative to groundwater pumping and treatment for the test area.

Consideration of a methane biostimulation system similar to the demonstration project at the Savannah River Site for OU-2 deep groundwater would have to account for the large expanse of the groundwater VOC plume as well as the difficulty of successfully removing DNAPLs. To successfully bioremediate the entire Units 3 and 4 VOC plume utilizing an air sparge system to introduce substrate and nutrients would have to rely on the existing groundwater flow to spread oxygenated water throughout the plume. A similar approach may utilize a series of injection wells to recirculate groundwater augmented with substrates and nutrients throughout the OU-2 plume. In either case, the boundary containment system would be operated to capture groundwater to insure removal of unutilized methane and nutrients.

Because of the uncertainties associated with DNAPL characterization capabilities, anticipated difficulties with DNAPL removal, and biotreatment feasibility, an accurate cost estimate for Alternative 4 is difficult to develop. Instead, a range of rough order of magnitude (ROM) costs have been applied to the activities associated with Alternative 4.

DNAPL characterization would potentially include surface geophysical and cone penetrometer surveys, drilling and sampling, well installation, analytical testing, and surfactant/solubilization testing at a ROM cost in the range of $0.5 to $2.5 million. Without a clear indication of the results of the DNAPL characterization efforts, and the difficulties associated with DNAPL removal, particularly in a complex geologic environment like that at TCAAP with the potential for multiple DNAPL targets that require remediation, a ROM cost for this phase of site restoration may range from $5 to $15 million. This ROM estimate assumes that multiple DNAPL occurrences exist and that each would require a uniquely designed remedial approach. Again, complete success in this effort is not assumed in this estimate.

Finally, remediation of the dissolved phase contaminant plume would include on-going operation of the TGRS (30 year present worth in the order of $9 million) in addition to the probable application of bioremediation technologies and large scale conveyance systems. A ROM cost for this activity may range from at least $10 million to as much as $20 million over the duration of the project to attain groundwater cleanup goals. It is anticipated this remedy would be operational for more than 30 years.

While simplistic, these estimates are not without merit when compared to other sites that have tried to address similar contaminant issues. These ROM estimates are considered realistic when taking into account the vertical and horizontal extent of the plume beneath TCAAP, the complex geologic conditions present at the site, and the probable wide distribution of residual DNAPLs in the subsurface.

This estimate does not imply any level of success or failure in attaining the goal of aquifer restoration. It is, however, provided to establish a relative overall cost for this remedial approach for comparison with the other alternatives. Assuming the addition of the ROM estimates to the baseline cost of operating, maintaining, and monitoring the TGRS, the 30-year present worth of Alternative 4 could range from $15,000,000 to $40,000,000.

H. Summary of the Comparative Analysis of Alternatives

This section discusses how the alternatives retained for detailed analysis compare to one another when measured against the EPA's nine evaluation criteria for addressing Superfund sites. Each of the nine criteria are briefly described before the alternatives are evaluated against them.

1) <u>Overall Protection of Human Health and the Environment</u>: This analysis provides a summary evaluation of how the alternative reduces the risk from potential exposure pathways under the industrial land use scenario through treatment, engineering, and/or

institutional controls. An examination of any short-term or cross-media impacts is also included.

2) Compliance with Applicable of Relevant and Appropriate Requirements (ARARs): The ability of each alternative to meet applicable or relevant and appropriate federal and state requirements, or the need to justify a waiver is noted.

3) Long-Term Effectiveness and Permanence: Long-term effectiveness and permanence are evaluated with respect to the magnitude of residual risk under an industrial land use scenario and the adequacy and reliability of controls used to manage remaining waste over the long term.

4) Reduction of Mobility, Toxicity, or Volume through Treatment: The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies included in the remedial alternative.

5) Short-Term Effectiveness: The assessment against this criterion examines how effectively the alternatives protect human health and the environment during construction and implementation of a remedy until the remedial action objectives have been met.

6) Implementability: The analysis of implementability evaluates the technical and administrative feasibility of the alternative and the availability of the goods and services needed to implement it.

7) Cost: The cost estimates for the alternatives are preliminary and approximate (Table 14). The assessment against this criterion evaluates the capital, indirect, and operation and maintenance costs of each alternative on a present worth basis. The present worth costs have generally been determined for a project life of 30 years (unless otherwise noted) at a 7% discount rate.

8 & 9) State and Community Acceptance: These criteria reflect the state's and community's apparent preferences among or concerns about each alternative.

Shallow Soil Sites A, C, E, H, 129-3 and 129-5

1) Overall Protection of Human Health and the Environment

Alternative 4, the selected remedy, is effective in preventing human exposure to contaminated soils that could result in unacceptable risks to human health by removing contaminated soils from the site, stabilizing them to fixate contaminants within the soil matrix, and disposing of the stabilized soils in an engineered and permitted landfill. Institutional controls also insure protectiveness by restricting access and use of the sites to those industrial activities consistent with facility operations. Alternative 3 is equally protective of human health and the environment by removing contaminants from site soils to levels below site-specific cleanup goals. Alternative

2 is effective in preventing human exposure to contaminated soils that could result in unacceptable risks to human health by fixating and capping contaminants in place and thereby removing any exposure pathways, but only partially protective of the environment as contaminants may still leach to groundwater at concentrations above acceptable standards and levels if the fixation process is not inclusive of all site contaminants. Alternative 1 is not effective in preventing human exposure to contaminated soils that could result in unacceptable risks to human health nor does it prevent the leaching of contaminants to groundwater.

2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternatives 3 and 4 effectively eliminate contaminants from any potential routes of exposure addressed by TBC guidance through treatment (Alternative 3) or removal (Alternative 4). Location and action-specific ARARs are met through proper management and disposal of materials encountered and/or generated by site activities, avoidance and minimization of impacts to local wetlands and/or sensitive habitats, and adherence to pertinent construction, operation and maintenance requirements for activities at each site. Alternative 2 is considered partially compliant with ARARs and TBC guidance because of the potential difficulties in fixating all site contaminants in place and thereby eliminating the potential for leaching of contaminants to groundwater at concentrations in excess of allowable limits. The no-action alternative does not comply with ARARs or TBC guidance values. There are numerous contaminants of concern in the shallow soils at each of the sites at concentrations that exceed the TBC guidance values which would be left unaddressed in this alternative.

3) Long-Term Effectiveness and Permanence

Alternative 3 and 4 are both considered very effective and permanent because either the contaminants above industrial cleanup goals are permanently removed from the soil (Alternative 3) through treatment, or the contaminated soils are permanently removed from the site (Alternative 4). While contaminated soils in Alternative 2 are stabilized to reduce leachability and capped to eliminate surface exposure, this alternative is only considered moderately effective in reducing long term site and residual risks. Although fixation offers a high degree of permanence, in and of itself it is not considered a permanent remedy. The no-action alternative does not provide any long-term protectiveness or permanence since the soil contaminants are not remediated below health risk-based or leaching-based cleanup goals.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment

The Soil Washing/Soil Leaching alternative (Alternative 3) provides the most effective reduction of contaminant toxicity, mobility and volume through treatment and recycling of toxic metals amongst the four alternatives. Alternatives 2 and 4 provide for a reduction of contaminant mobility through stabilization but also result in an increased volume of material to be managed and do little to affect contaminant toxicity. Alternative 1 provides no reduction as no treatment is involved with this remedy.

5) **Short-Term Effectiveness**

Alternative 4 includes more extensive construction activities than the other three alternatives, however the relatively short duration of the remedial action makes this alternative more effective in the short term. Alternative 3 provides a greater degree of short term effectiveness than Alternative 2 because of the reduced amount of overall construction activity associated with this alternative and the relative duration for remedy implementation and attainment of site cleanup goals.

6) **Implementability**

Alternative 4 is considered the most technically and administratively feasible alternative of the four. Sufficient vendors and equipment are available to execute this alternative and reliably perform the activities specific to this remedy. Sufficient space has been determined to be available in local landfills for the disposal of the volume of material anticipated to be removed from the shallow soil sites. Based on the past performance of soil washing/soil leaching at remediating metals contaminated soils at TCAAP, the application of this technology in Alternative 3 is considered technically and administratively feasible for the metals contaminated soils at Sites A, E, H, 129-3 and 129-5. The method of characterization through field screening and complete excavation would insure that all contaminated soils are removed for treatment and/or disposal. Although the soil washing process is a fairly standard and a readily available technology, the soil leaching vendors are relatively few and at different stages in process development and large scale application. The implementability of Alternative 2 is dependent on the ability to characterize and define the full extent of contaminated soils within a given site so that the technologies employed encapsulate and immobilize all of the contaminants that contribute to the risk to human health and the environment. Characterization efforts without complete excavation may not be capable of identifying the full extent of contamination. For the sites with relatively small volumes of contaminated soils, Alternative 2 may be technically feasible to construct and reliably operate and maintain. For those sites that are larger and with perhaps more complex disposal histories, the reliability of this alternative may be diminished. There is nothing new to implement with the no-action alternative.

7) **Cost**

The overall cleanup and risk reduction afforded by Alternative 4 and its relative cost compared to the other remedial alternatives make it the most cost-effective alternative. The present worth costs associated with Alternative 4 include construction costs for excavation and stabilization activities, characterization and disposal costs for site debris, disposal costs for stabilized soils, and O&M costs for remedy effectiveness monitoring. In addition, for those sites with dumps, the cost estimates include a range of costs for dump material disposal as either nonhazardous debris or hazardous waste. Costs for this alternative are typically lower than Alternatives 2 and 3 but not as low as Alternative 1.

8 & 9) State and Community Acceptance

The state and the community have endorsed Alternative 4 as the selected remedy for the shallow soil sites.

Deep Soil Sites D and G

1) Overall Protection of Human Health and the Environment

Alternative 3, the selected remedy, is the most effective alternative in preventing human exposure to contaminants. Sites D and G deep soil contaminants are removed resulting in less degradation of a drinking water aquifer. Maintenance of the existing site caps eliminates exposure to soil contaminants. Existing institutional controls and groundwater monitoring also provide protection to human exposure from deep groundwater contaminants. Alternative 2 is marginally effective in preventing human exposure to contaminants by maintaining the existing site caps. However, Site D and G soil contaminants below the radius of influence of the shallow SVE systems may continue to migrate to deep groundwater resulting in further degradation of a drinking water aquifer. The no-action alternative, in itself, is not effective in preventing human exposure to contaminants. Site D and G soil contaminants may continue to migrate to deep groundwater resulting in further degradation of the aquifer. However, existing institutional controls and groundwater monitoring already provide protection to human exposure from deep groundwater contaminants.

2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternative 3 provides the most complete compliance with ARARs and TBC guidance through soil treatment and employing proper management and monitoring efforts than the other two alternatives. There are no applicable chemical-specific ARARs for deep soils. Location and action-specific ARARs are met by proper management and disposal of materials encountered (e.g. ordnance) and/or generated (e.g. fugitive dust) by site activities; monitoring VOCs in SVE system air discharges to insure compliance with permitted emissions; and fulfilling well construction, groundwater monitoring and well abandonment requirements. Alternative 3 does comply with TBC guidance for protecting groundwater from leaching of contaminants by removing contaminants to levels below leaching-based goals. The other two alternatives do not meet TBC guidance for protecting groundwater from leaching of contaminants.

3) Long-Term Effectiveness and Permanence

Alternative 3 provides the best approach to long-term effectiveness and permanence as the deep soil contaminants are remediated below TBC guidance for contaminant leaching. Existing facility institutional controls are effective in restricting site access, and exposure to site contaminants is restricted through existing soil caps. Alternative 2 does not provide any long-term effectiveness or permanence since the deep soil contaminants are not remediated below TBC guidance for contaminant leaching. The no-action alternative does not provide any long-term effectiveness or permanence since the deep soil contaminants are not remediated below TBC guidance for contaminant leaching. Existing facility institutional controls are effective in restricting site access, and exposure to site contaminants is restricted through existing soil caps. However, cap disrepair over time may diminish this exposure restriction.

4) **Reduction of Toxicity, Mobility, or Volume Through Treatment**

Alternative 3 provides the greatest reduction in contaminant mobility and volume between the three alternatives through operation of the proposed deep soil SVE system. Contaminant mobility is also controlled through reduced infiltration due to the maintained soil caps. Alternative 2 provides minimal reduction in contaminant mobility and volume in soils through continued operation of the existing shallow SVE system. Contaminant mobility is partially controlled through reduced infiltration due to the maintained soil caps at each site. No reduction in contaminant mobility, toxicity or volume occurs as there is no treatment of soils in the no-action alternative.

5) **Short-Term Effectiveness**

While Alternative 3 includes more extensive construction activities than Alternatives 1 and 2, it provides for eventual cleanup of the site in a time period much less than the other two alternatives. Alternative 2 provides a level of short-term effectiveness intermediate between Alternatives 1 and 3. While Alternative 1 involves no additional activities to implement this alternative except the continuation of groundwater monitoring, it does not meet site cleanup goals nor reduce site and residual risks.

6) **Implementability**

Alternative 3 is considered readily implementable. The enhancements to SVE (hot air stripping, steam enhanced extraction, radio frequency heating and bioventing) would be based on specific site conditions as appropriate. Based on the performance of SVE systems at the sites and the cleanup potential for this technology, Alternative 3 is considered more implementable than the other two alternatives. Alternative 2 requires no further implementation as both SVE systems are in place and operating, although future site cleanup potential is considered minimal. There is nothing to implement with the no-action alternative.

7) **Cost**

Present worth costs for Alternative 3 - Expanding the SVE system vertically have been developed for both sites. For Site D, the cost is $670,800; for G the cost is $727,200. These cost estimates do not include any potential enhancements to the expanded SVE system such as steam injection or hot air stripping. While these costs are higher than the other two alternatives (for Site D, the present worth cost of Alternative 2 is $353,700; for G it is $392,300; for Alternative 1, the estimated 30-year present worth cost for continued groundwater monitoring is approximately $166,200 for Site D and $229,300 for Site G), the anticipated performance of the expanded systems and potential for meeting site cleanup goals make this alternative more cost-effective than Alternatives 1 and 2.

8 & 9) State and Community Acceptance

The state and the community have endorsed Alternative 3 as the recommended remedy for both Sites D and G.

Site A Shallow Groundwater

1) Overall Protection of Human Health and the Environment

Alternatives 2 (the selected remedy), 3 and 4 are protective of human health and the environment by removing VOC contaminants from the groundwater, restricting plume migration off site, and providing for institutional controls that prevent exposure to contaminated groundwater. Residents with private wells with drinking water advisories or contaminant concentrations that exceed allowable limits located within the impacted zone will be given the opportunity to have their wells abandoned by the Army and provided with an alternative water supply as appropriate. In addition, a Special Well Construction Zone will be designated that would regulate installation of wells in the impacted zone. These alternatives also include containment of the contaminant plume on site and removal of contaminants through extraction (and treatment for Alternatives 3 and 4). Therefore, these alternatives prevent further spreading of contaminated groundwater into portions of the aquifer that are less contaminated. Alternatives 2, 3 and 4 all project aquifer restoration within ten years of remedy implementation. No real differences exist in the protectiveness of these three alternatives. The no-action alternative is not effective in preventing human exposure to contaminated groundwater that could result in unacceptable risk to human health. This alternative would not contain the contaminant plume on site, nor would it invoke any institutional controls to restrict well installation or well use within the plume down gradient and off site of TCAAP. This would allow residents to extract and use groundwater with contaminant levels in excess of drinking water standards and health risk levels.

2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternatives 2, 3, and 4 do comply with ARARs and TBC guidance values through removal and subsequent treatment of groundwater to levels below acceptable standards. Location and action-specific ARARs are also met with each of these alternatives. It is estimated that contaminant concentrations will be reduced in the shallow aquifer to acceptable levels within ten years of remedy implementation for each of these alternatives. Again, no real difference exists between these three alternatives relative to meeting ARARs and TBC guidance. The no-action alternative does not comply with ARARs or TBC guidance values. There are currently eight contaminants of concern in the groundwater at Site A at concentrations above MCLs and HRLs which would be left unaddressed in this alternative.

3) Long-Term Effectiveness and Permanence

Alternatives 2, 3 and 4 are considered effective and permanent due to the anticipated or proven removal of contaminants from the groundwater aquifer to levels below ARARs. In addition, institutional controls that provide alternate water supplies and abandon existing wells are considered permanent. Since Alternative 2 is currently operational and reducing site risks, it is considered to have more long-term effectiveness and permanence than the other two alternatives that employ technologies that have yet to be proven effective at the site. The no-action alternative does not provide long-term effectiveness and permanence since the plume would not be contained under this alternative and private wells may be located in the plume pathway. VOC contaminants would be allowed to migrate off site, and the number of private wells that could be impacted by the advancing plume could potentially increase.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 2 reduces contaminant mobility and volume by removing contaminants from the aquifer through pumping. Contaminant toxicity is reduced through treatment at the POTW. Aquifer restoration with this alternative is projected within ten years of remedy implementation. Since this alternative is operating successfully at the site, it is considered more effective in contaminant reduction than the two as-yet unproven alternatives. Alternative 3 reduces contaminant mobility and volume by removing contaminants from the aquifer through pumping and stripping dissolved contaminants from groundwater through sparging. Contaminant volume and toxicity may be reduced if air treatment technologies are employed to treat SVE discharge following sparging. This alternative may be effective in reducing contaminant volume and mobility if air sparging is found to be an appropriate technology for removing contaminants from groundwater under the existing site conditions. Aquifer restoration with this alternative is projected within ten years of remedy implementation. Alternative 4 reduces contaminant toxicity, mobility and volume by removing contaminants from the aquifer through pumping, treating the extracted groundwater by air stripping, and potentially through bioremediation of in-place contaminants with the infiltration water. However, the applicability of bioremediation at the site is as yet unproven. The no-action alternative does not reduce contaminant toxicity, mobility or volume as there is not treatment associated with this remedy.

5) Short-Term Effectiveness

Alternative 2 involves the continued use of the existing boundary containment and groundwater monitoring system established at the site. In addition, source characterization and remediation will occur as part of this alternative. Alternative 2 provides a level of short-term effectiveness that is considered greater than Alternatives 3 and 4, which employ technologies that have not yet been proven to be effective at the site. While the only activity included as part of the no-action alternative is continuation of groundwater monitoring, this remedy does not attain site cleanup goals in a timely manner and therefore is considered less effective than alternatives 2, 3 and 4.

6) Implementability

Alternative 2 is considered the most implementable of the four alternatives. The boundary containment system is constructed and permitted. The only operational concerns are iron bacteria fouling of wells and pipelines that reduce system flow rates, requiring increased system maintenance. Characterizing and remediating the groundwater VOC plume source will require participation and oversight by the regulatory agencies and an evaluation of treatment options once the source of contamination has been defined. Air sparging (AS) applications, as called for in Alternative 3, have been demonstrated at many sites. An AS/SVE system would require pilot testing to determine system feasibility and effectiveness within the conditions present at Site A. The boundary containment system is constructed and permitted. Infiltration applications, as called for in Alternative 4, have been demonstrated at many sites. An infiltration system would require pilot testing to determine system feasibility and effectiveness within the conditions present at Site A. Alternative 4 is considered the most difficult to implement amongst the four alternatives. There is nothing new to implement with the no-action alternative.

7) Cost

Alternative 2 is considered the most cost-effective of the four alternatives because of the relative success of the system over the first two years of implementation and the proven capabilities of the technology. Alternative 2 present worth costs include additional O&M costs for the existing boundary containment system for a period of ten years. Costs for discharge of the extracted groundwater to the POTW at a rate of approximately $50,000 per year are included in this estimate. This cost also reflects the estimated additional capital expenditures for source delineation and remediation. The cost of Alternative 2 is $2,294,100..

Alternative 3 present worth costs include additional O&M costs for the existing boundary containment system for a period of ten years, and the installation and O&M of an air sparging/soil vapor extraction system that encompasses the entire area of the on-site portion of the contaminant plume. Costs for discharge of the extracted groundwater to the POTW at a rate of approximately $50,000 per year are included in this estimate. This cost also reflects the estimated additional capital expenditures for source delineation and remediation efforts. The cost of Alternative 3 is $3,076,100. This estimate assumes a ten year lifespan for the remedy.

Alternative 4 present worth costs include additional O&M costs for the existing boundary containment system for a period of ten years, and the installation and O&M of a treatment and infiltration system. This cost also reflects the estimated additional capital expenditures for source delineation and remediation efforts. The cost of Alternative 4 is $2,240,200. The cost of Alternative 4 is a direct result of the reduced cost incurred by reducing or eliminating POTW discharge of extracted groundwater (assuming treatment for metals is not required).

There are no new costs associated with the no-action alternative except for the continuation of groundwater monitoring. The no-action alternative present worth cost is $525,000.

8 & 9) State and Community Acceptance

The state and the community have endorsed Alternative 2 as the recommended remedy for the site.

Site I Shallow Groundwater

1) Overall Protection of Human Health and the Environment

Alternatives 2 (the selected remedy), 3, and 4 are equally protective of human health and the environment by removing VOC contaminants from the groundwater and restricting the flow of contaminated groundwater down to the Unit 3 aquifer. Alternatives 2 and 3 include extraction of contaminated groundwater and subsequent treatment to remove VOCs from the extracted groundwater. Alternative 4 includes in situ treatment to remove VOCs from the groundwater. Therefore these alternatives prevent further spreading of contaminated groundwater into the deeper aquifer. Human health and the environment are not significantly threatened under the No Action alternative. The shallow groundwater at Site I is contained in a depression in the surface of the Unit 2 and does not flow horizontally and, therefore, does not flow off site but trickles down to the more highly contaminated Unit 3 groundwater. As long as the TGRS is operational there is no risk of exposure to Site I shallow groundwater contaminants.

2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternatives 2, 3, and 4 equally comply with chemical specific ARARs and TBC guidance values through removal and subsequent treatment of groundwater to levels below acceptable standards (Alternatives 2 and 3) or through in-situ removal of contaminants from the groundwater (Alternative 4). Location specific and action specific ARARs are also met by these alternatives through proper implementation and operation of the systems. Alternative 1 does not comply with chemical specific ARARs or TBC guidance values. There are currently three contaminants of concern in the groundwater at Site I at concentration above HRLs which would be left unaddressed under Alternative 1. No action does comply with location specific ARARs and there are no action specific ARARs.

3) Long-Term Effectiveness and Permanence

Alternatives 2, 3, and 4 are considered effective and permanent due to the removal of contaminants from the groundwater. In Alternatives 2 and 3 contaminated groundwater would be extracted and then treated. In Alternative 4 contaminants are removed in-situ, however treatment may not be complete to below ARARs due to the heterogeneity of the soils. Alternative 1 is effective as long as the TGRS is operational. The Unit 1 groundwater does not flow horizontally off site and the contaminants in the Unit 1 groundwater would eventually migrate to the already contaminated Unit 3 aquifer which is contained by the TGRS.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 2 and 3 reduce contaminant mobility and volume by removing contaminants from the aquifer through pumping. Contaminant toxicity is reduced through treatment by the POTW (Alternative 2) or by the air stripping towers (Alternative 3). Alternative 4 reduces the volume and toxicity of VOCs in the shallow groundwater through in situ treatment. However treatment may not be complete due to the heterogeneity of the soils. Alternative 1 does not provide any direct reduction in toxicity, mobility, or volume. However, contaminants are eventually reduced in volume through treatment.

5) Short-Term Effectiveness

Alternative 2 involves pumping the contaminated groundwater to the POTW and groundwater monitoring. Minimal risk is associated with these activities. Alternative 2 provides a level of short-term effectiveness between Alternative 1 and Alternatives 3 and 4. Alternatives 3 and 4 emit VOCs into the atmosphere creating some short-term risk to the community and the environment. They also involve additional construction activities over Alternative 2. These two alternatives provide the least short-term effectiveness of the four alternatives. The only activity included as part of Alternative 1 is groundwater monitoring. However it is not anticipated to meet site cleanup goals, and is therefore considered to have minimal short-term effectiveness.

6) Implementability

Alternative 2 is implementable. The extraction well is already in place. A pump would be installed in the extraction well and a pipeline would be constructed to the nearest sanitary sewer connection. An MCES discharge permit would be obtained before beginning pumping. Alternative 2 is considered the most easily implemented of the three alternatives that involve additional construction activities. For Alternative 3, the extraction well is already in place. A pump would be installed in the extraction well and a pipeline would be constructed to existing air stripping towers west of Building 502. This alternative would operate seasonally making it less desirable. This alternative is considered easier to implement than Alternative 4, but more difficult than Alternative 2. Alternative 4 has many implementation concerns including the ongoing manufacturing operations in Building 502, underground utilities under the building, and the potential for iron and bacteria fouling of the sparging wells. In addition, the heterogeneity of the soils make the effectiveness of air sparging questionable. Alternative 4 is considered the most difficult to implement of the four alternatives. The No Action alternative requires nothing new to implement.

7) Cost

Alternative 2 is considered the most cost-effective of the four alternatives. The present worth costs associated with Alternative 2 include capital costs for the construction of the pipeline and installation of the pump as well as O&M costs to run the system for a period of 30 years. The estimated present worth cost of Alternative 2 is $393,000. Alternative 3 costs include capital costs for the construction of the pipeline and installation of the pump as well as O&M costs to run the system for a period of 30 years. The estimated present worth cost of Alternative 3 is $775,000. Alternative 4 costs include capital costs for the construction of an air sparging system as well as O&M costs to run the system for a period of 3 years. Separate cost estimates were developed for vertical and horizontal sparging wells. The estimated present worth cost of Alternative 4 is $482,000 for vertical sparging wells and $1,418,000 for horizontal sparging wells.

There are no new costs associated with the No Action alternative except for the continuation of groundwater monitoring. The estimated present worth cost of the No Action alternative is $142,000.

8 & 9) State and Community Acceptance

The state and community have endorsed Alternative 2 as the recommended remedy for the site.

Site K Shallow Groundwater

1) Overall Protection of Human Health and the Environment

Alternative 2, the selected remedy, is protective of human health and the environment by removing VOC contaminants from the groundwater and restricting plume migration off site. This alternative includes containment of the contaminant plume on site and removal of contaminants through extraction and treatment. Alternative 3 includes in situ treatment to remove VOCs from the groundwater. However, the applicability of this technology at the site has not as yet been proven. Therefore, Alternative 2 is considered more protective than Alternative 3. The No Action alternative is not effective in preventing human exposure to contaminated groundwater that could result in unacceptable risk to human health or the environment. This alternative would not contain the contaminant plume on site. Contaminated groundwater would be allowed to flow down gradient where it would eventually enter Rice Creek, potentially exposing aquatic organisms and recreational users of the creek to risk.

2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternatives 2 and 3 comply with chemical specific ARARs and TBC guidance values through removal and subsequent treatment of groundwater to levels below acceptable standards. Attainment of chemical specific ARARs within the aquifer would eventually be achieved, however, it is estimated that contaminants would remain in the aquifer at concentrations greater than ARARs for a significant period of time. Location specific and action specific ARARs are also met by these alternatives through proper implementation and operation of the systems. The No Action alternative does not comply with chemical specific ARARs or TBC guidance values. There are currently two contaminants of concern in the groundwater at Site K at concentrations above HRLs which would be left unaddressed in this alternative. No action does comply with location specific ARARs and there are no action specific ARARs.

3) Long-Term Effectiveness and Permanence

Alternatives 2 and 3 are considered effective and permanent due to the removal of contaminants from the groundwater through extraction and subsequent treatment. In Alternative 3 contaminants are also removed in situ. The No Action alternative does not provide long-term effectiveness and permanence since the plume would not be contained under this alternative. VOC contaminants would be allowed to migrate off site and eventually flow into Rice Creek.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 2 reduces contaminant mobility by containing the plume and reduces contaminant volume by removing contaminants from the aquifer through pumping. Contaminant toxicity is reduced through treatment by the air stripping towers. Alternative 3 reduces contaminant mobility by containing the plume and reduces contaminant volume by removing contaminants from the aquifer through pumping. Contaminant toxicity is reduced through treatment by the air stripping towers. This alternative also potentially reduces the volume and toxicity of VOCs in the shallow groundwater through in-situ treatment. The No Action alternative does not reduce contaminant toxicity, mobility, or volume as there is no treatment associated with this remedy.

5) Short-Term Effectiveness

Alternatives 2 and 3 emit VOCs into the atmosphere creating some short-term risk to the community and the environment. These alternatives also involve pumping and treating the contaminated groundwater followed by discharge to Rice Creek. Minimal risk is associated with these activities. Construction of sparging wells (Alternative 3) poses some risk of VOC exposure to workers. Therefore, Alternative 2 is considered more effective in the short term than Alternative 3. Although the only activity included as part of the No Action alternative is groundwater monitoring, it does not provide for cleanup of the site contaminants nor a reduction of risk over the period of implementation. Therefore, this alternative has the least short-term effectiveness of the three alternatives.

6) Implementability

Alternative 2 is considered the most easily implementable of the three alternatives. The interceptor/recovery trench is already in place and operating. The existing air stripping towers would be replaced with shallow tray air strippers. The existing system is currently meeting the discharge requirements. Alternative 3 has many implementation concerns including the ongoing manufacturing operations in Building 103, underground utilities under the building, and the potential for iron and bacteria fouling of the sparging wells. Alternative 3 is considered the most difficult to implement of the three alternatives. The No Action alternative requires nothing new to implement, although it would not meet the site cleanup objectives and is therefore considered unimplementable.

7) Cost

Alternative 2 is the least costly of the two alternatives that would generally meet the site cleanup objectives. Alternative 2 present worth costs include capital costs for the installation of the shallow tray air stripper as well as O&M costs to run the system for a period of 30 years. The estimated present worth cost of Alternative 2 is $734,000.

Alternative 3 present worth costs include capital costs for the construction of an air sparging system and O&M costs to run the sparging system for a period of 7 years and the groundwater containment and recovery system for 30 years. Separate cost estimates were developed for vertical and horizontal sparging wells. The estimated present worth cost of Alternative 3 is $2,237,000 for vertical sparging wells and $3,559,000 for horizontal sparging wells.

There are no new costs associated with the No Action alternative except for the continuation of groundwater monitoring. The estimated present worth cost of the No Action alternative is $163,000.

8 & 9) State and Community Acceptance

The state and community have endorsed Alternative 2 as the recommended remedy for the site.

Deep Groundwater

1) Overall Protection of Human Health and the Environment

Alternatives 2, 3 (the selected remedy) and 4 are protective of human health and the environment by removing VOC contaminants from the groundwater, restricting contaminant migration, and implementing institutional controls that prevent exposure to contaminated groundwater. A Special Well Construction Zone will be designated that would regulate installation of wells in the impacted zone. These alternatives also include containment of the contaminant plume or plume source area on site and removal of contaminants through extraction and treatment. Therefore, these alternatives prevent further spreading of contaminated groundwater into portions of the aquifer that are less contaminated. Alternative 1 is not effective in preventing human exposure to contaminated groundwater that could result in unacceptable risk to human health. Alternative 1 would not contain the contaminant plume or plume source area on TCAAP. This would allow TCAAP residents to extract and use groundwater with contaminant levels in excess of drinking water standards and health risk levels.

2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternatives 2, 3, and 4 comply with ARARs and TBC guidance values through removal and subsequent treatment of groundwater to levels below acceptable standards. Location and action-specific ARARs are also eventually met with each of these alternatives. However, it is estimated that contaminants would remain in the aquifer at concentrations approaching but still greater that ARARs and TBCs for a significant period of time for all of the alternatives. The no-action alternative does not comply with ARARs or TBC guidance values. There are currently seven contaminants of concern in the deep groundwater at concentrations above MCLs and HRLs which would be left unaddressed in Alternative 1.

3) Long-Term Effectiveness and Permanence

Alternative 3 provides the greatest long-term effectiveness and permanence by removing contaminant mass, enacting drilling advisories that regulate the installation of new wells within the plume, and controlling the spread of the most contaminated groundwater down gradient and off site through pumping. Keeping abreast of new and innovative technologies that may assist in more cost-effective aquifer remediation makes this alternative more effective than Alternative 1, 2 and 4. Alternative 4 provides the same long-term effectiveness and permanence as Alternatives 2 and 3, but may additionally remove contaminant mass through DNAPL remediation and dissolved contaminant remediation. Complete success of this approach is not guaranteed as evidenced by the lack of precedence in DNAPL remediation at other sites around the country. Alternative 2 provides long-term effectiveness and permanence by removing contaminant mass, enacting drilling advisories that regulate the installation of new wells within the plume, and controlling the spread of the plume down gradient and off site through pumping. The no-action alternative does not provide long-term effectiveness or permanence since no pumping of the TGRS would allow the plume to migrate beyond the OU-1 and OU-3 containment boundaries and potentially impact less contaminated portions of the aquifer.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 3 optimizes the efficiency of the TGRS as a mass removal system by focusing extraction on the high contaminant concentration areas and hydraulically containing only the source area of the plume. Based on computer modeling performed for the OU-2 FS, this alternative is projected to remove as much as 89 percent of the dissolved mass of the plume within OU-2. In comparison, the TGRS is projected to remove only 80 percent of the dissolved mass. This alternative is therefore more effective than Alternative 2 in reducing contaminant volume, since it removes more contaminant mass in less time. However, contaminant concentrations are anticipated to approach but still exceed ARARs even after a significant period of operation of this remedy. Alternative 4 retains the TGRS as a hydraulic containment system for the entire plume while utilizing other technologies to reduce contaminant mass within the aquifer. Complete success of this approach is not guaranteed as evidenced by the lack of precedence in DNAPL remediation and aquifer restoration at other sites around the country. Alternative 2 is moderately effective in reducing contaminant mobility and volume in the aquifer while containing the plume on site to the 5 ug/L TCE concentration contour. However, in maintaining complete hydraulic containment of the plume, a large volume of relatively clean (i.e., low VOC concentration) groundwater is extracted and treated. In addition, contaminant concentrations are anticipated to approach but still exceed ARARs even after a significant period of operation of this remedy. The no-action alternative results in no reduction in contaminant toxicity, mobility or volume as there is no treatment associated with this alternative.

5) Short-Term Effectiveness

Alternative 3 provides an anticipated level of short-term effectiveness greater than the other alternatives because of the provision to review and implement new technologies with better potential to achieve a reduction in the restoration timeframe. Alternative 3 also minimizes the potential construction activities. Alternative 4 is less effective in the short term because it includes more extensive construction activities than Alternatives 1,2 and 3 (more site characterization, more wells, more treatment facilities, etc.) and may not meet site remediation goals using the technologies currently available for aquifer restoration. Although Alternative 2 does not involve any additional construction activities, it is not anticipated to reach site remediation goals as soon as Alternative 3. The only activity included as part of this alternative is the continuation of TGRS O&M and groundwater monitoring of remedy performance. The no-action alternative will not reduce site risks or attain site cleanup, therefore the effectiveness of this remedy is minimal.

6) Implementability

Alternative 3 is considered the most technically feasible and implementable alternative for deep groundwater. The TGRS is already in place and operating in a manner that could be modified to focus on source area containment and optimized mass removal. Institutional controls are implementable through cooperative efforts with the Minnesota Department of Health and the MPCA. Alternative 2 is considered technically feasible and implementable, however it is anticipated that this action would not meet site remediation goals. The TGRS is already in place and operating in a manner consistent with containment of the on-site plume. Institutional controls are implementable through cooperative efforts with the Minnesota Department of Health. Regulatory acceptance of the TGRS as a containment system has already been established. For Alternative 4, the ability to locate and remove DNAPL contamination is not considered technically feasible. The use of bioremediation to reduce contaminant concentrations is considered technically and administratively feasible (assuming successful characterization/removal of DNAPLs and bench scale/pilot biotreatability testing) and would likely result in reduced contaminant concentrations, but is not anticipated to meet the groundwater remediation goals in a timely and cost effective manner. There is nothing new to implement with the no-action alternative, nor would it effect a reduction in site risk or attain site remediation goals.

7) Cost

While not the least costly, Alternative 3 is considered the most cost-effective of the four alternatives. The present worth costs associated with Alternative 3 were based on the operation and maintenance of the existing TGRS pump and treat system, monitoring of the remedy performance, and evaluations of new and emerging technologies that could potentially expedite site remediation. No additional wells (and associated capital costs) were included with this cost estimate. More detailed computer modeling and system evaluation are necessary during remedial design before such modifications can be addressed. The requirements and additional costs for installing new wells and/or abandoning existing wells are not included and will be developed as necessary. The 30-year present worth cost for Alternative 3 is $ 9,494,900.

The costs associated with Alternative 2 were based on the operation and maintenance of the TGRS pump and treat system, and monitoring of the remedy performance. The 30-year present worth for Alternative 2 is $9,441,000.

Because of the uncertainties associated with DNAPL characterization capabilities, anticipated difficulties with DNAPL removal, and biotreatment feasibility, an accurate cost estimate for Alternative 4 is difficult to develop. Instead, a range of rough order of magnitude (ROM) costs have been applied to the activities associated with Alternative 4. DNAPL characterization would potentially include surface geophysical and cone penetrometer surveys, drilling and sampling, well installation, analytical testing, and surfactant/solubilization testing at a ROM cost in the range of $0.5 to $2.5 million. Without a clear indication of the results of the DNAPL characterization efforts, and the difficulties associated with DNAPL removal, particularly in a complex geologic environment like that at TCAAP with the potential for multiple DNAPL targets that require remediation, a ROM cost for this phase of site restoration may range from $5 to $15 million. This ROM estimate assumes that multiple DNAPL occurrences exist and that each would require a uniquely designed remedial approach. Again, complete success in this effort is not assumed in this estimate.

Finally, remediation of the dissolved phase contaminant plume would include on-going operation of the TGRS (30 year present worth in the order of $9 million) in addition to the probable application of bioremediation technologies and large scale conveyance systems. A ROM cost for this activity may range from at least $10 million to as much as $20 million over the duration of the project to attain groundwater cleanup goals.

While simplistic, these estimates are not without merit when compared to other sites that have tried to address similar contaminant issues. These ROM estimates are considered realistic when taking into account the vertical and horizontal extent of the plume beneath TCAAP, the complex geologic conditions present at the site, and the probable wide distribution of residual DNAPLs in the subsurface.

This estimate does not imply any level of success or failure in attaining the goal of aquifer restoration. It is, however, provided to establish a relative overall cost for this remedial approach for comparison with the other alternatives. Assuming the addition of the ROM estimates to the baseline cost of operating, maintaining, and monitoring the TGRS, the 30-year present worth of Alternative 4 could range from $15,000,000 to $40,000,000.

The no-action alternative has a 30-year present worth of $2,315,577 and only includes continued groundwater monitoring.

8 & 9) State and Community Acceptance

The state and the community have endorsed Alternative 3 as the recommended remedy for deep groundwater at TCAAP.

I. The Selected Remedy

The selected remedies for the sites within OU-2 are as follows:

Shallow Soil Sites A, C, E, H, 129-3 and 129-5: The selected remedy for the shallow soil sites is Alternative 4: Excavation, Stabilization, and Off-Site Disposal. This remedy includes the identification and characterization of contaminated soil boundaries, surface and subsurface debris, and dump contents; excavation and sorting of hazardous and nonhazardous dump materials, debris, and ordnance; removal and disposal of ordnance, dump and oversized material; on-site stabilization of hazardous and contaminated soils from Sites A, E, H, 129-3 and 129-5; off-site disposal of stabilized materials from Sites A, E, H, 129-3 and 129-5; off-site transport, incineration and disposal of soils containing low levels of dioxin-furans from Site C (if required); backfill/regrade site excavations; and a limited period of monitoring to verify remedy effectiveness. Restrictions to site access and use during remedy implementation would be included.

Dumps at Sites B and 129-15: The dump adjacent to Site B and within Site 129-15 would be characterized to determine their contents. If contents are found to be toxic, hazardous, or contaminated, then a remedy for the landfill will be utilized and documented through a post-ROD amendment. If the contents are not toxic, hazardous or contaminated, a no further action remedy would be employed.

Deep Soil Sites D and G: The selected remedy for the deep soil sites is Alternative 3: Expand SVE System Vertically. This remedy includes groundwater monitoring; access and use restrictions of the site; installation and operation of deep SVE system with modified shallow SVE system, as appropriate; evaluation and potential use of enhancements to the SVE systems; maintenance of existing soil caps; and maintain surface drainage controls. Shallow soils and dump materials would be characterized at each site following cessation of SVE system operation.

Site A Shallow Groundwater: The selected remedy for Site A Shallow Groundwater is Alternative 2: Boundary Containment. This remedy would include groundwater monitoring to track plume migration and remedy effectiveness; use of existing gradient control wells to contain plume and remove contaminant mass; institutional controls to restrict new well installations and provide alternate water supplies and well abandonment as necessary; POTW discharge of extracted groundwater, and plume source characterization and remediation. Recommendations for operational changes to the remedy would be reviewed annually, should system performance require such an action.

Site I Shallow Groundwater: The selected remedy for Site I shallow groundwater is Alternative 2: Extraction with POTW Discharge. This remedy would include groundwater monitoring to track remedy performance; groundwater extraction using an existing well to remove impacted Unit 1 groundwater; POTW discharge of extracted groundwater; and characterization of the Unit 1 and Unit 2 soil and groundwater. The selected remedy would be reviewed for applicability after the completion of the Unit 1 and Unit 2 soil and groundwater characterization study.

Site K Shallow Groundwater: The selected remedy for Site K shallow groundwater is Alternative 2: Containment/Extraction with Air Stripping. This remedy would include groundwater monitoring to track remedy performance; installation of sentinel wells at the bottom of Unit 1 and the top of Unit 3; groundwater extraction and plume containment using the existing interceptor/recovery trench; treatment of extracted groundwater using air stripping; discharge of treated groundwater to Rice Creek; discharge monitoring to track compliance with discharge requirements; and characterization of the unsaturated Unit 1 soil.

Deep Groundwater: The selected remedy for Deep Groundwater is Alternative 3: Source Containment. This remedy would include groundwater extraction to hydraulically contain the source area contaminated groundwater to the 5 ug/L TCE concentration contour and optimize removal of contaminants from the deep groundwater plume source area; groundwater treatment using the existing air stripping towers; discharge of treated groundwater to the on-site gravel pit; institutional controls to restrict access to contaminated aquifers and prevent exposure to contaminated groundwater; annual reporting of new or emerging technologies that have the potential to cost-effectively accelerate the timeframe for aquifer restoration; and groundwater monitoring of remedy performance.

SELECTED CLEANUP LEVELS

Specific cleanup levels must be attained at each site before the remedy can be considered complete. Specific contaminant cleanup standards for each site are shown in Tables 8 (Shallow Soil and Deep Soil Sites), 3 (Sites A, I and K Shallow Groundwater), and 4 (Deep Groundwater). To be evaluated (TBE) compounds will be evaluated as part of the RD/RA effort. If any of these chemicals are found to be COCs, then chemical-specific ARARs will be added, if available.

- **Shallow Soil Sites** - For the shallow soil sites, the remedy will attain cleanup levels throughout the AOCs. The estimated area of attainment will be the boundaries of the AOCs where soil contaminant concentrations have been identified to exceed acceptable levels. In addition, all debris will be removed from the shallow soil sites (with the exception of Sites B and 129-15) and disposed of off site in accordance with ARARs.

  Alternative 4 will achieve substantial risk reduction by effectively removing all contaminants above cleanup goals and dump materials from the sites. The cleanup standards are based on both health risk-based remediation goals that take into account the current and most probable (industrial) future land use scenario, and leaching-based goals that are protective of the underlying groundwater. Excavated soils will be stabilized and must pass TCLP testing before being transported off site for disposal at a permitted Subtitle D landfill. All debris will be excavated, characterized, sorted, and disposed of in accordance with appropriate rules and regulations. Institutional controls to restrict site access and use will be the responsibility of the Army and associated caretakers of the facility.

Under federal law, there are no set maximum allowable residual levels for the chemicals of concern in shallow soils. The only state regulation for contaminated soil is a residential standard that applies to boards of health and any person performing lead abatement on residential property and playgrounds (Minn. Rules pt. 4761.0100) and requires that bare soils on residential property or on playgrounds must not contain lead in a concentration of 1/100 of one percent (100 ppm) or more by weight (Minn. Rules pt. 4761.0300 subpt. 4). Since this requirement does not apply to the situation at TCAAP, it should not be considered ARAR. TBC values based on human health, leaching and background values for the COCs in shallow soils at TCAAP are presented in Table 8.

- **Deep Soil Sites** - For the deep soil sites, the remedy will attain cleanup levels throughout the AOCs. The estimated area of attainment will be the vertical and areal extent of soils identified through remedial design characterization efforts where contaminant concentrations exceed acceptable levels. In addition, dump materials and shallow soils will be characterized and final remedy determination will be based on this effort.

Alternative 3 will achieve substantial risk reduction by effectively removing all contaminants above cleanup goals from the sites. Site caps also eliminate exposure potential to shallow soil contaminants and dump materials. The cleanup standards are based primarily on leaching-based goals that are protective of the underlying groundwater. Institutional controls to restrict site access and use will be the responsibility of the Army and associated caretakers of the facility.

Under federal law, there are no promulgated maximum allowable residual levels for the COCs in deep soils for Sites D and G. TBC values based on modeling and leaching values for the COCs in deep soils at TCAAP are presented in Table 8.

- **Site A Shallow Groundwater -** For Site A shallow groundwater, the remedy will attain cleanup levels throughout the plume. The area of attainment is considered to be the areal and vertical extent of the Unit 1 groundwater plume. Groundwater monitoring will be required until restoration of the aquifer is achieved. Should aquifer restoration not be attained within the anticipated ten year lifespan of the remedy, additional remedial measures will be addressed.

Alternative 2 will achieve substantial risk reduction by effectively containing the contaminant plume at the site boundary. In addition, the Unit 1 plume will be pumped until aquifer cleanup standards are achieved. The cleanup standards are based upon ARARs identified for the remedy. Extracted groundwater will be discharged directly to the MCES sanitary sewer for subsequent treatment at the POTW.

Chemical specific applicable or relevant and appropriate regulations (ARARs) include the following: Minn. R. pt. 4717.7100 - 4717.7800 - Health Risk Limits for antimony (6 ug/L); benzene (10 ug/L); chloroform (60 ug/L); 1,2-dichloroethane (4 ug/L); 1,1-dichloroethene (6 ug/L); *cis*-1,2-dichloroethene (70 ug/L); tetrachloroethene (7 ug/L); trichloroethene (30 ug/L); Applicable for groundwater remediation: Minn. R. pt. 4717.7700 - Health Risk Limits for carcinogenic mixtures; Minn. R. pt. 4717.7750 - Health Risk Limits for systemic toxicant mixtures; applicable for groundwater remediation - Minn. R. pt. 7060.0600, subpt. 8; and background value for antimony (<10 ug/L).

- **Site I Shallow Groundwater** - For Site I shallow groundwater, the remedy will attain cleanup levels throughout the plume. The area of attainment is considered to be the areal and vertical extent of the Unit 1 groundwater plume. Groundwater monitoring will be required until restoration of the aquifer is achieved.

  Alternative 2 will achieve substantial risk reduction by pumping available contaminated Unit 1 groundwater from the aquifer. The Unit 1 plume will be pumped until aquifer cleanup standards are achieved. The cleanup standards are based upon ARARs identified for the remedy. Extracted groundwater will be discharged directly to the TCAAP sanitary sewer which discharges to the MCES sanitary sewer for subsequent treatment at the POTW.

  Chemical specific ARARs for Site I remedies include the following: Minn. R. pt. 4717.7100 - 4717.7800 - Health Risk Limits for *cis*--1,2-dichloroethene (70 ug/L); *trans*-1,2-dichloroethene (100 ug/L); trichloroethene (30 ug/L); vinyl chloride (0.2 ug/L) -- Applicable for groundwater remediation. Minn. R. pt. 4717.7700 - Health Risk Limits for carcinogenic mixtures; Minn. R. pt. 4717.7750 - Health Risk Limits for systemic toxicant mixtures -- Applicable for groundwater remediation.

- **Site K Shallow Groundwater** - For Site K shallow groundwater, the remedy will attain cleanup levels throughout the plume. The area of attainment is considered to be the areal and vertical extent of the Unit 1 groundwater plume. Groundwater monitoring will be required until restoration of the aquifer is achieved.

  Alternative 2 will achieve substantial risk reduction by effectively containing the contaminant plume, while at the same time treating extracted groundwater to below cleanup standards. In addition, the Unit 1 plume will be contained until aquifer cleanup standards are achieved. The cleanup standards are based upon ARARs identified for the remedy. Extracted groundwater will be treated to meet the discharge requirements before being discharged to Rice Creek.

  Chemical specific ARARs for Site K remedies include the following: Minn. R. pt. 4717.7100 - 4717.7800 - Health Risk Limits for trichloroethene (30 ug/L), *cis*-1,2-dichloroethene (70 ug/L) and *trans*-1,2-dichloroethene (100 ug/L) -- Applicable for groundwater remediation. Minn. R. pt. 4717.7700 - Health Risk Limits for carcinogenic mixtures; Minn. R. pt. 4717.7750 - Health Risk Limits for systemic toxicant mixtures --

Applicable for groundwater remediation. Minn. R. pt. 7050.0220 subpts. 3 and 4 - Minnesota Aquatic Life Standard for parameters listed in current NPDES nonpermit.

- **Deep Groundwater** - For deep groundwater, the point of compliance will be the source area containment boundary at the 5 ug/L TCE contaminant concentration contour created by the pumping of the TGRS and any new wells installed to develop and maintain hydraulic containment of the deep groundwater plume source area. Groundwater modeling during remedial design will better define the location of the proposed line of capture of the plume source area. The remedy will attain cleanup levels throughout the plume. Groundwater monitoring will be required until restoration of the aquifer is achieved.

  Alternative 3 will achieve substantial risk reduction by effectively containing the source area of the contaminant plume within OU-2, while at the same time returning the treated water to the aquifer through direct recharge in the on-site gravel pit. In addition, the contaminated groundwater source area will be contained until groundwater cleanup standards are achieved. The cleanup standards are based upon ARARs identified for the remedy. Extracted groundwater will be treated to meet cleanup standards.

  Chemical specific ARARs for Deep Groundwater remedies include the following: Minn. R. pts. 4717.7100 through 4717.7800 - Health Risk Limits for 1,1-dichloroethane (70 ug/L), 1,2,-dichloroethane (4 ug/L), 1,1,-dichloroethene (6 ug/L). Applicable requirements for remediation of Units 3 and 4 groundwater. Minn. R. pt. 4717.7700 - Health Risk Limits for carcinogenic mixtures; Minn. R. pt. 4717.7750 - Health Risk Limits for systemic toxicant mixtures, applicable requirements for remediation of COCs in Units 3 and 4 groundwater. 40 CFR Part 141 Subparts F and G - Maximum contaminant levels (MCLs) for tetrachloroethene (5 ug/L) and trichloroethene (5 ug/L); Maximum Contaminant Level Goals (MCLGs) for *cis*-1,2,-dichloroethene (70 ug/L) and 1,1,1-trichloroethane (200 ug/L) - Relevant and appropriate requirements for remediation of Units 3 and 4 groundwater.

J. Statutory Determinations

This section discusses how the selected remedy for each of the sites or group of sites within OU-2 meets the five statutory requirements established by CERCLA.

Shallow Soil Sites

Protection of Human Health and the Environment The selected remedy will provide overall protection of human health and the environment through excavation, stabilization, and off-site disposal of contaminated soils. In addition, debris identified within each site will be characterized, sorted, and disposed of in accordance with appropriate rules and regulations. The removal of contaminated soils and debris will eliminate constraints on site use for industrial operations within the confines of the TCAAP facility. Restrictions on site access and use will insure site operations consistent with the industrial cleanup levels. No unacceptable short-term risks or cross-media impacts will be caused by implementation of the remedy.

Compliance with ARARs

The selected remedy will comply with ARARs and TBC guidance. The cleanup of site soils will meet the chemical-specific TBC guidance through removal of materials that exceed these levels for the protection of human health (health risk-based levels) and the protection of groundwater through leaching, while the action-specific ARARs will be met during the construction, operation, and monitoring phases of the remedy. The following is a list of ARARs and "to be considered" guidelines for the remedy:

Chemical-Specific

Under federal law, there are no set maximum allowable residual levels for the chemicals of concern in shallow soils. The only state regulation for contaminated soil is a residential standard that applies to boards of health and any person performing lead abatement on residential property and playgrounds (Minn. Rules pt. 4761.0100) and requires that bare soils on residential property or on playgrounds must not contain lead in a concentration of 1/100 of one percent (100 ppm) or more by weight (Minn. Rules pt. 4761.0300 subpt. 4). Since this requirement does not apply to the situation at TCAAP, it should not be considered ARAR. The selected cleanup levels are presented in Table 8 of this document.

Location-specific

- CFR 264.18(b); Minn. Stat. 103F.101-.155; Minn. R. pts. 6120.5000-.6200 - Applicable to impacts on floodplains for remedial actions at Sites A,B,H, and 129-5.
- Clean Water Act ' 404; 40 CFR 230; 33 CFR 320-330; Minn. R. pt. 7045.0460 Subpart 2; Minn. Stat. ' 116D.04; Minn. R. pts. 6115.0150-0272 - Applicable to impacts on wetlands for remedial actions at Sites A,B,H, and 129-5
- Fish and Wildlife Coordination Act (16 USC 661 *et seq.*); Clean Water Act ' 404; 40 CFR 230; 33 CFR 320-330 - Applicable to impacts on fish and wildlife resources in Rice Creek, Marsden Lake, Round Lake, or Sunfish Lake for remedial actions at Sites A,H,129-5, and 129-15.
- Executive Order 11988; 40 CFR 6.302(b); 40 CFR 6 (Appendix A) - TBC guidance for protection of floodplains during remedial actions at Sites A,B,H, and 129-5.
- Executive Order 11990; 40 CFR 6.302(a); and 40 CFR 6 (Appendix A); Wetland Conservation Act of 1991 Administrative Guidelines: Interim Program of Wetlands Regulation (Board of Water and Soil Resources) - TBC guidance for protection of wetlands during remedial actions at Sites A,B,H, and 129-5.
- 40 CFR 6.302(g); CERCLA Compliance with Other Laws Manual: Part II.; OSWER Directive 9234.1-02 - TBC guidance for protection of fish and wildlife resources during remedial actions at Sites A,H,129-5, and 129-15.
- Endangered Species Act (16 USC 1531 *et seq.*); 50 CFR 402; 40 CFR 6.302(h); Fish and Wildlife Coordination Act (16 USC 661 *et seq.*); Clean Water Act ' 404; 40 CFR 230.10(b); Minn. Stat. 84.0895; Minn. R. 6134.0100 *et seq.* - TBC guidance for impacts on Blandings turtle and its critical habitat during remedial actions at Site A and B.

- Consultation with the Minnesota Department of Natural Resources is TBC guidance for any potential impacts to the central kame during remedial actions at Sites A,C,E,H,129-3, 129-5, and 129-15.
- U.S. Army Regulation 420-40 - TBC guidance for impacts to historic properties during remedial actions at Site A.

Action-specific

- TBC guidance for identification/characterization of soil boundaries, debris, and dump contents: EPA OSWER Publication 9345.3-03FS.
- Applicable requirements for fugitive air emissions during excavation and sorting: Minn. R. pt. 7009.0080; Minn. R. pt. 7009.0020; Minn. R. pt. 7011.0150
- Applicable requirements for removal and disposal of ordnance and materials: Minn. R. pt.7045.0214, subpts. 1 and 2; Minn. R. pt. 7045.0221; Minn. R. pt. 7045.0261; Minn. R. pt. 7045.0265; Minn. R. pt. 7045.0270. Potentially applicable requirements for this activity: Minn. R. pt. 7045.0102; Minn. R. pts. 7045.0120 and .0121; Minn. R. pt. 7045.0127; Minn. R. pt. 7045.0205; Minn. R. pt. 7045.0208; Minn. R. pt. 7045.0211; Minn. R. pts. 7045.0215-.0218; Minn. R. pt. 7045.0275; Minn. R. pt. 7045.0292; Minn. R. pt. 7045.0294; Minn. R. pt. 7045.0298. TBC guidance for this activity: 60 FR. 56469, Nov. 8, 1995.
- Applicable requirements for off-site disposal of stabilized materials: CERCLA ' 121(d)(3); Minn. R. pt. 7045.0221; Minn. R. pt. 7045.0270; Potentially applicable requirements for this activity: Minn. R. pt. 7045.0102, subpt. 2; Minn. R. pt. 7045.0120 and.0121; Minn. R. pt. 7045.0127; Minn. R. pt. 7045.0205; Minn. R. pt. 7045.0208; Minn. R. pt. 7045.0211; Minn. R. pt. 7045.0214, subpt. 1 and 2; Minn. R. pt. 7045.0215-.0218; Minn. R. pt. 7045.0275; Minn. R. pt. 7045.0292; Minn. R. pt. 7045.0294; Minn. R. pt. 7045.0298; Minn. R. pt. 7035.0800, subpt. 1 and 3. TBC guidance for this activity: OSWER Directive 9834.11 (Nov. 13, 1987).
- Applicable requirements for land disposal restrictions: Minn. R. pt. 7045.0214, subpt. 1 and 2; Minn. R. pt. 7045.1300; Potentially applicable requirements for this activity: Minn. R. pt. 7045.1309, subpt.1,3,4; Minn. R. pt. 7045.1320, Minn. R. pt. 7045.1325, Minn. R. pt. 7045.1330, Minn. R. pt. 7045.1333, Minn. R. pt. 7045.1334, Minn. R. pt. 7045.1335, Minn. R. pt. 7045.1350, Minn. R. pt. 7045.1355, Minn. R. pt. 7045.1358, Minn. R. pt. 7045.1360; Minn. R. pt. 7045.1380; Relevant and appropriate requirements for this activity: Minn. R. pt. 7045.1305; Potentially relevant and appropriate requirements for this activity: Minn. R. pt. 7045.1315; TBC guidance for this activity: 61 FR 18780, April 29, 1996.
- Applicable requirements for construction of groundwater monitoring wells: Minn. R. pt. 4725. 3550; Potentially applicable requirements for this activity: Minn. R. pt. 4725.6450; Minn. R. pt. 4725.2020; Minn. R. pt. 4725.2050; Minn. R. pt. 4725.2150; Minn. R. pt. 4725.2175; Minn. R. pt. 4725.2185; Minn. R. pt. 4725.2250; Minn. R. pt. 4725.2350; Minn. R. pt. 4725.2450; Minn. R. pt. 4725.2550; Minn. R. pt. 4725.2650; Minn. R. pt. 4725.2750; Minn. R. pt. 4725.2850; Minn. R. pt. 4725.2950; Minn. R. pt. 4725.2975; Minn. R. pt. 4725.3050; Minn. R. pt. 4725.3150; Minn. R. pt. 4725.3250; Minn. R. pt. 4725.3350; Minn. R. pt. 4725.3450; Minn. R. pt. 4725.3650; Minn. R. pt. 4725.3750; Minn. R. pt. 4725.3850; Minn. R. pt. 4725.3875; Minn. R. pt. 4725.6650; Minn. R. pt. 4725.6755; Minn. R. pt. 4725.6850; Minn. R. pt. 4725.0050; Minn. R. pt. 4725.1830 (substantive requirements);

Minn. R. pt. 4725.1848 (substantive requirements); TBC guidance for this activity: MPCA Superfund and Voluntary Investigation and Cleanup Program Example Sampling Protocol for Monitoring Wells.

- Applicable requirements for well abandonment: Minn. R. pt. 4725.3850; Minn. R. pt. 4725.3875
- Potentially applicable requirements for institutional controls: 40 CFR Part 373; Minn. Stat. ' 115B.16 subd.2; Relevant and appropriate requirements for this activity: 40 CFR ' 300.430(a)(1)(iii)(D).
- Applicable requirements for protection of underground waters (antidegradation): Minn. Stat. ' 103H.001; Minn. Stat. ' 115.03 subd.1; Minn. Stat " 115.42, 115.43, 115.44; Minn. R. pt. 7060.0400; Minn. R. pt. 7060.0600, subpt. 2 and 3.
- TBC guidance for characterization of Site B and 129-15 dumps to verify contents: EPA OSWER Publication 9345.3-03FS (January 1992).

Cost-Effectiveness

The selected remedy provides an effective remedy proportionate to its cost. The degree of long-term effectiveness and permanence, reduction of toxicity, mobility or volume of contaminants, and ease of implementability afforded by this remedy give it a reasonable value for its cost.

Utilization of Permanent Solutions and Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy provides the best balance among the four alternatives evaluated against the nine evaluation criteria. Based on the available information, EPA and MPCA believe that the selected remedy is protective of human health and the environment, satisfies the remedial objectives of eliminating exposure to contaminated soils and protecting the waters of the state from dissolved contaminants in excess of acceptable levels, is cost-effective, and utilizes permanent solutions to the maximum extent practicable. Of the five statutory criteria met by the selected remedy, cost-effectiveness was the most critical in the selection decision. The acceptance of the remedy by the State and the active participation of the RAB representing the community were major considerations in the decision making process.

Preference for Treatment as a Principal Element

The selected remedy excavates and treats the contaminated soils through stabilization prior to placement in an off-site landfill. Therefore, it satisfies the statutory preference for remedies that employ treatment as a principal element.

Deep Soil Sites

Protection of Human Health and the Environment The selected remedy will provide overall protection of human health and the environment through treatment and capping of contaminated soils. In addition, dump materials and shallow soil contaminants not addressed by SVE will be characterized and managed in accordance with appropriate rules and regulations. The removal of deep soil contaminants and appropriate management of shallow wastes and dump materials will eliminate constraints on site use for industrial operations within the confines of the TCAAP facility. Institutional controls on site access and use will insure site operations consistent with the industrial cleanup levels. No unacceptable short-term risks or cross-media impacts will be caused by implementation of the remedy.

Compliance with ARARs

The selected remedy will comply with ARARs and TBC guidance. The cleanup of site soils will meet the chemical-specific TBC guidance through removal of contaminants that exceed these levels, while the action-specific ARARs will be met during the construction, operation, and monitoring phases of the remedy. The following is a list of ARARs and "to be considered" guidelines for the remedy:

Chemical-specific

Under federal law, there are no set maximum allowable residual levels for the chemicals of concern in deep soils for Sites D and G. TBC values based on modeling and leaching values for the COCs in deep soils at TCAAP are presented in Table 8 of this document.

Location-specific

- 40 CFR 6.302(g); CERCLA Compliance with Other Laws Manual: Part II.; OSWER Directive 9234.1-02 - TBC guidance for protection of fish and wildlife resources during remedial actions at Site D.
- Consultation with the Minnesota Department of Natural Resources is TBC guidance for any potential impacts to the central kame during remedial actions at Sites D and G.

Action-specific

- TBC guidance for characterization of the Site D shallow soils and the Site G dump: EPA OSWER Publication 9345.3-03FS (January 1992).
- Applicable requirements for off-site disposal of containers found during characterization (containers that meet the definition of a hazardous waste: Minn. R. pt. 7045.0214, subpts. 1 and 2; and Minn. R. pt. 7045.0221; Potentially applicable requirements for this activity: Minn. R. pt. 7045.0102; Minn. R. pt. 7045.0120 and .0121; Minn. R. pt. 7045.0127; Minn. R. pt. 7045.0205; Minn. R. pt. 7045.0208; Minn. R. pt. 7045.0211; Minn. R. pt. 7045.0215 through .0217; Minn. R. pt. 7045.0218; Minn. R. pt. 7045.0261; Minn. R. pt. 7045.0265; Minn. R. pt. 7045.0270; Minn. R. pt. 7045.0275; Minn. R. pt. 7045.0292; Minn. R. pt. 7045.0294; Minn. R. pt. 7045.0298; Minn. R. pt. 7045.1305; Minn. R. pt. 7045.1309; and Minn. R. pt. 7045.1380. Potentially relevant and appropriate requirements for this activity: CERCLA ' 121(d)(3). TBC guidance for this activity: OSWER Directive No. 9834.11 (Nov. 13, 1987).
- Applicable requirements for well construction and groundwater monitoring: Minn. R. pt.

4725. 3550; Potentially applicable requirements for this activity: Minn. R. pt. 4725.6450; Minn. R. pt. 4725.2020; Minn. R. pt. 4725.2050; Minn. R. pt. 4725.2150; Minn. R. pt. 4725.2175; Minn. R. pt. 4725.2185; Minn. R. pt. 4725.2250; Minn. R. pt. 4725.2350; Minn. R. pt. 4725.2450; Minn. R. pt. 4725.2550; Minn. R. pt. 4725.2650; Minn. R. pt. 4725.2750; Minn. R. pt. 4725.2850; Minn. R. pt. 4725.2950; Minn. R. pt. 4725.2975; Minn. R. pt. 4725.3050; Minn. R. pt. 4725.3150; Minn. R. pt. 4725.3250; Minn. R. pt. 4725.3350; Minn. R. pt. 4725.3450; Minn. R. pt. 4725.3650; Minn. R. pt. 4725.3750; Minn. R. pt. 4725.3850; Minn. R. pt. 4725.3875; Minn. R. pt. 4725.6650; Minn. R. pt. 4725.6755; Minn. R. pt. 4725.6850; Minn. R. pt. 4725.0050; Minn. R. pt. 4725.1830 (substantive requirements); Minn. R. pt. 4725.1848 (substantive requirements); TBC guidance for this activity: MPCA Superfund and Voluntary Investigation and Cleanup Program Example Sampling Protocol for Monitoring Wells.

- Potentially applicable requirements for well construction: Minn. R. pt. 4725.7450; Minn. R. pt. 4725.6650; Minn. R. pt. 4725.6775; and Minn. R. pt. 4725.6850.
- No ARARs develop for the installation and operation of the deep SVE system with modified shallow SVE.
- Potentially applicable requirements for fugitive dust emissions: Minn. R. pt. 7009.0080; Minn. R. pt. 7009.0020; and Minn. R. pt. 7011.0150.
- Potentially applicable requirements for air emissions: Minn. R. pt. 7009.0080; Minn. R. pt. 7007.0300; Minn. R. pt. 7007.0200; Minn. R. pt. 7007.0250; Minn. R. pt. 7007.0800, subpts. 1 through 4, 7, 9, 14, and 16; and Minn. R. pt. 7007.1100 through .1300.
- Potentially applicable requirements for institutional controls: 40 CFR Part 373; Minn. Stat. ' 115B.16 subd.2; Relevant and appropriate requirements for this activity: 40 CFR ' 300.430(a)(1)(iii)(D).
- Applicable requirements for protection of underground waters (antidegradation): Minn. Stat. ' 103H.001; Minn. Stat. ' 115.03 subd.1; Minn. Stat " 115.42, 115.43, 115.44; Minn. R. pt. 7060.0400; Minn. R. pt. 7060.0600, subpt. 2 and 3.

Cost-Effectiveness

The selected remedy provides an effective remedy proportionate to its cost. The degree of long-term effectiveness and permanence, reduction of toxicity, mobility or volume of contaminants, and ease of implementability afforded by this remedy give it a reasonable value for its cost.

Utilization of Permanent Solutions and Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy provides the best balance among the three alternatives evaluated against the nine evaluation criteria. Based on the available information, EPA and MPCA believe that the selected remedy is protective of human health and the environment, satisfies the remedial objectives of eliminating exposure to contaminated soils and protecting the waters of the state from dissolved contaminants in excess of acceptable levels, is cost-effective, and utilizes permanent solutions to the maximum extent practicable. Of the five statutory criteria met by the selected remedy, cost-effectiveness was the most critical in the selection decision. The acceptance of the remedy by the State and the active participation of the RAB representing the community were major considerations in the decision making process.

Preference for Treatment as a Principal Element

The selected remedy treats the contaminated soils through soil vapor extraction. Therefore, it satisfies the statutory preference for remedies that employ treatment as a principal element.

Site A Shallow Groundwater

Protection of Human Health and the Environment The selected remedy will provide overall protection of human health and the environment through containment and removal of contaminated groundwater. The extracted groundwater will subsequently be treated at the POTW. Institutional controls on the drilling of private wells will help to regulate the installation of new exposure points within the contaminated portions of the aquifer. In addition, supplying alternative water supplies and abandoning wells will help to limit and eliminate existing points of exposure to contaminated groundwater. No unacceptable short-term risks or cross-media impacts will be caused by implementation of the remedy.

Compliance with ARARs

The selected remedy will comply with ARARs and TBC guidance. The cleanup of contaminated groundwater will meet the chemical-specific ARARs and TBC guidance through removal of groundwater that contains contaminants that exceed these levels, while the action-specific ARARs will be met during the construction, operation, and monitoring phases of the remedy. The following is a list of ARARs and "to be considered" guidelines for the remedy:

Chemical-specific

- Minn. R. pt. 4717.7100 - 4717.7800 - Health Risk Limits for antimony (6 ug/L); benzene (10 ug/L); chloroform (60 ug/L); 1,2-dichloroethane (4 ug/L); 1,1-dichloroethene (6 ug/L); *cis*-1,2-dichloroethene (70 ug/L); tetrachloroethene (7 ug/L); trichloroethene (30 ug/L) -- Applicable for groundwater remediation. Minn. R. pt. 4717.7700 - Health Risk Limits for carcinogenic mixtures; Minn. R. pt. 4717.7750 - Health Risk Limits for systemic toxicant mixtures -- Applicable for groundwater remediation. Minn. R. pt. 7060.0600, subpt. 8 - Background value for antimony (<10 ug/L).

Location-specific

- 40 CFR 264.18(b); Minn. Stat. 103F.101-.155; Minn. R. pts. 6120.5000-.6200 - Applicable to impacts on floodplains for remedial actions at Site A.
- Clean Water Act ' 404; 40 CFR 230; 33 CFR 320-330; Minn. R. pt. 7045.0460 Subpart 2; Minn. Stat. ' 116D.04; Minn. R. pts. 6115.0150-0272 - Applicable to impacts on wetlands for remedial actions at Site A.

- Fish and Wildlife Coordination Act (16 USC 661 *et seq.*); Clean Water Act ' 404; 40 CFR 230; 33 CFR 320-330 - Applicable to impacts on fish and wildlife resources in Rice Creek and Marsden Lake for remedial actions at Site A.
- Executive Order 11988; 40 CFR 6.302(b); 40 CFR 6 (Appendix A) - TBC guidance for protection of floodplains during remedial actions at Site A.
- Executive Order 11990; 40 CFR 6.302(a); and 40 CFR 6 (Appendix A); Wetland Conservation Act of 1991 Administrative Guidelines: Interim Program of Wetlands Regulation (Board of Water and Soil Resources) - TBC guidance for protection of wetlands during remedial actions at Site A.
- 40 CFR 6.302(g); CERCLA Compliance with Other Laws Manual: Part II.; OSWER Directive 9234.1-02 - TBC guidance for protection of fish and wildlife resources during remedial actions at Site A.
- Endangered Species Act (16 USC 1531 *et seq.*); 50 CFR 402; 40 CFR 6.302(h); Fish and Wildlife Coordination Act (16 USC 661 *et seq.*); Clean Water Act ' 404; 40 CFR 230.10(b); Minn. Stat. 84.0895; Minn. R. 6134.0100 *et seq.* - TBC guidance for impacts on Blandings turtle and its critical habitat during remedial actions at Site A.
- Consultation with the Minnesota Department of Natural Resources is TBC guidance for any potential impacts to the central kame during remedial actions at Site A.
- U.S. Army Regulation 420-40 - TBC guidance for impacts to historic properties during remedial actions at Site A.

Action-specific

- Applicable requirements for construction of groundwater monitoring wells: Minn. R. pt. 4725. 3550; Potentially applicable requirements for this activity: Minn. R. pt. 4725.6450; Minn. R. pt. 4725.2020; Minn. R. pt. 4725.2050; Minn. R. pt. 4725.2150; Minn. R. pt. 4725.2175; Minn. R. pt. 4725.2185; Minn. R. pt. 4725.2250; Minn. R. pt. 4725.2350; Minn. R. pt. 4725.2450; Minn. R. pt. 4725.2550; Minn. R. pt. 4725.2650; Minn. R. pt. 4725.2750; Minn. R. pt. 4725.2850; Minn. R. pt. 4725.2950; Minn. R. pt. 4725.2975; Minn. R. pt. 4725.3050; Minn. R. pt. 4725.3150; Minn. R. pt. 4725.3250; Minn. R. pt. 4725.3350; Minn. R. pt. 4725.3450; Minn. R. pt. 4725.3650; Minn. R. pt. 4725.3750; Minn. R. pt. 4725.3850; Minn. R. pt. 4725.3875; Minn. R. pt. 4725.6650; Minn. R. pt. 4725.6755; Minn. R. pt. 4725.6850; Minn. R. pt. 4725.0050; Minn. R. pt. 4725.1830 (substantive requirements); Minn. R. pt. 4725.1848 (substantive requirements); TBC guidance for this activity: MPCA Superfund and Voluntary Investigation and Cleanup Program Example Sampling Protocol for Monitoring Wells.
- No ARARs develop for providing alternate water supplies.
- Applicable requirements for well abandonment: Minn. R. pt. 4725.3850; Minn. R. pt. 4725.3875
- Potentially applicable requirements for drilling advisories: Minn. R. pt. 4725.3650. TBC guidance for this activity: When finalized, memorandum designating special well construction area for the construction of any off-site wells or the sealing of off-site wells.
- Potentially applicable requirements for institutional controls: 40 CFR Part 373; Minn. Stat. ' 115B.16 subd.2; Relevant and appropriate requirements for this activity: 40 CFR ' 300.430(a)(1)(iii)(D).

- Applicable requirements for POTW discharge: Waste Discharge Rules for the Metropolitan Disposal System 202.00; 304.03; 401.00; 401.01; 401.02; 402.00; 406.00. Potentially applicable requirements for this activity: Waste Discharge Rules for the Metropolitan Disposal System 403.00; 406.01-406.22. Relevant and appropriate requirements for this activity: Waste Discharge Rules for the Metropolitan Disposal System 304.00; 304.01; 205.00; 212.00; 212.03; 212.04; 213.00; 213.01; 213.02; 213.03; 213.04; 214.00; 215.00; 218.00. Potentially relevant and appropriate requirements for this activity: Waste Discharge Rules for the Metropolitan Disposal System 212.01. TBC guidance for this activity: Pertinent provisions of Metropolitan Waste Control Commission Leachate and Contaminated Groundwater Program.
- TBC guidance for source characterization/remediation: EPA OSWER Publication 9345.03FS, January 1992.
- Applicable requirements for protection of underground waters (antidegradation): Minn. Stat. ' 103H.001; Minn. Stat. ' 115.03 subd.1; Minn. Stat " 115.42, 115.43, 115.44; Minn. R. pt. 7060.0400; Minn. R. pt. 7060.0600, subpt. 2 and 3.

Cost-Effectiveness

The selected remedy provides an effective remedy proportionate to its cost. The degree of long-term effectiveness and permanence, reduction of toxicity, mobility or volume of contaminants, and ease of implementability afforded by this remedy give it a reasonable value for its cost.

Utilization of Permanent Solutions and Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy provides the best balance among the three alternatives evaluated against the nine evaluation criteria. Based on the available information, EPA and MPCA believe that the selected remedy is protective of human health and the environment, satisfies the remedial objectives of plume containment and aquifer restoration, is cost-effective, and utilizes permanent solutions to the maximum extent practicable. Of the five statutory criteria met by the selected remedy, cost-effectiveness was the most critical in the selection decision. The acceptance of the remedy by the State and the active participation of the RAB representing the community were major considerations in the decision making process.

Preference for Treatment as a Principal Element

The selected remedy extracts contaminated groundwater from the aquifer then discharges it to the POTW for subsequent treatment. Therefore, it satisfies the statutory preference for remedies that employ treatment as a principal element.

Site I Shallow Groundwater

Protection of Human Health and the Environment

The selected remedy will provide overall protection of human health and the environment through extraction of the contaminated groundwater. The extracted groundwater will subsequently be treated at the POTW. The Unit 1 groundwater at Site I does not flow horizontally off-Site but is contained in a natural depression in the top of the Unit 2 formation. No unacceptable short-term risks or cross media impacts will be caused by implementation of the remedy.

Compliance with ARARs

The selected remedy will comply with ARARs and TBC guidance. The cleanup of contaminated groundwater will meet the chemical-specific ARARs and TBC guidance through removal of groundwater that contains contaminants that exceed these levels, while the action-specific ARARs will be met during the construction , operation, and monitoring phases of the remedy. The following is a list of ARARs and "to be considered" guidelines for the remedy:

Chemical-specific

- Minn. R. pt. 4717.7100 - 4717.7800 - Health Risk Limits for *cis*-1,2-dichloroethene (70 ug/L); *trans*-1,2-dichloroethene (100 ug/L); trichloroethene (30 ug/L); vinyl chloride (0.2 ug/L) -- Applicable for groundwater remediation. Minn. R. pt. 4717.7700 - Health Risk Limits for carcinogenic mixtures; Minn. R. pt. 4717.7750 - Health Risk Limits for systemic toxicant mixtures -- Applicable for groundwater remediation.

Location-specific

- Fish and Wildlife Coordination Act (16 USC 661 *et seq.*); Clean Water Act ' 404; 40 CFR 230; 33 CFR 320-330 - Applicable to impacts on wildlife resources for remedial actions at Site I.
- National Wildlife Refuge System Administration Act (16 USC 668dd-ee) - Applicable to impacts on Round Lake Natural Wildlife Refuge during remedial actions at Site I.
- 40 CFR 6.302(g); CERCLA Compliance with Other Laws Manual: Part II.; OSWER Directive 9234.1-02 - TBC guidance for protection of wildlife resources during remedial actions at Site I.

Action-specific

- Applicable requirements for the installation of the pump in the extraction well: Minn. R. pt. 4725.3250.
- Potentially applicable requirements for institutional controls: 40 CFR Part 373; Minn. Stat. ' 115B.16 subd.2; Relevant and appropriate requirements for this activity: 40 CFR ' 300.430(a)(1)(iii)(D).

- Applicable requirements for POTW discharge: Waste Discharge Rules for the Metropolitan Disposal System 202.00; 304.03; 401.00; 401.01; 401.02; 402.00; 406.00. Potentially applicable requirements for this activity: Waste Discharge Rules for the Metropolitan Disposal System 403.00; 406.01-406.22. Relevant and appropriate requirements for this activity: Waste Discharge Rules for the Metropolitan Disposal System 304.00; 304.01; 205.00; 212.00; 212.03; 212.04; 213.00; 213.01; 213.02; 213.03; 213.04; 214.00; 215.00; 218.00. Potentially relevant and appropriate requirements for this activity: Waste Discharge Rules for the Metropolitan Disposal System 212.01. TBC guidance for this activity: Pertinent provisions of Metropolitan Waste Control Commission Leachate and Contaminated Groundwater Program.
- Applicable requirements for construction of groundwater monitoring wells: Minn. R. pt. 4725. 3550; Potentially applicable requirements for this activity: Minn. R. pt. 4725.6450; Minn. R. pt. 4725.2020; Minn. R. pt. 4725.2050; Minn. R. pt. 4725.2150; Minn. R. pt. 4725.2175; Minn. R. pt. 4725.2185; Minn. R. pt. 4725.2250; Minn. R. pt. 4725.2350; Minn. R. pt. 4725.2450; Minn. R. pt. 4725.2550; Minn. R. pt. 4725.2650; Minn. R. pt. 4725.2750; Minn. R. pt. 4725.2850; Minn. R. pt. 4725.2950; Minn. R. pt. 4725.2975; Minn. R. pt. 4725.3050; Minn. R. pt. 4725.3150; Minn. R. pt. 4725.3250; Minn. R. pt. 4725.3350; Minn. R. pt. 4725.3450; Minn. R. pt. 4725.3650; Minn. R. pt. 4725.3750; Minn. R. pt. 4725.3850; Minn. R. pt. 4725.3875; Minn. R. pt. 4725.6650; Minn. R. pt. 4725.6755; Minn. R. pt. 4725.6850; Minn. R. pt. 4725.0050; Minn. R. pt. 4725.1830 (substantive requirements); Minn. R. pt. 4725.1848 (substantive requirements); TBC guidance for this activity: MPCA Superfund and Voluntary Investigation and Cleanup Program Example Sampling Protocol for Monitoring Wells.
- Applicable requirements for protection of underground waters (antidegradation): Minn. Stat. ' 103H.001; Minn. Stat. ' 115.03 subd.1; Minn. Stat " 115.42, 115.43, 115.44; Minn. R. pt. 7060.0400; Minn. R. pt. 7060.0600, subpt. 2 and 3.
- TBC Guidance for investigation-derived waste: EPA OSWER Publication 9345.03FS, January, 1992.

Cost-Effectiveness

The selected remedy provides an effective remedy proportionate to its cost. The degree of long-term effectiveness and permanence; reduction of toxicity, mobility or volume of contaminants; and ease of implementability afforded by this remedy give it a reasonable value for its cost.

Utilization of Permanent Solutions and Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy provides the best balance among the four alternatives evaluated against the nine evaluation criteria. Based on the available information, EPA and MPCA believe that the selected remedy is protective of human health and the environment, satisfies the remedial objectives of plume containment, is cost effective, and utilizes permanent solutions to the maximum extent practicable. Of the five statutory criteria met by the selected remedy, cost-effectiveness was the most critical in the selection decision. The acceptance of the remedy by the

State and the active participation of the RAB representing the community were major considerations in the decision making process.

Preference for Treatment as a Principal Element

The selected remedy extracts contaminated groundwater from the aquifer then discharges it the POTW for subsequent treatment. Therefore, it satisfies the statutory preference for remedies that employ treatment as a principal element.

Site K Shallow Groundwater

Protection of Human Health and the Environment

The selected remedy will provide overall protection of human health and the environment through containment and extraction of the contaminated groundwater. The containment trench will prevent the plume from migrating off-Site. The extracted groundwater will be treated by air stripping to meet standards for discharge to Rice Creek. No unacceptable short-term risks or cross media impacts will be caused by implementation of the remedy.

Compliance with ARARs

The selected remedy will comply with ARARs and TBC guidance over time. The cleanup of contaminated groundwater will meet the chemical-specific ARARs and TBC guidance through extraction and treatment of groundwater that exceed these levels, while the action-specific ARARs will be met during the construction , operation, and monitoring phases of the remedy. The following is a list of ARARs and "to be considered" guidelines for the remedy:

Chemical-specific

- Minn. R. pt. 4717.7100 - 4717.7800 - Health Risk Limits for trichloroethene (30 ug/L), *cis*-1,2-dichloroethene (70 ug/L) and *trans*-1,2-dichloroethene (100 ug/L) -- Applicable for groundwater remediation. Minn. R. pt. 4717.7700 - Health Risk Limits for carcinogenic mixtures, and Minn. R. pt. 4717.7750 - Health Risk Limits for systemic toxicant mixtures -- Applicable for groundwater remediation.
- Minn. R. pt. 7050.0220, subpts. 3 and 4 - Minnesota Aquatic Life Standard for parameters listed in current NPDES nonpermit.

Location-specific

- 40 CFR 264.18(b); Minn. Stat. 103F.101-.155; Minn. R. pts. 6120.5000-.6200 - Applicable to impacts on floodplains for remedial actions at Site K.
- Clean Water Act ' 404; 40 CFR 230; 33 CFR 320-330; Minn. R. pt. 7045.0460 Subpart 2; Minn. Stat. ' 116D.04; Minn. R. pts. 6115.0150-0272 - Applicable to impacts on wetlands for remedial actions at Site K.

- Fish and Wildlife Coordination Act (16 USC 661 *et seq.*); Clean Water Act ' 404; 40 CFR 230; 33 CFR 320-330 - Applicable to impacts on fish and wildlife resources in Rice Creek for remedial actions at Site K.
- Executive Order 11988; 40 CFR 6.302(b); 40 CFR 6 (Appendix A) - TBC guidance for protection of floodplains during remedial actions at Site K.
- Executive Order 11990; 40 CFR 6.302(a); and 40 CFR 6 (Appendix A); Wetland Conservation Act of 1991 Administrative Guidelines: Interim Program of Wetlands Regulation (Board of Water and Soil Resources) - TBC guidance for protection of wetlands during remedial actions at Site K.
- 40 CFR 6.302(g); CERCLA Compliance with Other Laws Manual: Part II.; OSWER Directive 9234.1-02 - TBC guidance for protection of fish and wildlife resources during remedial actions at Site K.
- Consultation with the Minnesota Department of Natural Resources is TBC guidance for any potential impacts to the central kame during remedial actions at Site K.
- U.S. Army Regulation 420-40 - TBC guidance for impacts to historic properties during remedial actions at Site K.

Action-specific

- Potentially applicable requirements for shallow tray air stripper: Minn. R. pt. 7045.0261; Minn. R. pt. 7045.0270 (If carbon filters used in strippers meet the definition of a RCRA hazardous waste and are transported off-site for disposal)
- Potentially applicable requirements for institutional controls: 40 CFR Part 373; Minn. Stat. ' 115B.16 subd.2; Relevant and appropriate requirements for this activity: 40 CFR ' 300.430(a)(1)(iii)(D).
- Potentially applicable requirements for air emissions: Minn. R. pt. 7009.0080; Minn. R. pt. 7007.0300; Minn. R. pt. 7007.0200; Minn. R. pt. 7007.0250; Minn. R. pt. 7007.0800, subpts. 1-4, 7, 9, 14, and 16; Minn. R. pt. 7007.1100-.1300.
- Discharge to Rice Creek must comply with the limitations set forth in the current NPDES nonpermit.
- Applicable requirements for construction of groundwater monitoring wells: Minn. R. pt. 4725. 3550; Potentially applicable requirements for this activity: Minn. R. pt. 4725.6450; Minn. R. pt. 4725.2020; Minn. R. pt. 4725.2050; Minn. R. pt. 4725.2150; Minn. R. pt. 4725.2175; Minn. R. pt. 4725.2185; Minn. R. pt. 4725.2250; Minn. R. pt. 4725.2350; Minn. R. pt. 4725.2450; Minn. R. pt. 4725.2550; Minn. R. pt. 4725.2650; Minn. R. pt. 4725.2750; Minn. R. pt. 4725.2850; Minn. R. pt. 4725.2950; Minn. R. pt. 4725.2975; Minn. R. pt. 4725.3050; Minn. R. pt. 4725.3150; Minn. R. pt. 4725.3250; Minn. R. pt. 4725.3350; Minn. R. pt. 4725.3450; Minn. R. pt. 4725.3650; Minn. R. pt. 4725.3750; Minn. R. pt. 4725.3850; Minn. R. pt. 4725.3875; Minn. R. pt. 4725.6650; Minn. R. pt. 4725.6755; Minn. R. pt. 4725.6850; Minn. R. pt. 4725.0050; Minn. R. pt. 4725.1830 (substantive requirements); Minn. R. pt. 4725.1848 (substantive requirements); TBC guidance for this activity: MPCA Superfund and Voluntary Investigation and Cleanup Program Example Sampling Protocol for Monitoring Wells.
- Applicable requirements for protection of underground waters (antidegradation): Minn. Stat. ' 103H.001; Minn. Stat. ' 115.03 subd.1; Minn. Stat " 115.42, 115.43, 115.44; Minn. R. pt.

7060.0400; Minn. R. pt. 7060.0600, subpt. 2 and 3.

- TBC Guidance for investigation-derived waste: EPA OSWER Publication 9345.03FS, January, 1992.

Cost-Effectiveness

The selected remedy provides an effective remedy proportionate to its cost. The degree of long-term effectiveness and permanence; reduction of toxicity, mobility or volume of contaminants; and ease of implementability afforded by this remedy give it a reasonable value for its cost.

Utilization of Permanent Solutions and Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy provides the best balance among the three alternatives evaluated against the nine evaluation criteria. Based on the available information, EPA and MPCA believe that the selected remedy is protective of human health and the environment, satisfies the remedial objectives of plume containment, is cost effective, and utilizes permanent solutions to the maximum extent practicable. Of the five statutory criteria met by the selected remedy, cost-effectiveness was the most critical in the selection decision. The acceptance of the remedy by the State and the active participation of the RAB representing the community were major considerations in the decision making process.

Preference for Treatment as a Principal Element

The selected remedy extracts contaminated groundwater from the aquifer then treats the extracted groundwater using air stripping. Therefore, it satisfies the statutory preference for remedies that employ treatment as a principal element.

Deep Groundwater

Protection of Human Health and the Environment The selected remedy will provide overall protection of human health and the environment through extraction and treatment of contaminated groundwater. The extraction of the groundwater will contain the most contaminated portions of the deep groundwater plume within OU-2 and prevent it from spreading further. The extracted water will be treated to meet drinking water standards and discharged to the aquifer as recharge. Institutional controls on site access and use will insure no additional points of exposure will be installed and that the groundwater resource will not be used in a manner that constitutes an exposure. No unacceptable short-term risks or cross-media impacts will be caused by implementation of the remedy. The review of new and emerging technologies that may cost-effectively accelerate aquifer restoration helps to insure a level of environmental protection of the remedy.

Compliance with ARARs

The selected remedy will comply with ARARs and TBC guidance over time. The cleanup of site groundwater will meet the chemical-specific ARARs and TBC guidance through extraction and treatment of contaminated groundwater that exceed these levels, while the action-specific ARARs will be met during the construction, operation, and monitoring phases of the remedy. The following is a list of ARARs and "to be considered" guidelines for the remedy:

Chemical-specific

- Minn. R. pts. 4717.7100 through 4717.7800 - Health Risk Limits for 1,1-dichloroethane (70 ug/L), 1,2,-dichloroethane (4 ug/L), 1,1,-dichloroethene (6 ug/L). Applicable requirements for remediation of Units 3 and 4 groundwater.
- Minn. R. pt. 4717.7700 - Health Risk Limits for carcinogenic mixtures, and Minn. R. pt. 4717.7750 - Health Risk Limits for systemic toxicant mixtures, applicable requirements for remediation of COCs in Units 3 and 4 groundwater.
- 40 CFR Part 141 Subparts F and G - Maximum contaminant levels (MCLs) for tetrachloroethene (5 ug/L) and trichloroethene (5 ug/L); Maximum Contaminant Level Goals (MCLGs) for *cis*-1,2,-dichloroethene (70 ug/L) and 1,1,1-trichloroethane (200 ug/L). Relevant and appropriate requirements for remediation of Units 3 and 4 groundwater.

Action-specific

- Applicable requirements for drilling advisories: Minn. R. pt. 4725.3650. TBC guidance for this activity: When finalized, a memorandum designating special well construction area for the construction of any off-site wells or the sealing of off-site wells.
- Potentially applicable requirements for institutional controls: 40 CFR Part 373; Minn. Stat. ' 115B.16 subd.2; Relevant and appropriate requirements for this activity: 40 CFR ' 300.430(a)(1)(iii)(D).
- Potentially applicable requirements for groundwater treatment using air stripping and carbon adsorption (potable supply only): Minn. R. pt. 7045.0261 and Minn. R. pt. 7045.0270
- Potentially applicable requirements for air emissions: Minn. R. pt. 7009.0080; Minn. R. pt. 7007.0300; Minn. R. pt. 7007.0200; Minn. R. pt. 7007.0250; Minn. R. pt. 7007.0800, Subparts 1 through 4, 7, 9, 14, and 16; Minn. R. pt. 7007.1100-.1300
- Potentially applicable requirements for well abandonment: Minn. R. pt. 4725.3850; Minn. R. pt. 4725.3875
- No ARARs developed for providing alternate water supplies.
- Applicable requirements for protection of underground waters (antidegradation): Minn. Stat. ' 103H.001; Minn. Stat. ' 115.03 subd.1; Minn. Stat " 115.42, 115.43, 115.44; Minn. R. pt. 7060.0400; Minn. R. pt. 7060.0600, subpt. 2 and 3.
- Applicable requirements for construction of groundwater monitoring wells: Minn. R. pt. 4725. 3550; Potentially applicable requirements for this activity: Minn. R. pt. 4725.6450; Minn. R. pt. 4725.2020; Minn. R. pt. 4725.2050; Minn. R. pt. 4725.2150; Minn. R. pt. 4725.2175; Minn. R. pt. 4725.2185; Minn. R. pt. 4725.2250; Minn. R. pt. 4725.2350; Minn. R. pt. 4725.2450; Minn. R. pt. 4725.2550; Minn. R. pt. 4725.2650; Minn. R. pt. 4725.2750;

Minn. R. pt. 4725.2850; Minn. R. pt. 4725.2950; Minn. R. pt. 4725.2975; Minn. R. pt. 4725.3050; Minn. R. pt. 4725.3150; Minn. R. pt. 4725.3250; Minn. R. pt. 4725.3350; Minn. R. pt. 4725.3450; Minn. R. pt. 4725.3650; Minn. R. pt. 4725.3750; Minn. R. pt. 4725.3850; Minn. R. pt. 4725.3875; Minn. R. pt. 4725.6650; Minn. R. pt. 4725.6755; Minn. R. pt. 4725.6850; Minn. R. pt. 4725.0050; Minn. R. pt. 4725.1830 (substantive requirements); Minn. R. pt. 4725.1848 (substantive requirements); TBC guidance for this activity: MPCA Superfund and Voluntary Investigation and Cleanup Program Example Sampling Protocol for Monitoring Wells.

- TBC Guidance for investigation-derived wastes: EPA OSWER Publication 9345.03FS (January 1992)

Cost-Effectiveness

The selected remedy provides an effective remedy proportionate to its cost. The degree of long-term effectiveness and permanence, reduction of toxicity, mobility or volume of contaminants, and ease of implementability afforded by this remedy give it a reasonable value for its cost.

Utilization of Permanent Solutions and Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy provides the best balance among the three alternatives evaluated against the nine evaluation criteria. Based on the available information, EPA and MPCA believe that the selected remedy is protective of human health and the environment, satisfies the remedial objective of plume source area containment, is cost-effective, and utilizes permanent solutions to the maximum extent practicable. Of the five statutory criteria met by the selected remedy, cost-effectiveness was the most critical in the selection decision. The acceptance of the remedy by the State and the active participation of the RAB representing the community were major considerations in the decision making process.

Preference for Treatment as a Principal Element

The selected remedy removes and treats VOCs in the groundwater using air stripping. Therefore, it satisfies the statutory preference for remedies that employ treatment as a principal element.

Responsiveness Summary
New Brighton/Arden Hills Operable Unit 2
Record of Decision

I. OVERVIEW

The public comment period for the Proposed Plan for Operable Unit 2 (OU-2) of the New Brighton/Arden Hills Superfund Site (the Site) began on April 7 and ended on May 6, 1997. A public notice summarizing the Proposed Plan and announcing the public comment period and public meeting was published in the Sunday, April 6 edition of the Minneapolis Star Tribune as well as the Wednesday, April 9 edition of the Shoreview Bulletin, a local paper with distribution in the communities surrounding the Twin Cities Army Ammunition Plant (TCAAP). In addition, the Proposed Plan was directly mailed to 322 addressees on the TCAAP mailing list.

During the public comment period, written comments were received from the City of Arden Hills and from four individuals. Comments directly related to the proposed OU-2 remedies were generally supportive of the U.S. Army's efforts to clean up the site. Several of the comments addressed issues not related to the OU-2 cleanup (e.g., reuse).

At the public meeting, which was held on Tuesday, April 22, 1997, at the New Brighton Family Services Center, questions and comments were received from several members of the audience. A transcript of the public meeting minutes has been included in the Site Administrative Record.

Based upon the comments received, the community is supportive of the remedies which are being proposed for the cleanup of shallow and deep soils and shallow and deep groundwater on and underneath TCAAP.

II. BACKGROUND ON COMMUNITY INVOLVEMENT

Contaminated groundwater has been a major environmental concern for the communities surrounding TCAAP since contamination was first discovered in 1981. Interim remedial actions taken by the U.S. Environmental Protection Agency (EPA) and the U.S. Army (Army), particularly actions involving the provision of alternate water supplies to affected residents, were implemented to address these concerns. Several lawsuits, which were eventually settled, were filed with respect to TCAAP-related groundwater contamination by the City of New Brighton, the Village of St. Anthony and a residents' group. With the signing of the Federal Facility Agreement by the Army, EPA and the Minnesota Pollution Control Agency (MPCA) in 1987, a coordinated effort for site remediation was begun. This effort included the implementation of an active community relations effort based upon a Site Community Relations Plan.

The Site has been divided into three operable units. In 1993 and 1992, respectively, groundwater remedial actions were selected in the Operable Unit 1 and Operable Unit 3 Records Decision (RODs) for the North and South Plumes of contaminated groundwater found in the deep aquifers beyond the TCAAP boundary. In addition, a removal action involving the installation of shallow groundwater extraction wells at Site A to prevent the migration of contaminated shallow groundwater was implemented in 1994.

The remedial actions proposed for OU-2 are based upon the findings in the OU-2 Feasibility Study, which was completed in March 1997. A significant community involvement effort has been part of the OU-2 remedy selection process through the participation of the TCAAP Restoration Advisory Board (RAB) in the process. Following are highlights of past community relations activities undertaken for the Site, up to and including activities specific to OU-2:

July 1981: Operators of public water supplies in the City of New Brighton and the Arden Manor Trailer Park were notified in person by Army officials of contamination and information was distributed to water users.

September 1981: News release announced the presence of contamination on-site at TCAAP. A meeting to discuss the contamination problem was held with state and local public officials and affected residents.

May 1983: Public meeting held to discuss the recommendation for a Granular Activated Carbon (GAC) treatment system to be used for temporary water supply at New Brighton.

May 10, 1987 - June 1, 1987: Public notice of Draft ROD and Public Meeting concerning the Boundary Groundwater Recovery System at TCAAP.

July 1987: News conference conducted by Attorney General for the State of Minnesota and the Army to announce the signing of the Federal Facility Agreement (FFA) for the TCAAP Environmental Restoration Program.

May 23, 1989: Public meeting held for the Record of Decision on the Interim Remedial Action Plan, Site D: PCB-Contaminated Soils.

November 7-9, 1989: Community interviews conducted by U.S. Army representatives with participation by EPA and MPCA.

November 18, 1991: Public meeting held to announce the completion and discuss the results of the on-TCAAP and off-TCAAP remedial investigations.

August 18, 1992: Public meeting held for the Record of Decision, Operable Unit 3 groundwater remedy.

August 19, 1993: Public meeting held for the Record of Decision, Operable Unit 1 groundwater remedy.

January, 1996: First meeting of the TCAAP RAB.

September 1996: Community Interviews for Community Relations Plan Update.

February, 1997: Revised and updated TCAAP Community Relations Plan.

April 22, 1997: Public meeting for the OU-2 Proposed Plan.

Ongoing community relations activities at TCAAP include:

Technical Review Committee (TRC): Established in 1985 pursuant to the Superfund Amendments and Reauthorization Act (SARA), Section 211, the TRC is open to the public and meetings are held on a monthly basis.

TCAAP Environmental Restoration Program Hotline: Established in 1987 to respond to questions from the public.

TCAAP Restoration Advisory Board (RAB): Pursuant to Department of Defense Policy, a RAB was formed at TCAAP in the fall of 1995 and held its first meeting in January 1996. The RAB has provided significant input in the OU-2 remedy selection decision and has been an active body since its inception. Additionally a RAB Hotline has been established. RAB meetings are held monthly and are open to the public.

TCAAP Installation Restoration Program (IRP) Update: Published several times per year and mailed out to the TCAAP mailing list, the IRP Update highlights current environmental cleanup progress at the site.

Site Tours: Numerous tours of TCAAP have been provided for community leaders and the general public.

Information Repository: The information repository for the Site is maintained at TCAAP and at the Shoreview Library.

III. SUMMARY OF COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD

A written comment was received from the City of Arden Hills thanking the Army and Alliant Techsystems for their continued participation in the TCAAP cleanup effort. Three comments were received which did not directly relate to the OU-2 remedies but to the issues of potential future land use and the public health of the community north of TCAAP. One commentor specifically backed Alternative 3 for deep groundwater and recommended the use of improved well technology for the extraction of contaminated groundwater.

Following is a summary of the verbal comments, and responses to those comments, made during the public meeting.

Comment: The commentor pointed out that the risk assessment was done to industrial cleanup levels because the Army is retaining the site and that it is the position of the Department of Defense that any future land owner who may choose to use it for a residential purpose, such as housing or schools, would be responsible for further cleanup.

Response: Comment noted.

Comment: The commentor wanted to know whether the dump contents at Site G will be addressed and whether soils that might be brought from off site would come from outside the facility.

Response: The dump site at Site G will be characterized to determine whether any further action is required. It is believed to be filled with rubble. However, if it contains hazardous waste, that would be removed.

If it becomes necessary to bring in soils from off site as fill material, only clean fill would be brought in.

Comment: The commentor stated he understood that there are not enough funds available to accomplish the proposed remediation. He wanted to know what citizens could do to facilitate obtaining the appropriate funding.

Response: The Army currently has sufficient funds to do most of the OU-2 design work and is working with their headquarters to obtain additional funds to complete all of the designs. Army expects to obtain sufficient funds to complete all of the OU-2 remedies by the year 2003.

Comment: The commentor noted that, for the deep groundwater remedy, the criteria of long-term effectiveness and reduction of toxicity, mobility and volume are only partially met because there currently exists no cleanup technology which will fully meet them and that this has led to a rather unique approach.

Response: Army and the regulators are looking at ways of reducing the time that it will take to clean up the deep aquifer and the cost of that cleanup. Annually Army will be reviewing, and reporting on, potential remedies and new technologies which have the potential to accomplish these goals.

Comment: The commentor wanted to know how much water will be discharged to Rice Creek from the Site K remediation system.

Response: The shallow groundwater treatment system at Site K currently operates between

15 and 18 gallons per minute. That volume is not expected to change significantly in the Site K shallow groundwater remedy.

Comment: The commentor wanted to know whether it was possible to restore the lake at Site H (Sunfish Lake) to its original shape.

Response: The area of Sunfish Lake to which the commentor refers was filled in with clean fill decades ago. Since it is not contaminated, there is no need for any remediation in this area of Sunfish Lake.

Comment: The commentor asked whether the cleanup processes specified in the proposed remedies are new or has there been experience with their rates of success, failure and results.

Response: The technologies proposed for the OU-2 remedies are established technologies. Pump-and-treat for groundwater gradient control; excavation, stabilization and off-site disposal of contaminated soils; and soil vapor extraction for deeper soils have all been around since the early 1980s. We expect these technologies to be very effective in meeting the site-specific cleanup goals. In addition, as previously indicated, innovative technologies will be reviewed annually to evaluate whether any have been developed which have the potential to cost-effectively reduce the timeframe for meeting the deep groundwater cleanup goals.

Comment: The commentor asked about the air sparging alternatives that were cited as non-implementable or marginally implementable for the shallow groundwater sites A and I.

Response: Air sparging actually requires two systems: one to force air into the groundwater and the other to capture those solvents that are liberated into the vadose zone (i.e., a soil vapor extraction system). At Site A, the installation of such systems would not justify its cost since the existing containment boundary system is expected to meet remedial action objectives within ten years. At Site I, the implementation of such systems would be very difficult due to the presence of an operating building on the site.

Comment: The commentor wanted to know whether excavated soils from the shallow soil sites will be consolidated before they are stabilized, necessitating the construction of a Corrective Action Management Unit (CAMU), or will they be excavated and stabilized individually.

Response: Although the CAMU remains an option, the current plan is remediate the shallow soil sites individually.

Comment: The commentor noted that nitroglycerine is the only explosive chemical of concern throughout all of the sites. He asked if, as remediation proceeds, there will be any additional characterization specifically for explosives, especially in light of the lessons learned at Site F.

Response: The experience at Site F, where significantly greater quantities of buried ammunition waste than originally anticipated were uncovered, has been very instructive. As part of remedial design, plans will be developed to deal with unknowns.

IV. OUTSTANDING CONCERNS

No outstanding public concerns regarding the OU-2 remedial actions have been identified.

EXPLANATION OF SIGNIFICANT DIFFERENCES

No differences exist between the preferred alternatives presented in the Proposed Plan for Operable Unit 2 and the selected remedies presented in this ROD.

TWIN CITIES ARMY AMMUNITION PLANT
INSTALLATION RESTORATION PROGRAM

Administrative Record File for New Brighton/Arden Hills NPL Site
Operable Unit 2

Draft Record of Decision Index
Volumes 1 and 2

August 18, 1997

TWIN CITIES ARMY AMMUNITION PLANT
INSTALLATION RESTORATION PROGRAM

Administrative Record File For New Brighton/Arden Hills NPL Site
Operable Unit - 2

Draft Record Of Decision Index

September 30, 1995

Prepared by:

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Purchase Order No. 420804
GPMMB No. 4008543/62747

TWIN CITIES ARMY AMMUNITION PLANT
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September 30, 1995

I. THE DRAFT RECORD OF DECISION INDEX

The draft Index identifies documents in the Administrative Record file for the New Brighton/Arden Hills NPL Site, Operable Unit-2 ("OU-2"). The Index is broken down into three (3) categories which correspond to the physical structure of the Administrative Record file. These categories are:

A. Site Specific Documents
B. Non-Site Specific Documents
C. Public Participation Documents

Site Specific Documents are those documents which qualify for inclusion in the Administrative Record file and relate to the New Brighton/Arden Hills NPL Site. Non-Site Specific Documents are those documents which qualify for inclusion in the Administrative Record file, but do not specifically relate to the Site. Public Participation Documents are those documents which relate to public involvement in and acceptance of the selected remedial alternatives. Documents which fall in the Site Specific or Public Participation category are listed on the draft Index in chronological order. Non-Site Specific Documents are listed in alphabetical order by author.

Generally, documents referenced on the Index may be located in the Administrative Record file by going to the category placement for the document (i.e., Site Specific, Non-Site Specific or Public Participation) and then locating the document by its date in the case of Site Specific or Public Participation Documents or author in the case of Non-Site Specific Documents. Cross-referenced documents may be located in the Administrative Record for previous Records of Decision ("RODs") by following the same procedure. Except as otherwise indicated, most Non-Site Specific Documents are in the public domain and therefore not physically located within the Administrative Record file. Sufficient information is given on this Index to locate the document in the public domain.

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II. EXPLANATION OF COLUMN HEADERS

1. **DOC DATE:** The date of the document. All the documents on this Index within the Site Specific or Public Participation categories are arranged in chronological order.

2. **TITLE:** The title of the document or a brief description of the document.

3. **AUTHOR:** Author of the document. Where available, the author's title and organization are included. All documents on this Index within the Non-Site Specific category are listed in alphabetical order.

4. **RCPNT:** Recipient of the document. Where available the recipient's title and organization are included.

5. **REF #:** This is the identifying number on the document itself. This may include the purchase order number, work assignment number, contract number or other reference number.

6. **XREF:** This identifies that a particular document has been included in the Administrative Record for a previous ROD. The number (ranging from 1-12) indicates the first ROD for which the particular document was included in the administrative record.

TWIN CITIES ARMY AMMUNITION PLANT
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Administrative Record File for New Brighton/Arden Hills NPL Site
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September 30, 1995

TAB 1

Site-Specific Documentation:
Includes site specific reports, studies,
correspondence and other documentation.

(References are arranged in chronological order.)

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
00/00/00	Sampling, testing data, chain of custody forms, Quality Assurance/Quality Control documentation for referenced reports is available from Army Environmental Center, Aberdeen Proving Ground, Maryland; contact TCAAP RPM for further information and access to these records.				13	62
00/00/00	Field Sampling Quality Assurance Guide	STS Consultants, Ltd.			13	752
00/00/00	Well Sampling Authorization	Malwitz, Michael (Metal-Matic, Inc.)				1251
00/00/00	New Brighton Well #12 Well Water Sampling	Proper, Leslie (Director of Public Works, City of New Brighton)				1201
10/00/78	Installation Assessment TCAAP	United States Army Toxic and Hazardous Materials Agency		129	12	101
10/00/80	TCAAP, Report on Monitoring of Wastewater Flows	Professional Services Group, Inc.			12	761
05/00/81	Installation Assessment TCAAP	Bionetics Corporation		Contract No. 68-03-2844 (TS-PIC-0066)	12	126
07/17/81	MDH Water Samples from Arden Hills Training Center and Minnesota Dept. of Transportation Maintenance Bldg.	Englund, Gary (Minnesota Department of Health)	Mobley, Owen (Commander's Representative, Department of the Army)			2017
09/04/81	Alternative Water Supply for New Brighton (Sampling Results and Emergency Action Plan)	Kanner, Michael (MPCA)	Bartlet, Richard (U.S. EPA)		01	129
09/25/81	Study of Subsurface Contamination	Soil Exploration Co.		P.O. #1210-03; SEC #120-7709	12	130
09/30/81	Subsurface Exploration for Soil and Groundwater Contamination - Honeywell Inc.	Soil Exploration Co.		P.O. #376434; SEC #120-7678-A	12	131
10/05/81	Contamination of New Brighton Municipal Wells	Albin, D.R.	Lee, S.		01	133

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		(Department of Interior)	(MPCA)			
10/09/81	Wells Serving Arden Manor Mobile Home Park	Clark, Richard (Supervisor Engineering Unit, Minnesota Department of Health)	Lee, Steven (MPCA)			2018
10/09/81	MDH Water Samples from New Brighton Municipal Wells	Clark, Richard (Supervisor Engineering Unit, Minnesota Department of Health)	Lee, Steven (MPCA)			2019
10/13/81	Emergency Action Plan/Twelve Point Plan	Briemhurst, Lewis J. (MPCA)	Bartlet, Richard (U.S. EPA)		01	134
11/05/81	Review of Geologic and Hydrogeologic Data and Reports	STS Consultants, Ltd.		92765	01	135
12/00/81	Final Submittal Potable Water Source Alternatives for TCAAP	Sanders & Thomas, Inc.		P.O. No. 1212-08; Proj. No. 05-4811	13	605
01/27/82	Report on Chemical Analyses of Round Lake Sample	Elder, James (Senior Staff Biologist, Fish and Wildlife Service, U.S. Dept of Interior)	Refuge Manager (Minnesota Valley National Wildlife Refuge)			1019
02/05/82	Off-TCAAP Investigation	Bonner, J.E. (Department of the Army)	Breimhurst, Lewis J. (MPCA)		01	136
03/00/82	Recommendations for Future Hydrogeologic Work in New Brighton/Arden Hills Area	CH2M Hill		TDD-FS-8112-19	01	137
08/00/82	Potential Groundwater Contamination Sources Twin Cities/New Brighton	Bionetics Corporation		Contract No. 68-03-2844; TS-PIC-2001	01	139
08/12/82	Sample Results from New Brighton/Arden Hills Groundwater Site	Hess, Paul (Ecology and Environment, Inc.)		TDD No. FD5-8112-10	01	140

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
09/02/82	Preliminary Results of Phase I Survey (35 Well Samples 7/82)	Department of the Army			01	141
11/00/82	Evaluation of Waste Water Constituents, TCAAP	Eugene A. Hickok and Associates			01	732
11/00/82	Potential Groundwater Contamination Sources Twin Cities/New Brighton (Addendum)	Bionetics Corporation		Contract No. 68-03-2844; TS-PIC-82001	01	142
11/01/82	Field Investigations of Uncontrolled Hazardous Waste Sites, FIT Project, Task Report to EPA, Sample Results from: Preliminary Surface Water Sampling Survey New Brighton/Arden Hills, Ramsey County, Minnesota	Ecology and Environment, Inc.		TDD #F05-8206-01 and 03; Contract No. 68-01-6056	01	764
11/12/82	Remedial Investigation - Action Memorandum	Breimhurst, Lewis J. (MPCA)	Bartlet, Richard (U.S. EPA)		01	143
11/16/82	Work Plan, Soil and Groundwater Investigation	Barr Engineering Company			01	817
01/00/83	Remedial Action Master Plan	Remedial Planning Field Investigation Team (CH2M Hill)		EPA No. 01-5V40.01; W65140	01	144
01/00/83	Aerial Photographic Analysis of Hazardous Waste Disposal Areas, Minnesota	Lockheed Engineering and Management Services Co., Inc.		68-03-3049	01	832
01/13/83	New Brighton/Arden Hills Groundwater Contamination - Report on Testing of 150 Drinking Wells	Hess, Paul G. (Ecology and Environment, Inc.)		TDD #F5-8112-10A	01	145
03/00/83	Sewer Line and Manhole Inspection Report	Professional Services Group, Inc.			02	617
03/00/83	Report on Sampling Results from New Brighton-Shoreview, Ramsey County	Field Investigation Team Ecology and Environment, Inc. (CH2M Hill)		TDD No. R05-8208-02A	01	146
03/00/83	Study of TCE in Sewers Near Bldg. 502, TCAAP	Eugene A. Hickok and Associates			01	702

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
03/30/83	Report on Water Supply System for St. Anthony, Minnesota	Bonestroo, Rosene (Anderlik & Associates, Inc./ Barr Engineering Company)			03	147
04/00/83	Scope of Work for Phase II of TCAAP Environmental Contamination Survey	Department of the Army			03	148
05/00/83	Phase I Sampling Program Bldg. 502 and Vicinity TCAAP Environmental Investigation	Conestoga-Rovers & Associates, Inc.		1219		754
05/00/83	Safety & Health Plan, Interim Surface Containment Program: Sprinkler Pit and Scrap Dock Area - Bldg. 502 and Vicinity	Conestoga-Rovers & Associates, Inc.		1219	01	755
05/00/83	Final Feasibility Study, Temporary Water Supply, New Brighton, Minnesota	CH2M Hill		EPA No. 22.5M40.0	01	831
05/16/83	TCAAP Environmental Contamination Survey Phase I Report: Vol. I (Contamination Rpt.); Vol. II (Geotechnical Rpt.); Vol. III (Geotechnical Appendix)	STS Consultants, Ltd.		DRXTH-AS-CR-83197	06	149
05/17/83	TCAAP Bldg. 502 PCB Study	Pace Laboratories				779
06/00/83	Final Alternative Screening Temporary Water Supply, St. Anthony, Minnesota	CH2M Hill		EPA No. 22.5M40.0	04	150
06/21/83	Superfund Record of Communications CDC Involvement Health Study New Brighton Site	McCumiskey, Peter	Jones, Georgi CEH/SIG			2210
06/27/83	Feasibility Study Temporary Water Supply, Private Well Users New Brighton/Arden Hills	CH2M Hill		W65340.00/EPA22.5M40 .0	02	151
06/27/83	Alternative Screening Temporary Water Supply, St. Anthony, Minnesota	CH2M Hill		W65340.00; EPA 22.5M40.0	02	152
06/27/83	Record of Decision: Interim Remedial Measure - Granular Activated Carbon filter for New Brighton Well Nos. 5 and 6	Lee Thomas (U.S. EPA)			01	63

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
07/00/83	Phase I - Sampling Program, Storm Sewer Discharge TCAAP Bldg. 103	Conestoga-Rovers & Associates, Inc.		1219	03	153
07/08/83	Superfund Record of Communications re: Health Study	McDumiskey, Peter Waldvogel, Karen (U.S. EPA)	McClanahan, Mark A.			2211
09/00/83	Work Statement, Engineering Analysis of Alternative Remedial Measures for Contamination Services at TCAAP	Department of the Army			03	154
09/00/83	Feasibility Study for Pretreatment of Metal Finishing Dept. Bldg. 502	Environmental Process, Inc.			01	769
09/01/83	Final Report Phase I - PCB Sampling Program Bldg. 502 and Vicinity, TCAAP Environmental Investigation	Conestoga-Rovers & Associates, Inc.		1219	12	413
09/13/83	Decommissioning of Well, Twin Cities Army Ammunition Plant Bldg. 502	Conestoga-Rovers & Associates, Inc.				4
09/19/83	Record of Decision: Extension of Municipal Water Supply to New Brighton/Arden Hills Private Well Users	Thomas, Lee (U.S. EPA)			02	64
10/00/83	Twin Cities Army Ammunition Plant Bldg. 103, Final Report Phase I - Sampling Program Bldg. 103 Storm Sewer Discharge	Conestoga-Rovers & Associates, Inc.		1244	12	5
10/00/83	Final Report on Exfiltration Tests of Selected Gravity Sanitary Sewers for TCAAP	Professional Services Group, Inc.			13	615
10/21/83	Superfund Record of Communications Regarding Health Effects Feasibility Study	Fabinski, Louis (Public Health Advisor/ Centers for Disease Control)	Waldvogel, Karen (U.S. EPA)			2212
11/00/83	Final Report on Pressure Tests of TCAAP's 18-Inch and 24-Inch Diameter Sanitary Sewer Force Mains	Professional Services Group, Inc.			13	616
11/24/83	Phase II - Sampling Program, Bldg. 502 and Vicinity, TCAAP	Conestoga-Rovers & Associates,		1282	12	412

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Environmental Investigation	Inc.				
12/16/83	Preliminary Concept Plan, TCAAP (Task Order 4) (Phase I - Component D)	Roy F. Weston, Inc.		DACA87-82-C-0063	08	155
00/00/84	Historic Properties Report Twin Cities Army Ammunition Plant	MacDonald and Mack Partnership		CX-0001-2-0033	06	6
01/00/84	Summary Report, Treatment of the Municipal Water Supply at New Brighton by Granular Activated Carbon	Barr Engineering Company			05	156
01/00/84	Preliminary Feasibility Evaluation for On-Site Waste Disposal	Roy F. Weston, Inc.		W.O. No. 1037-09-01		724
01/00/84	Sewer Sediment Testing Report	Eugene A. Hickok and Associates			13	619
03/00/84	Geophysical Survey of Southwest Boundary at TCAAP	Glaccum, Robert A. (Technos, Inc.)		Rpt. No. DRXTH-AS-CR-84280	05	612
03/14/84	Regional Remedial Investigation	Conestoga-Rovers & Associates, Inc.		1372	03	157
03/27/84	Feasibility Report for Temporary and Permanent Water Service from Roseville, Minnesota	Short-Elliott-Hendrickson, Inc.		SEH No. 84090	03	158
04/00/84	Sewer Cleaning, Testing and Inspection Plan for TCAAP	Professional Services Group, Inc.			13	618
04/18/84	Definition of Volatile Organics in Soil Bldg. 502 TCAAP	Haycock, Donald H. (Conestoga-Rovers & Associates, Inc.)	Jaska, James (Environmental Manager, Honeywell)	1282	03	763
06/00/84	Twin Cities Army Ammunition Plant, Engineering Analysis of Alternative Remedial Measures - Phase III Report - Vol. I	Roy F. Weston, Inc.		Contract No. DACA87-82C-0063; Rpt. No. DRXTH-AS-CR-84295	05	11
06/00/84	Final Report Remedial PCB Investigation/Feasibility Study Bldg. 502 and Vicinity, TCAAP Environmental Investigation	Conestoga-Rovers & Associates, Inc.		1282	12	414

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/00/84	Twin Cities Army Ammunition Plant, Engineering Analysis of Alternative Remedial Measures - Phase III Report - Vol. II (Appendix)	Roy F. Weston, Inc.		Contract No. DACA87-82C-0063; Rpt. No. DRXTH-AS-CR-84295	05	10
06/30/84	Environmental Contamination Survey Phase III Report: Vol. I (Source Assessment); Vol. II (Geotechnical Rpt.); Vol. III (Geotechnical Appendix); Vol. IV (Electrical Soil Resistivity Study); Vol. V (Source Assessment Appendix)	STS Consultants, Ltd.		Rpt. No. DRXTH-AS-CR-84289	03	159
08/00/84	Twin Cities Army Ammunition Plant Bldg. 103, Remedial Investigation Bldg. 103 Storm Sewer Discharge	Conestoga-Rovers & Associates, Inc.		1281	12	12
08/00/84	Twin Cities Army Ammunition Plant Bldg. 103 Remedial Feasibility Study, Bldg. 103 Storm Sewer Discharge	Conestoga-Rovers & Associates, Inc.			13	13
08/02/84	Record of Decision: Initial Remedial Alternative Selection - Interconnection Between City of Roseville and St. Anthony	Adamkus, Valdas V. (U.S. EPA)			03	65
09/00/84	Bldg. 502 Baseline Study, Sewer Integrity Television Inspection Survey, TCAAP Environmental Investigation	Donohue & Associates, Inc.		Project No. 13589	04	482
10/00/84	Twin Cities Army Ammunition Plant Bldg. 502, Remedial Feasibility Study Bldg. 502 Sewers	Conestoga-Rovers & Associates, Inc.		1251	12	16
10/00/84	TCAAP Bldg. 502, Baseline Study, Assessment of Sewer Water and Sediment Control	Conestoga-Rovers & Associates, Inc.		1251	12	17
10/00/84	Safety Plan Study for Solvent Stripping from Soil at TCAAP	Roy F. Weston, Inc.		W.O. No. 2281-01-11	08	162
10/00/84	Groundwater Remedial Action Alternative Analysis at TCAAP, Scope of Work	STS Consultants, Ltd.			06	161
12/00/84	TCAAP Sewer System Evaluation Survey, Interim Report	Professional Services Group, Inc.			12	614

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
12/00/84	TCAAP Bldg. 103, Supplemental Remedial Investigation/Feasibility Study, Bldg. 103	Conestoga-Rovers & Associates, Inc.		1281	12	18
12/00/84	Potable Source Water Study, TCAAP	Eugene A. Hickok and Associates			05	703
12/31/84	An Archeological Overview and Management Plan	Stafford, Barbara, et al. (Center for American Archeology, under supervision of Ruthann Knudson, Woodward-Clyde Consultants)		Contract No. CX-5000-3-0771; DARCOM Final Report No. 30		735
01/00/85	TCAAP Bldg. 103 Remedial Work Plan	Conestoga-Rovers & Associates, Inc.		1496	12	2(
01/00/85	Technical Work Plan Submittal, New Brighton/Arden Hills Force Main Remedial Investigation (Volume I)	Camp, Dresser & McKee, Inc.			09	836
01/00/85	TCAAP Bldg. 103, Addendum to Supplemental Remedial Investigation/Feasibility Study, Bldg. 103	Conestoga-Rovers & Associates, Inc.		1281	12	19
01/09/85	Addendum Report to Source Assessment Volume I, Phase II, TCAAP	STS Consultants, Ltd.			06	163
02/00/85	Project Operation Plan for New Brighton/Arden Hills Multi-Point Source Remedial Investigation	Camp, Dresser & McKee, Inc.			12	164
02/00/85	Report on Preliminary Survey of Industrial Waste Disposal Practices for New Brighton/Arden Hills (FIT 5 Report)	CH2M Hill Ecology and Environment, Inc.		TDD No. RS-8301-05A	04	165
02/00/85	Storm Sewer Evaluation and Sediment Testing at TCAAP	Eugene A. Hickok and Associates		P.O. No. 3335-01	04	775
03/00/85	TCAAP Bldg. 103, Final Engineering Report, Sewer Grouting Program Bldg. 103	Conestoga-Rovers & Associates, Inc.		1496	12	21
03/00/85	Volatile Organic Compound, Remedial Investigation, TCAAP Bldg. 502 and Vicinity	Conestoga-Rovers & Associates, Inc.		1461	12	25

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
03/00/85	Response Action Plan PCB Remediation Bldg. 502 TCAAP	Conestoga-Rovers & Associates, Inc.		1482		760
03/00/85	TCAAP Bldg. 502, Contract Documents and Specifications, Sewer Cleaning Program	Conestoga-Rovers & Associates, Inc.				22
03/00/85	Groundwater Monitoring Study, AMC Open Burning/Open Detonation Facilities	Army Environmental Hygiene Agency		Study No. 38-26-0457-86	08	166
03/29/85	TCAAP Bldg. 502, Final Engineering Report, Sewer Cleaning Program, Bldg. 502 (Appendices E, F & G)	Conestoga-Rovers & Associates, Inc.		1498	13	23
03/29/85	TCAAP Bldg. 502, Final Engineering Report, Sewer Cleaning Program Bldg. 502 (Appendices A, B, C & D)	Conestoga-Rovers & Associates, Inc.		1498	13	24
04/00/85	Work Plan Groundwater Remedial Action Alternatives Analysis	STS Consultants, Ltd. D'Appolonia Ltd.		92797K	12	167
05/00/85	Contract Documents and Specifications, Installation of Groundwater Collection Drain Bldg. 103	Conestoga-Rovers & Associates, Inc.			04	168
05/00/85	New Brighton/Arden Hills Phase I Multi-Point Source Remedial Investigation and Revisions	Camp, Dresser & McKee, Inc.			04	169
05/00/85	In-Situ Solvent Stripping from Soils, Pilot Study	Roy F. Weston, Inc.		DAAK11-82C-0017	08	170
05/00/85	U.S. EPA Comments on Groundwater Remedial Action Alternatives Analysis Work Plan (4/85)	Waldvogel, Karen (Site Manager, U.S. EPA)	Wyatt, Bill (U.S. Army AMCCOM Department of the Army)		13	790
05/01/85	Work Plan for New Brighton Municipal Well No. 7 Phased Feasibility Study	Camp, Dresser & McKee, Inc.		Doc. No. 108-WP1-WP-BBJK-1; Work Assignment 102-5L40	12	17[illegible]

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
05/08/85	Work Plan for New Brighton/Arden Hills Generic Technical Support for Document Review, New Brighton, Minnesota	Camp, Dresser & McKee, Inc.		Doc. No. 108-WP1-BBNQ-1; Work Assignment No. 102-5L40	12	839
05/10/85	Scope of Work Groundwater Remedial Action Alternatives Analysis	Kalitowski, Thomas (MPCA)	Schulte, Theodore E. (Department of the Army) Jaska, James (Honeywell Inc.) Benson, Victor (Federal Cartridge Company)		06	172
05/24/85	Response to Minnesota Pollution Control Agency Comments on Work Plan Groundwater Remedial Action Alternatives Analysis, TCAAP	Snow, Robert E. (Principal Engineer STS-D'Appolonia Ltd.)	Metzer, Nancy (Federal Cartridge Company)	92797K	13	791
06/00/85	TCAAP Groundwater Remediation Program, Area Investigation: Off-TCAAP	Conestoga-Rovers & Associates, Inc.		1499	06	173
06/00/85	Storm Sewer Evaluation and Sediment Testing at TCAAP	Eugene A. Hickok and Associates			13	600
06/07/85	TCAAP Bedrock Valley Survey Vol. I (Contamination Report), Vol. II (Geotechnical Report); Vol. III (Geotechnical Appendix)	STS Consultants, Ltd.		AMXTH-AS-CR-85020; AMXTH-AS-CR-85019; AMXTH-AS-CR-850	09	174
07/00/85	Production Well Alternatives, TCAAP	Eugene A. Hickok and Associates		P.O. #5021-4	04	613
07/08/85	Geophysical Investigation at TCAAP Site G	Bison Instruments, Inc.		SJ-308	08	175
08/07/85	TCAAP Well 5, 6 and Nursery Well Investigation	Eugene A. Hickok and Associates		Memo No. 91200.01	13	429
09/00/85	Off-TCAAP Study, Phase I: 96-10-8 Triangle	Conestoga-Rovers & Associates, Inc.		1500	12	177
09/00/85	Safety Plan for In-Situ Volatilization System at TCAAP	Wenck Associates, Inc.			08	178

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
09/00/85	Work Plan for In-Situ Volatilization System at TCAAP Sites D and G	Wenck Associates, Inc.			08	179
09/20/85	TCAAP Well 6 Investigation and Rehabilitation	Eugene A. Hickok and Associates		Memo No. 91200.02	13	372
10/00/85	TCAAP Bldg. 103, Final Engineering Report, Installation of Groundwater Collection Drain Bldg. 103	Conestoga-Rovers & Associates, Inc.		1496	13	26
10/00/85	Final Response Action Plan PCB Remediation Bldg. 502 TCAAP	Conestoga-Rovers & Associates, Inc.		1482	12	415
10/00/85	In-Situ Air Stripping of Soils, Pilot Study (Volumes 1 and 2)	Roy F. Weston, Inc.		DAAK11-82-C-0017; Rpt. No. AMXTH-TE-85026	08	180
10/07/85	Work Plan For In-Situ Volatilization System at TCAAP Sites D and G (Revised)	Wenck Associates, Inc.			13	806
10/25/85	Statistical Analysis of Water Quality Data from New Brighton Well No. 7 and St. Anthony Well Nos. 4 and 5	Goudreault, Paul (MPCA)	Twin Cities Army Ammunition Plant		04	181
11/00/85	Volatile Organic Compound Source Control, Remedial Action Plan, TCAAP Bldg. 502	Conestoga-Rovers & Associates, Inc.		1499	04	27
12/00/85	Test Plan: Column Leaching Tests of Contaminated Soils at TCAAP	Roy F. Weston, Inc.			13	750
12/31/85	Feasibility of Community-Wide Epidemologic Studies of Drinking Water and Health: St. Louis Park and New Brighton	Minnesota Department of Health			12	244
01/00/86	A Comprehensive Wildlife Management Plan for TCAAP	Landwehr, Thomas John (University of Minnesota)				773
01/03/86	Acceptance of October 3, 1985 Proposal for Air Stripping of Contaminated Soil	Chamberlain, Louis M. (Regulatory Compliance Section, Division of Air Quality, MPCA)	Schulte, Theodore E. (Commander's Representative, Department of the Army)			1276

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
01/31/86	Post Action Report on PCB Removal Site D, TCAAP	Wenck Associates, Inc.			11	733
02/00/86	Extraction Well Pumping Test Report (EW542U3), TCAAP Bldg. 502, Groundwater Remediation Program	Conestoga-Rovers & Associates, Inc.		1499	12	28
02/00/86	TCAAP, Groundwater Remediation Program Phase I Proposal	Conestoga-Rovers & Associates, Inc.		1412	06	184
02/00/86	Scope of Work, Off-TCAAP Study, Phase I Supplement, Phase II, Phase III	Conestoga-Rovers & Associates, Inc.		1638	04	705
02/00/86	Volatile Organic Compound Source Control Feasibility Study, Bldg. 502	Conestoga-Rovers & Associates, Inc.		1461	04	706
02/00/86	Comprehensive Summary Report, Potential Groundwater Contamination Sources, TCAAP and New Brighton (Volumes I and II)	Bionetics Corporation		Contract No. 68-03-3161; TS-PIC-85001M	04	185
02/00/86	Installation Restoration Program, TCAAP, Groundwater Remedial Action Alternatives Analysis	STS Consultants, Ltd.		AMXTH-AS-CR-86065	06	183
04/00/86	Proposed Plan of Investigation of Site F, TCAAP (Site F Closure)	Wenck Associates, Inc.			13	29
04/25/86	Work Plan for New Brighton/Arden Hills Mulit-Point Source Remedial Investigation Phase I Addendum	Camp, Dresser & McKee, Inc.			04	187
05/05/86	Phased Feasibility Study for Alternative Water Supply, New Brighton Well No. 7	Camp, Dresser & McKee, Inc.		Doc. No. 108-FS1-RT-CPBQ-1; Work Assignment 102-5L4D.8	04	189
06/00/86	Groundwater Remediation Program Plan	Conestoga-Rovers & Associates, Inc.		RFPDAAA09-86-R-0416	06	192
06/00/86	Installation Restoration Program, TCAAP, In-Situ Volatilization Air	Roy F. Weston, Inc.		W.O. No. 1037-12-01	08	191

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Emissions Study					
06/28/86	Installation Restoration Program, TCAAP, Groundwater Remediation Program, Boundary Groundwater Recovery System Contract Documents and Specifications	Conestoga-Rovers & Associates, Inc. Honeywell Inc.			06	193
06/30/86	Record of Decision: Remedial Alternative Selection - Operable Units for Provision of Alternative Water Supply (construction of new well [Well No. 13] to replace New Brighton Well No. 7)	Adamkus, Valdas V. (U.S. EPA)			04	66
07/00/86	TCAAP Phase II Sewer System Remedial Action (Vols. I and II, Vol. II Addendum)	Professional Services Group, Inc.			12	765
07/00/86	Volatile Organic Compound Source Management Feasibility Study, TCAAP Bldg. 502	Conestoga-Rovers & Associates, Inc.		1461	13	30
07/00/86	TCAAP, Outside Bldg. Sumps, Cleaning and Inspection (Volumes I and II)	Professional Services Group, Inc.				762
08/00/86	Installation Restoration Program, TCAAP, Boundary Groundwater Recovery System, Contract Documents and Specifications: Groundwater Treatment System	Conestoga-Rovers & Associates, Inc. Honeywell Inc. Michigan Technical University			06	194
08/00/86	Installation Restoration Program, TCAAP, Boundary Groundwater Recovery System, Contract Documents and Specifications: Groundwater Extraction, Monitoring and Return Wells	Conestoga-Rovers & Associates, Inc. Honeywell Inc.			06	195
08/00/86	Installation Restoration Program, TCAAP, Boundary Groundwater Recovery System, Contract Documents and Specifications: Pumphouse and Force Main System	Conestoga-Rovers & Associates, Inc. Honeywell Inc.			06	196
09/00/86	Off-Post Remedial Investigation/Feasibility Study TCAAP Scope of Work	International Technologies Corporation			13	774
10/00/86	Installation Restoration Program, TCAAP, Column Leaching Tests	Roy F. Weston, Inc.		DAAA09-86-Z-0013	08	197

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
10/20/86	Phase I Final Report: New Brighton/Arden Hills, Minnesota Multi-Point Source Remedial Investigation	Camp, Dresser & McKee, Inc.			13	730
11/00/86	Quality Assurance Project Plan, Off-TCAAP Study	Conestoga-Rovers & Associates, Inc.		1695	12	243
12/00/86	TCAAP, Bedrock Valley/Monitoring Well Installation Survey: Vol. I (Contamination Report); Vol. II (Geotechnical Report); Vol. III (Chemical Analytical Data); Vol. IV (Geotechnical Data)	STS Consultants, Ltd.		AMXTH-AS-CR-85020	06	198
12/00/86	Installation Restoration Program, TCAAP, Bedrock Valley/Monitoring Well Installation Survey: Errata Sheet			AMXTH-AS-CR-85020	13	805
12/10/86	Phased Feasibility Study for St. Anthony	Camp, Dresser & McKee, Inc.		Doc. No. 708-FS2-RT-DCTC-1; Work Assignment No. 102-SL40.10	05	199
12/30/86	TCAAP Wells 4, 5, 9 and 10 Investigation	Eugene A. Hickok and Associates			13	371
00/00/87	Fish and Wildlife Management Plan - TCAAP	Federal Cartridge Company				2220
02/00/87	TCAAP Bldg. 103, Performance Assessment Report, Volatile Organic Compound Remediation	Conestoga-Rovers & Associates, Inc.		1496	13	32
02/00/87	Off-TCAAP, Phase II, Old Northwest Refinery Site, Data Report	Conestoga-Rovers & Associates, Inc.		1638	09	815
02/00/87	Off-TCAAP, Phase II, Herbst Landfill, Data Report	Conestoga-Rovers & Associates, Inc.		1638	09	816
02/00/87	Final Report for the Findings of the Petrex Soil Gas Survey of TCAAP, Site F	Petrex			12	33
02/12/87	Farmstead Well Inventory and Assessment, TCAAP	Nielson, Robert C.			06	777

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		(Federal Cartridge Company)				
02/17/87	Phase I 96-10-8 Triangle Supplement Report	Conestoga-Rovers & Associates, Inc.		1695	12	200
02/18/87	Electromagnetic Inductance and Ground Probing Radar Survey, TCAAP Site F	STS Consultants, Ltd.		Project No. 92797-S	12	838
03/00/87	TCAAP Bldg. 502, Final Engineering Report, Sewer Cleaning Program	Conestoga-Rovers & Associates, Inc.		1498	04	34
03/00/87	Remedial Monitoring Plan TCAAP Bldgs. 103 and 502	Conestoga-Rovers & Associates, Inc.			04	203
03/00/87	Final Engineering Report, PCB Remediation, Bldg. 502 TCAAP	Conestoga-Rovers & Associates, Inc.		1987		751
03/00/87	Installation Restoration Program, TCAAP, Boundary Groundwater Recovery System Monitoring Plan	Conestoga-Rovers & Associates, Inc.			06	202
03/00/87	Installation Restoration Program, TCAAP, Boundary Groundwater Recovery System Quality Assurance Project Plan	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030	06	205
03/18/87	Test Results for Water Samples from Long Lake (February 2, 1987).	Wallner, Frank (Project Manager, (MPCA)	Holmberg, Larry (Ramsey County Dept. of Public Works)			2021
03/31/87	Record of Decision: Remedial Alternative Selection - Operable Unit for Provision of Alternative Water Supply (Granular Activated Carbon Water Treatment for St. Anthony Well Nos. 3, 4 and 5)	Adamkus, Valdas V. (U.S. EPA)			05	68
04/00/87	Off-TCAAP Study, Phase III: Aquifer Characterization Scope of Work	Conestoga-Rovers & Associates, Inc.		1695	04	204
04/00/87	Off-TCAAP, Phase II, Old Miller Dump Site, Data Report	Conestoga-Rovers & Associates,		1638	09	821

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Inc.				
04/01/87	Installation Restoration Program, TCAAP, Boundary Groundwater Recovery System Extraction Well Pumping Report	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030	06	206
04/14/87	PCB Information on Round Lake	Schulte, Theodore (Commander's Representative, Department of the Army)	Day, Doug (Project Manager, MPCA)			1020
04/16/87	Necessity of Wasting TCAAP Extracted Groundwater to Surface Water	Goudreault, Paul (MPCA)			07	207
05/01/87	Health and Safety Plan for Conducting Remedial Activities at TCAAP	International Technologies Corporation			08	208
05/08/87	Proposed Operation of In-Situ Volatilization Systems at TCAAP Sites D and G	Federal Cartridge Company			08	209
05/11/87	Request for ATSDR Health Assessment Under SARA	Van de North, John (Briggs & Morgan)	Johnson, Barry (Associate Administrator, Agency for Toxic Substances and Disease Registry)			2020
05/22/87	Round Lake Sampling	Wilmoth, Donald E. (Plant Manager, Federal Cartridge Company)	Contracting Officer's Representative (Department of the Army)			1521
05/27/87	PCB Sampling Round Lake	Schulte, Theodore (Commander's Representative, Department of the Army)	Day, Doug (Project Leader, Minnesota Pollution Control Agency)			1018
06/01/87	Technical Comments on Boundary Groundwater Recovery System	MPCA			06	210
06/18/87	Record of Decision: Operable Unit for Groundwater Remediation Program Phase I: Boundary Groundwater Recovery System	Walker, Lewis D. (Department of the Army)			06	119

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
07/00/87	Installation Restoration Program, TCAAP, Boundary Groundwater Recovery System Start-Up, Operation and Maintenance Manual (Vol. I) and Programmable Control Manual (Vol. II)	Conestoga-Rovers & Associates, Inc.			08	212
07/06/87	Groundwater Monitoring Site A and Round Lake	Wilmoth, Donald (Plant Manager, Federal Cartridge Co.)	Commanding Officer's Representative (Department of the Army)			1024
07/13/87	Boundary Groundwater Recovery System	Kalitowski, Thomas J (MPCA)	Adamkus, Valdas V. (U.S. EPA)		07	213
08/00/87	Off-TCAAP Study, Phase III: Plume Definition Report (Volumes I and II)	Conestoga-Rovers & Associates, Inc.		1695	04	214
08/12/87	Federal Facilities Agreement	Department of the Army; Minnesota Pollution Control Agency			07	78
08/31/87	Boundary Groundwater Recovery System	Adamkus, Valdas V. (U.S. EPA)	Walker, Lewis D. (Department of the Army)		07	215
09/02/87	TCE Permeability Study	International Technologies Corporation		303301	08	216
09/10/87	Boundary Groundwater Recovery System	Walker, Lewis D. (Department of the Army)	Adamkus, Valdas V. (U.S. EPA)		07	217
09/12/87	Request for ATSDR Health Assessment at TCAAP	Bashor, Mark (Director, Office of Health Assessment, Agency for Toxic Substances and Disease Registry)	Van de North, John (Briggs and Morgan)			2213
09/25/87	Record of Decision: Gradient Control System for Southwest Boundary of TCAAP	Adamkus, Valdas V. (U.S. EPA)			07	120

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
10/00/87	Remedial Design Work Plan for Alternate Water Supply Volume I - Technical Submittal for New Brighton/Arden Hills	Camp, Dresser & McKee, Inc.		Doc. #108-PPI-WP-FJGP-1; Work Assignment 420-5N40	12	241
10/08/87	Boundary Groundwater Recovery System	Adamkus, Valdas V. (U.S. EPA)	Walker, Lewis D. (Department of the Army)		07	218
11/00/87	Chemical Grouting Report, TCAAP	Visu-Sewer Clean & Seal, Inc.		Req. No. 270896	13	606
11/00/87	Volatile Organic Compound Remedial Investigation Addendum, Kendall Degreaser Investigation, Bldg. 502, TCAAP	Conestoga-Rovers & Associates, Inc.		1499	09	809
11/00/87	Interim Remedial Action-Boundary Groundwater Recovery System: Monitoring Plan, TCAAP	Conestoga-Rovers & Associates, Inc.		DAA09-76-0030	13	824
11/00/87	Installation Restoration Program, Boundary Groundwater Recovery System, Quality Assurance Project Plan, Interim Remedial Action Monitoring Program, TCAAP	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030	04	219
11/04/87	TCAAP Drinking Water Supply	Schulte, Theodore E. (Commander's Representative, Department of the Army)	TCAAP Tenants		13	64
11/05/87	Organic Vapor Monitoring BGRS Stack Sampling and Ambient Monitoring	Russell, Michael (Industrial Hygienist, Pace Laboratories)	Connell, Paula (Federal Cartridge Company)	871012.360		2016
11/10/87	Health Consultation: TCAAP (New Brighton - Arden Hills), Ramsey County, Minnesota.	Mellard, David N. (Toxicologist, Emergency Response Branch, Department of Health and Human Services)	Fabinski, Louise Denise Jordan-Izaguirre (U.S. EPA)			2214
12/00/87	Installation Restoration Program: TCAAP Contaminant Sources Remedial	STS Consultants, Ltd.		AMXTH-IR-CR-88005;	08	825

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Investigation (Field Work) Geophysical Investigations Sites A-EH, 129-3; 129-5 and 129-15 and Geotechnical Data (Appendix)			STS Project No. 92797-XF		
00/00/88	Off-Post Well Installations	STS Consultants, Ltd.		Proj. No. 92797-XA	13	602
01/00/88	Installation Restoration Program, TCAAP, Contaminant Sources Remedial Investigation (Field Work) Soil Trenching (Logs, Location and Coordinates)	International Technologies Corporation		AMXTH-IR-CR-88006	08	728
01/29/88	Consistency Test for Remedial Investigation Work Plan for TCAAP	Willet, Gerald (Commissioner, MPCA) Kleinrath, Arthur (Project Manager, U.S. EPA)	Oster, Clarence (Department of the Army)			826
02/00/88	Installation Restoration Program, Preliminary Assessment, TCAAP	Argonne National Laboratory		W-31-109-ENG-38/AMXTH-IR-CR-88002	10	39
02/00/88	Installation Restoration Program, Preliminary Assessment, TCAAP: Supplement	Argonne National Laboratory		W-31-109-ENG-38/AMXTH-IR-CR-88002	10	38
02/00/88	Installation Restoration Program, TCAAP, Boundary Groundwater Recovery System Modification and TCAAP Groundwater Recovery System Contract Documents and Specifications	Conestoga-Rovers & Associates, Inc.			13	757
02/12/88	Installation Restoration Program, Quality Assurance Project Plan, Remedial Investigation/Feasibility Study, TCAAP, Appendices	Biang, R.P., et al. (Argonne National Laboratory)		AMXTH-IR-CR-88004	13	79
02/18/88	Interim Remedial Action - Boundary Groundwater Recovery System Water Balance Report	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030	04	220
02/18/88	Record of Decision: Remedial Action - In-Situ Volatilization System for TCAAP Sites D and G	Brown, David (Department of the Army)			08	121
02/19/88	Interim Remedial Action - Boundary Groundwater Recovery System	Conestoga-Rovers & Associates,		DAA09-76-E-0030	04	221

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Monitoring Plan	Inc.				
02/29/88	Phase IA Piezometer Report New Brighton/Arden Hills Multi-Point Source Remedial Investigation	Camp, Dresser & McKee, Inc.			13	726
03/00/88	Installation Restoration Program, TCAAP, Volatile Organic Compound Air Quality Study	Roy F. Weston, Inc.		AMXTH-IR-CR-88011	08	223
03/00/88	Installation Restoration Program, TCAAP, Sand and Gravel Pit Surface Characterization	Pace Laboratories			09	224
03/09/88	Health Assessment for TCAAP NPL Site, Arden Hills, Ramsey County, Minnesota CERCLIS No. MND980614044.	Agency for Toxic Substances and Disease Registry				2209
04/00/88	Installation Restoration Program, TCAAP, Boundary Groundwater Recovery System, Quality Assurance Project Plan, Interim Remedial Action Monitoring Program TCAAP	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030	13	758
04/00/88	Installation Restoration Program, TCAAP, Contamination Sources Remedial Investigation, Shallow Gas Exploration - Site A (Grids A-1; A-2; A-3; A-4; A-5); Site F (Grids F-1); FG; H (Grids (H-1; H-2); 129-3; 129-5 and 129-15	STS Consultants, Ltd.			04	840
04/19/88	IRP, TCAAP, Site A Interim Response Action Technical Plan	Connell, P.J. (Federal Cartridge Company)			10	1621
04/21/88	New Brighton Well No. 13	Adamkus, Valdas V. (U.S. EPA)	Walker, Lewis D. (Department of the Army)		04	225
05/00/88	Interim Remedial Action - Boundary Groundwater Recovery System Performance Assessment Report	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030	13	226
05/00/88	Design Report for New Brighton/Arden Hills/St. Anthony Remedial Design	Camp, Dresser & McKee, Inc.		Doc. #108-DE1-RT-GBRL-1; Work Assignment	12	242

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
				420-5N40		
05/10/88	Record of Decision: Removal Action - Granular Activated Carbon System for New Brighton	Walker, Lewis D. (Department of the Army)			09	122
05/19/88	Consistency Test for Reports Entitled Preliminary Assessment of TCAAP (Final) and Supplement to the Preliminary Assessment of TCAAP (Draft Final)	Massey, Rodney E. (Director, Groundwater & Solid Waste Division, MPCA)	Oster, Clarence (Project Manager, Department of the Army)		13	890
05/20/88	Alternative Report to Dispose of Excess Treated Water From the City of New Brighton Treatment System	International Technologies Corporation		Project No. 302464	13	471
06/00/88	Installation Restoration Program, Remedial Investigation Work Plan for TCAAP	Argonne National Laboratory		AMXTH-IR-CR-88003; ANL/EES-LD-5	09	227
06/00/88	Installation Restoration Program, Quality Assurance Project Plan, Remedial Investigation/Feasibility Study, TCAAP	Biang, et al. (Argonne National Laboratory)		AMXTH-IR-CR-88004/ANL-EES-LD-6	13	40
06/03/88	Designation of DNR and MPCA as Trustees for Natural Resources Under CERCLA and SARA	Alexander, Joseph (Commissioner, Department of Natural Resources)	Huff, Sheila (Regional Environmental Officer, Department of Interior)			1349
06/20/88	Installation Restoration Program TCAAP Shoreview/Site A Summary Report	Connell, Paula (Federal Cartridge Company)			10	1624
07/29/88	Record of Decision: Removal Action - TCAAP Site A Groundwater Removal and Treatment	Walker, Lewis D. (Department of the Army)			10	123
08/24/88	Renewal of Request to Reconsider Decision on New Brighton Well No. 13	Walker, Lewis D. (Department of the Army)	Adamkus, Valdas V. (U.S. EPA)		04	231
09/00/88	Project Quality Control Plan for Installation Restoration Program at TCAAP	Interpoll Laboratories, Inc.			13	717

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
09/07/88	Off-Site Remedial Investigation (City of St. Anthony Water Quality Analysis)	Willet, Gerald L. (Commissioner, MPCA) Kleinrath, Arthur (Remedial Project Manager, U.S. EPA)	Oster, Clarence (Department of the Army) Walker, Lewis D. (Department of the Army)		13	880
09/22/88	New Brighton Well No. 13	Adamkus, Valdas V. (U.S. EPA)	Walker, Lewis D. (Department of the Army)		04	230
10/00/88	Chemical Grouting Report, TCAAP	Visu-Clean & Seal, Inc.		Reg. No. 270961	04	608
10/28/88	Pumping Rates for Modified Boundary Groundwater Recovery System	Boevers, Brian; Rovers, Frank; Petrie, John; Haycock, Don and Fedy, Bob (Conestoga-Rovers & Associates, Inc.)	Sola, Don (Conestoga-Rovers & Associates, Inc.)	2687-31	13	719
12/00/88	Final Remedial Investigation Report for New Brighton/Arden Hills TCAAP Force Main	Camp, Dresser & McKee, Inc.		Doc. No. 108-R11-RT-GSWG-1; Work Assignment No. 102-5L40	04	228
12/07/88	Plume Groundwater Recovery System	Pickering, R.H. (Location Manager, Honeywell)	Commander's Representative (Department of the Army)		13	718
00/00/89	Emydoidea Blandingi Study at the Twin Cities Army Ammunition Plant, Ramsey County, Minnesota	Linck, M.H.				1977
01/13/89	TCAAP Site A IRA 90-Day Performance Report	Federal Cartridge Company				1750
01/17/89	Minnesota Department of Health Analyses of Water Samples of Wells Located Around Round Lake	Schmitt, Mark (Project Manager, MPCA)	Oster, Clarence (Project Manager, Department of the Army)			1017

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
01/17/89	Minnesota Department of Health Laboratory report sheets for analyses of water samples from residential wells and a field blank collected by MPCA on 12/8/88	Schmitt, Mark (Project Manager, MPCA)	Oster, Clarence (Twin Cities Army Ammunition Plant)			1520
01/23/89	90-Day Performance Report for Site A Interim Response Action	Schulte, Theodore (Commander's Representative, Department of the Army)				1629
01/28/89	Amended Record of Decision: Replacement Well for New Brighton Well No. 7				04	67
02/08/89	Plume Groundwater Recovery System Alternatives Preliminary Letter Report	Massey, Rodney E. (Director, Groundwater & Solid Waste Division, MPCA); Kleinrath, Arthur (Project Manager, U.S EPA)	Oster, Clarence (Project Manager, Department of the Army)		13	803
02/27/89	Pump Tests, TCAAP	STS Consultants, Ltd.		STS Proj. No. 92797-XA	13	611
03/06/89	Response to PRC's Request for Information for the Risk Evaluation of Incinerating Site D Soils	Wilmoth, Donald E. (Plant Manager, Federal Cartridge Company)	Commander's Representative (Department of the Army)			2073
05/00/89	Installation Restoration Program, TCAAP, Boundary Groundwater Recovery System, Interim Remedial Action-Boundary Groundwater Recovery System, Annual Monitoring Report and Monitoring Plan (Volumes I and II)	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030		759
05/02/89	Addendum: Health and Safety and Security Plan for Conducting Remedial Activities at TCAAP	International Technologies Corporation			13	716
05/22/89	TCAAP Groundwater Extraction System Water End Use Alternatives	Clark, Richard (Supervisor Public Water Supply	Boevers, Brian (Conestoga-Rovers &			2022

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Unit, Minnesota Department of Health)	Associates, Inc.)			
05/28/89	Site A IRA 90-Day Performance Report TCAAP	Jacques, James (Department of the Army) Schwarz, Jeffrey (Federal Cartridge Company)				1751
06/00/89	Preliminary Health Assessment for the New Brighton/Arden Hills NPL Site	Agency for Toxic Substances and Disease Registry			13	914
06/00/89	TCAAP Potable Water Management Study Phase I	J.M. Montgomery Consulting Engineers, Inc.		Project No. 2449.0070	13	369
06/21/89	Focused Feasibility Study, TCAAP, Plume Groundwater Recovery System	Conestoga-Rovers & Associates, Inc.		2738	12	240
07/24/89	Comments on Proposed Scope of Work for Potable Water Management Study	Schmitt, Mark (Project Manager, MPCA) Kleinrath, Arthur (U.S. EPA)	Oster, Clarence (Remedial Project Manager Department of the Army)		13	589
08/09/89	Consistency Test for Boundary Groundwater Recovery System Annual Monitoring Report	Massey, Rodney E. (Dir. Groundwater & Solid Waste Div., MPCA) Kleinrath, Arthur (U.S. EPA)	McCleery, Martin (Remedial Project Manager Department of the Army)		13	708
08/11/89	Record of Decision: Removal Action - Thermal Treatment of PCB Contaminated Soils Near TCAAP Site D	Adamkus, Valdas V. U.S. EPA) Department of the Army			11	124
09/00/89	Closed Circuit Television Inspection for TCAAP	Visu-Sewer Clean & Seal, Inc.			13	607
09/00/89	Installation Restoration Program TCAAP 1988 Annual Monitoring Report (Volumes I - IV)	Wenck Associates, Inc.			13	609

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
09/25/89	Phase II Water Management Study	Mogren, Thomas D. (General Manager, St. Paul Board of Water Commissioners)	Mahady, James (Project Manager, J.M. Montgomery Consulting Engineers, Inc.)		13	588
10/00/89	Interim Remedial Action, 1988 Boundary Groundwater Recovery System, Annual Monitoring Report and Monitoring Plan (Volumes 1 and 2)	Conestoga-Rovers & Associates, Inc.		DAAA09-76-E-0030	12	238
10/06/89	Phase II Scope of Work TCAAP Potable Water Management Study	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Kleinrath, Arthur (U.S. EPA); Tuffard, Sarah, Drives, Evan (Dept. of Natural Resources); Englund, Gary (Chief Water Supply Section, Dept. of Natural Resources); Schmitt, Mark (Project Manager, MPCA)		13	590
10/10/89	Fate of Treated Groundwater from TCAAP	Englund, Gary (Chief, Section of Water Supply & Well Mgmt., Minnesota Department of Health)	Schulte, Theodore E. (Department of the Army)		13	591
10/20/89	U.S. EPA Comments on Scope of Work for Water Management Study	Kleinrath, Arthur (Remedial Project Manager U.S. EPA)	Fix, Michael R. (Department of the Army)		13	592
10/23/89	Scope of Work - Regional Potable Water Management Study	Schmitt, Mark (Project Manager, MPCA)	Fix, Michael R. (Commander's Representative, Department of the Army)		13	593
11/01/89	Aquifer Characterization Study, Off-TCAAP Study, Phase III: Supplement	Conestoga-Rovers & Associates, Inc.		1119	12	42
11/02/89	Results of Monitoring Well Installation and Sampling for FCC at TCAAP - On and Off Post, New Brighton/Arden Hills Well Nos. 414-U4, 03L137,	Minnesota Geophysical Associates		P.O. No. 9174-03; W.O. No. A6664	13	727

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	03L138					
11/14/89	TCAAP Use Groundwater Extraction Well Water	Schulte, Theodore E. (Commander's Representative Department of the Army)	All TCAAP Tenants		13	574
11/22/89	TCAAP Groundwater Recovery System Discharge Sample Results	Schulte, Theodore E. (Commander's Representative Department of the Army)	Kleinrath, Arthur (U.S. EPA) Schmitt, Mark (Project Manager, MPCA)		13	575
02/12/90	TCAAP Potable Water Management Study, Phase I	Schulte, Theodore E. (Commander's Representative Department of the Army)	Kleinrath, Arthur (U.S. EPA) Schmitt, Mark (Project Manager, MPCA) Englund, Gary (Chief Water Supply Section, Minnesota Department of Health)		13	584
02/20/90	Additional Data Needs for Risk Assessment - Disposition of Deer from TCAAP	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Kleinrath, Art (U.S. EPA)			1420
02/27/90	Additional Data Needs for Risk Assessment - Review of Deer Tissue Data	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Kleinrath, Art (U.S. EPA)			1419
03/01/90	Request for Comments and Notice of Public Meeting to Review TCAAP Water Management Study Phase I Report	Sande, Gerald (Rice Creek WaterShed District)	McCleery, Martin (Remedial Project Manager Department of the Army)		13	594
03/13/90	Comments on TCAAP Water Management Study, Phase I Report	Keefe, Steve (Metropolitan Council)	Sande, Gerald A. (Rice Creek Watershed District)		13	597

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
03/16/90	Fate of Treated Groundwater from TCAAP	Englund, Gary (Minnesota Department of Health)	Schulte, Theodore E. (Commander's Representative Department of the Army)		13	599
03/19/90	City of New Brighton's Comments on TCAAP Water Management Study Phase I	Proper, Leslie (Director of Public Works City of New Brighton)	Rice Creek Watershed District		13	585
03/19/90	Position Paper: Water Supply and Management of Excess Water from TCAAP Installation Restoration Program	Barr Engineering Company Messerli & Kramer			13	586
03/19/90	Comments on TCAAP Water Management Study, Phase I	Ahl, R. Charles (Director of Public Works, Village of Shoreview)	Rice Creek Watershed District Board		13	598
03/20/90	TCAAP Water Management Study	Flora, John G. (Director of Public Works, City of Fridley)	Rice Creek Watershed District		13	596
03/22/90	Effluent Limitations for Discharge to Long Lake	Johnson, Bruce L. (Team Leader Industrial Enforcement Unit, MPCA)	McCleery, Martin (Remedial Project Manager Department of the Army)		13	632
03/26/90	Comments on TCAAP Water Management Study, Phase I	Gerbensky, Michael P. (Hydraulics Project Engineer Minnesota Department of Transportation)	Mahady, James (J.M. Montgomery Consulting Engineers, Inc.)		13	595
04/00/90	Installation Restoration Program, TCAAP, 1990 Annual Monitoring Plan (Volumes 1-3)	Wenck Associates, Inc. Conestoga-Rovers & Associates, Inc.			13	778
04/02/90	TCAAP Water Management Study	Mogren, Thomas D. (General Manager,	Mahady, James J. (J.M. Montgomery Consulting		13	635

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		St. Paul Bd. of Water Commissioners)	Engineers, Inc.)			
04/06/90	Tour of TCAAP Water Remediation and Distribution System	Mogren, Thomas D. (General Manager, St. Paul Bd. of Water Commissioners)	Schulte, Theodore E. (Commander's Representative, Department of the Army)		13	634
04/09/90	Augmentation of Snail Lake	Satt, Mark (President, Snail Lake Improvement Ass'n)	Maki, Steve (Federal Cartridge Company)		13	631
04/12/90	Comments on TCAAP Water Management Study Phase I Report	Harnack, Ronald D. (Administrator Permits and Land Use Section, Department of Natural Resources)	Board of Managers (Rice Creek Watershed District)		13	630
04/14/90	Augmentation of Snail Lake	Sandberg, Frank E.	Maki, Steve (Federal Cartridge Company)		13	638
04/30/90	TCAAP Water Management Study	Sarkozy, Steven R. (City Manager, City of Roseville)	Mahady, James (J.M. Montgomery Consulting Engineers, Inc.)		13	637
05/00/90	Installation Restoration Program, TCAAP, Site D Final Remediation Report	Wenck Associates, Inc.				722
05/00/90	Installation Restoration Program, TCAAP, 1989 Annual Monitoring Report (Volumes I - III)	Wenck Associates, Inc.			12	237
05/00/90	IRP TCAAP Site F Closure Plan	Wenck Associates, Inc.		(03)213695		2080
05/00/90	Installation Restoration Program, TCAAP, Site D Final Remediation Report (Appendix F)	Dailey, Philip L. (Ecova Corporation)				721

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
05/07/90	Technical Support Services for Installation Restoration Program: Task 4 - Develop a Groundwater Model in Support of Feasibility Study for TCAAP and Vicinity - Steady State Calibration Results	Engineering Technologies Associates, Inc.		DAAA15-89-0009/0004	13	548
05/21/90	Interim Remedial Action, TCAAP Groundwater Recovery System, 1989 Annual Monitoring Report and Plan (Volumes 1 and 2)	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030	12	247
06/01/90	Addendum to TCAAP Water Management Study - Lake Augmentation	J.M. Montgomery Consulting Engineers, Inc.			13	573
06/04/90	MPCA Comments on Proposed Environmental Risk Assessment Scope of Work	Schmitt, Mark (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2013
06/07/90	Snail/Turtle Lakes - TCAAP Pumping	Stine, John L. (Regional Hydrologist, Department of Natural Resources)	Maki, Steve (Federal Cartridge Company)		13	564
06/12/90	TCAAP Water Management Study	Flora, John G. (Dir. of Public Works, City of Fridley) Proper, Les (Dir. of Public Works, City of New Brighton)	Mahady, James J. (J.M. Montgomery Consulting Engineers)		13	572
06/14/90	TCAAP Water Appropriation	Stine, John L. (Regional Hydrologist Department of Natural Resources)	Woods, Steve (District Engineer Rice Creek Watershed District)		13	565
06/14/90	Potential use of Plume Groundwater Recovery System water in Record of Decision	Kleinrath, Arthur (Remedial Project Manager, U.S. EPA	Benke, Robert (Mayor, City of New Brighton)		13	571
06/26/90	Preliminary TCAAP Effluent Evaluation	Sparks, Curtis J. (Chief, Program Development Section, Water Quality Division MPCA	Mahady, James (J.M. Montgomery Consulting Engineers, Inc.)		13	568

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/26/90	Minnesota Pollution Control Agency/CDM Comments on ANL Local-Scale Groundwater Model	Schmitt, Mark (MPCA)	McCleery, Martin (Remedial Project Manager Department of the Army)			466
06/27/90	TCAAP Site G Recharge Test	Schulte, Theodore E. (Commander's Representative, Department of the Army)			13	567
07/17/90	Consistency Test: 1988 Annual Monitoring Report	Massey, Rodney (Director, Groundwater & Solid Waste Division, MPCA) Kleinrath, Arthur (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	673
08/01/90	Survey for Possible Contaminants in Populations of Small Mammals Resident on Waste Sites at TCAAP (Risk Assessment Protocol).	Paul Jr., John T. (Biologist, Toxicology Div. Army Environmental Hygiene Agency) Watson, Charles E. (Toxicology Div., Army Environmental Hygiene Agency)		HSHB-MO-T Study No. 57-Y937		2216
08/22/90	ANL's Response to Comments from Minnesota Pollution Control Agency/CDM Draft Calibration and Sensitivity Analyses for Local-Scale Model at TCAAP	Durham, Lisa A. (Argonne National Laboratory)	Boston, Juan; Bowser, Dennis (United States Army Toxic and Hazardous Materials Agency)			46[illegible]
08/24/90	Review of 1989 Annual Monitoring Report; and 1989 TCAAP Groundwater Recovery System Annual Monitoring Report and Monitoring Plan for TCAAP	Chaudhry, Majid A. (Site Manager, PRC Environmental Management, Inc.)	Kleinrath, Arthur (Remedial Project Manager U.S. EPA)	Work Assignment No. 04-5P40; Contract No. 68-W8-0084	13	71[illegible]
09/05/90	TCAAP On-Post Remedial Investigation Report (May, 1990)	York, Robert J.				201[illegible]

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		(Chief, Installation Restoration Division, Department of the Army)				
09/25/90	Revised Scope of Work and Cost Estimate for TCAAP Groundwater Recharge Model Study	Mahady, James (Project Manager, J.M. Montgomery Consulting Engineers, Inc.)	Sande, Gerald (Rice Creek Watershed District)		13	558
10/12/90	Federal Facilities Agreement Modification Relating to Timetable for Annual Monitoring Report	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Schmitt, Mark (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	83
10/15/90	J.M. Montgomery Water Management Study Phase II	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager Department of the Army)		13	559
10/16/90	J.M. Montgomery Water Management Study	Schmitt, Mark (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager Department of the Army)		13	560
10/24/90	New Brighton Contaminated Groundwater Reducing System (NBCGRS) Monitoring Data	Meuwissen, Catherine (Barr Engineering Company)	Proper, Leslie (Director of Public Works, City of New Brighton)			1056
11/19/90	Federal Facilities Agreement, Field Modification Relating to Timetable for Annual Monitoring Report	Theodore E. Schulte (Commander's Representative, Department of the Army)	Barounis, Thomas (U.S. EPA)		13	81
11/19/90	Federal Facilities Agreement, Field Modifications Relating to Timetable for Annual Monitoring Report	Theodore E. Schulte (Commander's Representative, Department of the Army)	Schmitt, Mark (Project Manager MPCA)		13	82

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
11/29/90	Focused Groundwater Model Work Scope	J.M. Montgomery Consulting Engineers, Inc.			13	465
12/03/90	Response to Comment Letters from Minnesota Pollution Control Agency and U.S. EPA about Presentation at 10/2/90 Project Update Meeting at TCAAP Regarding Water Management Study	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Schmitt, Mark (Project Manager, MPCA)		13	561
12/06/90	Minnesota Pollution Control Agency Request for Additional Scenarios to be Evaluated with ANL Groundwater Flow Model	Schmitt, Mark (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager Department of the Army)		13	467
01/00/91	Recharge Test, TCAAP Site G	Conestoga-Rovers & Associates, Inc.		1687-22(18)	13	623
01/00/91	Final Engineering Report: Boundary Groundwater Recovery System	Conestoga-Rovers & Associates, Inc.		1687-24 (9B)	13	621
02/00/91	Phase IA Multi-Point Source Groundwater Remedial Investigation, New Brighton/Arden Hills, Minnesota	Camp, Dresser & McKee, Inc.			12	55
02/00/91	Installation Restoration Program-TCAAP Groundwater Recovery System: Interim Remedial Action-TCAAP Groundwater Recovery System 1990 Annual Monitoring Report (Volumes 1 & 2)	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030	13	620
02/06/91	Scope of Work and Estimated Cost for Detailed Hydraulic Data Evaluation/Advective Transport Modeling TCAAP Site	Nicklin, Michael E. (J.M. Montgomery Consulting Engineers, Inc.)	Sande, Gerald A. (Board of Managers, Rice Creek Watershed District)		13	464
02/11/91	Wenck 1989 Annual Monitoring Plan (Part I)	Benker, Keith W. (Wenck Associates, Inc.)	Terho, Darryl (Federal Cartridge Company)		13	714
03/00/91	Modeling Groundwater Flow for the TCAAP Site and Vicinity	Argonne National Laboratory			13	417
03/00/91	Summary Report for the Catch Basin Clean-Up at TCAAP (Vol. II)	International Technology		3818-5		2377

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		Corportion				
03/00/91	TCAAP Air Quality Volatile Organic Compound Survey	Federal Cartridge Company			13	641
03/00/91	Summary Report for the Catch Basin Clean-Up at TCAAP (Vol. I)	International Technology Corporation		3818-5		2376
03/26/91	Quarter 29 Well Sampling Procedures used by Alliant Techsystems Inc./ Conestoga-Rovers & Associates (CRA)	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Schmitt, Mark (Project Manager, MPCA)			1282
03/28/91	Consistency Test for 1989 Annual Monitoring Report	Massey, Rodney E. (Director, Groundwater & Solid Waste Division, MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	710
03/29/91	Preliminary Evaluation of Combined Demand for Potable Water, Cities of New Brighton and Fridley, Minnesota	Barr Engineering Company			13	562
04/00/91	Final Report Human Health Risk Assessment, New Brighton/Arden Hills, Superfund Site Including TCAAP, Vols. I and II	PRC Environmental Management, Inc.		ARCS No. 68-W8-0084/Work Assignment No. 04-5P40	12	57
04/00/91	Installation Restoration Program, Remedial Investigation, TCAAP: Volume 1 (Text); Volume 2 (Appendices A-F); Volume 3 (Appendix G); Volume 4 (Appendices H-I)	Biang, R.P., et al. Argonne National Laboratory		CETHA-IR-CR-91015; ANL/EAIS/LD-6	13	54
04/08/91	U.S. EPA's Comments on FY 90 Annual Monitoring Report	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	Schulte, Theodore E. (Commander's Representative, Department of the Army)		13	786

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
04/24/91	Water Quality Analysis Results	Schmitt, Mark (Project Manager, MPCA)	Gamradt, Max A.			1273
04/24/91	Water Quality Analysis Results	Schmitt, Mark (Project Manager, MPCA)	Martin, Daryl			1274
05/07/91	Ecological Assessment TCAAP, New Brighton, Minnesota (2/90 - 4/91)	Paul, J.T. (Army Environmental Hygiene Agency)				1625
05/28/91	TCAAP 1989 Annual Monitoring Report (Part I)	Benker, Keith W. (Wenck Associates, Inc.)	McCleery, Martin (Remedial Project Manager Department of the Army)		13	709
05/30/91	Work Plan for Plume Groundwater Recovery System Treatment System Design Data Collection	Barr Engineering Company			13	549
05/30/91	TSCA Comments on Draft Ecological Assessment	Johnson, Stephen M. (Geologist, U.S. EPA)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)			374
05/30/91	DOA's Proposed Modifications to Attachments 2-3 of the FFA, Annual Monitoring Report Requirements	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Schmitt, Mark (Project Manager, MPCA)			1350
06/00/91	Installation Restoration Program, TCAAP Groundwater Recovery System, Interim Remedial Action-TCAAP Groundwater Recovery System 1989 Annual Monitoring Report and Monitoring Plan (Volumes 1 and 2)	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030	13	756
06/00/91	Modeling Groundwater Flow for TCAAP and Vicinity	Durham, L.A., et al. (Argonne National Laboratory)		ANL/EAIS/TM-53	13	882
06/10/91	Plume Groundwater Recovery System Study Project	Beasley, John H.	Proper, Leslie		13	563

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		(Acting Chief, Environmental Law Department of the Army)	(City of New Brighton)			
06/17/91	Department of Interior Comments on Draft Ecological Assessment	Lewis, Lynn M. (Field Supervisor, Department of Interior)	McCleery, Martin (Remedial Project Manager, Department of the Army)			378
07/00/91	Installation Restoration Program, TCAAP, Fiscal Year 1990 Annual Monitoring Report	Wenck Associates, Inc.			12	252
07/00/91	Interim Remedial Action, TCAAP Groundwater Recovery System, Site I and Site K, Annual Monitoring Report (Volumes 1 and 2)	Conestoga-Rovers & Associates, Inc.		DAA09-76-E-0030	12	254
07/00/91	Groundwater Recharge Model for Evaluation of Groundwater Recharge Alternatives at TCAAP - Water Management Study Phase II	J.M. Montgomery Consulting Engineers, Inc.			13	370
07/12/91	Confirmation of Conversation Regarding Requested Water Sampling Results at 5589 N. Fairview Avenue	Gnabasik, Barbara J. (Staff Hydrologist, MPCA)	Kraus, Richard			1272
07/24/91	Interim Remedial Action at Site A	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA) Schmitt, Mark (Project Manager, MPCA)			1461
07/26/91	Minnesota Pollution Control Agency's Comments on Ecological Assessment	Schmitt, Mark (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			380
07/29/91	Minnesota Department of Health TCAAP Site A Water Analyses	Minnesota Department of Health				1458
08/16/91	Site A Interim Remedial Action	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA) Schmitt, Mark			1460

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			(Project Manager, MPCA)			
08/21/91	Response to MPCA Comments, Site A Interim Remedial Action	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Schmitt, Mark (Project Manager, MPCA)			1601
08/21/91	Installation Restoration Program Twin Cities Army Ammunition Plant 1991 Shqreview Sampling Program	Fuller, David B. (Federal Cartridge Company)				1522
08/22/91	Site A Monitoring	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA) Schmitt, Mark (Project Manager, MPCA)			1459
08/28/91	Proposal for Interim Remedial Measure Feasibility Study Site A	International Technology Corporation				1608
08/29/91	Private Well Survey	Schmitt, Mark (Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	454
09/00/91	Installation Restoration Program TCAAP Water Management Study Phase II, Volume 1: Feasibility Study Report	J.M. Montgomery Consulting Engineers, Inc.		Project No. 2449.0410	13	507
09/00/91	Plume Groundwater Recovery System Alternatives Evaluation	Conestoga-Rovers & Associates, Inc. Barr Engineering Company		3877(2)	13	551
09/00/91	Installation Restoration Program TCAAP Water Management Study Phase II, Volume 2: Appendices	J.M. Montgomery Consulting Engineers, Inc.		Project No. 2449.0402	13	506

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09/03/91	Review Comments on Groundwater Recharge Model for Evaluation of Groundwater Alternatives at TCAAP	PRC Environmental Management, Inc.		Work Assignment 04-05P40; ARCS Contract No. 68-W8-0084	13	553
09/04/91	Sampling Plan for Additional Characterization of Site J, Twin Cities Army Ammunition Plant, New Brighton, MN ARCS Work Assignment No. 04-5P40, Contract No. 68-W-0084	Chaudhry, Majid A. (Site Manager, PRC Environmental Management, Inc.)	Barounis, Tom (Remedial Project Manager, U.S. EPA)			1519
09/26/91	Consistency Determination for Army's Scope of Work at Site J, TCAAP	Schmitt, Mark (Project Manager, MPCA) Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1518
10/01/91	Minnesota Pollution Control Agency Comments on J.M. Montgomery, Water Management Study, Phase II	Schmitt, Mark (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	552
10/03/91	U.S. EPA Comments on the Preliminary Draft, TCAAP Water Management Study, Phase I	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	554
10/04/91	Ecological Assessment TCAAP (2/90-4/91) and Appendices	Paul, J.T. (Army Environmental Hygiene Agency)			13	50
10/08/91	Site A Interim Remedial Action Focused Feasibility Study Laboratory Analysis	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA) Schmitt, Mark (Project Manager, MPCA)			1457
10/11/91	Feasibility Study Initiation Meeting	Schulte, Theodore (Commander's Representative,	Barounis, Thomas (Remedial Project Manager,			1663

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Department of the Army)	U.S. EPA); Schmitt, Mark (Project Manager, MPCA)			
10/15/91	Feasibility Study Meeting Minutes	Schulte, Theodore (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Schmitt, Mark (Project Manager, MPCA)			1661
10/15/91	U.S. EPA Comments on the Site A Interim Remedial Action, Scope of Work	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1456
10/18/91	Proposed Additional Physical Sampling and Biota Sampling Work Plans for Feasibility Study of Ecological Assessment	Broadwater, William T.				379
10/18/91	Consistency Test for Site A Interim Remedial Action Scope of Work	Barounis, Tom (Remedial Project Manager, U.S. EPA) Schmitt, Mark (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1455
10/21/91	Sampling Plan for Additional Characterization at Site J	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Schmitt, Mark (Project Manager, MPCA)			1517
11/00/91	TCAAP, Feasibility Study, Sampling Design Plan	J.M. Montgomery Consulting Engineers, Inc.		Data Item A003; Contract No. DAAA 15-90-D-0011		246
11/05/91	Notification that the Modified Scope of Work for Site J at TCAAP Passed	Schmitt, Mark	McCleery, Martin			1516

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	the Consistency Test	(Project Manager, MPCA) Barounis, Tom (Remedial Project Manager, U.S. EPA)	(Remedial Project Manager, Department of the Army)			
11/13/91	Site J Soil Borings	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Schmitt, Mark (Project Manager, MPCA)			1515
11/19/91	Ecological Assessment - Consistency Determination	Schmitt, Mark (Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	381
12/00/91	Proposal for a Project to Identify and Locate Privately-Owned Wells in Area Downgradient of TCAAP	S.S. Papadopolous & Associates, Inc.			13	451
12/00/91	TCAAP Water Management Study, Phase II (Volumes I and II)	J.M. Montgomery Consulting Engineers, Inc.			12	251
12/00/91	Installation Restoration Program, Twin Cities Army Ammunition Plant, Off-Post Monitoring Well Installation Work Plan	Wenck Associates, Inc.				938
12/03/91	Consistency Test: 1990 Annual Monitoring Report for TCAAP	Schmitt, Mark (Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	895
12/04/91	Requirements for TCAAP Quarterly/Annual Army Quality Assurance Reports	Mattsfield, Wayne (QA Coordinator, MPCA)	Schmitt, Mark (Project Manager, Minnesota Pollution Control Agency)		13	86

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
12/04/91	Consistency Determination for Scope of Work for Private Well Survey	Schmitt, Mark (Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	452
12/06/91	Requirements for TCAAP Quarterly/Annual Army Quality Assurance Reports	Schmitt, Mark (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	87
12/10/91	TCAAP Off-Post Monitoring Well Installation Work Plan	Benker, Keith (Wenck Associates, Inc.)	Schmitt, Mark (Project Manager, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)			1638
12/13/91	Requirements for TCAAP Quarterly/Annual Army Quality Assurance Reports	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Plant Manager, (Federal Cartridge Company, Twin Cities Army Ammunition Plant)		13	85
12/17/91	Report Summarizing Field Activity from Subsurface Exploration	STS Consultants Ltd.		92797-TE		1607
12/18/91	TCAAP Production Well Reconstruction or Abandonment	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Schmitt, Mark (Project Manager, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)		13	461
12/26/91	Response to Agency Review Comments Water Management Study, Phase II	Nicklin, Michael E. (Principal Engineer, J.M. Montgomery Consulting Engineers, Inc.)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)		13	555
12/26/91	Response to Agency Review Comments, Water Management Study, Phase II	Nicklin, Michael E. (Principal Engineer,	Schmitt, Mark (Project Manager, MPCA)		13	556

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		J.M. Montgomery Consulting Engineers, Inc.)				
01/00/92	Preliminary Report of Findings Site F Soils Investigation TCAAP	Wenck Associates, Inc.			13	446
01/00/92	TCAAP Feasibility Study Final Work Plan	J.M. Montgomery Consulting Engineers, Inc.		Data Item A003; Contract No. DAAA15-90-D-0011, Delivery Order		245
01/08/92	Draft Final Work Plan for the TCAAP Feasibility Study	Schulte, Theodore (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Schmitt, Mark (Project Manager, MPCA)			1660
01/10/92	TCAAP Water Management Study Phase II, Final Report	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Schmitt, Mark (Project Manager, MPCA)		13	557
01/22/92	Site F Closure	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1440
02/03/92	Site J Additional Characterization	Sweesy, George (Plant Manager, Federal Cartridge Company)	Contracting Officer's Representative (Department of the Army)			1504
02/04/92	Technical Support Services for Installation Restoration Program: Task 4 - Develop a Groundwater Model in Support of Feasibility Study for TCAAP and Vicinity	Engineering Technologies Associates, Inc.		DAAA15-89-D-0009/000 4	13	361
02/05/92	Federal Facilities Agreement Modifications	Schmitt, Mark	McCleery, Martin		13	95

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		(Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)	(Remedial Project Manager, Department of the Army)			
02/11/92	Request to Abandon Gravel Pit Wells	Schmitt, Mark (Project Manager, MCPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	460
02/14/92	Federal Facilities Agreement Minor Modifications (Exhibit 1)	Department of Army MPCA U.S. EPA			13	96
02/14/92	Federal Facilities Agreement Modifications	Fix, Michael R. (Acting Commander's Representative, Department of the Army)	Barounis, Thomas (U.S. EPA)		13	9[illegible]
02/14/92	Federal Facilities Agreement Modifications	Fix, Michael R. (Acting Commander's Representative, Department of the Army)	Schmitt, Mark (Project Manager, MPCA)		13	94
02/24/92	Department of Natural Resources Amended Water Appropriation Permit #87-6048	Milles, David B. (Supervisor, Permits Unit, Department of Natural Resources)	Schulte, Theodore E. (Commander's Representative, Department of the Army)		13	57[illegible]
02/24/92	MPCA Comments on the Draft Sampling Design Plan/Feasibility Study Work Plan for TCAAP	Schmitt, Mark (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			165
03/00/92	Plume Groundwater Recovery System Design Data Collection Study	Conestoga-Rovers & Associates, Inc. Barr Engineering Company			12	249

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
03/02/92	Quarterly Well Sampling	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Malwitz, Michael (Metal-Matic, Inc.)			1259
03/03/92	Groundwater Modeling Calculations at TCAAP	International Technology Corporation				2083
03/03/92	Federal Facilities Agreement Attachment 4 Modifications	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Schmitt, Mark (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	71
03/05/92	Site A Interim Remedial Action (IRA) Feasibility Study Proposal	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Schmitt, Mark (Project Manager, MPCA); Barounis, Tom (Remedial Project Manager, U.S. EPA)			1501
03/13/92	Comments of U.S. Fish and Wildlife Service on the TCAAP Feasibility Study Draft Final Work Plan (January, 1992)	Schreiner, Terry (Acting Refuge Manager, Department of Interior)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1657
03/13/92	Request to Abandon Gravel Pit Wells	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	459
03/25/92	Off-Post Well Elevations	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Schmitt, Mark (Project Manager, MPCA)		13	442
04/00/92	TCAAP Feasibility Study, Final Work Plan, Data Item A003, Contract No. DAAA 15-90-D-0011, Delivery Order	J.M. Montgomery Consulting Engineers, Inc.		DAAA 15-90-D-0011		59

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
04/03/92	Preliminary Remediation Goals for Soils at New Brighton/Arden Hills Superfund Site	Chaudhry, Majid (Contractor Project Manager, PRC Environmental Management, Inc.)	Barounis, Thomas (Remedial Project Manager-Waste Management Division U.S. EPA)	Work Assignment 04-5140; Contract No. 68-W8-0084		101
04/07/92	Groundwater Model in Support of Feasibility Study - Modeling Progress	Engineering Technologies Associates, Inc.		DAAA-15-89-D-0009/00 04	12	250
04/07/92	Feasibility Study Work Plan Comments Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)				1295
04/07/92	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	102
04/10/92	U.S. EPA Comments on Proposal for Interim Remedial Measure Feasibility Study Site A (August 28, 1991)	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1499
05/04/92	U.S. EPA Comments on Site A Focused Feasibility Study (Method of Characterization Model)	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1498
05/04/92	TCAAP Feasibility Study Final Work Plan, April 1992	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Schmitt, Mark (Project Manager, MPCA)			1291
05/05/92	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	104

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
05/11/92	Federal Facilities Agreement Amendment No. 1	Theodore E. Schulte (Commander's Representative, Department of the Army)	Barounis, Thomas (U.S. EPA)		13	74
05/11/92	Sample Results Re: Site A Focused Feasibility Study	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Schmitt, Mark (Project Manager, MPCA)			1496
05/14/92	OU-3 Feasibility Study	Conestoga-Rovers & Associates, Inc.		3877(4)	12	253
05/19/92	Site A Focused Feasibility Study, Metals Sampling Plan	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Schmitt, Mark (Project Manager, MPCA)			1494
05/19/92	Potential New Brighton/Fridley Interconnection	Beasley, John H. (Lieutenant Colonel, Department of the Army)	City Council of the City of Fridley		13	802
05/28/92	Changes to the Ecological Assessment Portion of the Feasibility Study Work Plan	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Schmitt, Mark (Project Manager, MPCA); Barounis, Tom (Remedial Project Manager, U.S. EPA)			1294
05/29/92	Quarterly Well Sampling	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Perry, Todd (Honeywell Inc.)			1267
05/29/92	Quarterly Well Sampling	Schulte, Theodore E.	Newville, Harold			1266

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		(Commanding Officer's Representative, Department of the Army)	(Gross Golf Course)			
05/29/92	Quarterly Well Sampling	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Brungardt, Karl E. (Dr.) (Mounds View High School)			1264
05/29/92	Quarterly Well Sampling	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Proper, Leslie (Director of Public Works, City of New Brighton)			1265
06/00/92	Report on Caretaker Status Off TCAAP Sewer Re-Route Study	Howard Needles Tammen and Bergendoff				2375
06/00/92	Evaluating the Effectiveness of Interim Remedial Actions at Source Areas D & G - TCAAP	Rissell, Peter, et al. (Presented at the 16th Annual Army Environmental R&D Symposium, Williamsburg, VA)				1781
06/02/92	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	105
06/05/92	Consistency Test for the Site A Focused Feasibility Study, Metals Sampling Plan	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1493
06/08/92	Federal Facilities Agreement - Amendment No. 1	Theodore E. Schulte (Commander's Representative, Department of the Army)			13	72

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/09/92	U.S. Department of the Interior Comments on TCAAP Feasibility Study, Final Work Plan	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1293
06/09/92	MPCA Comments to Pumping Test Scope of Work for Site A	Seaberg, John (MPCA)) Gnabasik, Barbara (Staff Hydrologist, MPCA)	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)			1492
06/09/92	Consistency Test for TCAAP Feasibility Study Work Plan	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	256
06/17/92	Response to Oak Ridge National Laboratory's Request for ARAR Information	Schulte, Theodore E. (Commander's Representative, Department of the Army)	MacDonald, Beverly (Oak Ridge National Laboratory)			2074
06/22/92	Long-Term Litigation Settlement Agreement Implement Agreement Between the City of New Brighton and the U.S. Department of the Army	City of New Brighton; Department of the Army			13	472
06/26/92	Revised USEPA Comments on the Site A Focused Feasibility Study (FFS) Pump Test Scope of Work	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1490
06/30/92	Site A Focused Feasibility Study, Pump Test Scope of Work Comments	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1491
07/00/92	TCAAP, OU-3 Feasibility Study	Conestoga-Rovers & Associates, Inc.		3877(4)	12	248

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
07/00/92	Site F Soil Investigation Work Plan	Wenck Associates, Inc.				1467
07/00/92	Final Conceptual Design Report Plume Groundwater Recovery System	Barr Engineering Company				2494
07/07/92	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	106
07/07/92	Consistency Test for TCAAP Feasibility Study Final Work Plan	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Smith, Stan (U.S Fish and Wildlife Service)			1290
07/10/92	OU-3 Feasibility Study and Proposed Plan	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	677
07/10/92	Consistency Test for TCAAP OU-3 Feasibility Study	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	678
07/16/92	TCAAP OU-3 Feasibility Study for OU-3: Plume Groundwater Recovery System Monitoring Well Installation and Sampling Plan	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	675
07/16/92	Comments on Additional Groundwater Modeling Scenarios (ETA-6/30/92)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	676
07/16/92	Notice to Natural Resources Trustee	Barounis, Thomas (Remedial Project Manager, U.S.	McCleery, Martin (Remedial Project Manager,		12	785

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		EPA)	Department of the Army)			
07/17/92	Site A Pumping Test Scope of Work Consistency Letter	Romano, Dagmar (Project Manager, MPCA) Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1489
07/21/92	Consistency Test for TCAAP Feasibility Work Plan - Satisfaction of Conditions 1 and 2	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)		13	255
08/00/92	Development of a Groundwater Model in Support of the Feasibility Study for TCAAP and Vicinity	Engineering Technologies Associates, Inc.		Contract No. DAAA15-89-D-0009/0004	13	420
08/00/92	Statement of Work, TCAAP Well Inventory Phase II	S.S. Papadopolous & Associates, Inc.			13	450
08/04/92	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	107
08/13/92	Assessment of Discharge from TCAAP to Ditch	Maschwitz, Davis (MPCA)	Gnabasik, Barbara (MPCA)			1488
08/24/92	Braun Intertec Report of 07/14/92 Samples for Chemical Analyses	Weber, Cynthia H. (Project Manager, Braun Intertec) Ochs, Anne L. (Laboratory Manager, Braun Intertec)	Gnabasik, Barbara J. (MPCA)	Proj. #CVXX-91-033G; Rpt. No. 92-1561		1453
08/28/92	Pump Test and Groundwater Metals Analysis Data From Site A	Fix, Michael R,	Romano, Dagmar			1628

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		(Commander's Representative, Department of the Army)	(Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)			
09/00/92	Supplemental RCRA Alternative Analysis TCAAP Site F	Wenck Associates, Inc.		#0003-06-03		444
09/00/92	Installation Restoration Program TCAAP Site F Soil Investigation Work Plan	Wenck Associates, Inc.				640
09/01/92	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	108
09/09/92	Memorandum Regarding August, 1992 Site A Pumping Test Report	Seaberg, John	Gnabasik, Barbara J. (Staff Hydrologist, MPCA); Romano, Dagmar (Project Manager, MPCA)			1487
09/15/92	Inventory of Water-Supply Wells in the Vicinity of TCAAP - Phase I Report	S.S. Papadopolous & Associates, Inc.			13	223
09/16/92	Groundwater Metals Analysis Data from Site A	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1486
09/18/92	Inventory of Water-Supply Wells in Vicinity of TCAAP, Phase I Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)		13	448
09/23/92	Abandonment of Gravel Pit Wells	Sweesy, George (Plant Manager,	Commander's Representative (Department of the Army)		13	458

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Federal Cartridge Company)				
09/23/92	Periodic Well Sampling	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	White, Fred (Mr.) White, Fred (Mrs.)			1258
09/24/92	Abandonment of Gravel Pit Wells	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)		13	457
09/24/92	Final Site F Soil Investigation Work Plan - September 1992, Twin Cities Army Ammunition Plant (TCAAP) MN7213820908	Brott, Bruce (Supervisor, Permit and Review Unit, MPCA)	Schulte, Theodore E. (Commander's Representative, Department of the Army)			1466
09/29/92	Listing of Soil Sample Splits and Field Visits for the OU-2 Feasibility Study	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1288
09/30/92	Aquifer Test, Site A, TCAAP	International Technologies Corporation				622
09/30/92	TCAAP On-Plant and Off-Post Monitoring Wells	Kemper & Associates, Inc.			13	235
09/30/92	Record of Decision: Final Remedial Measure - OU-3 - Plume Groundwater Recovery System	Walker, Lewis D. (Department of the Army)/Adamkus, Valdas V. (U.S. EPA)/Jepsen, Cynthia C. (MPCA)			12	118
09/30/92	Recommendations for Sample Splits for Feasibility Study Sampling Program	Seaberg, John K. (MPCA)	Romano, Dagmar (Project Manager, MPCA)			1289
09/30/92	Consistency Test for TCAAP Feasibility Study Work Plan - Satisfaction of Condition No. 3	Schulte, Theodore E. (Department of the Army)	Barounis, Thomas (U.S. EPA) Romano, Dagmar (MPCA)		13	257

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
10/00/92	FY 1991 Annual Monitoring Report	Wenck Associates, Inc. Conestoga-Rovers & Associates, Inc.			13	500
10/02/92	Lowry Grove Trailer Park	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1060
10/05/92	Sample Splits for Feasibility Study Sampling Program	LeBlanc, Jeffrey J. (James M. Montgomery Consulting Engineers, Inc.)	Duncanson, Dawn (MPCA)			1287
10/06/92	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	109
10/08/92	Consistency Test for FY 1991 Annual Monitoring Report/FY 1993 Annual Monitoring Plan for TCAAP	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	783
10/13/92	Well Sampling Results	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	White, Fred (Mr.) White, Fred (Mrs.)			1257
10/13/92	Site F Soil Investigation Work Plan	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1465

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
10/14/92	Status of Blanding's Turtle Habitat at TCAAP	Linck, Madeleine H.	Chudek, John (Federal Cartridge Company)			2221
10/20/92	Minnesota Pollution Control Agency Comments on S.S. Papadopolous & Associates, Inc. Inventory of Water Supply Wells, Phase I Report	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	395
10/21/92	U.S. EPA Review of S.S. Papadopolous & Associates, Inc. Inventory of Water Supply Wells, Phase I Report	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	396
10/27/92	Fridley Resolution Regarding Water System Interconnection between the City of New Brighton and City of Fridley	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)	Resolution No. 45-1992	13	438
10/28/92	Materials for October 27, 1992 Site A Model Scenario Runs Meeting	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA)			1483
10/29/92	OU-1 Groundwater Modeling Results	Schulte, Theodore (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1645
11/00/92	Contract Documents Plume Groundwater Recovery System Water Treatment Facility	Barr Engineering Company			13	469
11/03/92	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	110

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
11/06/92	S.S. Papadopolous & Associates, Inc. Phase I Water-Supply Wells Inventory - Consistency Determination	Sweesy, George (Plant Manager, Federal Cartridge Company)	Commander's Representative (Department of the Army)		13	397
11/20/92	Pump Test Discharge Water Quality Results; Resampling and Installation of Additional Wells; Model and Feasibility Study Status of Site A	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1481
11/20/92	Final PGRS Well Installation Plan; PGRS Pumping Test Plan	Romano, Dagmar M. (Project Manager, Groundwater and Solid Waste Division, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2499
11/24/92	Soil Remediation Investigation, Phase I & II Treatability Studies	Fristad, William E. (Project Manager, Cognis, Inc.) Mielenz, Jonathan R. (Senior Project Manager, Cognis, Inc.)				1332
11/24/92	MPCA Comments on Army's Comments on MPCA Procedures for Establishing Soil Cleanup Levels	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1550
11/24/92	Site A Off-Post Well Sampling	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1480
11/25/92	Site A Removal Action	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1613
12/00/92	Site F Soil Washing Treatability Study Work Plan	Wenck Associates, Inc.				1463
12/01/92	MPCA Soil Cleanup Methodology Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)				1549

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
12/01/92	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	111
12/01/92	Site F Soil Washing Treatability Study Work Plan Twin Cities Army Ammunition Plant MN7213820908	Card, Dan (Engineer, Hazardous Waste Division, MPCA)	Schulte, Theodore E. (Commander's Representative, Department of the Army)			1464
12/01/92	VOC Standards for Discharge at Site A and Numeric Clean-up Standards for Groundwater at Site A	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1479
12/09/92	Installation Restoration Program, Twin Cities Army Ammunition Plant, Site J Additional Characterization	Federal Cartridge Company				941
12/18/92	Preliminary Remediation Goals for VOCs at TCAAP	Chaudhry, Majid (Contract Project Manager, PRC Environmental Management, Inc.)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)		13	490
12/18/92	Assessment of Location-Specific ARARs for TCAAP	McDonald, Elizabeth; et al. (Chemical Hazard Evaluation Group, Oak Ridge National Laboratory)			13	61
12/22/92	OU-1 FS Presentation to the City of New Brighton, December 2, 1992	Schulte, Theodore (Commander's Representative, Department of the Army)	Proper, Leslie (City of New Brighton)			1639
12/28/92	Preliminary Remediation Goals (PRG) for VOCs at TCAAP	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	491
12/29/92	TCAAP Site A Remediation Discharge	Voelkers, Caroline, (MPCA)	Huls, Hubert (Project Manager,			1478

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			International Technology Corporation)			
01/05/93	Site A Surface Water Standards and Criteria Referenced in MPCA Letter Dated December 1, 1992	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1470
01/05/93	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	112
01/08/93	Review of TCAAP VOC Data from Minnesota Department of Health (MDH)	Charpentier, Luke (Manager's Office, MPCA)	Duncanson, Dawn (On-Site Inspector, MPCA)			1472
01/19/93	Quality Assurance Data for FY 92 Quarterly Monitoring	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1189
01/22/93	Draft Final Site F Closure Plan	Schulte, Theodore (Commander's Representative, Department of the Army)	Card, Dan (MPCA)			1754
02/00/93	Feasibility Evaluation New Brighton-Fridley Water Supply System Interconnection	Barr Engineering Company Maier-Stewart Associates, Inc.			13	474
02/02/93	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	113
02/05/93	Assessment of Action-Specific ARARs for OU-1, TCAAP	Etnier, Elizabeth L. (Chemical Hazard Evaluation Group, Oak Ridge National Laboratory)			13	479

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
02/09/93	Site A - Preliminary Soil Cleanup Goals	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1548
02/14/93	Fiscal Year 1993 Annual Monitoring Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA)			993
02/17/93	Quarterly Well Sampling	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Newville, Harold (Gross Golf Course)			1244
02/17/93	Quarterly Well Sampling	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Henrickssen, Finn W. (Plant Manager, Old Dutch Foods, Inc.)			1243
02/17/93	Quarterly Well Sampling	Schulte, Theodore E. (Commander's Respresentative, Department of the Army)	Malwitz, Michael (Metal-Matic, Inc.)			1245
02/17/93	Quarterly Well Sampling	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Perry, Todd E. (Honeywell Inc.)			1246
02/17/93	Quarterly Well Sampling	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Proper, Leslie (Director of Public Works, City of New Brighton)			1249
02/17/93	Quarterly Well Sampling	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Tankenoff, Scott (Hillcrest Development)			1247

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
02/17/93	Quarterly Well Sampling	Schulte, Theodore E. (Commanding Officer's Representative, Department of the Army)	Brungardt, Karl E. (Dr.) (Mounds View High School)			1248
02/19/93	Assessment of Chemical-Specific ARARs for OU-2, TCAAP	Hitch, Jean Pearson (Chemical Hazard Evaluation Group, Oak Ridge National Laboratory)			13	475
02/23/93	U.S. EPA Comments on the Engineering Evaluation/Cost Analysis (EE/CA), Site A	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1473
02/25/93	Abandonment of TCAAP Production Wells Nos. 6, 7 and 8	Schulte, Theodore E. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)		13	456
03/00/93	TCAAP, OU-3, Plume Groundwater Recovery System Health and Safety Plan, Remedial Action and Construction	Conestoga-Rovers & Associates, Inc.		3877(6)	13	601
03/00/93	Installation Restoration Program, TCAAP, Site F Soil Washing Treatability Study Work Plan	Wenck Associates, Inc.				443
03/02/93	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	114
03/05/93	MPCA Comments on the Engineering Evaluation/Cost Analysis Site A - Twin Cities Army Ammunition Plant, New Brighton, Minnesota, January 22, 1993	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1468
03/26/93	U.S. EPA Comments on TCAAP Draft Final FY 1992 Annual Monitoring Report/FY 1994 Annual Monitoring Plan	Barounis, Tom (Remedial Project Manager, U.S.	McCleery, Martin (Remedial Project Manager,			1447

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		EPA)	Department of the Army)			
03/29/93	Final Site F Closure Plan	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1182
04/02/93	MPCA Comments on the Fiscal Year 1992 Annual Monitoring Report/Fiscal Year 1994 Annual Monitoring Plan	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1446
04/05/93	U.S. EPA's Comments on Final Report, Feasibility Evaluation - New Brighton-Fridley Water Supply System Interconnection (2/93), Barr and Maier-Stewart Associates, Inc.	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	434
04/06/93	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	116
04/19/93	New Brighton-Fridley Water System Interconnection Responses to EPA Comments on Final Report - Feasibility Evaluation	Keil, Gregory D. (Barr Engineering Company)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	435
04/23/93	Assessment of Chemical-Specific Applicable or Relevant and Appropriate Requirements (ARARs); Assessment of Action-Specific Applicable or Relevant and Appropriate Requirements (ARARs)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1579
05/00/93	TCAAP OU-3 Monitoring Plan	Conestoga-Rovers & Associates, Inc.		3877(7)	13	700
05/00/93	TCAAP Site J Closure Report	Montgomery Watson				972
05/04/93	Assessment of Action-Specific ARARs (2/5/93) and Assessment of Chemical Specific ARARs (2/19/93)	Romano, Dagmar (Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S.	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	493

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		EPA)				
05/04/93	TCAAP Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	117
05/05/93	1992 Annual Monitoring Report/1994 Annual Monitoring Plan Response to EPA/MPCA Comments Meeting					1448
05/10/93	New Brighton-Fridley Water System Interconnection Montgomery Watson's Responses to EPA Comments on Final Report - Feasibility Evaluation	LeBlanc, Jeffrey J. (Supervising Engineer, Montgomery Watson)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	437
05/12/93	TCAAP Site F Special Discharge Authorization, MWCC Permit 0578	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Nordquist, Robert (Staff Engineer, Metropolitan Waste Control Commission)			1167
05/13/93	Big Ten Supper Club Well Sampling	MPCA	Welsch, Jack (Big Ten Supper Club)			1072
05/14/93	ARARs for the OU-1 Feasibility Study	Hovatter, Patricia S. (Oak Ridge National Laboratory)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	362
05/14/93	Quarterly Well Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Brungardt, Karl E. (Dr.) (Mounds View High School)			1237
05/14/93	Quarterly Well Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Perry, Todd (Honeywell Inc.)			1236
05/14/93	Quarterly Water Sampling	Fix, Michael R. (Commander's Representative,	Malwitz, Michael (Metal-Matic, Inc.)			1234

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Department of the Army)				
05/14/93	Quarterly Well Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Newville, Harold (Gross Golf Course)			1233
05/14/93	Quarterly Water Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Proper, Leslie (Director of Public Works, City of New Brighton)			1235
05/17/93	Final Report, Feasibility Evaluation - New Brighton-Fridley Water Supply System Interconnection	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)		13	436
05/17/93	U.S. Army Response to U.S. EPA Comments on Final Report, Feasibility Evaluation, New Brighton/Fridley Water Supply System Interconnection	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA)			1345
05/18/93	Response to April 13, 1993 Letter Concerning Turtle Lake in Ramsey County	Stine, John L. (Acting Assistant Director, Minnesota Department of Natural Resources)	Johnson, Carl (Turtle Lake Homeowners Association)			1381
05/18/93	TCAAP: Potential Innovative Technologies for Consideration	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1407
05/18/93	MPCA Staff Comments on the Response to Comments on the Draft Engineering Evaluation/Cost Analysis, Site A (April 30, 1993)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1469
05/24/93	Site J Closure Report (May, 1993)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA)			970

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
05/24/93	Site J Closure Report (May, 1993)	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA)			967
05/25/93	Engineering Evaluation/Cost Estimate Site A TCAAP	International Technology Corporation				1008
05/25/93	Big Ten Supper Club Well Sampling	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1071
05/25/93	ATSDR Public Health Assessment (Site 31)	Campbell, Gary H. (Chief, Army Unit Federal Programs Branch, ATSDR)	Romano, Dagmar (Project Manager, MPCA)			1417
05/26/93	TCAAP Major Permit Modification Number 1, Site F Closure, Twin Cities Army Ammunition Plant	Scherkenbach, Timothy, (Manager, Hazradous Waste Division, MPCA)	Fix, Michael, (Commander's Representative, Department of the Army)			2495
05/26/93	Interim Report of the Federal Facilities Environmental Restoration Dialogue Committee	Romano, Dagmar (Project Manager, MPCA)	Davidson, Gordon (Director, U.S. EPA)			1568
05/28/93	TCAAP FY 92 Annual Monitoring Report	Banker, Keith W. (Project Manager, Wenck Associates, Inc.)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)	0003-14		1451
05/28/93	1992 Annual Monitoring Report/1994 Annual Monitoring Plan	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA) Barounis, Tom (Remedial Project Manager, U.S. EPA)			1450
06/00/93	Addendum I: Final Report Feasibility Evaluation New Brighton-Fridley	Barr Engineering Company			13	626

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Water Supply System Interconnection	Maier-Stewart Associates, Inc.				
06/00/93	Addendum I, Final Report Feasibility Evaluation, New Brighton/Fridley Water Supply Interconnection	Barr Engineering Company Maier-Stewart Associates				1344
06/01/93	Engineering Evaluation/Cost Analysis (EE/CA) Site A Final Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1011
06/01/93	Response to U.S. EPA's Comments on Draft Engineering Evaluation/Cost Analysis (EE/CA) for Site A	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1009
06/02/93	TCAAP Environmental Update	Department of the Army				629
06/02/93	Technical Review Committee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)			13	234
06/10/93	Environmental Update (May 1, 1993)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)			1372
06/15/93	Scope of Work for Soil Washing Services Relating to Closure of Site F at the Twin Cities Army Ammunition Plant					937
06/23/93	MPCA Comments on Site J Closure Report	Romano, Dagmar (Project Manager, MPCA) Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			971

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/25/93	Consistency Test for the Fiscal Year 1992 Annual Monitoring Report/Fiscal Year 1994 Annual Monitoring Plan for the Twin Cities Army Ammunition Plant	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	1449
06/29/93	MPCA Comments on Site A Engineering Co. Evaluation/Cost Analysis (EE/CA)	Gnabasik, Barbara J. (Staff Hydrologist, MPCA)	Romano, Dagmar (Project Manager, MPCA)			1014
06/30/93	OU-2 Feasibility Study Data Review Meeting Held at TCAAP on 06/02/93	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)			1319
07/00/93	TCAAP, Feasibility Study, Final, OU-1 Feasibility Study	Montgomery Watson		Contract No. DAAA15-90-D-0011; Delivery Order 2	13	789
07/00/93	Installation Restoration Program, TCAAP, FY 1992 Annual Monitoring Report	Wenck Associates, Inc. Conestoga-Rovers & Associates, Inc.			13	885
07/00/93	Installation Restoration Program TCAAP Site F Closure Plan	Wenck Associates, Inc.		0003-06		1063
07/01/93	U.S. EPA's Comments on Engineering Evaluation/Cost Analysis (EE/CA) for Site A Final Report (May 25, 1993)	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1010
07/02/93	Montgomery Watson Feasibility Study Consistency Determination	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)		13	368

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
07/07/93	TCAAP Technical Review Committee Meeting Minutes	Department of the Army			13	896
07/07/93	TCAAP: Site F Closure Plan Addendum No. 1	Benker, Keith W. (Wenck Associates, Inc.)	Card, Dan (Hazardous Waste Division, MPCA)	0003-06		2496
07/07/93	ATSDR Public Health Assessment (Site 31)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1415
07/09/93	Environmental Update (June, 1993)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)			1371
07/12/93	Final Engineering Evaluation/Cost Analysis for Site A	International Technology Corporation				1015
07/13/93	New Brighton/Fridley Water Supply System Interconnection	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1343
07/16/93	Scope of Work for Remedial Design/Remedial Action (RD/RA) Quality Assurance Project Plan (QAPP)	U.S. Army Corps of Engineers - Omaha District		DACW 45-92-D-0007		1627
07/19/93	TCAAP Site F Special Discharge Approval	Nordquist, Robert (Senior Engineer, Metropolitan Waste Control Commission)	Fix, Michael R. (Commander's Representative, Department of the Army)			1166
07/21/93	Approval of Scope of Work for Soil Washing Services and Laboratory Services Relating to Closure of Site F	Brott, Bruce (Supervisor, Permit and Review Unit, MPCA)	Fix, Michael R. (Commander's Representative, Department of the Army)			1186

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
07/22/93	U.S. EPA Comments on Site J Closure Report (May, 1993)	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery Martin (Remedial Project Manager, Department of the Army)			969
07/22/93	ATSDR Public Health Assessment (Site 31)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA)			1414
07/27/93	Engineering Evaluation/Cost Analysis (EE/CA) Site A	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1007
08/00/93	TCAAP, Sites A, D and G Interim Response Actions, Monthly Operations Report	Fuller, David (Project Engineer, Federal Cartridge Company)			13	892
08/03/93	TCAAP Technical Review Committee Meeting Minutes	Department of the Army			13	913
08/04/93	Minutes of June 30, 1993, Site A Engineering Evaluation/Cost Evaluation (EE/CA) Minutes	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1006
08/04/93	Response from U.S. Army Site 31 and a Possible Release of Solvents Associated with Rail Transportation	Romano, Dagmar (Project Manager, MPCA)	Mann, John (Agency for Toxic Substances and Disease Registry)			1413
08/10/93	Environmental Update (July, 1993)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar			1370

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			(Project Manager, MPCA)			
08/16/93	Selection of Groundwater for a Bench Scale Feasibility Study of the EnviroMetal Process, Candidate Sites A and K, TCAAP	Vogan, John (Hydrogeologist, EnviroMetal Technologies, Inc.)	Romano, Dagmar (Project Manager, MPCA)			1405
08/18/93	Site F Closure Plan - Final	Lantz, Scott (Acting Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA); Romano, Dagmar (Project Manager, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)			1180
08/22/93	Weekly Progress Report - TCAAP Site F Closure	Bowers, Matt Johnsen, Bill (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1439
08/23/93	Quarterly Well Sampling	McCleery, Martin (Acting Commander's Representative, Department of the Army)	Newville, Harold (Gross Golf Course)			1231
08/23/93	Quarterly Well Sampling	McCleery, Martin (Acting Commander's Representative, Department of the Army)	Proper, Leslie (Director of Public Works, City of New Brighton)			1232
08/23/93	Quarterly Well Sampling	McCleery, Martin (Acting Commander's Representative, Department of the Army)	Brungardt, Karl E. (Dr.) (Mounds View High School)			1230
08/23/93	Groundwater Modeling in Support of OU-2 FS	McCleery, Martin (Acting Commander's	Barounis, Thomas (Remedial Project Manager,			1644

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Representative, Department of the Army)	U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			
08/24/93	Site Health and Safety Plan: TCAAP Site F	Cognis, Incorporated				965
08/25/93	Minnesota Department of Health Review of Site J Closure Report	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1508
08/25/93	Site J Closure Report	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			968
08/26/93	Request for Information to Properly Document TCAAP, OU-1 Administrative Record File	Barounis, Tom (Remedial Project Manager, U.S. EPA)			13	910
08/27/93	Site A Engineering Evaluation/Cost Analysis (EE/CA)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1005
08/27/93	Site F - MPCA Hazardous Waste Feedstocks Fact Sheet	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Plant Manager (Federal Cartridge Company)			1179
08/30/93	Addendum No. 2 to Site F Closure Plan/Site F Approved Remediation Levels	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1177
08/31/93	Selection of Groundwater for a Bench Scale Feasibility Study of the EnviroMetal Process	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1404

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
09/00/93	Record of Decision: Groundwater Remediation Operable Unit 1 at New Brighton/Arden Hills Superfund Site.	Adamkus, Valdas V.(Regional Administrator U.S. EPA); Williams, Charles (Commissioner, MPCA); Walker, Lewis D. (Deputy Ass't. Sec. for Army)				2474
09/00/93	Site A Removal Action - Specification No. 1053	Federal Cartridge Company				1529
09/06/93	Weekly Progress Report - TCAAP Site F Closure	Johnsen, Bill Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1438
09/07/93	Periodic Well Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Martin, Daryl T. Martin, Karen			1221
09/07/93	Periodic Well Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Gramradt, Max Gramradt, Sharon			1220
09/07/93	Periodic Well Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Andreasen, Joanne			1219
09/07/93	Periodic Well Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Gaffy, Tom			1218
09/08/93	TCAAP Technical Review Committee Meeting Minutes	Department of the Army			13	912
09/10/93	Environmental Update (August, 1993)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1369

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
09/12/93	Weekly Progress Report - TCAAP Site F Closure	Johnsen, Bill (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1436
09/14/93	Preliminary Remediation Goals for Soils at the New Brighton/Arden Hills Superfund Site	Chaudhry, Majid (Contractor Project Manager, PRC Environmental Management, Inc.)	Barounis, Tom (Remedial Project Manager, U.S. EPA)	Work Assignment No. 04-5140, Contract No. 68-W8-0084		1567
09/16/93	Amendment to the RCRA Permit Modification for Closure of Site F at TCAAP for Detonation of Unexploded Ordnance	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1174
09/20/93	Weekly Progress Report - TCAAP Site F Closure	Johnsen, Bill Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1435
09/20/93	Review of TCAAP Data Run by Minnesota Department of Health from Sampling Dates March 8, 1993 - July 20, 1993	Charpentier, Luke (QA/QC Coordinator, MPCA)	Trapp, Paul (On Site Inspector, MPCA)			1614
09/27/93	Site A Removal Action	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1540
09/28/93	Request for Permission to Dispose of Hazardous Explosive Items as Part of the Site F Closure Process	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1173
09/30/93	Site A Removal Action Report (Specification No. 1053)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1538

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
10/04/93	Weekly Progress Report - TCAAP Site F Closure	Johnsen, Bill Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1434
10/05/93	TCAAP Technical Review Committee Meeting Minutes	Department of the Army			13	911
10/05/93	MPCA Outline of Additional Work Required as Part of Operable Unit 2 Feasibility Study	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1327
10/07/93	Environmental Update (September, 1993)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1368
10/07/93	Site F Closure Plan Addendum - Approval for Open Detonation of Explosive Items	Brott, Bruce (Supervisor, Permit and Review Unit, MPCA)	Fix, Michael R. (Commander's Representative, Department of the Army)			1172
10/14/93	U.S. EPA Comments on Technical Memoranda Numbers 1a through 7, prepared by Montgomery Watson (September 1993)	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1330
10/14/93	Site A Plans and Specifications	Gnabasik, Barbara J. (Staff Hydrologist, MPCA)	Romano, Dagmar (Project Manager, MPCA)			1539
10/15/93	TCAAP Site F Closure - Summary of Recent Discussions and to Require Written Concurrence Re: Cadmium Cleanup Levels and Completion of Acceptance Testing	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1122
10/15/93	Site F Sampling Plan	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1171

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
10/18/93	TCAAP Site F Closure - DOA Request to MPCA Re: Discontinuation of Sampling and Analysis of Oversize Materials	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1121
10/19/93	TCAAP Site F Closure Actions - Site Health and Safety Plan	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			964
10/19/93	U.S. EPA Comments on the Site A Removal Action Specification No. 1053 for the Twin Cities Army Ammunition Plant	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1537
10/21/93	Site J Closure Report Page Changes, dated October 14, 1993, Provided by Montgomery Watson	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1511
10/21/93	Site J	Romano, Dagmar (Project Manager, MPCA); Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1477
10/25/93	Application of the MPCA Soil Leaching Model at Site A	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1510
10/28/93	MPCA Staff Comments on Development of Remediation Goals, Operable Unit 2, Prepared by Montgomery Watson, September 15, 1993	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1328
10/29/93	Site F Soil Washing/Soil Leaching Process	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1168
11/00/93	TCAAP Lowry Grove Trailer Park Water Service & Well Abandonment	Federal Cartridge Company				1057

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
11/01/93	Weekly Progress Report - TCAAP Site F Closure	Johnsen, Bill Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1433
11/08/93	Environmental Update (October, 1993)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1367
11/08/93	Site F Closure: Response to Letters of October 15, 1993 and October 18, 1993 Re: Oversized material, and Response to Letter of October 15, 1993 Re: Summary of 9/30/93 Meeting	Brott, Bruce W. (Supervisor, Permit and Review Unit, MPCA)	Fix, Michael R. (Commander's Representative, Department of the Army)			1120
11/08/93	Tissue Test Results of Muskies Netted from Sunfish Lake at Twin Cities Army Ammunition Plant	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Williams, Keith (U.S. Army Environmental Hygiene Agency)			1441
11/09/93	Minutes of November 2, 1993 Site J Meeting	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1507
11/09/93	TCAAP Technical Review Committee Meeting Minutes (November, 1993)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1604
11/10/93	Revisions to Site J Closure Report	Romano, Dagmar (Project Manager, MPCA) Barounis, Tom (Remedial Project Manager, U.S.	McCleery, Martin (Remedial Project Manager, Department of the Army)			1506

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		EPA)				
11/12/93	TCAAP Site F Disposal Area - Soil Sampling and Characterization	Lantz, Scott (Acting Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1163
11/15/93	Weekly Progress Report - TCAAP Site F Closure	Johnsen, Bill Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1432
11/15/93	ATSDR Public Health Assessment - New Brighton/Arden Hills (November 15, 1993)	Howie, Max M. Jr. (Chief, Records and Information Management Branch, Agency for Toxic Substances and Disease Registry)	Romano, Dagmar (Project Manager, MPCA)			2067
11/16/93	Operable Unit 2 (OU2) Feasibility Study (FS) Comments Review Meeting/Conference Call					1324
11/23/93	Quality Assurance Data for FY 93 Quarterly Monitoring	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA)			1195
11/30/93	TCAAP Site F Disposal Area - Soil Sampling and Characterization	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1162
12/00/93	Inventory of Water-Supply Wells in the Vicinity of the Twin Cities Army Ammunition Plant, Phase II Report	S.S. Papadopolous & Associates, Inc.				936
12/06/93	Environmental Update (November, 1993)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar			1366

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			(Project Manager, MPCA)			
12/06/93	Completed Scenarios for TCAAP OU-2	Anderson, Grant (Engineering Technologies Associates, Inc.)	Al Hassan, Sumani			1642
12/07/93	TCAAP Technical Review Committee (TRC) Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)				1377
12/08/93	Attendance Sheet for Operable Unit 2 Feasibility Study Ecological Data Meeting; USWFS/MPCA/AEHA					1325
12/10/93	MPCA Staff Comments on Operable Unit 2 Chemicals of Concern by Montgomery Watson, dated December 1994 [sic]	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1323
12/13/93	Site F Closure (Sampling Frequency)	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1119
12/15/93	ATSDR Public Health Assessment for New Brighton/Arden Hills	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	McCarthy, Elissa (U.S. Army Environmental Hygiene Agency)			1411
12/15/93	Changes to the Final Site J Closure Report	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1505
12/16/93	Site F Closure Levels and Property Deed Restrictions	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA);			1161

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			Romano, Dagmar (Project Manager, MPCA)			
12/16/93	TCAAP Technical Review Committee Meeting Minutes (December, 1993)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1605
12/17/93	OU-2 FS Groundwater Model Runs Meeting Minutes	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1641
12/20/93	Public Health Assessment for New Brighton/Arden Hills	Romano, Dagmar (Project Manager, MPCA)	Director, (Division of Health Assessment and Consultation, Agency for Toxic Substances and Disease Registry)			1410
12/23/93	EnviroMetal Technologies Inc: Draft Report (November, 1993) Regarding In-situ Treatment of Groundwater at Sites A and K Using Funnel-and-Gate Technology	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1403
12/23/93	Draft Effluent Limitations, Site K	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1444
12/27/93	Application of the MPCA Soil Leaching Model - Operable Unit 2 Sites	Lantz, Scott (Acting Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA)			1545
12/29/93	Consistency Test for Final Site J Closure Report	Barounis, Tom (Remedial Project Manager, U.S.	McCleery, Martin (Remedial Project Manager,			1599

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		EPA) Romano, Dagmar (Project Manager, MPCA)	Department of the Army)			
01/00/94	Draft Final Feasibility Study (Vol. III)	Montgomery Watson		DAAA15-90-D-0011		944
01/00/94	Draft Final OU-2 Feasibility Study (Vol. II)	Montgomery Watson		DAAA15-90-D-0011		943
01/00/94	Draft Final OU-2 Feasibility Study (Vol. I)	Montgomery Watson		DAAA15-90-D-0011		942
01/00/94	TCAAP Sites A, D and G IRA Monthly Operations Report (January, 1994)	Fuller, David (Project Engineer, Federal Cartridge Company)				2082
01/00/94	Draft Remedial Design/Remedial Action Work Plan for Operable Unit 1	Montgomery Watson		DACW45-92-0007		1303
01/00/94	Remedial Design/Remedial Action Quality Assurance Project Plan	Montgomery Watson		1868.1200		963
01/03/94	TCAAP Volatiles Data Review from MDH	Charpentier, Luke (QA/QC Coordinator, MPCA)	Gnabasik, Barbara J. (Technical Analyst, Minnesota Pollution Control Agency)			1073
01/05/94	Reduction in Sampling/Analysis of Oversized Material at Site F	Brott, Bruce W. (Supervisor, Permit and Review Unit, MPCA)	Fix, Michael R. (Commander's Representative, Department of the Army)			1118
01/07/94	Environmental Update (December, 1993)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)			136[illegible]
01/10/94	OU-2 FS Groundwater Model Runs Meeting, December 7, 1993	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			164[illegible]

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			Romano, Dagmar (Project Manager, Minnesota Pollution Control Agency)			
01/13/94	December 27, 1993 Letter from the Army on Soil Leaching Model	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1544
01/19/94	Discharge Report for Remediation Work at TCAAP Site F and Request for Extension of Special Discharge Approval	Fix, Michael R. (Commander's Representative, Department of the Army)	Nordquist, Robert (Staff Engineer, Metropolitan Waste Control Commission)			1108
01/24/94	Results of Soil Contamination Leaching Evaluation for Operable Unit 2	Lantz, Scott (Acting Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA)			1543
01/27/94	Leaching Model for Select Metals at Site K	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1442
01/28/94	MPCA Comments on Review of the Draft Work Plan, Phase III - Inventory of Water Supply Wells in the Vicinity of TCAAP (December, 1993)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1656
01/31/94	U.S. EPA Comments on Draft Work Plan, Phase III, Inventory of Water Supply Wells in the Vicinity of TCAAP, FCC (December, 1993)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1654
02/00/94	Application of a Ground Water Model in Support of the Feasibility Study for Operable Unit 2 at the Twin Cities Army Ammunition Plant	Engineering Technologies Associates, Inc.		93302.10		934
02/00/94	Final Draft Conceptual Design Report Permanent Granular Activated Carbon Water Treatment Facility Modifications	Barr Engineering Company				1023

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
02/03/94	Discharge Report for Remediation Work at TCAAP Site F and Request for Extension of Special Discharge Approval	Fix, Michael R. (Commander's Representative, Department of the Army)	Nordquist, Robert (Staff Engineer, Metropolitan Waste Control Commission)			1107
02/07/94	TGRS Fiscal Year 1994 First Quarter (Q41) Monitoring Report	Boevers, Brian (Conestoga-Rovers & Associates, Inc.)	McCleery, Martin (Remedial Project Manager, Department of the Army)	1496, 5530 - 40		973
02/07/94	Review & Consistency Determination of the Draft Remedial Design/Remedial Action Work Plan	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1302
02/09/94	Environmental Update (January, 1994)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1364
02/14/94	Fiscal Year 1993 Annual Monitoring Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA)			992
02/14/94	Abandonment of TCAAP Production Well No. 3	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1649
02/16/94	Lead Abatement Standard	Romano, Dagmar (Project Manager, MPCA)	Hovatter, Patti (Oak Ridge National Laboratory)			1575
02/16/94	Flow Rates/Water Treated TGRS, Site A, Site I and Site K (January,	Fix, Michael R.	Barounis, Thomas			1036

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	1994)	(Commander's Representative, Department of the Army)	(Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			
02/16/94	Follow-up to the February 8, 1994 MPCA and TCAAP Meeting	Brott, Bruce (Supervisor, Permit and Review Unit, MPCA)	Fix, Michael R. (Commander's Representative, Department of the Army)			1112
02/17/94	TCAAP Site F Closure	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			939
02/17/94	Removing Lead from Contaminated Soil	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1116
02/17/94	U.S. EPA Comments on the Draft Remedial Design/Remedial Action Quality Assurance Project Plan (QAPP) for the Twin Cities Army Ammunition Plant, January 1994.	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1557
02/22/94	Quarterly Sampling of Wells	Fix, Michael R. (Commander's Representative, Department of the Army)	Brungardt, Karl E. (Dr.) (Mounds View High School)			1208
02/22/94	Quarterly Sampling of Wells	Fix, Michael R. (Commander's Representative, Department of the Army)	Henrickssen, Finn (Old Dutch Foods, Inc.)			1212
02/22/94	Quarterly Sampling of Wells	Fix, Michael R. (Commander's Representative, Department of the Army)	Perry, Todd (Honeywell Inc.)			1211

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
02/22/94	Quarterly Sampling of Wells	Fix, Michael R. (Commander's Representative, Department of the Army)	Newville, Harold (Gross Golf Course)			1210
02/22/94	Quarterly Sampling of Wells	Fix, Michael R. (Commander's Representative, Department of the Army)	White, Fred			1209
02/22/94	Quarterly Sampling of Wells	Fix, Michael R. (Commander's Representative, Department of the Army)	Proper, Leslie (Director of Public Works, City of New Brighton)			1207
02/27/94	TCAAP Technical Review Committee Meeting Minutes (February 1995).	Lantz, Scott F. (Acting COR, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2342
02/28/94	Site J Closure Report - Revised Pages Dated February 10, 1994	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1598
03/00/94	Final Site J Closure Report	Montgomery Watson				1514
03/00/94	Laboratory Evaluation Report Treatability Test of the Envirometal Process at Site A	EnviroMetal Technologies, Inc.		31019.20		1526
03/00/94	Intermediate Design Submittal Operable Unit 1 Modifications: Permanent Granular Activated Carbon Water Treatment Facility Modification	Barr Engineering Company				1050
03/00/94	Comparison of Design Options: Permanent Granular Activated Carbon Water Treatment Facility Raw Water and Waste Water Pipelines	Barr Engineering Company				1022
03/02/94	Assessment of Location-Specific Applicable or Relevant and Appropriate Requirements (ARARs) for Operable Unit 2	McDonald, Elizabeth P. Hovatter, Patricia S.				1572

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Ross, Robert H. (Oak Ridge National Laboratory)				
03/03/94	MPCA Comments on Remedial Design/Remedial Action Quality Assurance Project Plan (January 1994)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1556
03/04/94	Assessment of Action-Specific Applicable or Relevant and Appropriate Requirements (ARARs) for Operable Unit 2, Twin Cities Army Ammunition Plant, Minnesota	Arnold, Susan E. Bock, Robert E. Hovatter, Patricia S. Ross, Robert H. (Oak Ridge National Laboratories)				1574
03/04/94	Quarterly Well Sampling	Lantz, Scott F. (Acting Commander's Representative, Department of the Army)	Schorn, Robert			1205
03/04/94	Assessment of Chemical-Specific Applicable or Relevant and Appropriate Requirements (ARARs) for Operable Unit 2	Hitch, Pearson Jean Hovatter, Patricia S. Ross, Robert H. (Oak Ridge National Laboratory)				1573
03/07/94	Environmental Update (February, 1994)	Lantz, Scott (Acting Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1363
03/08/94	Highview Junior High School Well #409556: Chemical Analysis Results	Lantz, Scott F. (Acting Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1206

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
03/08/94	Effluent Limitations Based on Three Scenarios for Discharge to Rice Creek	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1375
03/09/94	TCAAP Site F Closure	Lantz, Scott F. (Acting Commander's Representative, Department of the Army)	Bjork, Roger (Section Manager, MPCA)			1113
03/11/94	USEPA Comments on the Remedial Design/Remedial Action (RD/RA) Work Plan for Operable Unit 1, TCAAP	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1300
03/14/94	Determination of Background Levels for Soils and Groundwater of TCAAP	Romano, Dagmar (Project Manager, MPCA) Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1338
03/17/94	Flow Rates/Water Treated TGRS, Site A, Site I and Site K (February, 1994)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			1037
03/17/94	MPCA Comments on Remedial Design/Remedial Action Work Plan for Operable Unit 1 (January 1994)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1301
03/18/94	Predictive Modeling of Additional Phosphorous Loading to Long Lake	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1336
03/18/94	TCAAP Technical Review Committee Meeting Minutes (March 1995)	Fix, Michael R. (Commander's Representative,	Barounis, Thomas (Remedial Project Manager,			2291

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Department of the Army)	U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			
03/22/94	Three-Party Agreement, Site A, Twin Cities Army Ammunition Plant	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Hammitt, Thomas L. (City of Shoreview)			1524
03/23/94	1988 Access Agreement between the Salvation Army and the MPCA, regarding Minnesota Unique Number 447889	Romano, Dagmar M. (Project Manager, MPCA)	McAlpine, Shawn A. (Silver Lake Camp)			1204
03/24/94	TCAAP Site F Special Discharge Approval - Request for Additional Discharges	Fix, Michael R. (Commander's Representative, Department of the Army)	Nordquist, Robert (Staff Engineer, Metropolitan Waste Control Commission)			1106
03/24/94	TCAAP Site A Dewatering Discharge to Sanitary Sewer	Fix, Michael R. (Commander's Representative, Department of the Army)	Nordquist, Robert (Staff Engineer, Metropolitan Waste Control Commission)			1533
03/25/94	U.S. EPA Comments on Draft - Final Fiscal Year 1993 Annual Monitoring Report (January, 1994)	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1029
03/25/94	U.S. EPA Comments on Final Draft Conceptual Design Report Permanent Granular Activated Carbon Water Treatment Facility Modifications (February, 1994)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1051
03/29/94	Site F Closure Cleanup Goals	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1111
03/29/94	Draft Final Addendum No. 3, (March 24, 1994) Site F Closure Plan	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1103

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
03/31/94	MPCA Comments on the Draft Final Fiscal Year 1993 Annual Monitoring Report (February, 1994)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1030
03/31/94	MPCA Comments on Draft Final Fiscal Year 1993 Annual Monitoring Report/1995 Monitoring Plan (February, 1994)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			976
04/00/94	Conceptual Design Report: Permanent Granular Activated Carbon Water Treatment Facility Raw Water and Waste Water Pipelines	Barr Engineering Company				1021
04/04/94	Site F Closure Plan, Draft Final Addendum No. 3	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1101
04/06/94	Site A Removal Action Construction	Fuller, David (Federal Cartridge Company)				1535
04/07/94	Environmental Update (March, 1994)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1362
04/07/94	Site F Closure - Need for Hazardous Waste Storage Facility (HWSF) or Corrective Action Management Unit (CAMU)	Fix, Michael R. (Commander's Representative, Department of the Army)	Bjork, Roger (Section Manager, MPCA)			1109
04/07/94	TCAAP Site A Dewatering Discharge Approval	Nordquist, Robert (Staff Engineer, Metropolitan Waste Control Commission)	Fix, Michael R. (Commander's Representative, Department of the Army)			1532
04/11/94	MPCA Comments on Draft Final Fiscal Year 1993 Annual Monitoring Report (February, 1994)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			991

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
04/11/94	Quality Assurance Quality Control (QA/QC) Data for Fiscal Year 1993 Annual Monitoring Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1031
04/13/94	Flow Rates/Water Treated TGRS, Site A, Site I and Site K (March, 1994)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1038
04/18/94	TCAAP Technical Review Committee Meeting Minutes (April, 1994)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S EPA)			1606
04/19/94	1993 Annual Monitoring Report Comments Review Meeting Minutes	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA); Barounis, Tom (Remedial Project Manager, U.S. EPA)			1028
04/19/94	Requirements for the Performance of Removal Actions at TCAAP	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Dagmar, Romano (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1085
04/21/94	Sampling of Round & Sunfish Lakes at TCAAP for Acid Volatile Sulfides, Simultaneously Extractable Metals and Total Organic Carbon	Ferrey, Mark L.(Research Scientist, MPCA)	Smith, Stan (U.S Fish and Wildlife Service)			1335
04/21/94	Well Sample Results	Trapp, Paul (On-Site Inspector, MPCA)	Indykiewicz, George			2065

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
04/21/94	Well Sample Results	Trapp, Paul (On-Site Inspector, MPCA)	Welsch, Jack			2066
04/21/94	Well Sample Results	Trapp, Paul (On-Site Inspector, MPCA)	DeWitt, Richard			2064
04/22/94	U.S. EPA Comments on Assessment of Location-Specific Applicable or Relevant and Appropriate Requirements (ARARs); Assessment of Action-Specific ARARs; Assessment of Chemical-Specific ARARs.	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1571
04/26/94	Final Site J Closure Report. Prepared by Montgomery Watson for the United States Army Environmental Center (March 1994)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1513
04/26/94	TCAAP Site A Dewatering on Aldine Street	Hammitt, Thomas L. (Senior Engineering Technician, City of Shoreview)	Fix, Michael R. (Commander's Representative, Department of the Army)			1523
04/26/94	Minutes of the January 14, 1994 Site F Meeting	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA); Brott, Bruce (Supervisor, Permit and Review Unit, MPCA); Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1110
04/28/94	Addendum No. 3 (April 28, 1994) - Site F Closure Plan	Sweesy, George (Plant Manager, Federal Cartridge Company)	Contracting Officer's Representative (Department of the Army)			1102
05/00/94	TCAAP Operable Unit 2, Feasibility Study, Site I & K Field Investigation, Data Report	Conestoga-Rovers & Associates, Inc.		1496 (16)		931
05/00/94	Installation Restoration Program, TCAAP, Inventory of Water-Supply	Wenck Associates, Inc.				935

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Wells in the Vicinity of the Twin Cities Army Ammunition Plant					
05/01/94	TCAAP Final Year 1994 Second Quarter (Q42) Monitoring Report	Boevers, Brian (Conestoga-Rovers & Associates, Inc.)	McCleery, Martin (Remedial Project Manager, Department of the Army)	1496, 4304, 5530 - 40		974
05/02/94	F494 Annual Monitoring Plan - Revised Page	Sweesy, George (Plant Manager, Federal Cartridge Company)	Commander's Representative (Department of the Army)			1452
05/03/94	Assessment of Location-Specific Applicable or Relevant and Appropriate Requirements (ARARs) for Operable Unit 2; Assessment of Chemical-Specific Applicable or Relevant and Appropriate Requirements (ARARs) for Operable Unit 2; Assessment of Action-Specific Applicable or Relevant and Appropriate Requirements (ARARs) for Operable Unit 2.	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1570
05/05/94	U.S. EPA comments on Intermediate Design Submittal for the TCAAP Operable Unit 1 Modifications: PGACWTF Addition	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1047
05/05/94	Application of MPCA Soil Leaching Model at Site K	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA)			1445
05/09/94	Environmental Update (April, 1994)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1361
05/09/94	Addendum No. 4, Site F Closure Plan	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1100

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
05/10/94	Site J Closure Report - Correction to T-Value Calculation	LeBlanc, Jeffrey J. (Project Manager, Montgomery Watson)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1512
05/12/94	TCAAP Site F Special Discharge Approval - Documentation of Change from Previous Correspondence	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Nordquist, Robert (Senior Engineer, Metropolitan Waste Control Commission)			1286
05/12/94	Abandonment of TCAAP Production Well No. 3	Fix, Michael R. (Commander's Representative, Department of the Army)	Nye, Jim (Hydrologist, Minnesota Department of Health)			1647
05/12/94	TCAAP Sewer Manhole Survey and Decontamination Report	Entwistle, Frederick (Advanced Health Physics Specialist, 3M)	Fix, Michael R. (Commander's Representative, Department of the Army)			1391
05/12/94	Alliant Monthly Sampling Report TGRS, Bldg. 103 and Bldg. 502 (May, 1994)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)			1033
05/13/94	Quarterly Sampling of Well Water at Mounds View High School	Fix, Michael R. (Commander's Representative, Department of the Army)	Brungardt, Karl E. (Dr.) (Mounds View High School)			1196
05/13/94	Quarterly Sampling of Well Water at Gross Golf Course	Fix, Michael R. (Commander's Representative, Department of the Army)	Newville, Harold (Gross Golf Course)			1198
05/13/94	Quarterly Sampling of Well Water	Fix, Michael R. (Commander's Representative, Department of the Army)	White, Fred			1197

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
05/13/94	Quarterly Sampling of Well Water for the City of New Brighton	Fix, Michael R. (Commander's Representative, Department of the Army)	Proper, Leslie (Director of Public Works, City of New Brighton)			1199
05/13/94	Site F Closure - Sampling Procedure for Unknown Substances	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1105
05/16/94	Flow Rates/Water Treated TGRS, Site A, Site I and Site K (April, 1994)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1039
05/16/94	Weekly Progress Report - TCAAP Site F Closure	Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1431
05/18/94	Policy on Arsenic Concentrations in Private Wells, April 12, 1994; Health Risk Limits and Recommended Allowable Limits, April 13, 1994	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1569
05/18/94	Proposed Abandonment of Production Well No. 3 Located at TCAAP, Unique No. 206758	Nye, James (Hydrologist, Minnesota Department of Health)	Fix, Michael R. (Commander's Representative, Department of the Army)			1648
05/19/94	RD/RA QAPP (Draft) Review Meeting EPA, MPCA, Army	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1555
05/19/94	U.S. EPA Comments on the Conceptual Design Report: Permanent Granular Activated Carbon Water Treatment Facility (PGACWTF) Raw Water and Waste Water Pipelines (April, 1994)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1046

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
05/20/94	Addendum No. 4 to Site F Closure Plan	Brott, Bruce (Supervisor, Permit and Review Unit, MPCA)	Fix, Michael R. (Commander's Representative, Department of the Army)			1099
05/23/94	Weekly Progress Report - TCAAP Site F Closure	Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1430
05/24/94	Public Health Assessment for New Brighton/Arden Hills (a/k/a U.S. Army Twin Cities Ammunition Plant) New Brighton, Ramsey County, Minnesota	Agency for Toxic Substances and Disease Registry		CERCLIS No. MN7213820908		1752
05/24/94	ATSDR's Public Health Assessment for New Brighton/Arden Hills (May 24, 1994)	Williams, Robert C. (Director, Department of Health and Human Services)	Fix, Michael R. (Commander's Representative, Department of the Army)			1409
05/24/94	MPCA Comments on Conceptual Design Report: Permanent Granular Activated Carbon Water Treatment Facility Raw Water and Waste Water Pipelines (April, 1994)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1045
05/24/94	ATSDR Public Health Assessment (May 24, 1994)	Howie, Max M. (Chief, Records and Information Management Branch, Agency for Toxic Substances and Disease Registry)	Romano, Dagmar (Project Manager, MPCA)			2071
05/27/94	Fiscal Year 1993 Annual Monitoring Report: Missing Pages	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1026
05/30/94	Weekly Progress Report - TCAAP Site F Closure	Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1429
06/00/94	TCAAP OU-2 FS, Supplemental Data Report (Volume II)	Montgomery Watson		DAAA 15-90-D-0011		933

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/00/94	TCAAP OU-2 FS, Supplemental Data Report (Volume I)	Montgomery Watson		DAAA 15-90-D-0011		932
06/00/94	Inventory of Water-Supply Wells in the Vicinity of TCAAP: 1993 Update Report	S.S. Papadopolous & Associates, Inc.				1633
06/00/94	Health and Safety Plan Environmental Field Activities	Rust Environmental & Infrastructure				1635
06/00/94	Draft Final OU-2 Feasibility Study (Vol. I)	Montgomery Watson Conestoga-Rovers & Associates, Inc.				945
06/00/94	Installation Restoration Program TCAAP Fiscal Year 1993 Annual Monitoring Report/Fiscal Year 1995 Annual Monitoring Plan	Wenck Associates Inc. Conestoga-Rovers and Associates Ltd.				1062
06/00/94	Draft Final OU-2 Feasibility Study (Vol. II)	Montgomery Watson Conestoga-Rovers & Associates				946
06/01/94	Site D Sanitary Discharge (Rainwater Tank)	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				1126
06/01/94	TCAAP Site A Dewatering Discharge Approval	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Nordquist, Robert (Senior Engineer, Metropolitan Waste Control Commission)			1531
06/01/94	Fiscal Year 1993 Annual Monitoring Report/Fiscal Year 1995 Annual Monitoring Plan Revisions	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1025
06/02/94	Notification of Intent to Discharge to the Sanitary Sewer - Site D	Sweesy, George (Plant Manager, Federal Cartridge Company)	Commander's Representative (Department of the Army)			1125

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/03/94	Consistency Test for Fiscal Year 1993 Annual Monitoring Report/Fiscal Year 1995 Annual Monitoring Plan	Romano, Dagmar (Project Manager, MPCA) Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			996
06/03/94	Draft Final Operable Unit 2 Feasibility Study (June, 1994)	McCleery, Martin (Acting Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			2031
06/06/94	1993 Annual Monitoring Report/1995 Annual Monitoring Plan Final Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)			1066
06/06/94	1993 Annual Monitoring Report/1995 Annual Monitoring Plan Final Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA)			1067
06/07/94	Well Sampling Results	Fix, MIchael R. (Commander's Representative, Department of the Army)	Nockleby	249199		1677
06/07/94	Text Changes to the TCAAP OU-1 RD/RA Work Plan	LeBlanc, Jeffrey J. (Project Manager, Montgomery Watson)	U.S. EPA MPCA			1298
06/07/94	Presentation and Tracking of Quality Assurance Data for Future Monitoring and Annual Monitoring Reports	Romano, Dagmar (Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2053
06/08/94	Site D Sanitary Discharge (Rain Water Tank)	Fairbanks, Michael				1094

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		(Environmental Technician, Federal Cartridge Company)				
06/09/94	Well Sample Results	Trapp, Paul (On-Site Inspector, MPCA)	DeWitt, Richard			2063
06/10/94	Environmental Update (May, 1994)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1360
06/13/94	Weekly Progress Report - TCAAP Site F Closure	Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1428
06/14/94	Site D - Discharge of Rain Water	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				1124
06/15/94	Alliant Monthly Sampling Report TGRS, Bldg. 103 and Bldg. 502 (June, 1994)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1034
06/15/94	Flow Rates/Water Treated TGRS, Site A, Site I and Site K (May, 1994)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1040
06/15/94	Revised Table 6-5 for Draft Final Operable Unit 2 Feasibility Study	LeBlanc, Jeffrey J. (Project Manager, Montgomery Watson)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1339

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/15/94	Pre-Final Design Submittal for the TCAAP Operable Unit 1 Modifications: (PGACWTF) Addition	Romano, Dagmar M. (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2497
06/17/94	Request for Removal Authority Action to Investigate Source of the Upper Hillside Aquifer Contamination	Romano, Dagmar (Project Manager, MPCA) Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1373
06/17/94	Draft Remedial Design/Remedial Action Work Plan for OU-1, Text Changes, Montgomery Watson Memorandum (June 7, 1994)	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1297
06/20/94	Weekly Progress Report - TCAAP Site F Closure	Johnsen, Bill (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1427
06/21/94	Environmental Documentation for Disposal of TCAAP 24-inch & 18-inch Forcemains	Sweesy, George (Plant Manager, Federal Cartridge Company)	Contracting Officer's Representative (Department of the Army)			1321
06/22/94	Design for Addition to Permanent Granular Activated Carbon Water Treatment Facility in New Brighton	Keil, Gregory (Barr Engineering Company)	Proper, Leslie (Director of Public Works, City of New Brighton)			959
06/22/94	Meeting on Operable Unit 2 Feasibility Study Overview by Montgomery Watson	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1786
06/23/94	TCAAP Site F Special Discharge Approval Modification	Nordquist, Robert	Fix, Michael R.			1091

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		(Staff Engineer, Metropolitan Waste Control Commission)	(Commander's Representative, Department of the Army)			
06/23/94	Site A Removal Action	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1530
06/27/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Beneke, Paul (University of Minnesota)	242219		1687
06/27/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Hoipomt, Sherry (Sunset Memorial Cemetery)	242207		1688
06/27/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	MacLauahan, Lorin (Public Works Supervisor, Labelle Park)	234334		1696
06/27/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Roback, Richard	249148		1704
06/27/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Dean, Richard	249638		1712
06/27/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Fouts, Bill	206688		1717
06/27/94	Well Sampling Results	Fix, Michael R. (Commander's Representative,	Clark, Charley (Gordon Rendering Company)	234350		1691

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Department of the Army)				
06/27/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Montzka, Harold and Marilyn	249632		1728
06/27/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Bochnak, Muriel	234368		1738
06/27/94	Weekly Progress Report - TCAAP Site F Closure	Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1426
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Nockleby	249199		1678
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Lawrence, Kent	234345		1680
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Raddatz, Robert	437758		1681
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	DeWitt, Richard	234301		1684
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Zenench, Rev. Stefan	206763		1685
06/28/94	Well Sampling Results	Fix, Michael R.	Campbell, Dennis	509052		1686

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		(Commander's Representative, Department of the Army)	(Shriners Hospital)			
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Reiner, Tom	234549		1689
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Phillips Petroleum	234357		1690
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Reynolds, Jody (Chemclean Truck Wash)	234421		1692
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Holte, Asbjorn	249200		1693
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Walseth, Jeri	234507		1694
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Bona, Jerome	249149		1695
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Marinello, Roger and Sharon	249137		1697
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Nardecchia, John	249134		1698

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Fudro, Marion	234426		1699
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Benedix, Margy	234449		1700
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Walker, John	234450		1701
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Markely	249153		1702
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Ciske, Don	249631		1703
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Glen (Pletschers Greenhouse)	200525		1705
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Tacheny, Carl	249144		1706
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Grey, Richard	249643		1707
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Leiser, Mark	234571		1708

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Molenaar, Don	249140		1709
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Smith, Orval	234377		1710
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Hopstock, David	249186		1711
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Ripienski, Ronald	156076		1713
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Boyle, Gerald and Charlotte	249152		1714
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Kracht, Steven	249139		1715
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Anderson, Chris	W30005		1716
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Linke, Gordon and Erleen	249143		1718
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Martin, Darryl	234372		1719

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Nordquist, Bob	234356		1720
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Hart, Daniel	480785		1721
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Roebke	234429		1722
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Ruppel, Thomas	234331		1724
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Hansen, Robert	206766		1725
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Hinnenkamp, William	249635		1726
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Winiecki, Jeanne	234306		1733
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Gamradt, Max	249637		1727
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Chose, Bill (University of Minnesota)	249639		1729

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Beaulieu, Conrad	234318		1730
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Igbal, Anwar	234311		1731
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Grudnoske, John	234310		1732
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Holmquist, Tom (Arden Manor Trailer Park)	151568		1734
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Lange, Michael	112344		1735
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Tran, Hung	249630		1736
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Schroer, Patti (Rapid Printing)	249608		1737
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Grudnoske, Leonard	234308		1739
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Hagerty, Bruce (KSTP Radio TV)	200173		1740

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Henrickssen, Finn (Old Dutch Foods)	200076		1741
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Wilson, Donald and Helen	249160		1742
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Timmers, Pamela	249147		1743
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Aulich, Jerald	249145		1744
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Gaffy, Thomas and Charlotte	249003		1745
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Kavanagh, Michael	234394		1746
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Williams, Chester	249603		1747
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Robbins, Kathy	249601		1748
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Bellis, Lyle	249636		1788

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Grudnoske, Gerald	234312		1789
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Lindorff, Jeffrey	249159		1790
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Coon, Joe (Midland Hills Country Club)	200149		1679
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Peck, Charles	234313		1682
06/28/94	Well Sampling Results	Fix, Michael R. (Commander's Representative, Department of the Army)	Schilleman, Reed and Beverly	234307		1683
07/00/94	Final Remedial Design/Remedial Action Work Plan for Operable Unit 1	Montgomery Watson				1142
07/00/94	Performance Monitoring Plan for OU-1 - Draft	Montgomery Watson		1868-1240		1383
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Salo, Marlen			1662
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Schorn, Robert			1664
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Michels, Jennie			1665

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Busch, Paul			1666
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Clayes, Doris			1668
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Kroon, Rita			1669
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Reese, Lois			1670
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Aamoth, Clifford			1671
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Wolfe, Terrie			1672
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Larson, Doug			1673
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Mulcahy, Michael			1674
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Nielsen, Susan			1675

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Poshus, Eileen			1676
07/06/94	TCAAP Phase III Water Supply Wells Inventory	Fix, Michael R. (Commander's Representative, Department of the Army)	Ryan, Karen			1667
07/06/94	EPA SITE Program Demonstration of Cognis's Terramet Lead Extraction Process	Royer, Michael (Site Project Manager, U.S. EPA)	Gertsema, Barb (Twin Cities Army Ammunition Plant)			1137
07/06/94	Weekly Progress Report - TCAAP Site F Closure	Johnsen, Bill (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1425
07/07/94	Environmental Update (June, 1994)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1359
07/08/94	Lead Clean-up Goals for Superfund Sites	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1143
07/09/94	Weekly Progress Report - TCAAP Site F Closure	Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1424
07/18/94	Consistency Test for the Remedial Design/Remedial Action Work Plan for OU-1, TCAAP, prepared by Montgomery Watson	Barounis, Tom (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1296

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
07/18/94	Well Sample Results	Gust, Larry (Supervisor, Health Risk Assessment Unit, Minnesota Department of Health)	Haggarty, Bruce (KSTP TV and Radio Station)			2062
07/19/94	Amended Groundwater Appropriation Permit (83-6056)	Japs, James (Program Manager, Water Appropriation and Permit Program, Minnesota DNR)	Fix, Michael R. (Commander's Representative, Department of the Army)			955
07/19/94	U.S. EPA Comments on the Prefinal Design Submittal for the OU-1 Permanent Granular Activated Carbon Water Treatment Facility Modifications, Raw Water and Wastewater Pipelines, TCAAP, New Brighton, MN	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2498
07/25/94	TCAAP Site F Closure	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			953
08/00/94	Site D and Site G Operations Report (August 1994)					2060
08/02/94	Final Remedial Design/Remedial Action (RD/RA) Work Plan for Operable Unit 1	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)			1140
08/02/94	Draft Remedial Design/Remedial Action (RD/RA) Performance Monitoring Plan for Operable Unit 1 (July, 1994).	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)			2048
08/02/94	Final Remedial Design/Remedial Action (RD/RA) Work Plan for Operable Unit 1	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA)			1141
08/08/94	Environmental Update (July, 1994)	Fix, Michael R. (Commanding Officer's	Barounis, Tom (Remedial Project Manager,			1358

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Representative, Department of the Army)	U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			
08/09/94	Public Health Assessment for New Brighton/Arden Hills dated May 24, 1994	Romano, Dagmar (Project Manager, MPCA)	Director, (Division of Health Assessment and Consultation Agency for Toxic Substances and Disease Registry)			1134
08/11/94	TCAAP Fiscal Year 1994 Third Quarter (Q43) Monitoring Report	Boevers, Brian C. (Conestoga-Rovers & Associates)	McCleery, Martin (Remedial Project Manager, Department of the Army)	1496, 4304, 5530-40		1160
08/13/94	Page Change to Final OU-1 Remedial Design/Remedial Action Work Plan	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1619
08/16/94	Site F Closure - "Substance" Treatment by Soil Washing	Brott, Bruce W. (Supervisor, MPCA)	Fix, Michael R. (Commander's Representative, Department of the Army)			1773
08/17/94	TCAAP Technical Review Committee Meeting Minutes (August, 1994).	McCleery, Martin (Acting Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)			1145
08/19/94	TCAAP Fiscal Year 1994 Third Quarter (Q43) Monitoring Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA)			1158
08/19/94	TCAAP Fiscal Year 1994 Third Quarter (Q43) Monitoring Report	Fix, Michael R. (Commander's Representative,	Barounis, Thomas (Remedial Project Manager,			1159

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Department of the Army)	U.S. EPA)			
08/24/94	Monitoring TGARS Site I and K Groundwater Treatment Systems - July, 1994	McCleery, Martin (Acting Commander's Representative, Department of Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1042
08/25/94	TCAAP "Restoring The Environment"	FCC				2493
08/25/94	Site F	McCleery, Martin (Acting Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA); Card, Dan (Engineer, Hazardous Waste Division, MPCA)			1128
08/26/94	Information Regarding Well Number 2 at Arden Manor Mobile Home Park	Trapp, Paul (On-site Inspector, MPCA)	Shellenberger, Lynn (All Parks Alliance for Change)			1147
08/26/94	Information Regarding Well Number 2 at Arden Manor Mobile Home Park	Trapp, Paul (On-site Inspector, MPCA)	Hosford, Jennifer			1146
08/31/94	Response to Comments on the ATSDR Public Health Assessment	Williams, Robert C. (Director, Division of Health Assessment and Consultation, Agency for Toxic Substances and Disease Registry)	Romano, Dagmar (Project Manager, MPCA)			2070
09/00/94	TCAAP Environmental Update	McCleery, Martin (Remedial Project Manager, Department of the Army)				2055

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
09/00/94	Site D and Site G Operations Report (September 1994)					2061
09/02/94	Summary of Meeting Held on August 30, 1994 at TCAAP to Discuss Objective & Scope of Work for Additional Computer Modeling Relating to OU-1	Perry, Teresa J. (Barr Engineering Company)	Ryan, Mark (USACE)			1779
09/03/94	Weekly Progress Report - TCAAP Site F Closure	Johnsen, Bill Wenck Associates, Inc.				1763
09/08/94	Environmental Update (August, 1994)	Fix, Michael R. (Commanding Officer's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1357
09/08/94	503 Pad - Discharge of Rain Water	Fairbanks, Michael (Federal Cartridge Company)				1777
09/12/94	Draft Final Feasibility Study for OU-2, TCAAP, New Brighton, MN	Fix, Michael R. (Commander's Representative, Department of the Army)	Thomas Barounis (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			1778
09/12/94	U.S. EPA Comments on the Draft Performance Monitoring Plan for Operable Unit 1, TCAAP (July, 1994).	Barounis, Thomas (Remedial Project Manager, U.S. EPA	McCleery, Martin R. (Remedial Project Manager, Department of the Army)			2047
09/12/94	Letter Attaching Petitions Requesting Establishment of a Restoration Advisory Board	Flicker, LeEtta (Arsenal Clean-up and Conversion Project)	Fix, Michael R. (Commander's Representative, Department of the Army)			1757
09/13/94	Page Change to Final OU-1 Remedial Design/Remedial Action Work Plan	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar			1776

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			(Project Manager, MPCA)			
09/13/94	Meeting on Operable Unit 2 Feasibility Study Overview by Montgomery Watson	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1787
09/15/94	503 Pad A - Discharge of Rain Water	Fairbanks, Michael (Federal Cartridge Company)				1766
09/17/94	Review of the Ecological Risk Assessment for TCAAP	Balcom, Thomas W. (Supervisor, Minnesota Department of Natural Resources)	McCleery, Martin (Remedial Project Manager, Department of the Army)			1761
09/19/94	TCAAP Technical Review Committee Meeting Minutes (September, 1994)	Department of the Army				947
09/20/94	Replacement Water Supply for Arden Manor Trailer Home Park, Arden Hills, MN	Finch, Frank R. (Director, Department of the Army)	Commander (U.S. Army Material Command)			1759
09/21/94	Site F Closure	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (MPCA)			1772
09/21/94	Presentation and Tracking of Quality Assurance Data for Future Monitoring and Annual Monitoring Reports	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			2052
09/22/94	Phase III Well Inventory - Response to Comments on Phase III Draft Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar			1771

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			(Project Manager, MPCA)			
09/23/94	EPA/MPCA - Site F/Other NPL Site Cleanup Meeting on September 7, 1994	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar Brott, Bruce Card, Dan Gawrys, Beth (MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)			1758
09/26/94	Site D - Discharge of Rain Water	Fairbanks, Michael (Federal Cartridge Company)				1765
09/26/94	Receipt of Petition and Establishment of TCAAP Restoration Advisory Board	Fix, Michael R. (Commander's Representative, Department of the Army)	Flicker, LeEtta (Arsenal Clean-up and Conversion Project)			1756
09/28/94	503 Pads A & B - Discharge of Rain Water	Fairbanks, Michael (Federal Cartridge Company)				1767
09/29/94	Alternative Method for Treatment of Iron Bacteria Problems in Wells	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2302
09/30/94	MPCA Comments on the Final Design Submitted (Plans and Specification) Operable Unit 1 Modifications: PGACWTF (July, 1994).	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2050
09/30/94	Surface and Subsurface Survey and Unexploded Ordinance/Other Explosive Waste Removal at TCAAP - Area East of Snelling Ave.	Gimmestad, Dennis (Minnesota Historical Society)	Chudek, John (Federal Cartridge Company)			2464
10/00/94	MPCA Comments on TCAAP Draft Final OU-2 Feasibility Study (June, 1994)	MPCA				2024

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
10/03/94	U.S. EPA Comments on TCAAP Draft Final OU-2 Feasibility Study (June, 1994)	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin R. (Remedial Project Manager, Department of the Army)			2032
10/04/94	Presentation and Tracking of Quality Assurance Data for Future Monitoring and Annual Monitoring Reports	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2051
10/04/94	Building 503 - Discharge of Rainwater	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				2045
10/05/94	Site D - Discharge of Rainwater	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				2046
10/08/94	Weekly Progress Report - Site F Closure	Panian, Mark (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			2042
10/12/94	Site D - Discharge of Rainwater	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				2040
10/14/94	TCAAP Technical Review Committee Meeting Minutes (October, 1994)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			1618
10/17/94	Sediment Sampling at Valentine Lake.	McCleery, Martin (Remedial Project Manager, Department of the Army)	Romano, Dagmar (Project Manager, MPCA)			2226

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
10/18/94	Bldg. 503 - Discharge of Rainwater	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				2038
10/19/94	Meeting Minutes - OU-2 RD/RA Work Plan Assumptions and Considerations	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)			2054
10/19/94	Site D - Discharge of Rainwater	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				2075
10/20/94	TCAAP Restoration Advisory Board (RAB)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Manager, MPCA)			2039
10/22/94	Weekly Progress Report TCAAP Site F Closure	Panian, Mark Bowers, Matt (Wenck Associates, Inc.)	Card, Dan (Engineer, Hazardous Waste Division, MPCA)			2033
10/24/94	Site D - Discharge of Rainwater	Manderfeld, Bridgette (Environmental Manager, Federal Cartridge Company)				2035
10/26/94	503 Pads A & B - Discharge of Rainwater	Manderfeld, Bridgette (Environmental Manager, Federal Cartridge Company)				2034
10/28/94	Site A Removal Action Quarterly Report	Fix, Michael R. (Commander's Representative,	Metropolitan Council Wastewater Services			2028

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Department of the Army)				
10/28/94	U.S. EPA Comments on the Draft TCAAP Operable Unit 3 Remedial Action Report (September 1994) Including the Draft Operable Unit 3 Pumping Test Report (October 1994)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2058
11/00/94	Interim Remedial Action Performance Evaluation: Soil Vapor Extraction Systems at Sites D and G	Wenck Associates, Inc.		0003-28		2249
11/01/94	TCAAP Technical Review Committee Meeting Minutes (November 1994)	McCleery, Martin R. (Remedial Project Manager, Department of the Army)				2222
11/01/94	Site D - Discharge of Rain Water	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				2237
11/04/94	MPCA Comments on Draft Final OU-2 Feasibility Study (June, 1994)	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2023
11/09/94	TCAAP Fiscal Year 1994 Fourth Quarter (Q44) Monitoring Report	Boevers, Brian C. (Conestoga-Rovers & Associates, Inc.)	Gosen, David (Alliant Techsystems)	1496, 4304, 5530-40		2367
11/18/94	Phase III Well Inventory - Response to Comments on Phase III Draft Report, August 25, 1994	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2227
11/18/94	Site A Extraction Well 01U350 Shut-down Report.	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2233

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
11/21/94	503 Pad - Discharge of Rain Water	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				2223
11/21/94	Sampling at TCAAP	Romano, Dagmar (Project Manager, MPCA	McCleery, Martin (Remedial Project Manager, Department of the Army)			2229
11/29/94	Agenda: Agency Comments Review Meeting OU-2 Feasibility Study, TCAAP					2228
11/30/94	Valentine Lake Meeting Minutes (Revised 11/22/94) from Meeting Held on 11/3/94	McCleery, Martin (Remedial Project Manager, Department of the Army)	Romano, Dagmar Ferrey, Mark (MPCA)			2225
12/00/94	TCAAP OU-2 Chemicals of Concern	Montgomery Watson				1643
12/00/94	Draft Conceptual Design Report Extraction/Production Wells	Barr Engineering Co.				2242
12/02/94	Draft Final OU-2 FS	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2303
12/02/94	TCAAP Corrective Action Management Unit (CAMU) - Operable Unit 2	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Leader, MPCA			2258
12/02/94	TCAAP Corrective Action Management Unit (CAMU) - Operable Unit	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)			2259
12/06/94	TCAAP Technical Review Committee Meeting Minutes (December 1994)	McCleery, Martin R. (Remedial Project Manager, Department of the Army)				2217

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
12/08/94	TCAAP Site F Closure	McCleery, Martin (Acting COR, Department of the Army)	Card, Dan (MPCA)			2301
12/12/94	EPA Paper Presented at Superfund 15 Conference	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Leader, MPCA)			2304
12/16/94	Health To Safety - Restricted Areas at Site A and 129-5	McCleery, Martin (Remedial Project Manager, Department of the Army)	Barounis, Thomas (Remedial Project Manager, Department of the Army) Romano, Dagmar (Project Leader, MPCA)			2299
12/20/94	Annual Monitoring Plan	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2295
12/27/94	TCAAP Corrective Action Management Unit (CAMU) Operable Unit 2	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2257
00/00/95	Flow Rates/Water Treated (TGRS)	Romano, Dagmar (Project Manager, MPCA)	Gosen, David (Alliant Techsystems, Inc.)			2326
01/00/95	TCAAP Operable Unit 3 Remedial Action Report	Conestoga-Rovers & Associates, Inc.		3877(11)		2250
01/00/95	Installation Restoration Program TCAAP Inventory of Water-Supply Wells In the Vicinity of TCAAP	Wenck Associates, Inc.				2251

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
01/00/95	Installation Restoration Program TCAAP Update: Army Investigating Need for Additional Public Involvement in TCAAP Cleanup	Office of Public Affairs Department of the Army				2282
01/00/95	TCAAP Operable Unit 3 Pumping Test Report	Conestoga - Rovers & Associates		3877(9)		2239
01/04/95	MPCA Procedures for Establishing Soil Cleanup Levels	Romano, Dagmar (Project Manager. MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2260
01/04/95	Updates to Non-Thama Approved Methods (NTAM) database and to NTAM Data Management System (NDMS) for PC IRDMIS	Romano, Dagmar (Project Leader, MPCA)	Pete Rissell (U.S. Army Environmental Center)			2276
01/05/95	Deviations from TGRS, PGRS, Site I and Site K Sampling Programs - 1994 Fiscal Year	Cooke, Charles F. (Conestoga-Rovers & Associates, Inc.)	McCleery, Martin (Remedial Project Manager, Department of the Army)	5530-40		2261
01/09/95	Environmental Update (December 1994)	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Leader, MPCA)			2266
01/12/95	Minnesota Wellhead Protection Program	Englund, Gary L. (Program Manager, Minnesota Department of Health)	Schulte, Theodore (Commander's Representative, Department of the Army)			2271
01/17/95	TCAAP OU-2 Feasibility Study, Agency Comments Review Meeting	Fix, Michael R. (Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2262
01/17/95	TCAAP Technical Review Committee Meeting Minutes (January 1995)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar			2292

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			(Project Leader, MPCA)			
01/18/95	Sign-In Sheet Re: CAMU Site Selection					2268
01/18/95	Discharge Report for Remediation Work at TCAAP Site F and Request for Extension of Special Discharge Approval	Fix, Michael R. (Commander's Representative, Department of the Army)	Nordquist, Robert (Metropolitan Council Waste Water Services)			2263
01/23/95	Minutes of the OU-2 Sediment and Surface Water Ecological Risk Assessment Clarification and Revision Approach Meeting for TCAAP.	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)			2267
01/24/95	Inventory of Water-Supply Wells in the Vicinity of TCAAP, Phase III Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U. S. EPA); Romano, Dagmar (Project Manager, MPCA)			2272
01/25/95	Meeting Minutes-MPCA and EPA comments Concerning the PGRS Pumping Test Report and PGRS Remedial Action Report	Storlie, Pete (Conestoga-Rovers & Associates, Inc.)	McCleery, Martin (Remedial Project Manager, Department of the Army)	3877		2277
01/31/95	OU-1 Remedial Design	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2275
02/00/95	Installation Restoration Program, TCAAP Fiscal Year 1994 Annual Monitoring Report	Wenck Associates, Inc./Conestoga Rovers Associates				2378
02/00/95	Installation Restoration Program TCAAP- Interim Remedial Action Performance Evaluation: Soil Vapor Extraction Systems at Sites D and G (Final Report)	Wenck Associates, Inc.				2503

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
02/00/95	Final Conceptual Design Report Containment/Production Wells	Barr Engineering Company				2363
02/02/95	Draft Final OU-2 FS-Section 4, Human Health Risk Assessment and Appendix E, Human Health Risk Based Preliminary Remediation Goals	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2422
02/03/95	Corrective Action Management Unit (CAMU): Approach to Waiving Relevant RCRA Requirement for the Use of CAMU as Part of TCAAP OU-2	Romano, Dagmar (Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S.EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2421
02/06/95	Final Operable Unit 3 Remedial Action Report and Pumping Test Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2289
02/07/95	Explosive Testing at Site F Treated Soils	Card, Dan (MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2448
02/09/95	TCAAP Fiscal Year 1995 First Quarter (Q45) Monitoring Report	Boevers, Brian C. (Conestoga-Rovers & Associates, Inc.)	Gosen, David (Alliant Techsystems)	1496, 4304, 6317-40 (Task 4.2)		2368
02/09/95	Removal and Disposal of Building 308	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Leader, MPCA) Barounis, Thomas (Remedial Project Manager, U.S.EPA)			2420
02/13/95	Quarterly Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	White, Fred			2433

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
02/14/95	Installation Restoration Program, TCAAP Fiscal Year 1994 AMR/Fiscal Year 1996 AMP	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S.EPA) Romano, Dagmar Project Leader, MPCA)			2379
02/15/95	Quarterly Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Henrikssen, Finn W. (Old Dutch Foods)			2434
02/15/95	Quarterly Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Newville, Harold (Gross Golf Course)			2435
02/15/95	Quarterly Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Perry, Todd (Honeywell Ridgeway)			2436
02/15/95	Quarterly Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Brungardt, Karl (Mounds View High School)			2437
02/15/95	Quarterly Sampling	Fix, Michael R. (Commander's Representative, Department of the Army)	Proper, Les (City of New Brighton)			2438
02/17/95	Comments Resolution Draft Conceptual Design Report Extraction/Production Wells	Perry, Teresa J. (Barr Engineering)	Ryan, Mark (US ACE Omaha District)			2427
02/21/95	Scope of Work CAMU Conceptual Design Report OU-2					2418
02/24/95	TCAAP Fiscal Year 1994 Fourth Quarter (Q44) and Fiscal Year 1995 1st Quarter (Q45) Monitoring Report	Lantz, Scott F. (Acting Commander's Representative, Department of the Army)	Romano, Dagmar (Project Leader, MPCA) Barounis, Thomas (Remedial Project Manager,			2419

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			U.S.EPA)			
02/27/95	Revisions to 01/17/95 Letter Regarding "TCAAP OU-2 Feasibility Study, Agency Comments Review Meeting 12/14-15/94"	Romano, Dagmar (Project Leader, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2417
02/28/95	Final Conceptual Design Report, Containment/Production Wells	Lantz, Scott F. (Acting COR, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2290
03/00/95	IRP TCAAP Site A Removal Action - 90 Day Operations Report	STS Consultants Ltd.				2477
03/00/95	Corective Action Management Unit-Conceptual Design	Montgomery Watson				2373
03/03/95	Site F Closure Plan Addendum No. 5	Lantz, Scott F. (Acting COR, Department of the Army)	Card, Dan (MPCA)			2355
03/06/95	Remedial Investigation Report, Leak #00006996	Bay West, Inc.		BW #93539-4		2324
03/09/95	Addendum No. 5 - Site F Closure Plan	Brott, Bruce W. (Supervisor, Permit and Review Unit, MPCA)	Lantz, Scott F. (Acting COR Department fo the Army)			2356
03/10/95	TCAAP Site F Special Discharge Approval Extension.	Nordquist, Robert (Senior Engineer, Metropolitan Council)	Fix, Michael R. (Commander's Representative, Department of the Army)			2349
03/14/95	503 Pad - Discharge of Rain Water	Fairbanks, Michael (Federal Cartridge Company)				2350
03/16/95	TCAAP OU-3 Remedial Action Report (January 1995)	Barounis, Thomas (Remedial Project Manager, U.S.	McCleery, Martin (Remedial Project Manager,			2317

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		EPA)	Department of the Army)			
03/16/95	Laboratory Certification	Romano, Dagmar (Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)	Shanahan, Lisa (Pace Environmental Laboratories)			2359
03/23/95	90-Day Operation Report for the Site A Removal Action	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Leader, MPCA)			2310
03/23/95	TCAAP Technical Review Committee Meeting Minutes (March 1994)	McCleery, Martin (Remedial Project Manager, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2264
03/23/95	Final Report/IRA Performance Evaluation: Soil Vapor Extraction Systems at Sites D and G	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2549
03/24/95	Request for Well Abandonment (Hunter/Harstad residence; unique no. 23441)	Romano, Dagmar (Remedial Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2331
03/24/95	PGRS Construction Documentation Report	Gosen, David (Principal Engineer, Alliant Techsystems, Inc.)	Romano, Dagmar (Project Leader, MPCA) Barounis, Thomas (Remedial Project Manager, U.S.EPA)			2372

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
03/27/95	TCAAP OU-3 Remedial Action Report (January 1995)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2318
03/31/95	Consistency Test for the Final Conceptual Design Report, Containment/Production Wells (February 1995)	Romano, Dagmar (Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2330
04/00/95	Final Construction Documentation Report-Plume Groundwater Recovery System (PGRS) Water Treatment Facility (Vol. II)	Barr Engineering Company				2371
04/00/95	Final Construction Documentation Report-Plume Groundwater Recovery System (PGRS) Water Treatment Facility (Vol. I)	Barr Engineering Company				2370
04/00/95	TCAAP Well 03U031 Preliminary Assessment	Montgomery Watson				2306
04/00/95	Phase II Investigation Work Plan Outdoor Firing Range	Rust Environment and Infrastructure		43171:100		2364
04/04/95	Remedial Investigation Report, Leak #00006996	Fix, Michael R. (Commander's Representative, Department of the Army)	Joslyn, James (Tanks and Spills, MPCA)			2323
04/04/95	Technical Review Committeee Meeting Minutes	McCleery, Martin (Remedial Project Manager, Department of the Army)				2548
04/06/95	Removal and Disposal of Bldg. 308	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Leader, MPCA)			2325

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
04/07/95	Site Health and Safety Plan-Site F Closure Remedial Actions	COGNIS, Inc.				2366
04/13/95	USEPA Comments on Draft Final Fiscal Year 1994 Annual Monitoring Report (AMR) for TCAAP (February 1995)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2321
04/13/95	U.S. EPA Comments on the Draft Corrective Action Management Unit Conceptual Design, March, 1995	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2387
04/14/95	MPCA Comments on Corrective Action Management Unit (CAMU) Conceptual Design Report, Draft Report, March, 1995	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager Department of the Army)			2386
04/17/95	503 Pad A - Discharge of Rain Water.	Fairbanks, Michael (Federal Cartridge Company)				2334
04/17/95	Well 03U031 Preliminary Assessment, Final Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2305
04/19/95	503 Pad - Discharge of Rain Water	Fairbanks, Michael (Federal Cartridge Company)				2340
04/21/95	TGRS Treatment Center Water Meter Reading Log for the period of December 31, 1994 through January 31, 1995	Gosen, David P. (Principal Engineer, Alliant Techsystems, Inc.)	Romano, Dagmar (Project Leader, MPCA)			2315
04/21/95	Technical Review Committee Meeting Minutes	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2547

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
04/27/95	Consistently Test OU-3, Remedial Action Report (January 1995).	Warner, James L. (Division Manager, MPCA) Poy, Thomas L. (Remedial Response, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2319
05/00/95	Historical Aerial Photography	Malcolm Pirnie, Inc.				2362
05/01/95	Site F Soil Washing/Soil Leaching Remediation Tour	Fix, Michael R. (Commander's Representative, Department of the Army)	Various			2311
05/08/95	Data package for TCAAP SITE Demonstration	Banerjee, Pinaki (Project Manager, PRC, Inc.)	Roger, Mike (U.S.EPA)			2414
05/09/95	Alternative Method of Treatment of Iron Bacteria Problems in Wells	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2312
05/11/95	MPCA Comments on Inventory of Water Supply Wells in the Vicinity of TCAAP, Phase III - Final Report	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2320
05/12/95	TCAAP Fiscal Year 1995 Second Quarter (Q46) Monitoring Report	Boevers, Brian C. (Conestoga-Rovers & Associates, Inc.)	Gosen, David (Alliant Techsystems)			2369
05/12/95	OU-1 Modifications, Pre-Final Design Report, Containment/Production Wells (May, 1995)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S.EPA) Romano, Dagmar (Project Leader, MPCA)			2450

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
05/15/95	Technical Review Committee Meeting Minutes	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2553
05/17/95	Replacement Water System for Arden Manor Mobile Home Park	Scongers, Anthony B. (Chief Counsel, Department of the Army)				2316
05/30/95	MPCA Comments on Draft Fiscal Year 1994 Annual Monitoring Report (AMR) for TCAAP (February 1995).	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2322
06/01/95	Well 03U031 Preliminary Assessment, Final Report, April, 1995	Romano, Dagmar (Project Manager, MPCA) Barounis, Thomas (Remedial Project Manager, U.S.EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2388
06/02/95	Site D - Discharge of Rain Water	Fairbanks, Michael (Federal Cartridge Company)				2401
06/02/95	Quarterly Well Sampling	Lantz, Scott F. (Acting Commander's Representative, Department of the Army)	Newville, Harold (Gross Golf Course)			2403
06/02/95	Quarterly Well Sampling	Lantz, Scott F. (Acting Commander's Representative, Department of the Army)	Henrikssen, Finn (Old Dutch Foods, Inc.)			2404
06/02/95	Quarterly Well Sampling	Lantz, Scott F. (Acting Commander's Representative,	White, Fred			2405

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Department of the Army)				
06/02/95	Quarterly Well Sampling	Lantz, Scott F. (Acting Commander's Representative, Department of the Army)	Brungardt, Karl (Mounds View High School)			2406
06/05/95	503 Pads A&B - Discharge of Rain Water	Fairbanks, Michael (Federal Cartridge Company)				2399
06/05/95	Cobalt and Molybdenum Advisories	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2391
06/06/95	Army's Request for a Special Well Construction Advisory Area	Romano, Dagmar (Project Manager (MPCA)	Grunseth, Mike (Montgomery Watson)			2397
06/07/95	503 Pads A&B - Discharge of Rain Water	Fairbanks, Michael (Federal Cartridge Company)				2400
06/09/95	Site D-Discharge of Rain Water	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				2381
06/13/95	OW-1 Modifications, Pre-Final Design Report	Romano, Dagmar Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2451
06/13/95	U.S. EPA Review of the Pre-Final Design Report for Containment/Production Wells, Prepared for the City of New Brighton (May 1995)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2458
06/14/95	Calculation of Preliminary Remediation Goals for TCAAP Soils	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2392

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
06/15/95	503 Pad's A to B - Discharge of Rainwater	Fairbanks, Michael (Environmental Technician, Federal Cartridge Company)				2383
06/15/95	Quality Assurance Project Plan (QAPP)	Lantz, Scott F. (Acting Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S.EPA) Romano, Dagmar (Project Leader, MPCA)			2389
06/19/95	OU-2 Corrective Action Management Unit (CAMU) Comments Review Meeting	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S.EPA) Romano, Dagmar (Project Leader, MPCA)			2385
06/20/95	TCAAP Technical Review Committee Meeting Minutes (June, 1995)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S.EPA) Romano, Dagmar (Project Leader, MPCA)			2439
06/23/95	Alliant Monthly Sampling Report (June, 1995)	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S.EPA) Romano, Dagmar (Project Leader, MPCA)			2415
06/23/95	Request for Document	Fix, Michael R. (Commander's Representative, Department of the Army)	Bjelland, Mark (Arsenal Clean-up and Conversion Project)			2416
06/27/95	Final Responses to MPCA/EPA IRP TCAAP Fiscal Year 1994 Annual Monitoring Report/Fiscal Year 1996 Monitoring Plan	Fix, Michael R. (Commander's Representative, Department of thc Army)	Barounis, Thomas (Remedial Project Manager, U.S.EPA)			2413

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			Romano, Dagmar (Project Leader, MPCA)			
06/27/95	Letter of No Action -Extended Storage of High Explosive Ordanance Generated From Site F Closure	Scherkenbach, Timothy K. (Hazardous Waste Division, MPCA)	Fix, Michael R. (Commander's Representative, Department of the Army)			2393
06/28/95	Technical Review (TRC) Meeting	Fix, Michael R. Commander's Representative Department of the Army	Barounis, Thomas (Remedial Project Manager, U.S.EPA) Romano, Dagmar (Project Leader, MPCA)			2412
06/29/95	TGRS Shutdown Report	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S.EPA)			2410
07/00/95	OU-1 Performance Monitoring Plan (Final)	Montgomery Watson				2440
07/00/95	Contract Documents: City of New Brighton Improvement Number 93-09 OU-1 Modifications Containment/Production Wells; Well 14 Construction.	Barr Engineering				2473
07/00/95	Remedial Design/ Remedial Action Quality Assurance Project Plan	Data Chem Laboratories				2480
07/00/95	Remedial Design/Remedial Action Quality Assurance Project Plan	CompuChem Environmental Corporation				2481
07/00/95	Twin Cities Army Ammunition Plant-Operable Unit 2 Feasibility Study: Determination of Health-Risk Based Preliminary Remediation Goals	Montgomery Watson				2500
07/00/95	Twin Cities Army Ammunition Plant-Operable Unit 2 Feasibility Study: Determination of Chemicals of Concern	Montgomery Watson				2501
07/00/95	Twin Cities Army Ammunition Plant-Operable Unit 2 Feasibility Study: Determination of Background Concentrations for Metals in Soil and	Montgomery Watson				2502

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Groundwater					
07/03/95	Research Funding	Benke, Robert J. (Mayor, City of New Brighton)	The Honarable Paul Wellstone (U.S. Senator)			2540
07/03/95	Research Funding	Benke, Robert J. (Mayor, City of New Brighton)	The Honorable Rod Grams (U.S. Representative)			2541
07/03/95	Research Funding	Benke, Robert J. (Mayor, City of New Brighton)	The Honorable Bruce Vento (U.S. Representative)			2542
07/06/95	Construction Documentation Report, Plume Groundwater Recovery System Water Treatment Facility, Final Volume I and II, Alliant Techsystems Inc., City of New Brighton, MN April 1995	Romano, Dagmar (Project Manager Site Response Section, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)	Gosen, Dave (Alliant Techsystems, Inc.)			2544
07/10/95	OU-1 Draft Final Alternative Water Supply Plan (March 1995)	Romano, Dagmar (Project Leader, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2461
07/10/95	90-Day Operations Report for the Site A Removal Action.	Romano, Dagmar (Project Manager, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)	Fix, Michael (Commander's Representative, Department of the Army)			2472
07/12/95	Explosive Testing at Site F	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (MPCA)			2447
07/24/95	Addendum No. 6, TCCAP Site F Closure Plan	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (Permit Review Unit, Hazardous Waste Division, MPCA)			2538

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
07/24/95	Operable Unit 1 Modification, Containment Production Wells, Well 14 Construction, Final Design Submittal.	Fix, Michael (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Leader, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)			2471
07/25/95	FY 94 Annual Monitoring Report/FY 96 Annual Monitoring Plan Comments Resolution Meeting	Fix, Michael (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA) Romano, Dagmar (Project Leader, MPCA)			2456
07/25/95	Response to Regulator Comments on the Operable Unit 2 Feasibility Study (OU2 FS)	Fix, Michael (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2465
07/26/95	OU-1 Performance Monitoring Plan and OU-1 Alternate Water Supply Meeting to Discuss Regulator Comments	Fix, Michael (Remedial Project Manager, Department of the Army)	Barounis, Thomas (Remedial Project Manager, Department of the Army); Romano, Dagmar (Project Leader, MPCA)			2462
07/26/95	TCAAP Technical Review Committee Minutes (July, 1995)	McCleery, Martin (Remedial Project Manager, Department of the Army)				2475
07/27/95	Corrective Action Management Unit (CAMU) Draft Conceptual Design Report (March 1995) Additional Response to Agency Comments	Fix, Michael (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2463
07/28/95	Response to July 17, 1995, Letter Clarification of Verbal Agreements	Card, Dan R. (Permit and Review	Fix, Michael R. (Commander's			2536

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Unit, Hazardous Waste Division, MPCA)	Representative, Department of the Army)			
07/31/95	Addendum Number Six (6) - TCAAP Site F Closure Plan On-Site Detonation of High Explosive Items	Brott, Bruce W., P.E. (Supervisor, Permit and Review Unit, Hazardous Waste Division, MPCA)	Fix, Michael R. (Commander's Representative, Department of the Army)			2539
08/00/95	Twin Cities Army Ammunition Plant Production Well 3, 6, 7, & 8 Abandonment: Final Project Report	STS Consultants, Ltd.				2529
08/01/95	Correction to Addendum No. 4, Twin Cities Army Ammunition Plant Site F Closure Plan	Brott, Bruce W., P.E., (Supervisor, Hazarous Waste Division)	Fix, Michael R. (Commander's Representative, Department of the Army)			2505
08/01/95	Memorandum for See Distribution: Video Presentation	Fix, Micahel R. (Commander's Representative, Department of the Army)	Barrett, Erv (Arsenal Clean-up and Conversion Project); Schwerm, Terry (City Manager, City of Shoreview) Fulton, Matthew (City of New Brighton) Fritsinger, Brian (City of Arden Hills); Romano, Dagmar (Project Leader, MPCA); Barouis, Thomas (Remedial Project Manager, U.S. EPA)			2545
08/02/95	Memorandum for See Distribution: Restoration Advisory Board (RAB) Selection Panel	Fix, Michael R. (Commander's Representative, Department of the Army)	Honorable Dennis Probst (Mayor, City of Arden Hills); Honorable Jerome Linke (Mayor, City of Mounds View); Honorable Robert Benke (Mayor, City of New Brighton); Honorable Clarence Ranello			2533

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			(Mayor, City of St. Anthony); Honorable James Chalmers (Mayor, City of Shoreview); Barrett, Erv (Arsenal Cleanup & Conversion Project); Romano, Dagmar Reppe, Emme (MPCA); Barounis, Thomas Kimbrough, Derrick (U.S. EPA)			
08/02/95	TCAAP OU-2 Feasibility Study, Sites I and K Tables for COC Position Papers	Twaddle, Jason (Conestoga-Rovers & Associates)	Barounis, Tom (Remedial Project Manager, U.S. EPA); Romano, Dagmar (Porject Leader, MPCA)			2513
08/03/95	Metal Leaching Numbers	Romano, Dagmar (Project Manager, Site Repsonse Section, Groundwater and Solid Waste Division, MPCA)	McCleery, Martin (Remedial Project Manager)			2534
08/04/95	Response to Department of Army July 17, 1995, Letter of No Action (LONA) Correction and Clarifications for Extended Storage of High Explosive Ordinance Generated from Site F Closure, TCAAP	Scherkenback, Timothy K. (Division Manager, Hazardous Waste Division, MPCA)	Fix, Michael, R. (Commander's Representative, Department of the Army)			2532
08/07/95	Interim Remedial Action Performance Evaluation: Soil Vapor Extraction System at Sites D & G, February 1995, Final Report	Romano, Dagmar (Project Manager, Site Response Section, MPCA)	McCleery, Martin (Remedial Project Manager Department of the Army)			2530
08/11/95	Draft Final Fiscal Year 1994 Annual Monitoring Report/Fiscal Year 1996 Annual Monitoring Plan	Romano, Dagmar (Project Manager, Site Response Section, MPCA)	McCleery, Martin (Remedial Project Manager Department of the Army)			2527
08/15/95	Minutes of the RAB Selection Panel Meeting	McCleery, Marty (Remedial Project	RAB Selection Panel Members			2526

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Manager, Department of the Army)				
08/17/95	U.S. EPA Technical Review of the Final Operable Unit Perfomance Monitoring Plan (PMP), Montgomery Watson, July 1995	Barounis, Tom (Remedial Project Manager, U.S. EPA)	McCleery, Martin R. (Remedial Project Manager Department of the Army)			2521
08/21/95	TCAAP FY94 Annual Monitoring Report/FY96 Annual Monitoring Plan	Olson, Lance R. (Environmental Engineer, Wenck Associates, Inc.)	Romano, Dagmar (Project Manager, Groundwater and Solid Waste Division, MPCA)			2511
08/21/95	MPCA Staff Review of the Final OU-1 Performance Monitoring Plan (PMP), Montgomery Watson, July, 1995	Romano, Dagmar (Remedial Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager Department of the Army)			2523
08/21/95	FY94 Annual Monitoring Report/FY96 Annual Monitoring Plan Comments Resolution Meeting	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Leader, Superfund Unit, Site Response Section, MPCA)			2528
08/23/95	TCAAP Technical Review Committee Meeting Minutes (August, 1995)	McCleery, Martin (Remedial Project Manager, Department of Army)				2476
08/24/95	Production Well 3, 6, 7, & 8 Abandonment Report, August 1995	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA)			2520
08/25/95	Operable Unit 2 Feasibility Study Response to Comments	Montgomery Watson				2478
08/28/95	OU2 Feasiblity Study - Groundwater Modeling	Fix, Michael R. (Commander's Representative, Department of the Army)	Romano, Dagmar (Project Manager, MPCA) Barounis, Tom (Remedial Project Manager, U.S EPA)			2506
08/28/95	Historical Aerial Photography, Final Report, Twin Cities Army Ammunition Plant	Fix, Michael, R. (Comander's Representative, Department of the	Minnesota Department of Health; Agency for Toxic			2510

SEARCH PHRASE: (DOC_TYPE CONTAINS "TCAAP Specific Report" OR DOC_TYPE CONTAINS "TCAAP Specific Letter" OR DOC_TYPE CONTAINS Other OR DOC_TYPE FAILS) AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Army)	Substances and Disease Registry (ATSDR); U.S. Fish & Wildlife Service; Minnesota Department of Natural Resources			
08/30/95	Site F Soil Washing/Soil Leaching Technology	Fix, Michael R. (Commander's Representative, Department of the Army)	Dougherty, Kathy (c/o St. Paul Foundation)			2514
08/30/95	OU-1 Performance Monitoring Plan - Conference Call Meeting Minutes	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)			2522
08/30/95	1994 Annual Monitoring Report/1996 Annual Monitoring Plan	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA)			2524
08/31/95	MPCA Soil Leaching Model Comments	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Tom (Remedial Project Manager, U.S. EPA)			2515
09/13/95	Technical Review Committee Meeting Minutes	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager U.S. EPA); Romano, Dagmar (Project Leader, MPCA)			2554

TWIN CITIES ARMY AMMUNITION PLANT
INSTALLATION RESTORATION PROGRAM

Administrative Record File for New Brighton/Arden Hills NPL Site
Operable Unit-2
Draft Administrative Record Index

September 30, 1995

TAB 2

Non-Site Specific Documents

(References are arranged in alphabetical order by author.)

Note: Most documents identified on the Index for Non-Site Specific Documents are exempt from physical inclusion in the Administrative Record file. *See* 40 C.F.R. § 300.805(b).

SEARCH PHRASE: DOC_TYPE CONTAINS "Non-TC*" and FL_STRUC CONTAINS "Non-Site Specific" AND INCL2 EQ Y

AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Benzene	PB/88/208464/AS	00/00/88	13	877
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Phenol		00/00/88		1834
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 1, 2 Trichloroethane		00/00/88		1835
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 2 Dichloroethene	PB/91/180364; PB/90/171422/AS	00/00/89	12	273
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Nickel	PB/89/160378/AS	00/00/89	13	852
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Cadmium	PB/89/194476/AS	00/00/89	13	858
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Arsenic	PB/185708/AS	00/00/89	13	860
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Methylene Chloride	PB/89/194488/AS	00/00/89	13	867
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Di (2-ethylhexyl)phthalate	PB/89/194484/AS	00/00/89	13	871
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Chloroform	PB/89/160360/AS	00/00/89	13	873
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Trichloroethylene	ATSDR/TP-88/24; PB/90/127523/AS	10/00/89	12	272
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 1-Dichloroethene	PB/90/182114/AS	00/00/90	12	274
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 1, 1-Trichloroethane	PB/91/180463/AS	00/00/90	12	276
Agency for Toxic Substances and Disease	Toxicological Profile for 1, 1, 2-Trichloroethane	PB/90/196411/AS	00/00/90	12	277

SEARCH PHRASE: DOC_TYPE CONTAINS "Non-TC*" and FL_STRUC CONTAINS "Non-Site Specific" AND INCL2 EQ Y

AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Registry					
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Carbon Tetrachloride	PB/90/188196/AS	00/00/90	13	826
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Zinc	PB/90/171414/AS	00/00/90	13	848
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Lead	PB/90/267378/AS	00/00/90	13	854
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Cyanide	PB/90/162058/AS	00/00/90	13	855
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Vinyl Chloride	PB/90/103870/AS	00/00/90	13	863
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Toluene	PB/90/188904/AS	00/00/90	13	864
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Tetrachloroethylene	PB/90/247628/AS	00/00/90	13	865
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Phenol	PB/90/181249/AS	00/00/90	13	866
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 2-Dichloroethane	PB/90/171422/AS	00/00/90	13	870
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Chlorothane	PB/90/181264/AS	00/00/90	13	874
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Bromodichloromethane	PB/90/187481/AS	00/00/90	13	878
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Mercury	PB/90/181256/AS	00/00/90		2095

SEARCH PHRASE: DOC_TYPE CONTAINS "Non-TC*" and FL_STRUC CONTAINS "Non-Site Specific" AND INCL2 EQ Y

AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Selenium	PB/90/182155/AS	00/00/90		2098
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Zinc	PB/90/171414/AS	00/00/90		2102
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Benzo(a)anthracene	PB/90/247669/AS	00/00/90		2105
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Benzo(b)fluoranthene	PB/90/247651/AS	00/00/90		2106
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Benzo(a)pyrene	PB/90/258245/AS	00/00/90		2108
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Carbon Tetrachloride	PB/90/168196/AS	00/00/90		2110
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Chrysene	PB/90/247644/AS	00/00/90		2111
Agency for Toxic Substances and Disease Registry	Toxicological Profile for DDT, DDE, DDD	PB/90/182171/AS	00/00/90		2113
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 1-Dichloroethene	PB/90/182114/AS	00/00/90		2114
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 2-Dichloroethene	PB/90/171422/AS	00/00/90		2115
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 2, 4-Dinitrotoluene	PB/90/171430/AS	00/00/90		2119
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 1, 2-Trichloroethene	PB/90/196411/AS	00/00/90		2122
Agency for Toxic Substances and Disease	Toxicological Profile for cis-1,2-Dichloroethene,	TP-90-13	12/00/90	13	398

SEARCH PHRASE: DOC_TYPE CONTAINS "Non-TC*" and FL_STRUC CONTAINS "Non-Site Specific" AND INCL2 EQ Y

AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Registry	trans-1,2-Dichloroethane and 1,2-Dichloroethane				
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 1-Dichloroethane	PB/91/180539/AS	00/00/91	12	275
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Silver	PB/91/180430/AS	00/00/91	13	851
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Copper	PB/91/180613/AS	00/00/91	13	856
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Total Xylenes	PB/91/181552/AS	00/00/91	13	862
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Ethylbenzene	PB/91/180372/AS	00/00/91	13	868
Agency for Toxic Substances and Disease Registry	Toxicological Profile for cis, trans-1, 2-Dichloroethane	PB/91/180364/AS	00/00/91	13	869
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Di-n-butylphthalate	PB/91/180521/AS	00/00/91	13	872
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Copper	PB/91/180513/AS	00/00/91		2091
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Silver	PB/91/180430/AS	00/00/91		2099
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Benzo(k)fluorathene	PB/91/181537/AS	00/00/91		2107
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 1-Dichloroethene	PB/91/180539/AS	00/00/91		2116
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Cis-, Trans-1, 2-Dichloroethene	PB/91/180364/AS	00/00/91		2117

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 1, 1, 1-Trichloroethene	PB/91/180463/AS	00/00/91		2121
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Naphthalene	PB/91/180562/AS	00/00/91		2128
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Polyaromatic Hydrocarbons (PAHs)	PB/91/181537/AS	00/00/91		2130
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Vanadium	PB/93/110880/AS	00/00/93	13	849
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Thallium	PB/93/110856/AS	00/00/93	13	850
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Manganese	PB/93/110781/AS	00/00/93	13	853
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Cobalt	PB/93/110724/AS	00/00/93	13	857
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Barium	PB/93/110658/AS	00/00/93	13	859
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Antimony	PB/93/110641/AS	00/00/93	13	861
Agency for Toxic Substances and Disease Registry	Toxicological Profile for 2-Butanone	PB/93/110708/AS	00/00/93	13	875
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Aluminum	PB/93/110633/AS	00/00/93		2084
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Antimony	PB/93/110641/AS	00/00/93		2085
Agency for Toxic Substances and Disease	Toxicological Profile for Arsenic	PB/93/182376/AS	00/00/93		2086

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Registry					
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Barium	PB/93/110658/AS	00/00/93		2087
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Cadmium	PB/93/182418/AS	00/00/93		2088
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Chromium	PB/93/182434/AS	00/00/93		2089
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Cobalt	PB/93/110724/AS	00/00/93		2090
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Cyanide	PB/93/182442/AS	00/00/93		2092
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Lead	PB/93/182475/AS	00/00/93		2093
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Manganese	PB/93/110781/AS	00/00/93		2094
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Nickel	PB/93/182491/AS	00/00/93		2097
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Thallium	PB/93/110856/AS	00/00/93		2100
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Vanadium	PB/93/110880/AS	00/00/93		2101
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Benzene	PB/93/182384/AS	00/00/93		2104
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Chloroform	PB/93/182426/AS	00/00/93		2112

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Tetrachloroethene (PERC)	PB/93/182525/AS	00/00/93		2118
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Trichloroethene	PB/93/182533/AS	00/00/93		2120
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Vinyl Chloride	PB/93/182541/AS	00/00/93		2123
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Heptachlor Epoxide	PB/93/182467/AS	00/00/93		2124
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Methylene Chloride	PB/93/182483/AS	00/00/93		2125
Agency for Toxic Substances and Disease Registry	Toxicological Profile for Nitrosodiphenylamine	PB/93/182509/AS	00/00/93		2129
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Sudicky, E.A., et al.	"Migration of Contaminants in Groundwater at a Landfill: A Case Study," J. Hydrology	Vol. 63, pp. 81-108	00/00/83	06	324
Sumprini, L., et al.	"A Field and Modeling Comparison of In-Situ Transformation of TCE by Methane Utilizers and Phenyl Utilizers. On-Site Bioreclamation," Second International Symposium		04/00/93		1993

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Suzuki, T.	"Dose-Effect and Dose-Response Relationships of Mercury and its Derivatives," The Biogeochemistry of Mercury in the Environment	pp. 399-431	00/00/79		1943
Tabak, H.H., et al.	"Biodegradability Studies with Organic Priority Pollutant Compounds," Water Pollution Control Federation Journal	Vol. 53, No. 10, pp. 1503-1518	00/00/81	12	325
Theis, C.V., Trans. Am. Geophys. Union	The Relation Between the Lowering of the Piezometric Surface and the Rate of Duration of Discharge of a Well Using Groundwater Storage	Vol.16, p. 519-524	00/00/35	13	426
Todd, David Keith	Groundwater Hydrology (John Wiley & Sons)	p. 535	00/00/80	06	326
Trela, J.J. Miller, L.R. Division of Hazardous Waste Management New Jersey Department of Environmental Protection	The Development of Soil Clean-up Standards in New Jersey		00/00/89		1827
Trippler, D.J.	MPCA Memorandum: Defining Action Levels for Arsenic in Soil		01/01/90		1828
Trippler, D.J. Schmitt, M.	MPCA Memorandum: Soil Data for Minnesota		00/00/89		1829
Tseng, W.P.	"Effects and Dose Response Relationships of Skin Cancer and Blackfoot Disease with Arsenic," Environ. Health Perspect	19: 109-119	00/00/77		1901
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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
In cooperation with the MN Agricultural Experiment Station					
United States Army Toxic and Hazardous Materials Agency,	Geotechnical Requirements for Drilling, Monitoring Wells, Data Acquisition, and Reports		05/00/83	13	792
United States Army Toxic and Hazardous Materials Agency	Geotechnical Requirements for Drilling, Monitoring Wells, Data Acquisition, and Reports		03/00/87	13	35
United States Army Toxic and Hazardous Materials Agency	USATHAMA Quality Assurance Program	USATHAMA PAM 11-41	01/00/90	13	736
United States Environmental Protection Agency	Health Effects Assessment for 1, 1, 2-Trichloroethane	PB86-134566	00/00/00	12	336
United States Environmental Protection Agency	Use of the Water Balance Method for Predicting Leachate Generation from Solid Waste Disposal Sites	U.S. EPA Pub. # 530 SW-168	00/00/75	06	328
United States Environmental Protection Agency	Ambient Water Quality Criteria Document for Dichloroethylene	PB81-117525	00/00/80	13	739
United States Environmental Protection Agency	Ambient Water Quality Criteria for Cadmium	EPA/440/5-80-025	00/00/80		1941
United States Environmental Protection Agency	Ambient Water Quality Criteria for Nickel	EPA/400/5-80-060	00/00/80		1944
United States Environmental Protection Agency	Ambient Water Quality Criteria for PCBs	EPA/440/5-80-068	00/00/80		1945
United States Environmental Protection Agency	An Exposure and Risk Assessment for Mercury		00/00/80		2132
United States Environmental Protection Agency	An Exposure and Risk Assessment for Silver	EPA/440/4-81-017	00/00/81		1946
United States Environmental Protection	An Exposure and Risk Assessment for Mercury		00/00/81		2133

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Agency					
United States Environmental Protection Agency	PAH Ambient Water Quality Criterion for the Protection of Human Health	ECAO-CIN-D024	00/00/82		2134
United States Environmental Protection Agency	Health Assessment Document for Carbon Tetrachloride		00/00/82		2135
United States Environmental Protection Agency	An Exposure and Risk Assessment for Benzo(a)pyrene and Other Polycylic Aromatic Hydrocarbons		00/00/82		2136
United States Environmental Protection Agency	Treatment of Volatile Organic Compounds In Drinking Water	EPA-600/8-83-019	00/00/83	04	841
United States Environmental Protection Agency	Health Assessment Document for Manganese	EPA/600/8-83-013	00/00/83		1947
United States Environmental Protection Agency	Methods for Chemical Analysis of Water and Wastes	EPA-600/4-79-020	03/00/83	06	3
United States Environmental Protection Agency	Hazardous Waste Land Treatment	SW-874, p. 273, Table 6.46	04/00/83		1864
United States Environmental Protection Agency	Drinking Water Criteria Document for Silver	PB86-118288/AS	04/01/83		2164
United States Environmental Protection Agency	Drinking Water Criteria Document for Mercury	PB86-117827/AS	07/01/83		2158
United States Environmental Protection Agency	State of the Art Aquifer Restoration Volume II		00/00/84	13	259
United States Environmental Protection Agency	Health Effects Assessment Document for Trichloroethylene	EPA-5540/1-86-046	00/00/84	04	829
United States Environmental Protection Agency	Health Assessment Document for Chromium	EPA-600/8-83-014F	00/00/84		2137

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
United States Environmental Protection Agency	Health Effects Assessment for Zinc (and Compounds)		00/00/84		2138
United States Environmental Protection Agency	Health Assessment Document for 1, 1, 1-Trichloroethane (Methyl Chloroform) (Final Report)	PB84-1853565; EPA 600/8-82-003F	02/00/84	12	337
United States Environmental Protection Agency	Test Method For the Determination of Inorganic Anions in Water by Ion Chromatography, Method 300.0	EPA-600/4-84/017	03/00/84	13	9
United States Environmental Protection Agency	National Primary Drinking Water Regulations: Volatile Synthetic Organic Chemicals	Fed. Reg. 50(114): 24330	06/12/84	13	740
United States Environmental Protection Agency	Drinking Water Criteria Document for Copper	PB86-118239/AS	08/01/84		2151
United States Environmental Protection Agency	Drinking Water Criteria Document for Cyanide	PB86-117793/AS	08/01/84		2153
United States Environmental Protection Agency	Drinking Water Criteria Document for Nickel	PB86-117801/AS	08/01/84		2161
United States Environmental Protection Agency	Health & Environmental Effects Profile for Chrysene	PB88-131123/AS	08/01/84		2175
United States Environmental Protection Agency	Drinking Water Criteria Document for Dioxins	PB86-117983/AS	08/01/84		2188
United States Environmental Protection Agency	Drinking Water Criteria Document for Heptachlor Epoxide	PB86-117991/AS	08/01/84		2192
United States Environmental Protection Agency	Health Effects Assessment for 1, 1, 1-Trichloroethane	PB86-134566; EPA 540/1-86-005	09/00/84	13	335
United States Environmental Protection Agency	Health Effects Assessments for 1, 2-Dichloroethane	PB86-134160; EPA 86-134137	09/00/84	12	338
United States Environmental Protection	Health Effects Assessment for Trichloroethene (Trichloroethylene)	PB86-134574/AS	09/03/84		2204

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Agency					
United States Environmental Protection Agency	Health & Environmental Effects Profile for Dioxins	PB88-103833/AS	09/13/84		2189
United States Environmental Protection Agency	Health Effects Assessment for Arsenic	PB86-134319/AS	09/30/84		2145
United States Environmental Protection Agency	Health Effects Assessment for Barium	PB86-134327/AS	09/30/84		2146
United States Environmental Protection Agency	Health Effects Assessment for Cadmium	PB86-134491/AS	09/30/84		2147
United States Environmental Protection Agency	Health Effects Assessment for Chromium (Hexavalent)		09/30/84		2148
United States Environmental Protection Agency	Health Effects Assessment for Chromium (Trivalent)	PB86-134467/AS	09/30/84		2149
United States Environmental Protection Agency	Health Effects Assessment for Copper	PB86-134368/AS	09/30/84		2150
United States Environmental Protection Agency	Health Effects Assessment for Cyanide	PB86-134228/AS	09/30/84		2152
United States Environmental Protection Agency	Health Effects Assessment for Lead	PB86-134665/AS	09/30/84		2154
United States Environmental Protection Agency	Health Effects Assessment for Manganese (and Compounds)	PB86-134681/AS	09/30/84		2156
United States Environmental Protection Agency	Health Effects Assessment for Mercury	PB86-134533/AS	09/30/84		2157
United States Environmental Protection Agency	Health Effects Assessment for Nickel	PB86-134293/AS	09/30/84		2160

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
United States Environmental Protection Agency	Health Effects Assessment for Selenium (and Compounds)	PB86-134699/AS	09/30/84		2163
United States Environmental Protection Agency	Health Effects Assessment for Zinc (and Compounds)	PB86-134590/AS	09/30/84		2166
United States Environmental Protection Agency	Health Effects Assessment for Acetone	PB86-134277/AS	09/30/84		2167
United States Environmental Protection Agency	Health Effects Assessment for Benzene	PB86-134483/AS	09/30/84		2170
United States Environmental Protection Agency	Health Effects Assessment for Benzo(a)pyrene	PB86-134335/AS	09/30/84		2172
United States Environmental Protection Agency	Health Effects Assessment for Carbon Tetrachloride	PB86-134509/AS	09/30/84		2173
United States Environmental Protection Agency	Health Effects Assessment for Chloroform	PB86-134210/AS	09/30/84		2176
United States Environmental Protection Agency	Health Effects Assessment for DDT	PB86-134376/AS	09/30/84		2179
United States Environmental Protection Agency	Health Effects Assessment for 1, 1-Dichloroethene	PB86-134624/AS	09/30/84		2182
United States Environmental Protection Agency	Health Effects Assessment for 1, 2-Dichloroethane	PB86-134137/AS	09/30/84		2183
United States Environmental Protection Agency	Health Effects Assessment for 1, 1-Dichloroethane	PB86-134384/AS	09/30/84		2184
United States Environmental Protection Agency	Health Effects Assessment for Trans 1, 2-Dichloroethene	PB86-134525/AS	09/30/84		2185
United States Environmental Protection	Health Effects Assessment for Cis-1, 2-Dichloroethene	PB86-134269/AS	09/30/84		2186

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Agency					
United States Environmental Protection Agency	Health Effects Assessment for Dioxins	PB86-134558/AS	09/30/84		2190
United States Environmental Protection Agency	Health Effects Assessment for Naphthalene	PB86-134251/AS	09/30/84		2195
United States Environmental Protection Agency	Health Effects Assessment for Polyaromatic Hydrocarbons (PAHs)	PB86-134244/AS	09/30/84		2200
United States Environmental Protection Agency	Health Effects Assessment for Pyrene	PB86-134418/AS	09/30/84		2201
United States Environmental Protection Agency	Health Effects Assessment for Phenanthrene	PB86-134400/AS	09/30/84		2202
United States Environmental Protection Agency	Health Effects Assessment for 1, 1, 1-Trichloroethane	PB86-134160/AS	09/30/84		2206
United States Environmental Protection Agency	Health Effects Assessment for 1, 1, 2-Trichloroethane	PB86-134566/AS	09/30/84		2207
United States Environmental Protection Agency	Health Effects Assessment for Vinyl Chloride	PB86-134475/AS	09/30/84		2208
United States Environmental Protection Agency	Methods for Organic Analysis of Municipal and Industrial Wastewater	EPA Pub. # 600/4-82-057, Method 624 (49 F.R. 43323-43384)	10/26/84	05	846
United States Environmental Protection Agency	Methods for Organic Compounds in Municipal Water and Industrial Wastewater	EPA Pub. # 600/4-82-057, Methods 601 (49 F.R. 43261-43271)	10/26/84	05	847
United States Environmental Protection Agency	Handbook - Remedial Action at Waste Disposal Sites		00/00/85		1884

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
United States Environmental Protection Agency	Ambient Water Quality Criteria for Lead - 1984	EPA/440/5-84-027	00/00/85		1948
United States Environmental Protection Agency	Cancer Assessment for DDD, DDE	PB87-110904/AS	01/15/85		2178
United States Environmental Protection Agency	Cancer Assessment for DDT	PB87-110904/AS	01/15/85		2181
United States Environmental Protection Agency	Guidance on Feasibility Studies Under CERCLA	EPA/540/G-85/003	06/00/85	04	340
United States Environmental Protection Agency	Health Assessment Document for Trichloroethylene (Final Report)	PB-85-249696; EPA 600/8-82-006F	07/00/85	12	333
United States Environmental Protection Agency	Health Assessment Document for Vinylidene Chloride	(Final Report) EPA 600/8-83/031F	08/00/85	12	339
United States Environmental Protection Agency	Health & Environmental Effects Profile	PB88-175039/AS	08/15/85		2144
United States Environmental Protection Agency	Risk Assessment and Management: Framework for Decision Making	EPA 600/9-85-002	09/00/85		1594
United States Environmental Protection Agency	Health & Environmental Effects Profile for Lead (Aikyis)	PB88-174511/AS	09/04/85		2155
United States Environmental Protection Agency	National Primary Drinking Water Regulations: Volatile Synthetic Organic Chemicals	40 CFR Part 141; Federal Register 40 (210): 46880-46933	11/00/85	05	342
United States Environmental Protection Agency	National Primary Drinking Water Regulations: Synthetic Organic Chemicals, Inorganic Chemicals and Microorganisms	40 CFR Part 141; Federal Register 50 (219): 46936-47022	11/00/85	05	343
United States Environmental Protection Agency	Health & Environmental Effects Profile for Acetone Cyanohydrin	PB88-170816/AS	11/13/85		2169

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
United States Environmental Protection Agency	Guidelines for the Health Risk Assessment of Chemical Mixtures	51 F.R. 34014-34025	00/00/86		1830
United States Environmental Protection Agency	Superfund Remedial Design and Remedial Action Guidance		00/00/86		1906
United States Environmental Protection Agency	Quality Criteria for Water	EPA/440/5-86-001	00/00/86		1949
United States Environmental Protection Agency	Quality Criteria for Water 1986	EPA 440/5-86-001	05/00/86	13	344
United States Environmental Protection Agency	Proposed Rules: Hazardous Waste Management System; Identification and Listing of Hazardous Waste, Notification Requirements, Reportable Quantity Adjustment	Vol. 51, No. 114, pp. 21648-21693, 40 C.F.R. parts 161, 271, 302	06/13/86		1802
United States Environmental Protection Agency	Water Pollution Control: National Primary Drinking Water Regulations; Radionuclides	40 CFR part 141; Federal Register 51 (189): 34836-34862	09/00/86	13	345
United States Environmental Protection Agency	Health & Environmental Effects Profile for Naphthalene	PB88-242383/AS	09/05/86		2196
United States Environmental Protection Agency	Superfund Public Health Evaluation Manuel	EPA 540/1-86/060; NTIS No. PB87-183125	10/00/86		1833
United States Environmental Protection Agency	Test Methods For Evaluating Solid Wastes: Physical/Chemical Methods (3rd. Ed.)	EPA/SW-846	11/00/86	13	31
United States Environmental Protection Agency	Drinking Water Criteria Document for Mercury	PB89-192207/AS	03/13/87		2159
United States Environmental Protection Agency	Drinking Water Criteria Document for Heptachlor Epoxide	PB89-192157/AS	04/13/87		2193
United States Environmental Protection Agency	Addendum to the Health Assessment Document for Trichloroethylene: Updated Carcinogenicity Assessment for Trichloroethylene (External	EPA 600/8-82-006FA	06/00/87	12	334

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
	Review Draft)				
United States Environmental Protection Agency	Health Effects Assessment for 2, 4-Dinitrotoluene	PB88-178793/AS	06/16/87		2187
United States Environmental Protection Agency	Health Effects Assessment for a-Endosulfan	PB88-180229/AS	06/16/87		2191
United States Environmental Protection Agency	Health Effects Assessment for Antimony (and Compounds)	PB88-179445/AS	06/25/87		2143
United States Environmental Protection Agency	Health Effects Assessment for Aluminum	PB88-179429/AS	07/01/87		2142
United States Environmental Protection Agency	Memorandum from J. Winston Porter, Office of Solid Waste and Emergency Response, Interim Guidance on Compliance with Applicable or Relevant and Appropriate Requirements		07/09/87	12	346
United States Environmental Protection Agency	Health Effects Assessment for n-Nitrosodiphenyl Amine	PB88-178959/AS	07/24/87		2198
United States Environmental Protection Agency	Health Effects Assessment for Vanadium (and Compounds)	PB88-176383/AS	08/10/87		2165
United States Environmental Protection Agency	Drinking Water Criteria Document for PCBs	PB89-192256/AS	10/23/87		2199
United States Environmental Protection Agency	Guidance for Conducting Remedial Investigation and Feasibility Study under CERCLA	EPA/540/5-89/013	00/00/88		1882
United States Environmental Protection Agency	Cleanup of Releases from Petroleum USTS: Selected Techniques	EPA/530/UST-88/004	00/00/88		1883
United States Environmental Protection Agency	Health Effects Assessment for Tetrachloroethene (PERC)	PB90-142480/AS	04/08/88		2203
United States Environmental Protection	Health Effects Assessment for Acetone	PB90-142373/AS	05/20/88		2168

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Agency					
United States Environmental Protection Agency	Health Effects Assessment for Chloroform	PB90-142423/AS	05/20/88		2177
United States Environmental Protection Agency	Health Effects Assessment for Naphthalene	PB90-142464/AS	06/04/88		2197
United States Environmental Protection Agency	Health Effects Assessment for Trichloroethene (Trichloroethylene)	PB90-142498/AS	06/04/88		2205
United States Environmental Protection Agency	Intent to Review Guidelines for Carcinogen Risk Assessment	53 F.R. 32656	08/26/88		1589
United States Environmental Protection Agency	Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Interim Final)	OSWER Dir. 9355.3-01	10/00/88	13	341
United States Environmental Protection Agency	Health Effects Assessment for DDT	PB90-142431/AS	02/02/89		2180
United States Environmental Protection Agency	Risk Assessment Guidance for Superfund--Environmental Evaluation Manual, Interim Final		03/00/89		350
United States Environmental Protection Agency	Workshop Report on EPA Guidelines for Carcinogen Risk Assessment	EPA 625/3-89/015	03/00/89		1586
United States Environmental Protection Agency	Compendium of CERCLA Response Selection Guidance Documents - Users Manual	PB92-102052	05/00/89		1636
United States Environmental Protection Agency	Risk Assessment Guidance for Superfund--Environmental Evaluation Manual, Interim Final		07/00/89	13	349
United States Environmental Protection Agency	Health Effects Assessment for Carbon Tetrachloride	PB90-142407/AS	09/11/89		2174
United States Environmental Protection Agency	Health Effects Assessment for Benzene	PB90-142381/AS	10/19/89		2171

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
United States Environmental Protection Agency	Health Effects Assessment for Methylene Chloride	PB90-142449/AS	10/19/89		2194
United States Environmental Protection Agency	Guide for Conducting Treatability Studies under CERCLA	EPA/540/2-89/058	12/00/89	13	44
United States Environmental Protection Agency	CERCLA Site Discharges to POTWS'S: Guidance Manual	EPA/540/G-90/005	00/00/90		1881
United States Environmental Protection Agency	EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties		00/00/90		1905
United States Environmental Protection Agency	Health Effects Summary Tables: First/Second OSWER/ORD Quarter, FY-1990		00/00/90		2139
United States Environmental Protection Agency	Drinking Water Regulations and Health Advisories		04/00/90		2140
United States Environmental Protection Agency	Management of Investigation-Derived Waste During Site Investigations	EPA/540/G-91/009	05/00/90	13	49
United States Environmental Protection Agency	Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings	40 CFR Part 192	07/01/90		2141
United States Environmental Protection Agency	Drinking Water Criteria Document for Nickel	PB90-215054/AS	09/20/90		2162
United States Environmental Protection Agency	Guide for Conducting Treatability Studies Under CERCLA: Soil Washing, Interim Guidance		09/00/91		1867
United States Environmental Protection Agency	Guidelines for Developmental Toxicity Risk Assessment	56 F.R. 63798	12/05/91		1584
United States Environmental Protection Agency	Sediment Classification Methods Compendium	EPA-823-R-92-006	00/00/92		1858
United States Environmental Protection	Final Guidelines for Exposure Assessment	57 F.R. 22888; EPA	05/29/92		1583

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Agency		600/7-92/001			
United States Environmental Protection Agency	The Superfund Innovate Technology Evaluation Program: Technology Profiles		11/00/92		2004
United States Environmental Protection Agency	Technical Basis for Deriving Sediment Quality Criteria for Nonionic Organic Contaminants for the Protection of Benthic Organisms by Using Equilibrium Partition	EPA-822-R-93-011	00/00/93		1857
United States Environmental Protection Agency	In-Situ Treatment of Contaminated Groundwater: An Inventory of Research and Field Demonstrations and Strategies for Improving Groundwater Remediation	EPA/500/K-93/001	01/00/93		2001
United States Environmental Protection Agency	Guidance for Evaluating the Technical Impractability of Groundwater Restoration	EPA/540/R-93/080	09/00/93		2002
United States Environmental Protection Agency	Technology Assessment of Soil Vapor Extraction and Air Sparging	EPA/600/R-92/173	09/00/93		2003
United States Environmental Protection Agency Office of Solid Waste and Emergency Response	Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites	OSWER Dir. 9355.0-28	06/15/89	13	351
United States Geological Survey	New Brighton Quadrangle, Minnesota 7.5 Minute Series (Topographic) (Photo Revised 1972 and 1980)		00/00/67	06	1622
United States Geological Survey	1:100,000 Scale Planimetric Map Series, Anoka and St. Paul, Minnesota	Map #44093-A1-PL-600 and 44093-B1-TM-100	00/00/85	13	427
United States Geological Survey	Effects of Present and Projected Ground-Water Withdrawals from the Twin Cities Aquifer System, Minnesota	Water-Resources Investigation Report 90-4001	00/00/90	13	428
Valocchi, A.J., et al.	Simulation of the Transport of Ion-Exchange Solutes Using Laboratory-Determined Chemical Parameter Values - Groundwater	Vol. 19(6), pp. 600-607	00/00/81	06	352

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Verschueren, K. (Van Nostrand Reinhold Company)	Handbook of Environmental Data on Organic Chemicals, Second Edition (Van Nostrand Reinhold Company)	p. 1310	00/00/83		1836
Vogel, T.M. McCarty, P.L.	Abiotic and Biotic Transformations of 1, 1, 1-Trichloroethane under Methanogenic Conditions - Environmental Science and Technology	Vol. 21, No. 12	00/00/87	12	354
Vogel, T.M., et al.	Transformations of Halogenated Aliphatic Compounds - Environmental Science and Technology	Vol. 21, pp. 722-736	00/00/87	12	353
Wackett, L.P., et al.	"Survey of Microbial Oxygenases: TCA Degradation by Propane-Oxidizing Bacteria," Applied and Environmental Microbiology	55/11	00/00/89		2005
Wahl, T.E. and Tipping, R.E. Minnesota Geological Survey	Groundwater Data Management, The County Well Index		00/00/91	13	262
Wahlig, T.R. Chief, Environmental and Natural Resources Division, DOA	Memorandum of Understanding (MOU) Between DOD and U.S. Department of Agriculture on Animal Damage Assessment and Control on Military Installations.		10/17/90		2219
Walker, Lewis D. (Department of the Army) Johnson, Barry L. (Assistant Administrator, Agency for Toxic and Hazardous Substances)	Inter-Agency Agreement Between DOA and ATSDR		07/30/90	13	384
Walton, M., et al. Minnesota Geological Survey	Engineering Geology of the St. Paul Energy Park and Vicinity	Reprint Series 44	05/00/81	12	355
Weil, C.S. McCollister, D.D.	"Relationship Between Short and Long-Term Feeding Studies in Designing an Effective Toxicity Test," Agric Food Chem	Vol. 11, pp. 486-491	00/00/63		2006
Weston Geophysical Corporation	Description and Evaluation of Bedrock Structures in the Vicinity of the Midland Plant--Units 1 and 2 Midland, Michigan		02/00/82	12	356
Wiencke, J.K. Yaker, J.W.	"Specificity of Arsenite in Potentiating Cytogenetic Damage Induced by the SNA Cross Linking Agent Diepoxybutane," Environ. Molec. Mutagenesis	19: 195-200	00/00/00		1903

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Willenbring, P.R., et al. Eugene A. Hickok and Associates	Non-Point Source Pollution in the Rice Creek Watershed District--The Results of 10 Years of Water Quality Monitoring; Wayzata, MN		00/00/00	12	357
Williams, Joseph R. United States Environmental Protection Agency	Parameter Sensitivity Evaluation of Selected Unsaturated Zone Models - Project Update Report		04/22/93		2077
Wilson, B.H., et al.	"Bioremediation of Chlorinated Solvents in the Vadose Zone. In-Situ and On-Site Bioremediation," The Second International Symposium		04/00/93		2008
Wilson, C. Bruce	Lake Quality Modeling Used In Minnesota - Enhancing States' Lake Management Program	1989: pp. 33-43	00/00/89	13	633
Wilson, J.L. Miller, P.J.	"Two-Dimensional Plume in Uniform Groundwater Flow," Journal of the Hydraulics Division American Society of Civil Engineers	Paper No. 13665; HY4; pp. 503-514	00/00/78		1837
Wilson, J.T., et al. United States Environmental Protection Agency	Biodegradation and Sorption of Organic Solvents and Hydrocarbon Fuel Constituents in Subsurface Environments		00/00/88		2007
Winter, T.C. and Pfannkuch, H.O. United States Geological Survey	Hydrogeology of a Drift-Filled Bedrock Valley Near Lino Lakes, Anoka County, Minnesota		00/00/76	12	358
Wisconsin Department of Natural Resources	Guidance for Design, Installation and Operation of In-Situ Air Sparging Systems	PUBL-SW186-93	09/00/93		2009
Wong, P.T.S., et al.	"Lead and the Aquatic Biota," The Biochemistry of Lead in the Environment. Part B - Biological Effects	pp. 279-342	00/00/78		1950
Woolf, A., et al.	"Regional Variation in Metals in Livers of White-Tailed Deer" in Illinois Trans. Ill. Acad. Sci	Vols. 1-2, pp. 305-310	00/00/83		1951
Wrensch, M., et al.	"Pregnancy Outcomes in Women Potentially Exposed to Solvent-Contaminated Drinking Water in San Jose, California," American Journal of Epidemiology	(131:283-300)	00/00/90	13	407
Wright, H.E., Jr.	Quaternary History of Minnesota, Geology of Minnesota: A Centennial	p. 515-547	00/00/72	12	359

SEARCH PHRASE: DOC_TYPE CONTAINS "Non-TC*" and FL_STRUC CONTAINS "Non-Site Specific" AND INCL2 EQ Y

AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
	Volume (P.K. Sims and G.W. Morey, Eds.)				
Yang, J-L, et al.	"Posttreatment with Sodium Arsenite Alters the Mutational Spectrum Induced by Ultraviolet Light Irradiation in Chinese Hamster Ovary Cells," Environ. Molec. Mutagenesis	20: 156-164	00/00/92		1904
Zandlo, J.A. Minnesota Department of Natural Resources State Climatology Office	Western and South Central Twin Cities Flash Flood, July 23-24		00/00/87	12	360
Zielhuis, G.A.	"Menstrual Disorders among Dry-Cleaning Workers," Scandinavian Journal of Work & Environmental Health	(15:238)	00/00/89	13	406
Brown, Gerald C. (Brigadier General, U.S. Army, Director, Environmental Programs, Department of the Army)	Guidance for Developing Restoration Advisory Boards		04/18/94		2552
California Department of Health Services	Scientific and Technical Standards for Hazardous Waste Sites		00/00/90		1798
Cohen, R.M.; Mercer, J.W.	DNAPL Site Evaluation (C.K. Smoley/CRC Press, Inc.)		00/00/93		2489
Fountain, J.C.	"Field Test of Surfactant Flooding: Mobility Control of Dense Nonaqueous-phase Liquids" Transport and Remediation of Subsurface Contamination. (ACS Symposium Series 491, American Chemical Society)		00/00/92		2486
Longino, Bettina L.; Kueper, Bernard H.	"The Use of Solubilizing Surfactants to Remove Pooled DNAPL Under Upward Gradient Flow Conditions" 87th Annual Meeting and Exhibition Air and Solid Waste Management Conf. (June 19-24, 1994)	Paper No. 94-WP-104.04	00/00/94		2487
Minnesota Department of Health	Tolerable Risk		00/00/85		1821
Minnesota Department of Health	Health Risk Assessment for Calculation of a Soil Exposure Guideline for Polycyclic Aromatic Hydrocarbons (PAHs)		02/01/89		1819
Minnesota Department of Health	Soil Exposure Guideline Concentration for Metals		10/16/89		1820
New York State Department of Environmental	Draft New York State Soil Cleanup Goals		00/00/90		1822

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Conservation					
United States Environmental Protection Agency	Water-Related Environmental Fate of 129 Priority Pollutants		12/00/79	12	329
United States Environmental Protection Agency	Preparation of Soil Sampling Protocol: Techniques and Strategies	EPA-600/4-83-020	05/00/83	12	331
United States Environmental Protection Agency	Groundwater Protection Strategy		00/00/84	12	332
United States Environmental Protection Agency	The Risk Assessment Guidelines of 1986		00/08/87		1889
United States Environmental Protection Agency	The Risk Assessment Guidelines of 1986		08/00/87		1591
United States Environmental Protection Agency	Remedial Action Costing Procedures Manual	EPA/600/8-87/049	10/00/87	13	258
United States Environmental Protection Agency	Interim Guidance for Conducting Remedial Investigation/Feasibility Study under CERCLA	EPA/540/G-89/004; OSWER Dir. 9355.3-10	00/00/88	13	69
United States Environmental Protection Agency	Section Criteria for Mathematical Models Used in Exposure Assessment: Groundwater Models	EPA 600/8-88/075	00/00/88		1832
United States Environmental Protection Agency	CERCLA Compliance with Other Laws Manual, Draft Guidance	Vol. I OSWER Dir. 9234.1001	00/00/88		1885
United States Environmental Protection Agency	Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses		05/00/88		1870
United States Environmental Protection Agency	Community Relations In Superfund: A Handbook	EPA/540/G-88/002; OSWER Dir. 9230.0-3B	06/00/88	13	644
United States Environmental Protection Agency	CERCLA Compliance With Other Law Vol. 1		08/00/88	13	37

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
United States Environmental Protection Agency	Risk Assessment Guidance for Superfund Vol. II, Environmental Evaluation Manual	EPA/540/1-89/001	00/00/89	13	41
United States Environmental Protection Agency	CERCLA Compliance With Other Laws Manual: Part II; Clean Air Act and Other Environmental Statutes and State Requirements		00/00/89	12	348
United States Environmental Protection Agency	Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater: A Compendium of Examples		00/00/89		1831
United States Environmental Protection Agency	Risk Assessment Guidance for Superfund Human Health Evaluation Manual	Vol. I, EPA/540/1-89/002	00/00/89		1886
United States Environmental Protection Agency	HAZCLN Solidification Process, Douglassville, PA: Applications Analysis Report	EPA/540/A5-89/001	05/00/89		1846
United States Environmental Protection Agency	Stabilization/Solidification of CERCLA and RCRA Wastes: Physical Tests, Chemical Testing Procedures, Technology Screening and Field Activities	EPA/625/6-89/022	05/00/89		1847
United States Environmental Protection Agency	Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater: A Compendium of Examples	EPA/540/2-89/057	10/00/89		2000
United States Environmental Protection Agency	The Superfund Innovative Technology Evaluation Program: Technology Profiles	EPA/540/5-89/013	11/00/89		1849
United States Environmental Protection Agency	Applicability of Land Disposal Restrictions to RCRA and CERCLA Groundwater Treatment Reinjection	Dir. #9234, 1-06	12/00/89	13	43
United States Environmental Protection Agency	Characterization of Hazardous Waste Sites - A Methods Manual: Vol. II - Available Sampling Methods (Second Ed.)	EPA 600/4-84-076; PB 83-206979	12/00/89	13	45
United States Environmental Protection Agency	Risk Assessment Guidance for Superfund, Vol. 1, Human Health Evaluation Part A	EPA/540/1-89/002	12/00/89	13	46
United States Environmental Protection Agency	CERCLA Compliance With Other Laws Manual Part II: Clean Air Act and Other Environmental Statutes and State Requirements		12/00/89	13	47

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
United States Environmental Protection Agency	Characterization of Hazardous Waste Sites--A Methods Manual: Volume II; Available Sampling Methods, Second Edition	EPA 600/4-84-076; PB83-206979	12/00/89	13	347
United States Environmental Protection Agency	Risk Assessment, Management and Communication of Drinking Water Contamination		00/00/90		1890
United States Environmental Protection Agency	Handbook of In-Situ Treatment of Hazardous Waste-Contaminated Soils	EPA/540/2-90/002	01/00/90		1850
United States Environmental Protection Agency	Guidance on Remedial Actions for Superfund Sites with PCB Contamination, August 1990	OSWER Dir. 9355.4-01	08/00/90		1887
United States Environmental Protection Agency	Engineering Bulletin: Soil Washing Treatment	EPA/540/2-90/017	09/00/90		1851
United States Environmental Protection Agency	Soliditech, Inc. Solidification/Stabilization Process: Applications Analysis Report	EPA/540/A5-89/005	09/00/90		1852
United States Environmental Protection Agency	Technology Demonstration Summary: Chemfix Solidification/Stabilization Process, Clackamas, Oregon	EPA/540/S5-89/011	12/00/90		1853
United States Environmental Protection Agency	Final Guidance on Administrative Records for Selecting CERCLA Response Actions	Dir. #9833.3A-1; PB-139121	12/03/90	13	84
United States Environmental Protection Agency	Health Effects Assessment Summary Tables Annual FY - 1991		01/00/91		1891
United States Environmental Protection Agency	Compendium of CERCLA Response Selection Guidance Documents - Users Manual	PB92-102052/9833.4	03/00/91	13	56
United States Environmental Protection Agency	Guide to Discharge CERCLA Aqueous Wastes to Publicly Owned Treatment Works (POTWs)		03/00/91		1474
United States Environmental Protection Agency	Treatment of Lead Contaminated Soils	EPA/540/2-91/009	04/00/91		1854
United States Environmental Protection	Model Quality Assurance Project Plan - Region V		08/00/91		1874

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
Agency					
United States Environmental Protection Agency	Guide To Management of Investigation - Derived Wastes	9343.3-03FS	01/00/92	13	58
United States Environmental Protection Agency	Biotrol Soil Washing System for Treatment of a Wood Preserving Site: Applications Analysis Report	EPA/540/A5-91/003	02/00/92		1855
United States Environmental Protection Agency	Health Effects Assessment Summary Tables Annual FY - 1992		03/00/92		1892
United States Environmental Protection Agency	Considerations of ARARs During Removal Actions	9360.3-02FS	04/00/92		1595
United States Environmental Protection Agency	Remedial Action Report Documentation for Operable Unit Completion		06/00/92		1563
United States Environmental Protection Agency	Test Methods for Evaluating Solid Waste, Fourth Edition	SW-846	07/00/92		1873
United States Environmental Protection Agency	Bioremediation in the Field	EPA/540/n-92/004 No. 7	10/00/92		1314
United States Environmental Protection Agency	Health Effects Assessment Summary Tables Annual FY - 1993		03/00/93		1893
United States Environmental Protection Agency	Chemical Assessment and Related Activities Database	OHEA-1-127	05/00/93	13	894
United States Environmental Protection Agency	USEPA - Presumptive Remedies: Policy & Procedures	EPA 540-F-93-047/PB 93-963345	09/00/93		1379
United States Environmental Protection Agency	Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils	EPA 540-F-93-048; PB 93-963346	09/00/93		1609
United States Environmental Protection Agency	Federal Register Notice of Availability for Public Comment on Sediment Quality Criteria for the Protection of Benthic Organisms		01/14/94		1576

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AUTHOR	TITLE	REF#	DOC_DATE	XREF	ID
United States Environmental Protection Agency	Guidelines for Reproductive Toxicity Risk Assessment	EPA 600/AP-94/001	02/00/94		1581
United States Environmental Protection Agency	Draft Revisions to the Guidelines for Carcinogen Risk Assessment	EPA 600/BP-92/003	08/00/94		1580
United States Environmental Protection Agency	Superfund Public Health Evaluation Manual	EPA 540/1-86/060	00/00/86	13	737
United States Environmental Protection Agency	Guidance on Remedial Actions for Superfund Sites with PCB Contamination	EPA/540/G-90/007	08/00/90		2483
United States Environmental Protection Agency	Considerations in Ground-Water Remediation at Superfund Sites and Resource Conservation and Recovery Act (RCRA) Facilities-Update	OSWER Directive 9283.1-06	05/27/92		2484
United States Environmental Protection Agency	Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA	EPA/540-R-93-057, Pub. # 9360-0-32, PB93-963402	08/00/93		1135
United States Environmental Protection Agency	Guidance for Evaluating the Technical Impractibility of Ground-Water Restoration	OSWER Directive 9234.2-25	09/00/93		2485
	A Random-Walk Solute Transport Model for Selected Groundwater Quality Evaluations	Illinois State Water Survey Bulletin 65	00/00/81	13	260
	Predicting the Fate and Transport of Organic Compounds in Groundwater, Part 1, Hazardous Material Control		00/00/90	13	421

TWIN CITIES ARMY AMMUNITION PLANT
INSTALLATION RESTORATION PROGRAM

Administrative Record File for New Brighton/Arden Hills NPL Site
Operable Unit-2
Draft Administrative Record Index

September 30, 1995

TAB 3

Public Participation Documents

(Documents are arranged in chronological order.)

SEARCH PHRASE: DOC_TYPE CONTAINS "Public Participation Document" AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
00/00/00	TCAAP Compendium of Newspaper Articles and Press Releases Relating to Environmental Investigation and Remediation				01	701
00/00/00	ATSDR Public Health Assessments Information Sheet	Agency for Toxic Substances and Disease Registry				2069
05/00/86	Superfund Program Fact Sheet, New Brighton Well No. 7	United States Environmental Protection Agency			04	188
08/21/86	TCAAP Tour of Environmental Cleanup of Groundwater Contamination Projects	Department of the Army			13	672
04/28/87	TCAAP Community Relations Plan: Mailing List	Brustman, Susan M. Public Information Officer Minnesota Pollution Control Agency	Powell, Paul Department of the Army		13	679
05/12/87	TCAAP Fact Sheet: "TCAAP"	Office of Public Affairs Department of the Army		No. 87-05	13	510
05/12/87	TCAAP Fact Sheet: "Installation Restoration Program Background"	Office of Public Affairs Department of the Army		No. 87-04	13	511
05/12/87	TCAAP Fact Sheet: "TCAAP Site Geology and Hydrogeology"	Office of Public Affairs Department of the Army		No. 87-03	13	512
05/12/87	TCAAP Fact Sheet: "Glossary - Abbreviations Relating to TCAAP Environmental Cleanup"	Office of Public Affairs Department of the Army		No. 87-02	13	513
05/12/87	TCAAP Fact Sheet: "Boundary Groundwater Recovery System"	Office of Public Affairs Department of the Army		No. 87-01	13	514
05/15/87	TCAAP Fact Sheet: "Bldg. 103 Groundwater Collection/Treatment System and TCAAP Sewers"	Office of Public Affairs Department of the Army		No. 87-07	13	508
05/15/87	TCAAP Fact Sheet: "Farmstead Wells"	Office of Public Affairs Department of the Army		No. 87-06	13	509
05/15/87	TCAAP News Release: "Public Notice of Draft	Office of Public Affairs		No. 87-01	13	515

SEARCH PHRASE: DOC_TYPE CONTAINS "Public Participation Document" AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Record of Decision and Public Meeting Concerning the Boundary Groundwater Recovery System at TCAAP"	Department of the Army				
05/15/87	TCAAP News Release: "TCAAP Sets 5/20/87 Public Meeting on Groundwater Recovery System"	Office of Public Affairs Department of the Army		No. 87-02	13	516
05/15/87	TCAAP News Release: "Army Document Now Available for Public Review"	Office of Public Affairs Department of the Army		No. 87-03	13	517
05/15/87	TCAAP News Release: "TCAAP Hotline Established"	Office of Public Affairs Department of the Army		No. 87-04	13	518
05/15/87	TCAAP News Release: "TCAAP Mailing Lists for Concerned Citizens"	Office of Public Affairs Department of the Army		No. 87-05	13	519
05/15/87	TCAAP News Release: "Information Repositories"	Office of Public Affairs Department of the Army		No. 87-06	13	520
05/15/87	TCAAP Fact Sheet: "Army Expenditures at TCAAP"	Office of Public Affairs Department of the Army		No. 87-12	13	578
05/15/87	TCAAP Fact Sheet: "In-Situ-Volatilization"	Office of Public Affairs Department of the Army		No. 87-11		579
05/15/87	TCAAP Fact Sheet: "Bldg. 502 Purge Well, Air Stripping Tower; Bldg. 502 - Volatile Organic Compound Source Control"	Office of Public Affairs Department of the Army		No. 87-10	13	580
05/15/87	TCAAP Fact Sheet: "Basewide Groundwater Treatment System"	Office of Public Affairs Department of the Army		No. 87-09	13	581
05/15/87	TCAAP Fact Sheet: "TCAAP Groundwater Collection and Treatment System Bldg. 103; Bldg. 103 Volatile Organic Compound Remediation"	Office of Public Affairs Department of the Army		No. 87-08	13	582
05/19/87	Statement of Lewis D. Walker before the	Walker, Lewis D.			06	671

SEARCH PHRASE: DOC_TYPE CONTAINS "Public Participation Document" AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Minnesota Pollution Control Agency	Department of the Army				
05/20/87	TCAAP Fact Sheet: "Cleanup Actions at TCAAP"	Office of Public Affairs Department of the Army		No. 87-13	13	528
05/20/87	Environmental Impact Hearing Held by TCAAP				06	670
06/08/87	TCAAP News Release: "Video of TCAAP Public Meeting Schedule for Public Viewing"	Office of Public Affairs Department of the Army		No. 87-08	13	521
06/08/87	TCAAP News Release: "Video of TCAAP Public Meeting Schedule for Public Viewing"	Office of Public Affairs Department of the Army		No. 87-07	13	522
06/17/87	TCAAP News Release: "TCAAP Civilian Gets Top Award"	Office of Public Affairs Department of the Army		No. 87-09	13	523
06/22/87	TCAAP News Release: "Final Record of Decision and Responsiveness Summary on Boundary Groundwater Recovery System Available For Public Review"	Office of Public Affairs Department of the Army		No. 87-10	13	524
06/23/87	TCAAP News Release: "TCAAP Civilian Gets Top Army Award"	Office of Public Affairs Department of the Army		No. 87-11		525
06/23/87	TCAAP News Release: "TCAAP Civilian Gets Top Award"	Office of Public Affairs Department of the Army		No. 87-12		526
06/26/87	TCAAP News Release: "Army Document Now Available for Public Review"	Office of Public Affairs Department of the Army		No. 87-13	13	527
07/00/87	TCAAP Public Involvement and Response Plan	Department of the Army			13	674
07/16/87	TCAAP Office of Public Affairs Mailing List	Office of Public Affairs Department of the Army			13	643
07/29/87	TCAAP News Release: "Low Level Contamination Found at Northwestern Corner of TCAAP"	Office of Public Affairs Department of the Army		No. 87-14		529

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
08/04/87	TCAAP News Release: "Army Document Now Available for Public Review"	Office of Public Affairs Department of the Army		No. 87-15	13	530
08/06/87	Community Leaders Meeting	Oster, Clarence Department of the Army	various		13	667
08/10/87	Transcript of Public Hearing Relating to Federal Facilities Agreement				13	669
08/14/87	Groundwater Contamination (Site A)	Schulte, Theodore E. Commander's Representative Department of the Army	Residents of Edgetown Acres and Northwest Shoreview			682
08/18/87	TCAAP Community Leaders Meeting: Sign-In Sheet				13	668
10/00/87	Invitation to Dedication Ceremony of TCAAP Boundary Groundwater Recovery System	Department of the Army	various		13	665
10/19/87	Dedication Ceremony of TCAAP Boundary Groundwater Recovery System				13	666
11/12/87	TCAAP Community Leaders Meeting	Schulte, Theodore E. Commander's Representative Department of the Army	various		13	662
11/18/87	TCAAP Community Leaders Meeting: Sign-In Sheet				13	663
12/16/87	TCAAP News Release: "Federal Budget Cuts to Reduce Contractor Work Force at TCAAP"	Office of Public Affairs Department of the Army		No. 87-16		531
02/02/88	TCAAP Informational Meeting (Site A) Sign-In Sheet					680
02/02/88	TCAAP Informational Meeting (Site A) Agenda					681
02/12/88	TCAAP Community Leaders Meeting	Schulte, Theodore E. Commander's Representative	various		13	661

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Department of the Army				
02/24/88	TCAAP Community Leaders Meeting: Agenda				13	660
02/24/88	TCAAP Community Leaders Meeting: Sign-In Sheet				13	698
03/04/88	TCAAP News Release: "Army Makes Document Available for Public Review and Comment"	Office of Public Affairs Department of the Army		No. 87-17	13	532
05/06/88	TCAAP Community Leaders Meeting	Schulte, Theodore E. Commander's Representative Department of the Army	various		13	697
05/09/88	TCAAP Community Leaders Meeting: Attendees					659
05/09/88	TCAAP Community Leaders Meeting: Agenda					699
05/25/88	TCAAP Community Leaders Meeting: Sign-In Sheet				13	693
05/31/88	TCAAP Community Leaders Meeting	Oster, Clarence C. Department of the Army	Lohman, Robert Preserve Our Land		13	696
07/00/88	Technology Fact Sheet Thermal: "Treatment of TCAAP Site D Soils"	Ecova				691
07/01/88	TCAAP News Release: "Army Makes Document Available for Public Review and Comment"	Office of Public Affairs Department of the Army		No. 87-18		533
07/06/88	TCAAP Community Leaders Meeting	Schulte, Theodore E. Commander's Representative Department of the Army	various			692
07/28/88	TCAAP Public Information Meeting: Thermal Treatment of PCB Contaminated Soil: Sign-In Sheet					690
08/09/88	TCAAP Community Leaders Meeting	Schulte, Theodore E.	Dagleisch, Janet (Alt. Proj.		13	688

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Commander's Representative Department of the Army	Mgr., Minnesota Pollution Control Agency) Kleinrath, Arthur (United States Environmental Protection Agency) Johnson, Maureen (Project Manager, Minnesota Pollution Control Agency)			
08/09/88	TCAAP Community Leaders Meeting	Schulte, Theodore E. Commander's Representative Department of the Army	various		13	689
08/24/88	TCAAP Community Leaders Meeting: Agenda and Sign-In Sheet				13	695
11/03/88	TCAAP News Release: "Army Opens Repository in New Brighton City Hall"	Office of Public Affairs Department of the Army		No. 87-19	13	534
11/07/88	TCAAP Community Leaders Meeting	Schulte, Theodore E. Commander's Representative Department of the Army			13	657
11/23/88	EPA Environmental New Release	United States Environmental Protection Agency		No. 88-321	04	229
11/30/88	TCAAP Community Leaders Meeting: Sign-In Sheet				13	656
11/30/88	TCAAP Community Leaders Meeting: Agenda				13	658
12/02/88	TCAAP News Release: "TCAAP to Study Uses for Treated Groundwater"	Office of Public Affairs Department of the Army		No. 87-20	13	535
12/13/88	Transcript of Proceedings - City Council Meeting, New Brighton, Minnesota				13	627
01/11/89	TCAAP News Release: "Army Initiates Groundwater	Office of Public Affairs		No. 89-21		536

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Treatment at North Side of TCAAP"	Department of the Army				
02/07/89	TCAAP Community Leaders Meeting	Schulte, Theodore E. Commander's Representative Department of the Army	various		13	642
02/22/89	TCAAP Community Leaders Meeting: Sign-In Sheet				13	683
02/22/89	TCAAP Community Leaders Meeting: Agenda				13	684
05/10/89	TCAAP Community Leaders Meeting	Schulte, Theodore E. Commander's Representative Department of the Army	various		13	685
05/22/89	TCAAP News Release: "Army Makes Document Available for Public Review and Comments"	Office of Public Affairs Department of the Army		No. 89-22		686
08/18/89	TCAAP News Release: "U.S. Army and U.S. EPA Region V Have Signed a Record of Decision for Thermal Treatment of PCB-Contaminated Soil at Ammunition Plant"	Office of Public Affairs Department of the Army		No. 89-23		537
03/01/90	News Release: "Rick Creek Watershed District to Present Results of TCAAP Water Management Study"	Rice Creek Watershed District			13	546
03/19/90	TCAAP Installation Restoration Program Water Management Study Public Meeting - Sign-In Sheet				13	587
05/25/90	"Cities Vie for Decontaminated Water from Arden Hills Plant"	Walsh, James Star Tribune				545
06/00/90	Minnesota Pollution Control Agency Superfund Fact Sheet: "New Brighton/St. Anthony"	Minnesota Pollution Control Agency			13	653
07/05/90	Turtle Lake-Snail Lake - TCAAP Pumping Meeting	Stine, John L. Regional Hydrologist Department of Natural			13	570

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Resources				
03/00/91	Minnesota Pollution Control Agency Superfund Fact Sheet: "New Brighton/Arden Hills/St. Anthony - Remedial Investigation Phase IA"	Minnesota Pollution Control Agency		Fact Sheet #2	13	543
03/00/91	Minnesota Pollution Control Agency Superfund Fact Sheet: "New Brighton/Arden Hills/St. Anthony - Background and History"	Minnesota Pollution Control Agency		Fact Sheet #1	13	544
05/00/91	TCAAP Community Relations Plan	Department of the Army			13	441
10/00/91	U.S. EPA Fact Sheet: "U.S. EPA Completes Study of Human Health Risks Associated with New Brighton/Arden Hills Superfund Site"	United States Environmental Protection Agency			13	541
10/30/91	TCAAP Community Leaders Meeting	Schulte, Theodore E. Commander's Representative Department of the Army	various		13	655
11/00/91	USATHAMA Fact Sheet: "Remedial Investigation TCAAP"	United States Army Toxic and Hazardous Materials Agency			13	540
11/00/91	Minnesota Pollution Control Agency Fact Sheet: "TCAAP/New Brighton/Arden Hills/St. Anthony - Off-TCAAP Remedial Investigation"	Minnesota Pollution Control Agency			13	542
11/00/91	USATHAMA Fact Sheet: "Ecological Assessment - TCAAP"	United States Army Toxic and Hazardous Materials Agency			13	647
11/00/91	Public Meeting Notice	United States Environmental Protection Agency Department of the Army Minnesota Pollution Control Agency			13	652
11/13/91	Public Meeting: Remedial Investigation Studies:				13	648

SEARCH PHRASE: DOC_TYPE CONTAINS "Public Participation Document" AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Attendees					
11/14/91	Public Meeting on Remedial Investigation: Agenda and Sign-In Sheet	United States Environmental Protection Agency Department of the Army Minnesota Pollution Control Agency			13	650
11/20/91	TCAAP Technical Review Committee Meetings	Daves, Joseph Lieutenant Colonel, Commander Department of the Army	various		13	646
06/03/92	"MPCA Answers Questions About TCAAP"	The Bulletin				1617
08/12/92	"Twin Cities Army Ammunition Plant Groundwater Cleanup Options Are Up for Public Hearing August 18"	Northeaster				990
08/12/92	"Army's Arsenal Plan Would Give Water to New Brighton"	Schwartz, Jim Shoreview-Arden Hills Bulletin		Vol. 16, No. 49		1616
08/18/92	Public Meeting Minutes TCAAP OU-3 Proposed Plan, Shoreview Community Center				12	625
09/00/92	TCAAP Installation Restoration Program Update	Department of the Army		No. 1	13	365
09/00/92	Dept. of Health Test Results for Lowry Grove	Swan, Hobart (Resident Manager, Lowry Grove)	Residents of Lowry Grove			1058
09/23/92	TCAAP Community Leaders Meeting	Schulte, Theodore E. Commander's Representative Department of the Army	various		13	651
10/07/92	Chronology Regarding Drinking Water Notification Process (5/81-7/92)	Minnesota Pollution Control Agency			13	447

SEARCH PHRASE: DOC_TYPE CONTAINS "Public Participation Document" AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
12/00/92	TCAAP Installation Restoration Program Update	Department of the Army		No. 2	13	364
12/00/92	Superfund: Progress at National Priority List Sites - MN 1992 Update: New Brighton/Arden Hills Superfund Site	United States Environmental Protection Agency				1378
12/16/92	"A Chapter Closes in Water Contamination Saga"	Schwartz, Jim The Bulletin				989
02/23/93	"New Brighton, Fridley Set to Connect Water"	Meade, MacDonald Focus News		Vol. 3, No. 8		988
03/00/93	TCAAP Installation Restoration Program Update	Department of the Army		No. 3	13	98
03/15/93	TCAAP News Release: "Army Makes TCAAP Installation Restoration Program Documents Available for Public Review"	Office of Public Affairs Department of the Army		No. 93-24	13	97
04/13/93	TCAAP News Release: "Rare Trumpeter Swans to be Released at TCAAP"	Office of Public Affairs Department of the Army		No. 93-25		1796
04/20/93	New Brighton/Fridley Interconnection Informational Meeting at Fridley City Council Chamber					430
04/20/93	Presentation Outline: New Brighton/Fridley Interconnection Informational Meeting at Fridley City Council Chambers					433
04/20/93	TCAAP News Release: "Natural Resources Program Judged Best in Department of Defense Competition"	Office of Public Affairs Department of the Army		No. 93-26		1795
05/04/93	TCAAP News Release: "TCAAP to Selectively Burn Prairie Grass for Restoration of Native Species"	Office of Public Affairs Department of the Army		No. 93-27		539
05/11/93	"Council Approves Construction Agreement for	Meade, MacDonald		Vol. 3, No. 20		432

SEARCH PHRASE: DOC_TYPE CONTAINS "Public Participation Document" AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Fridley/New Brighton Water Connection"	Fridley Focus News				
05/25/93	"Two-City Water Connection Approved"	Meade, MacDonald Fridley Focus News		Vol. 3, No. 22		431
06/00/93	TCAAP Installation Restoration Program Update	Department of the Army		No. 4	13	366
06/01/93	Public Notice regarding proposed extraction wells at Site A and availability of Engineering Evaluation/Cost Analysis	St. Paul Pioneer Press				1012
06/01/93	Public Notice regarding proposed extraction wells at Site A and availability of Engineering Evaluation/Cost Analysis	Star Tribune				1013
06/28/93	TCAAP News Release: "Steam Plant Shut Down Marks the End of an Era at Arms Plant"	Office of Public Affairs Department of the Army		No. 93-28		367
08/00/93	Proposed Plan for Groundwater Cleanup at Operable Unit 1 of the New Brighton/Arden Hills Superfund Site	Department of the Army; United States Environmental Protection Agency; Minnesota Pollution Control Agency			13	893
08/00/93	TCAAP Installation Restoration Program Update: "Construction Starts on New Treatment Plant"	Office of Public Affairs Department of the Army		Vol. 1; No. 1	13	917
08/05/93	Public Meeting/Comment Sought	United States Environmental Protection Agency Minnesota Pollution Control Agency		St. Paul Pioneer Press, Section F	13	888
08/06/93	Public Meeting/Comment Sought	Star Tribune		Star Tribune	13	891
08/19/93	Operable Unit 1 Public Meeting Agenda				13	916
08/19/93	Transcript of Public Hearing Relating to				13	918

SEARCH PHRASE: DOC_TYPE CONTAINS "Public Participation Document" AND INCL2 EQ Y

DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Operable Unit 1					
09/00/93	TCAAP Installation Restoration Program Update: "Groundwater Cleanup Receives Final Approval"	Office of Public Affairs, Department of the Army		Vol. 1, No. 2	13	1149
09/17/93	TCAAP News Release: "Army Consolidates Repositories"	Office of Public Affairs Department of the Army		No. 93-29	13	915
10/00/93	TCAAP Installation Restoration Program Update "Fridley to Aid Groundwater Cleanup Effort"	Office of Public Affairs, Department of the Army		Vol. 1, No. 3		1150
10/08/93	TCAAP News Release: "TCAAP To Host Family Nature Walk on October 23rd"	Office of Public Affairs Department of the Army		No. 93-32		906
10/08/93	TCAAP Fact Sheet: "The Site F Closure Project"	Office of Public Affairs Department of the Army		No. 93-14		908
10/15/93	TCAAP News Release: "You're Invited on a Site F Tour"	Office of Public Affairs Department of the Army		No. 93-30		905
10/21/93	TCAAP News Release: "Breakthrough Soil Cleanup at TCAAP"	Office of Public Affairs Department of the Army		No. 93-31		907
10/22/93	"New Lead-Removal Process Called Success at an Ammunition Plant by Developer"	Environment Reporter The Bureau of National Affairs, Inc.		Vol. 24, No. 25		1169
10/26/93	"Arsenal Gets Lead Out - Of Soil, That Is"	Nicolaus - Dunski, Shelby Focus News		Vol. 3, No. 44		986
10/27/93	"Revolutionary Soil Clean-up Debuts at Arsenal"	Brennan, Amber Shoreview - Arden Hills Bulletin		Vol. 18, No. 22		987
11/00/93	TCAAP IRP Update: "TCAAP First in Nation to Use Innovative Soil Treatment Technology"	Office of Public Affairs Department of the Army		Vol. 1, No. 4		1096

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
11/00/93	Public Notice	Agency for Toxic Substances and Disease Registry				2068
11/05/93	TCAAP News Release: "Removal Action at TCAAP"	Office of Public Affairs Department of the Army		No. 93-33		1794
11/12/93	Lead is Washed from Soil at TCAAP Site	Superfund Week (Pasha Publications, Inc.)		Vol. 7, No. 44		1422
11/12/93	News Release	Lantz, Scott (Acting Commander's Representative, Department of the Army)	Commander U.S. Army Armament, Munitions and Chemical Command			1536
11/17/93	"Arsenal Cleanup - Groundwater Extraction Set"	Shoreview - Arden Hills Bulletin		Vol. 19, No. 3		985
11/30/93	"Plant to Attend Public Availability Sessions for Public Health Assessment of New Brighton/Arden Hills (A.K.A. Twin Cities Army Ammunition Plant) Superfund Site"	Focus News				982
11/30/93	"Cleanup Begins for Contaminated Water Headed for Shoreview"	Nicolaus - Dunski, Shelby Focus News				983
11/30/93	"Volunteers Sought to Help Decide Fate of Arsenal Land"	Focus News				984
12/00/93	TCAAP Installation Restoration Program Update: "TCAAP Takes Initiative in Groundwater Containment"	Office of Public Affairs, Department of the Army		Vol. 1, No. 5		1151
12/01/93	TCAAP News Release: "Army Makes Documents Available for Public Review"	Office of Public Affairs Department of the Army		No. 93-34		1610
12/15/93	"Army continues its Search for Contaminated Wells as Study Determines Extent of Pollution"	The Bulletin				981

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
01/00/94	TCAAP Installation Restoration Program Update: "TCAAP Prevents Off-Site Contaminant Migration"	Office of Public Affairs Department of the Army		Vol.2, No. 1		1153
02/09/94	Learn the Latest About the Status of TCAAP	Probst, Dennis Council Member, City of Arden Hills				2072
03/01/94	Water Supply Wells Inventory Planned	Office of Public Affairs Department of the Army		No. 94-35		1749
03/01/94	TCAAP News Release: "Water Supply Wells Inventory Planned"	Office of Public Affairs Department of the Army		No. 94-35		1792
03/09/94	"Water Supply Wells Inventory Planned"	Northeaster				1652
03/22/94	"It's Time for Arden Hills Locals to Take Charge of City's Future"	Nicolaus - Dunski, Shelby Focus News				979
03/29/94	"Twin Cities Arsenal is Home to Wildlife History and a Huge Pollution Problem"	Flores, Terry Shoreview Press				977
03/30/94	"Well Tests - Arsenal Continues Program"	Shoreview - Arden Hills Bulletin		Vol. 19, No. 22		980
04/00/94	TCAAP Installation Restoration update: "First Major TCAAP Site Confirmed Clean"	Office of Public Affairs Department of the Army		Vol. 2, No. 2	13	1541
04/11/94	TCAAP Fact Sheet: "The Site F Closure Project"	Office of Public Affairs Department of the Army		No. 94-14		962
04/13/94	"Newsbriefs: Arsenal Receives Award"	The Bulletin				1615
04/27/94	"Arsenal Land Use Discussion Moves to Planning Board"	Schwartz, Jim Shoreview - Arden Hills Bulletin		Vol. 19, No. 26		978
05/24/94	TCAAP News Release: "Site A Groundwater	Office of Public Affairs		No. 94-36		1032

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Extraction System"	Department of the Army				
06/08/94	"Arsenal Completes Project"	The Bulletin				1003
06/29/94	Demonstration of COGNIS, Inc. Terramet Lead Extraction Process TCAAP Site F - Visitors' Day Packet	Superfund Innovative Technology Evaluation (SITE) Office of Research and Development, (United States Environmental Protection Agency)				961
07/25/94	TCAAP Mailing List	Fix, Michael R. (Commander's Representative, Department of the Army)	Grove, Molly (District Director, Congressman Bruce f. Vento's Office)			956
08/02/94	"Keeping up with the Turtles, DNR Studies Endangered Species on Arsenal Land"	Nicolaus-Dunski, Shelby Focus News				1154
08/09/94	"City, Grassroots Group Move Separately on Land Issue"	Nicolaus-Dunski, Shelby Focus News				1155
08/16/94	"Vento Schedules TCAAP Meeting for August 30"	Focus News				1156
08/24/94	"Arsenal Summit Re-Use is August 30 Topic"	Shoreview Bulletin - Arden Hills		Vol. 19, No. 43		1157
09/00/94	TCAAP Installation Restoration Program Update "Partners Begin Final Phase in Providing Clean Water for New Brighton/Fridley"	Office of Public Affairs Department of the Army		Vol. 2, No. 3		1603
09/06/94	"A Good Deal or Investment Into the Unknown?"	Nicolaus-Dunski, Shelby Focus News				1775
09/07/94	"Committee Will Weigh Fate of Arsenal Land"	Uhlig, Keith Staff Writer, White Bear Press/Vadnais Heights Press				1770

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
09/07/94	"Vento Takes Aim at Arsenal Development Question"	Kannel, Leah Shoreview-Arden Hills Bulletin		Vol. 19, No. 45		1
09/13/94	Public Invitation: Dedication Ceremony - PGRS Plant and New Brighton/Fridley Interconnection, September 26	Focus News				1
09/14/94	"Public Invitation: Dedication Ceremony - PGRS Plant and New Brighton/Fridley Interconnection, September 26"	Northeaster				1
09/15/94	Community Leaders Tour of TCAAP	Fix, Michael R. (Commander's Representative, Department of the Army)	Various			1
09/21/94	News Release: "TCAAP to Host Family Nature Walk on October 8 and 9"	Office of Public Affairs Department of the Army		No. 94-37		1
09/21/94	"Public Invitation: Dedication Ceremony - PGRS Plant and New Brighton/Fridley Interconnection, Monday, September 26"	The Bulletin				1
09/27/94	Restoration Advisory Board (RAB) Implementation Guidelines.	Goodman, Sherri W. (Deputy Under Secretary of Defense, Department of Defense)	Laws, Elliot P. (Assistant Administrator, U.S. EPA)			2
10/00/94	TCAAP Installation Restoration Program Update: "Innovative Cleanup Successful"	Office of Public Affairs Department of the Army		Vol. 2, No. 4		2
10/05/94	"Plant Gives New Life to Water"	The Bulletin				2
10/09/94	Legal Notice: DOA Armament, Munitions and Chemical Command Finding of No Significant Impact	Star Tribune				2
10/13/94	TCAAP Community Leaders Meeting and Site F Tour					2

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
10/19/94	TCAAP Site F Tour Sign-Up Sheet					
10/31/94	TCAAP IRP Update (October 1994)	Fix, Michael R. (Commander's Representative, Department of the Army)	Card, Dan (MPCA) Smith, Stan (U.S. Fish & Wildlife Service)			
11/02/94	Public Notice DOA Armament, Munitions and Chemical Command Finding of No Significant Impact	The Bulletin				2
11/02/94	"Arden Hills Candidates Have Ideas for Arsenal Development"	Chanco, Ben Saint Paul Pioneer Press				20
11/02/94	"Watchable Wildlife Walk."	The Bulletin				22
11/02/94	"Re-Use, Arsenal is Topic of Forum."	Shoreview - Arden Hills Bulletin.		Vol. 20, No. 1		223
11/09/94	"Mississippi River Activity is Topic of Public Hearing."	Niskanen, Chirs Saint Paul Pioneer Press				2235
11/18/94	Affidavit of Barbara Gertsema	Gertsema, Barbara				2215
11/18/94	Additional Petitioners for a Restoration Advisory Board.	Fix, Michael R. Commander's Representative Department of the Army	Romano, Dagmar (Project Leader, MPCA); Barounis, Thomas (Remedial Project Manager, U.S. EPA)			2288
11/22/94	Minutes for TCAAP Restoration Advisory Board Scoping Meeting.	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2283
11/23/94	TCAAP Restoration Advisory Board (RAB) Scoping Meeting.	Fix, Michael R. (Commander's Representative, Department of the Army)	Barounis, Thomas (Remedial Project Manager, U.S. EPA);			2284

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
			Romano, Dagmar (Project Leader, MPCA)			
12/00/94	U.S. Army Cleans up Superfund Site	Superfund at Work - Hazardous Waste Cleanup Efforts Nationwide United States Environmental Protection Agency		EPA 520-F-94-00X		1376
12/00/94	TCAAP Installation Restoration Program Updated "Partners Celebrate Dedication of Water Treatment Plant"			Vol. 2, No. 5		2218
12/22/94	Comments on DOD Questionaire for Providing Input to Work Group on Technical Assistance for Public Participation	Barounis, Thomas (Remedial Project Manager, U.S. EPA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2255
12/22/94	Restoration Advisory Board (RAB) Meeting Minutes.	Michael R. Fix (Commander's Representative, Department of the Army)	Thomas Barounis (Remedial Project Manager, U.S. EPA); Dagmar Romano (Project Leader, MPCA)			2293
01/04/95	"Arsenal Housing Targeted for Homeless Families"	Schwartz, Jim Shoreview-Arden Hills Bulletin		Vol. 20, No. 10		2265
01/05/95	DOD Questionnaire for Providing Input to Work Group on Technical Assistance for Public Participation	Romano, Dagmar (Project Manager, MPCA)	McCleery, Martin (Remedial Project Manager, Department of the Army)			2256
02/08/95	"Arsenal Land Would Become Regional Park"	The Bulletin				2430
02/08/95	"New Boss-Fritsinger Receives Nod"	Becker, Denise Shoreview Arden Hills Bulletin		Vol. 20, No. 15		2431
02/15/95	Public Notice Regarding Update of Rice Creek Watershed District Management Plan	The Bulletin				2432

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
02/22/95	"Huge Army Open Space Faces Future Plans"	Uhlig, Keith White Bear/Vadnais Heights Press				2428
03/01/95	"Arsenal re-use group will meet."	The Bulletin				2344
03/29/95	"Arsenal building gets new life-in houses worldwide."	Schwartz, Jim Shoreview - Arden Hills Bulletin		Vol. 20, No. 22		2307
03/29/95	"Arsenal group meets."	The Bulletin				2308
04/00/95	TCAAP Installation Restoration Program Update: "Protective Measures Continue - Major Project Underway to Locate, Remove, and Dispose of Old Ammunition Materials."	Office of Public Affairs Department of the Army		Vol. 13, No. 2		2329
04/13/95	TCAAP News Release: "New Report identifies Top Department of Defense Environmental Programs-TCAAP Cleanup Program and Program to Save Endangered Species" is Highlighted.	Office of Public Affairs Department of the Army		No. 95-38		2332
04/15/95	"Tribe eyes home far from plant - Arden Hills military site seen as safe alternative to Prairie Island."	Parker, Walter St. Paul Pioneer Press				2336
05/31/95	"Arsenal Group Will Meet"	The Bulletin				2402
06/00/95	"A Changing Landscape"	Morrison, Blake (St. Paul Pioneer Press); Hardman, Dave (St. Paul Pioneer Press)				2550
06/11/95	Finding a No Significant Impact Regarding Demolition of Bldgs. 118, 165 and 964	Star Tribune				2382
06/29/95	TCAAP Installation Restoration Program Display	Fix, Michael R. (Commander's Representative,	Tadsen, Ron (Metropolitan Airports			2411

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
		Department of the Army)	Commission)			
07/00/95	"Arden Hills has big - and many - plans for land"	Ojeda - Zapata, Julio				2443
07/12/95	TCAAP Restoration Advisory Board	Bjelland, Mark (Arsenal Cleanup and Conversion Project)	Simmers, Lori (Public Affairs Office, U.S. Army Environmental Center)			2446
07/13/95	TCAAP Restoration Advisory Board Selection Panel	Fix, Michael R. (Commander's Representative, Department of the Army)	Various			2449
07/17/95	Restoration Advisory Board (RAB) Planning Meeting	Fix, Michael R. (Commander's Representative, Department of the Army)	Barrett, Erv (Arsenal Cleanup and Conversion Project)			2525
07/23/95	"Two trumpeter swans born"	Star Tribune				2444
07/24/95	TCAAP Restoration Advisory Board	Fix, Michael (Commander's Representative, Department of the Army)	Various			2454
07/25/95	"Four Scenarios Proposed For Arsenal"	Focus News		Vol. 5, No. 30		2442
08/02/95	Concerns regarding Restoration Advisory Board (RAB) Selection Panel Meeting held July 18, 1995	Barrett, Erv; Flicker, LeEtta; Quillopa, Naomi; and Bjelland, Mark (Arsenal Cleanup and Conversion Project)	Fix, Michael R. (Commander's Representative, Department of the Army)			2531
08/04/95	RAB Selection Panel Meeting - August 19, 1995	Fix, Michael R. (Commander's Representative, Department of the Army)	Members of the Twin Cities Army Ammunition Plant Restoration Advisory Board (RAB) Selection Panel			2537
08/17/95	RAB Member Solicitation at Twin City Army	Bjelland, Mark (Arsenal	James, Linda (U.S. Army			2516

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DOC_DATE	TITLE	AUTHOR	RCPNT	REF#	XREF	ID
	Ammunition Plant	Cleanup and Conversion Project)	Industrial Operations Command)			
08/28/95	Restoration Advisory Board (RAB) Selection Panel Meeting	Fix, Michael R. (Commander's Representative, Department of the Army)	Honorable Dennis Probst (Mayor, City of Arden Hills) Honorable Jerome Linke (Mayor, City of Mounds View) Honorable Robert Benke (Mayor, City of New Brighton) Honorable Clarence Ranello (Mayor, City of St. Anthony) Honorable James Chalmers (Mayor, City of Shoreview) Barrett, Erv (Arsenal Cleanup & Conversion Project)			2507
	"AH nears new administrator"	Jones, Allison Shoreview-Arden Hills Bulletin				2278
	TCAAP: Preparing for the Future	Department of the Army				2380

TWIN CITIES ARMY AMMUNITION PLANT
INSTALLATION RESTORATION PROGRAM

Administrative Record File for New Brighton/Arden Hills NPL Site
Operable Unit 2

Draft Record of Decision Index Volume 2

August 18, 1997

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TWIN CITIES ARMY AMMUNITION PLANT
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I. THE DRAFT RECORD OF DECISION INDEX - VOLUME 2

The draft Index identifies documents in the Administrative Record file for the New Brighton/Arden Hills NPL Site, Operable Unit 2 (OU-2). Volume 2 is not broken into categories. All documents are listed in chronological order.

Documents referenced in Volume 2 of the Index may be located in the Administrative Record file by locating the document by its document number. The documents in the Administrative Record file are filed in order of document number. All documents listed in Volume 2 of the Index are contained in the Administrative Record files.

TWIN CITIES ARMY AMMUNITION PLANT
INSTALLATION RESTORATION PROGRAM

Administrative Record File for New Brighton/Arden Hills NPL Site
Operable Unit 2

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August 18, 1997

II. EXPLANATION OF COLUMN HEADERS

1. **Date:** The date of the document. All of the documents in this Index are arranged in chronological order.

2. **Title:** The title of the document or a brief description of the document.

3. **Author:** Author of the document. Where available, the author's title and organization are included.

4. **Recipient:** Recipient of the document. Where available, the recipient's title and organization are included. In some instances, due to space limitations, only the first few recipients of the document are listed.

5. **Ref #:** The number assigned to the document in the Army's electronic filing system (the INMAGIC system). The documents are only numbered on the front page of the document.

Date	Title	Author	Recipient	Ref #
7/93	Site F Closure Plan July 1993 - Final Report	Wenck Associates	Marty McCleery, SIOTC-EV	11279
3/8/94	NPDES Permit Application	MPCA	Marty McCleery, SIOTC-EV, cc: Tom Barounis/EPA	11274
3/18/94	Predictive Modeling of Additional Phosphorus Loading to Long Lake	MPCA	Marty McCleery, SIOTC-EV	10039
5/12/94	TCAAP Sewer Manhole Survey and Decontamination Report	3M Company	Mike Fix, SIOTC-CO	11189
5/16/94	Transfer of NPDES to Stormwater Runoff Program	Federal Cartridge Company	Mike Fix, SIOTC-CO	11272
10/94	TCAAP IRP Monitoring Well Ownership, Access, and Abandonment Plan	Montgomery Watson	Distribution	10155
4/95	Phase II Investigation Work Plan Outdoor Firing Range - Final Twin Cities Army Ammunition Plant	Rust Environmental & Infrastructure	Mike Fix, SIOTC-CO	10071
4/26/95	Phase II Investigation Work Plan, Outdoor Firing Range - Final	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA cc: Rebecca Goetzke, HQ, IOC, ATTN:	10070
5/95	Pre-Final Design Report, Containment/Production Wells	Barr Engineering Company	Distribution	10169
5/95	Historical Aerial Photography Final Report	Malcolm Pirnie, Inc.	U.S. Army Corps of Engineers/Omaha District	10258
5/31/95	Arsenal Cleanup and Conversion Project (ACCP) Meeting	Bulletin newspaper	Mike Fix, SIOTC-CO	10032

Date	Title	Author	Recipient	Ref #
6/1/95	OU-2 FS Groundwater Modeling Comment Discussion June 6 or 7, 1995	Montgomery Watson	Distribution	10002
6/1/95	June 6, 1995, Pre-TRC meeting information session, Argonne National Laboratory on Sunfish and Marsden Lake Geophysical Characterization Methods and	Federal Cartridge Company	Marty McCleery, SIOTC-EV	10025
6/2/95	Quarterly Sampling	TCAAP	Gross Golf Course/ATTN: Harold Newville, Fred White, Mounds View High	10028
6/5/95	Cobalt and Molybdenum Advisories	MPCA	Marty McCleery, SIOTC-EV	10026
6/9/95	Final Phase II Investigation Work Plan, Outdoor Firing Range Twin Cities Army Ammunition Plant, April 1995	TCAAP	Plant Manager, Federal Cartridge Company, cc: David Knight, FCC engineer	10072
6/11/95	FONSI -Demolition of Bldgs 118,165 & 964	Star Tribune newspaper	Distribution	10044
6/13/95	Twin Cities Restoration Advisory Board Establishment	TCAAP	Rebecca Goetzke, AMSIO-EQ	10047
6/14/95	Well Construction Advisories	TCAAP	Pete Rissell, U.S. Army Environmental Center Jay Hodges, U.S. Army Corps of	10006
6/14/95	Arsenal Cleanup and Conversion Project Meeting	TCAAP	Pete Rissell, U.S. Army Environmental Center Rebecca Goetzke, AMSIO-EQ	10007
6/14/95	Technical Assistance for Public Participation in the Defense Environmental Restoration Program--Federal Register Notice of Request for Comments	TCAAP	Erv Barrett, ACCP Tom Barounis, EPA Dagmar Romano, MPCA Pete Rissell,	10048

Date	Title	Author	Recipient	Ref #
6/15/95	Quality Assurance Project Plan (QAPP)	TCAAP	Tom Barounis, EPA, Dagmar Romano/MPCA, cc: Rebecca Goetzke, HQ, IOC, ATTN:	10051
6/15/95	June TRC Meeting Minutes		Marty McCleery, SIOTC-EV	10052
6/16/95	Final Phase II Investigation Work Plan, Outdoor Firing Range, TCAAP, April 1995.	Federal Cartridge Company	Marty McCleery, SIOTC-EV	10073
6/19/95	OU2 Corrective Action Management Unit (CAMU) Comments Review Meeting	TCAAP	EPA/Tom Barnouinis, MPCA/Dagmar Romano Dan Card, AEC/Pete Rissell,	10076
6/20/95	Well 03U031 Preliminary Assessment, Final Report, April 1995	TCAAP	Rebecca Goetzke, AMSIO-EQ Pete Rissell, U.S. Army Environmental Center Jay	10010
6/21/95	Containment/Production Wells	TCAAP	Jay Hodges, U.S. Army Corps of Engineers, Omaha Dist.	10003
6/22/95	Site F Tour - Fort Benjamin Harrison	TCAAP	Plant Manager, Federal Cartridge Co. Dan Card, MPCA Bill Johnsen, Wenck	10055
6/23/95	Request for Documents	TCAAP	Mark Bjelland, ACCP	10011
6/26/95	Calculation of Preliminary Remediation Goals for TCAAP Soils	TCAAP	Pete Rissell, U.S. Army Environmental Center	10012
6/27/95	Installation Restoration Program Twin Cities Army Ammunition Plant Fiscal Year 1994 Annual Monitoring Report/Fiscal Year 1996 Annual Monitoring Plan	TCAAP	Tom Barounis, EPA, Dagmar Romano, MPCA, cc: Pete Rissell/AEC, Dave	10062

Date	Title	Author	Recipient	Ref #
6/27/95	OU-1 Modifications	Barr Engineering Company	Mark Ryan, CEMRO-ED-EC cf: Marty McCleery, SIOTC-EV	10063
6/27/95	FY94 Annual Monitoring Report/FY96 Annual Monitoring Plan	Federal Cartridge Company	Marty McCleery, SIOTC-EV	10082
6/28/95	TCAAP Water Supply Report-MN Department of Health	TCAAP	Plant Manager, Federal Cartridge Co.	10015
6/28/95	Technical Review Committee (TRC) Meeting	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10016
6/28/95	TCAAP Environmental Update	TCAAP	Dagmar Romano, MPCA	10020
6/28/95	TCAAP Environmental Update	TCAAP	Tom Barounis, EPA	10021
6/28/95	Final Phase II Investigation Work Plan, Outdoor Firing Range, TCAAP, April 1995	Federal Cartridge Company	Marty McCleery, SIOTC-EV	10074
6/29/95	TCAAP Installation Restoration Program Display	TCAAP	Metropolitan Airports Commission ATTN: Mr. Ron Tadsen 6040 - 28th Avenue	10017
6/30/95	Final Phase II Investigation Work Plan, Outdoor Firing Range	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10066
7/95	Restoration Advisory Board FACT SHEET and Community Concerns and Participation Interest Survey	U.S. Army Industrial Operations Command	Marty McCleery, SIOTC-EV	10152
7/95	Determination of Background Concentrations for Metals in Soil and Groundwater July 1995	Montgomery Watson	Marty McCleery, SIOTC-EV	10260

Date	Title	Author	Recipient	Ref #
7/95	Determination of Health-Risk Based Preliminary Remediation Goals July 1995	Montgomery Watson	Marty McCleery, SIOTC-EV Distribution	10261
7/95	Determination of Chemicals of Concern July 1995	Montgomery Watson	Marty McCleery, SIOTC-EV Distribution	10262
7/95	Contract Documents City of New Brighton Improvement Number 93-09 OU1 Modifications Containment/Production Wells Well 14 Construction	Barr Engineering Company	Marty McCleery, SIOTC-EV	10429
7/3/95	none listed (letter from Barr Engineering suggesting necessity to modify the New Brighton PGACWTF)	Corps of Engineers, Omaha District	Les Proper, City of New Brighton cc: Teresa J. Perry/Barr Engineering Marty	10143
7/3/95	none listed (funding for research on Superfund projects as in TCAAP)	City of New Brighton	Senator Paul Wellstone, St. Paul, MN, Senator Rod Grams, Anoka,	10170
7/10/95	none listed (Operable Unit 1 (OU1) Draft Final Alternative Water Supply Plan	MPCA EPA	Marty McCleery, SIOTC-EV	10091
7/11/95	Twin Cities Army Ammunition Plant (TCAAP) Site F Bus Tour	TCAAP	Larry Roth, Metropolitan Council Transit Operations	10092
7/11/95	Preliminary Draft TCAAP IRP Monitoring Well Ownership, Access, and Abandonment Plan	TCAAP	Plant Manager, Federal Cartridge Co.	10153
7/12/95	Restoration Advisory Board (RAB)	Arsenal Cleanup and Conversion Project	Lori Simmers Geckle, AEC cc: Marty McCleery/SIOTC-EV Wayne	10094
7/12/95	Explosives Testing at Site F, Twin Cities Army Ammunition Plant	TCAAP	Dan Card, MPCA	10156

Date	Title	Author	Recipient	Ref #
7/13/95	Briefing to Restoration Advisory Board (RAB) Selection Panel	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA Wayne Gilbert, Alliant Techsystems	10098
7/13/95	Restoration Advisory Board Selection Panel	TCAAP	Mayor Robert Benke/New Brighton Mayor Clarence Ranello/St. Anthony Mayor	10100
7/17/95	Letter of No Action - Extended Storage of High Explosive Ordnance Generated From Site F Closure, U.S. Army, Twin Cities Army Ammunition Plant	TCAAP	Dan Card, MPCA cc: Keith Benker/Wenck Plt Mgr/FCC Bridgette Manderfeld/FCC	10104
7/18/95	None listed (Pre-Final Design Report, Containment/Production Wells, May 1995)	Corps of Engineers, Omaha District	Les Proper, City of New Brighton cc: Marty McCleery, SIOTC-EV, CEMRO-ED-EC	10144
7/19/95	CHPPM Project	Federal Cartridge Company	Marty McCleery, SIOTC-EV, cc: Darryl Terho/Federal Cartridge, Bridgette	10110
7/19/95	none listed (discussion on TRC meeting minutes)	Corps of Engineers, Omaha District	Marty McCleery, SIOTC-EV, cc: Brenda (no last name) Mark Ryan - CofE, Omaha	10150
7/21/95	Twin Cities Army Ammunition Plant (TCAAP) UPDATE	TCAAP	Marcia A. Soper, Roy F. Weston, Inc. Lakewood, CO	10102
7/21/95	Site F Closure Boundary	TCAAP	Plant Manager, Federal Cartridge Company cc: Bridgette Manderfeld/FCC	10117
7/24/95	Twin Cities Army Ammunition Plant (TCAAP) Restoration Advisory Board	TCAAP	Dennis Probst, Mayor of Arden Hills, Robert Benke, Mayor of New Brighton,	10160

Date	Title	Author	Recipient	Ref #
7/24/95	Review of Response To Comments on the OU-2 FS, TCAAP	Montgomery Watson	Marty McCleery, SIOTC-EV	10161
7/24/95	Preliminary Assessment Report for Minnesota ARNG New Brighton Facility, Twin Cities Army Ammunition Plant, Minnesota	Environmental Resources Management	U.S. Army Environmental Center	10744
7/25/95	TCAAP Reuse Task Force	Focus newspaper	Distribution	10120
7/25/95	Four scenarios proposed for arsenal	Focus newspaper	Distribution	10121
7/25/95	FY 94 Annual Monitoring Report/FY 96 Annual Monitoring Plan Comments Resolution Meeting	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA Jay Hodges, U.S. Army Corps of	10122
7/25/95	TCAAP FY 94 AMR/FY 96 AMP	Wenck Associates	Bridgette Manderfeld, FCC-TCAAP cc: Marty McCleery/SIOTC-EV	10164
7/25/95	Response to Regulator Comments on the Operable Unit 2 Feasibility Study (OU2 FS)	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA cc: Distribution	10165
7/26/95	OU1 Performance Monitoring Plan and OU1 Alternate Water Supply Meeting to Discuss Regulator Comments	TCAAP	Dagmar Romano./MPCA, Tom Barounis/EPA, Majid Chaudhry/PRC, Mark	10127
7/26/95	OU1 Performance Monitoring Plan and OU1 Alternate Water Supply Meeting to Discuss Regulator Comments	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA Majid Chaudhry Mark Ryan,	10166
7/27/95	Tour of the PGAC	TCAAP	Plant Manager, Federal Cartridge Co.	10130

Date	Title	Author	Recipient	Ref #
7/27/95	Farmstead Well Inventory & Assessment - Final Report	TCAAP	Scott Anfinson, MN Historical Society	10131
7/27/95	Corrective Action Management Unit (CAMU) Draft Conceptual Design, March 1995, Additional Response to Agency Comments	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA Dan Card, MPCA Pete Rissell, U.S.	10132
7/27/95	Site F Ordnance and Explosive Waste Work Plan	TCAAP	Plant Manager, Federal Cartridge Co.	10167
8/95	Production Well 3, 6, 7, & 8 Abandonment	Federal Cartridge Company, STS Consultants, Ltd.`	Dagmar Romano, MPCA Tom Barounis, EPA cc: Rebecca Goetzke, HQ, IOC, ATTN:	10256
8/95	Operable Unit 1 Alternate Water Supply Plan Final	Montgomery Watson	Distribution	10433
8/95	Environmental Geophysics and Sequential Aerial Photo Study at Sunfish and Marsden Lakes, TCAAP	Argonne National Laboratory	Marty McCleery, SIOTC-EV	10711
8/1/95	PGRS Construction Documentation Report	TCAAP	Rebecca Goetzke, HQ, IOC, ATTN: AMSIO-EQ, Pete Rissell/AEC, Keith	10178
8/1/95	Installation Restoration Program Funding	TCAAP	Plant Manager, Federal Cartridge Co. cc: Darryl Terho/Federal Cartridge	10179
8/1/95	Video Presentation	TCAAP	Distribution	10180
8/2/95	TCAAP OU2 FS, Sites I and K Tables for COC Position Papers	Conestoga Rovers Associates	Tom Barounis, EPA Dagmar Romano, MPCA, cc: Dave Gosen/Alliant Techsystems,	10188

Date	Title	Author	Recipient	Ref #
8/2/95	Restoration Advisory Board (RAB) Selection Panel	TCAAP	Mayors and City Managers from Arden Hills, Mounds View, New Brighton, St.	10249
8/3/95	Site F Closure	TCAAP	Plant Manager, Federal Cartridge Co.	10190
8/3/95	Metal Leaching Numbers	MPCA	Marty McCleery, SIOTC-EV	10250
8/4/95	RAB Selection Panel Meeting - August 9, 1995	TCAAP	Members of the TCAAP RAB Selection Board	10191
8/4/95	Addendum No. 6, TCAAP Site F Closure Plan	TCAAP	Plant Manager, Federal Cartridge Co.	10251
8/6/95	Corrections to the 6/21/95 RAB Planning Meeting Minutes	Representing the Arsenal Cleanup and Conversion group	Mike Fix, SIOTC-CO	10192
8/7/95	Restoration Advisory Board (RAB)	TCAAP	TCAAP RAB Selection Panel Members, cc: Lori Geckle/AEC, ATTN: PAO	10186
8/15/95	Minutes of the RAB Selection Panel Meeting	TCAAP	RAB Selection Panel Members	10203
8/16/95	Site F Closure - Storage of High Explosive Ordnance	TCAAP	Plant Manager, Federal Cartridge Co.	10207
8/17/95	Containment/Production Wells - Well 14	Corps of Engineers, Omaha District	Marty McCleery, SIOTC-EV	10211
8/21/95	Minnesota Pollution Control Agency (MPCA) staff review of the Final Operable Unit (OU-1) Performance Monitoring Plan (PMP), Montgomery Watson, July 1995	MPCA	Marty McCleery, SIOTC-EV, cc: Tom Barounis/EPA, Jeff LeBlanc/Montgomery Watson	10214

Date	Title	Author	Recipient	Ref #
8/21/95	FY 94 Annual Monitoring Report/FY 96 Annual Monitoring Plan Comments Resolution Meeting	TCAAP	Dagmar Romano, MPCA, cc: Tom Barnouis/EPA, Jay Hodges/CofE, Omaha District,	10215
8/21/95	TCAAP FY 94 Annual Monitoring Report/FY 96 Annual Monitoring Plan	Wenck Associates	Dagmar Romano, MPCA, cc: Marty McCleery, SIOTC-EV, Bridgette	10216
8/21/95	OU1 - Performance Monitoring Plan Conference Call	Montgomery Watson	Marty McCleery, SIOTC-EV	10217
8/22/95	Interim Remedial Action Performance Evaluation: Soil Vapor Extraction System at Sites D & G, February 1995, Final Report	TCAAP	Pete Rissell, U.S. Army Environmental Center, cc: Dagmar Romano/MPCA, Tom	10219
8/24/95	Production Well 3, 6, 7 & 8 Abandonment Report, August 1995	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA cc: HQ, IOC, ATTN: AMSIO-EQ,	10255
8/25/95	Principles for Environmental Cleanup of Federal Facilities	EPA, Washington, D.C.	Federal Facilities Evironmental Restoration Dialogue Committee Members	10229
8/28/95	Amended Estimate of U.S. EPA FY96 Cost for TCAAP Oversight	TCAAP	Pete Rissell, U.S. Army Environmental Center Rebecca Goetzke, HQ, IOC,	10230
8/28/95	Restoration Advisory Board (RAB) Selection Panel Meeting	TCAAP	Mayor Dennis Probst/Arden Hills, Mayor Jerome Linke/Mounds View, Mayor	10231
8/28/95	OU2 FS - Groundwater Modeling	TCAAP	MPCA/Dagmar Romano, EPA/Tom Barnouis, PRC/Majid Chaudhry,	10232

Date	Title	Author	Recipient	Ref #
8/28/95	Correction to Addendum No. 4, Twin Cities Army Ammunition Plant Site F Closure	TCAAP	Plant Manager, Federal Cartridge Co., cc: HQ, IOC, ATTN: AMSIO-EQ, Rebecca	10233
8/28/95	Categories for the TCAAP Well Inventory	TCAAP	Dagmar Romano, MPCA Barb Gnabisik, MPCA Tom Barounis, EPA Dave Fuller,	10235
8/28/95	Soil Technologies, Inc.	TCAAP	Jeff LeBlanc, Montgomery Watson Darryl Terho, FCC	10236
8/28/95	Wells	MPCA	David Fuller, FCC, Marty McCleery/SIOTC-EV	10238
8/28/95	Historical Aerial Photography, Final Report, Twin Cities Army Ammunition Plant	TCAAP	Distribution	10257
8/28/95	Site F Deed Notice	TCAAP	Tom Jackson, HQ, IOC, ATTN: AMSIO-GC, cc: Dan Card/MPCA, HQ, IOC,	10810
8/30/95	Response to Comments of Surface Water and Sediments in the Draft Final OU2 FS, TCAAP	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10242
8/30/95	1994 Annual Monitoring Report/1996 Annual Monitoring Plan	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA, cc: Distribution	10243
8/30/95	OU1 Performance Monitoring Plan - Conference Call Meeting Minutes	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA, cc: Jay Hodges/CofE, Omaha District,	10244
8/30/95	Site F Soil Washing/Soil Leaching Technology	TCAAP	Kathy Dougherty, St. Paul Foundation, St. Paul, MN, cc: Barbara Gertsema/Federal	10245

Date	Title	Author	Recipient	Ref #
8/30/95	TCAAP Position Papers	Montgomery Watson	Marty McCleery, SIOTC-EV	10259
8/30/95	Valentine Lake Sediment Samples Review	MPCA	Barb Gnabasik, MPCA	10268
8/31/95	MPCA Soil Leaching Model Comments	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10247
8/31/95	OU2 FS	TCAAP	Pete Rissell, U.S. Army Environmental Center Jeff LeBlanc, Montgomery Watson	10248
9/95	Mailing List	TCAAP	All on the TCAAP Mailing List	10270
9/95	Compilation of Information From Previous Studies of Round Lake and Valentine Lake	TCAAP	Mark Ferrey, MPCA cc: Tom Barnouis, EPA Pete Rissell, AEC	10350
9/95	Inventory of Water-Supply Wells in the Vicinity of the Twin Cities Army Ammunition Plant	S.S. Papadopulos & Associates, Inc.	Marty McCleery, SIOTC-EV	10832
9/5/95	Consistency Test for the Fiscal Year 1994, Annual Monitoring Report/Fiscal Year 1996; Annual Monitoring Plan for the Twin Cities Army Ammunition Plant, Draft	MPCA	Marty McCleery, SIOTC-EV	10272
9/5/95	Update on RAB Selection Process	U.S. Army Industrial Operations Command	Marty McCleery, SIOTC-EV	10275
9/7/95	Sites I and K	MPCA	Marty McCleery, SIOTC-EV cc: Tom Barnouis, EPA	10279
9/11/95	A Cobalt Advisory Level and Modifications to the Ground Water Health Risk Limits (HRLs) in Table 7 of the Determination of Contaminants of Concern, July	TCAAP	Pete Rissell, U.S. Army Environmental Center Rebecca Goetzke, AMSIO-EQ	10281

Date	Title	Author	Recipient	Ref #
9/11/95	Water Tower Area Draft Sampling Plan	TCAAP	Plant Manager, Federal Cartridge Co. cc: David Knight, FCC	10346
9/11/95	Arden Manor Watermain Final Project Letter	MSA Consulting Engineers	Marty McCleery, SIOTC-EV	10654
9/12/95	Analytical Results from Sampling of Proposed Watchable Wildlife Area	TCAAP	Dagmar Romano, MPCA, cc: Tom Barnouis/EPA	10287
9/12/95	The 104th Congress and Federal Facility Environmental Activities: A Preliminary Assessment	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA Pete Rissell, U.S. Army Environmental	10290
9/12/95	Compilation of Information from Previous Studies of Round Lake and Valentine Lake	TCAAP	Dagmar Romano, MPCA cc: Tom Barnouis, EPA Pete Rissell, AEC Plt Mgr,	10349
9/13/95	September Monitoring for TCAAP OU3	Conestoga Rovers Associates	Tom Barnouis/EPA, Dagmar Romano/MPCA, cc: Dave Gosen/Alliant Techsystems,	10292
9/14/95	Restoration Advisory Board	TCAAP	Plant Manager, Federal Cartridge Co,. cc: Darryl Terho/FCC, Bridgette	10294
9/14/95	COGNIS SITE Demonstration Project at TCAAP	TCAAP	Distribution	10351
9/15/95	Containment/Production Wells - Well 14	MPCA	Teresa Perry/Barr Engineering, cc: Martin McCleery/SIOTC-EV, Mark	10300
9/20/95	Community Leaders Tour at Twin Cities Army Ammunition Plant	TCAAP	Distribution	10353

Date	Title	Author	Recipient	Ref #
9/20/95	FCC Access Agreement for Monitor Wells	Federal Cartridge Company	Marty McCleery, SIOTC-EV	10963
9/21/95	Final Performance Monitoring Plan for OU1	TCAAP	Jeff LeBlanc, Montgomery Watson	10316
9/21/95	City of New Brighton Containment/Production Wells, Well 14 Construction	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA cc: Rebecca Goetzke, HQ, IOC, ATTN:	10319
9/22/95	Wetland Field Trip to TCAAP	TCAAP	Jackie Howard, USACHPPM	10320
9/25/95	FY95 Annual Monitoring Report/FY97 Annual Monitoring Plan	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10326
9/25/95	8:00 A.M. Presentation Prior to the October TRC Meeting	TCAAP	Distribution	10327
9/25/95	Operable Unit 2 Feasibility Study	TCAAP	Pete Rissell, U.S. Army Environmental Center Dave Gosen, Alliant Techsystems	10329
9/25/95	TCAAP UPDATE- October 1995 Issue	TCAAP	Distribution	11175
9/26/95	Private Well Abandonment	MPCA	Paul Johnson, Wheelbrator Clean Water Inc. Ms. Helen Cmiel, Arden Hills, MN Ms.	10333
9/27/95	Inorganic Contaminants in Soil	MPCA	Marty McCleery, SIOTC-EV	10334
9/27/95	OU1 Performance Monitoring OU1 Alternate Water Supply Meeting	TCAAP	Mark Ryan, CEMRO-ED-EC Jeff LeBlanc, Montgomery Watson	10337

Date	Title	Author	Recipient	Ref #
9/27/95	Minutes of the Comments Resolution Meeting on OU-2 FS Position Papers, Sites I & K	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA Pete Rissell, U.S. Army Environmental	10355
9/27/95	Federal Cartridge Company Access Agreement for Monitor Wells	TCAAP	Minnesota Department of Transportion, Permits Division, ATTN: Lars	10962
9/28/95	TCAAP Tour Packet Update/Fact Sheets 1995	TCAAP	Plant Manager, Federal Cartridge Co.	10339
9/28/95	Revised Metals Background Numbers and Rationale, Operable Unit 2 (OU-2), Twin Cities Army Ammunition Plant (TCAAP)	MPCA	Marty McCleery, SIOTC-EV	10340
10/95	Twin Cities Army Ammunition Plant Operable Unit 1 Alternate Water Supply Plan Final	TCAAP	Distribution	10438
10/95	TCAAP IRP Monitoring Well Ownership, Access, and Abandonment Plan	Montgomery Watson	Federal Cartridge Company (FCC)	10540
10/95	Final Summary Report Open Detonation of Grenades from the CERCLA Site Characterization and UXO Removal Project Phase II - Site B, C, E, 129-3, Trap	Federal Cartridge Company	Mike Fix, SIOTC-CO	10542
10/95	Site A Removal Action 90 Day Operations Report TCAAP Installation Restoration Program May - October 1994	TCAAP	Distribution	10547
10/3/95	Surface Water and Sediments - Operable Unit 2 Feasibility Study (OU-2 FS)	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA cc: Dave Warburton/U.S. Fish and	10366
10/3/95	Well Search Status	MPCA	David Fuller, Federal Cartridge Company, cc:	10368

Date	Title	Author	Recipient	Ref #
			Martin McCleery, SIOTC-EV,	
10/3/95	TCAAP Site F		Dan Card, MPCA	10471
10/4/95	Inventory of Water-Supply Wells in the Vicinity of the Twin Cities Army Ammunition Plant - Responses to MPCA Comments on Phase III Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10420
10/5/95	TCAAP Reutilization Committee	U.S. House of Representatives	Marty McCleery, SIOTC-EV	10373
10/10/95	Transmittal of the Preliminary Draft Schedule of Activies Pertaining to Surface Waters and Sediments at the Twin Cities Army Ammunition Plant	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA Dave Warburton/U.S. Fish and	10376
10/10/95	Class Discussion of TCAAP Environmental Issues with Emphasis on Groundwater Pollution and Tour of New Brighton Contaminated Groundwater Recovery System	TCAAP	Professor Fahima Aziz, Hamline University, cc: Teri Perry/Barr Engineering, Les	10377
10/10/95	Approval of Proposed Site F Boundary	TCAAP	Plant Manager, Federal Cartridge Co., cc: Rebecca Goetzke, HQ, IOC, ATTN:	10378
10/10/95	Operable Unit 1 Remedial Design/Remedial Action Quality Assurance Project Plan	TCAAP	Jay Hodges, U.S. Army Corps of Engineers, Omaha Dist. Dave Gosen, Alliant	10422
10/16/95	Abandonment of Arden Manor Mobile Home Park Well #2	Federal Cartridge Company	Marty McCleery, SIOTC-EV	10387
10/16/95	Explosives Testing at Site F	TCAAP	Pete Rissell, U.S. Army Environmental Center	10388
10/17/95	Soil Leaching Model Application Criteria and Leaching Numbers for Organics	TCAAP	Pete Rissell, U.S. Army Environmental Center, cc:	10390

Date	Title	Author	Recipient	Ref #
			Rebecca Goetzke, HQ, IOC,	
10/17/95	Conveyance of Easements, Twin Cities Army Ammunition Plant, Arden Hills, MN	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA, cc: Jim Johnsen/North States Power	10392
10/17/95	Restoration Advisory Board (RAB)	TCAAP	Robert Benke, Mayor of New Brighton, cc: Linda James, HQ, IOC, ATTN:	10395
10/19/95	New Brighton - Army L^2SAGIA Meeting: November 14 and 15, 1995	Fredrikson & Byron, P.A.	Gerald Paul Kohns, Attorney, Environmental Law Division, U.S. Army Litigation Center,	10399
10/23/95	TCAAP Reutilization Committee	TCAAP	Rebecca Goetzke, HQ, IOC, ATTN: AMSIO-EQ Pete Rissell, U.S. Army	10402
10/23/95	Community Leaders Tour	TCAAP	Linda James, HQ, IOC, ATTN: AMSIO-EA Les Proper, City of New Brighton	10403
10/23/95	Consistency Test for the Contract Documents, Well 14 Construction, Containment/Production Wells, OU1 Modifications, Twin Cities Army Ammunition Plant,	TCAAP	Jay Hodges, U.S. Army Corps of Engineers, Omaha Dist. Distribution	10428
10/23/95	Consistency Test for the Final Alternate Water Supply Plan for Operable Unit 1, Twin Cities Army Ammunition Plant, August 1995	TCAAP	Jay Hodges, U.S. Army Corps of Engineers, Omaha Dist., cc: Jeff LeBlanc/Montgomery	10432
10/23/95	Draft Operable Unit 1 Off-Post Monitoring Well Conceptual Design Report	TCAAP	Jay Hodges, U.S. Army Corps of Engineers, Omaha Dist. cc: Jeff LeBlanc/Montgomery	10434

Date	Title	Author	Recipient	Ref #
10/25/95	Draft Site F Closure Certification Report (Incomplete)	TCAAP	Dan Card, MPCA, cc: Rebecca Goetzke, HQ, IOC, ATTN: AMSIO-EQ, Pete	10410
10/25/95	Valentine Lake Sediment Samples	TCAAP	Pete Rissell/AEC Dave Gosen/Alliant Techsystems, cc: Rebecca Goetzke, HQ,	10411
10/25/95	Installation Restoration Program, Twin Cities Army Ammunition Plant UPDATE	TCAAP	Distribution	10412
10/26/95	OU-2 FS	TCAAP	Jeff LeBlanc, Montgomery Watson Pete Rissell, U.S. Army Environmental Center	10414
10/27/95	TCAAP Off-Post Groundwater Recovery System	TCAAP	Distribution	10416
10/30/95	Quarterly Submittal of Twin Cities Army Ammunition Plant Administrative Record Index	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10417
10/31/95	Twin Cities Army Ammunition Plant, Operable Unit 1 Alternate Water Supply Plan, Final, October 1995	TCAAP	Distribution	10437
10/31/95	CERCLA Site Characterization and Unexploded Ordnance (UXO) Removal, Twin Cities Army Ammunition Plant	Federal Cartridge Company	Marty McCleery, SIOTC-EV	10826
11/95	Twin Cities Army Ammunition Plant: Future Land Use	MPCA EPA	Marty McCleery, SIOTC-EV Dave Gosen, Alliant Techsystems Inc.	10538
11/95	Innovative Technology Evaluation Report for the COGNIS TerraMet Lead Extraction Process - Twin Cities Army Ammunition Plant - Minnesota	EPA	TCAAP	10611

Date	Title	Author	Recipient	Ref #
11/1/95	1.Leaching Numbers for Organics 2. Exceptions to PCOCs	TCAAP	Pete Rissell, U.S. Army Environmental Center	10676
11/2/95	TCAAP Restoration Advisory Board (RAB)	TCAAP	Linda James, AMSIO-EA Karen Baker, AEC Robin Rockney, ATK	10458
11/2/95	Removal of Contaminated Soils from Zappa Property	TCAAP	Don Nelson, MPCA	10462
11/3/95	Operable Unit 2 Feasibility Study (OU-2 FS)	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10472
11/3/95	Phase I Archaeological Investigations of the Trap Shooting Area and CERCLA Site B	TCAAP	Pete Rissell, U.S. Army Environmental Center Jay Hodges, U.S. Army Corps of	10473
11/3/95	RAB Process at TCAAP	Arsenal Cleanup & Conversion Project	Marty McCleery, SIOTC-EV	10675
11/13/95	TGRS SHUTDOWN INCIDENT REPORT		Marty McCleery, SIOTC-EV	10487
11/14/95	New Brighton/Army Meeting	City of New Brighton	Marty McCleery, SIOTC-EV	10488
11/14/95	Annual Well Inventory	TCAAP	Robin Rockney, ATK, cc: Rebecca Goetzke, HQ, IOC, ATTN: AMSIO-EQ, Pete	10490
11/20/95	Public Notice Twin Cities Army Ammunition Plant Formation of Restoration Advisory Board Membership Solicitation	TCAAP	Blake Morrison/St. Paul Pioneer Press	10497
11/20/95	Clean-up Goals for Inorganic Chemicals	TCAAP	Pete Rissell, U.S. Army Environmental Center	10498

Date	Title	Author	Recipient	Ref #
11/20/95	May 4, 1995, Request to Change the Sampling Procedure for Site K Monitoring Well 01U611	TCAAP	Dave Gosen, Alliant Techsystems Inc.	10499
11/20/95	U.S. EPA Comments on the Draft Operable Unit 2 (OU2) Alternatives Tables 1, 2A-B, 3, 4A-B, 5A-G, 6A-G, 7, 8A-E, and 9	TCAAP	Dave Gosen, Alliant Techsystems Inc. Pete Rissell, U.S. Army Environmental	10500
11/20/95	Alternatives for Site Within Operable Unit 2 at the Twin Cities Army Ammunition Plant, October 4, 1995	TCAAP	Dave Gosen, Alliant Techsystems Inc. Pete Rissell, U.S. Army Environmental	10501
11/20/95	PGRS and PGAC Flow Rates	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10502
11/20/95	Site A Removal Action Operation & Maintenance Manual	TCAAP	Dagmar Romano, MPCA Jay Hodges, U.S. Army Corps of Engineers, Omaha Dist. Pete	10549
11/21/95	Production Well 3, 6, 7 and 8 Abandonment, Final Project Report	TCAAP	Robin Rockney, ATK	10507
11/21/95	OU1 Modifications: Well 14 Construction	MPCA	Marty McCleery, SIOTC-EV	10512
11/22/95	Twin Cities Army Ammunition Plant Restoration Advisory Board	TCAAP	ACCP Steering Committee Representatives	10516
11/22/95	Command Policy on Establishing Remediation Goals and Objectives at U.S. Army Industrial Operations Command (IOC) Installations	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA Pete Rissell, U.S. Army Environmental	10517
11/27/95	PGRS and PGAC Flow Rates	MPCA	Mike Fix, SIOTC-CO	10523
11/27/95	Request for Information on TCAAP Installation Restoration Program	TCAAP	Alison Han, AVEDA	10527

Date	Title	Author	Recipient	Ref #
11/28/95	Sites D & G SVE Downtime	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10528
11/29/95	PGRS and PGACWTF Flow Rates	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA Robin Rockney, ATK	10530
11/30/95	Installation 1995 Pollution Prevention Plan	TCAAP	Robin Rockney, ATK	10551
12/95	Prefinal Design Submittal OU1 Modifications Well 14 Wellhouse for City of New Brighton, Minnesota	Barr Engineering Company		10663
12/1/95	Review of OU2 FS Army-Preferred Alternatives Meeting	TCAAP	Pete Rissell, U.S. Army Environmental Center Rebecca Goetzke, AMSIO-EQ	10557
12/1/95	TCAAP RAB Meeting Minutes Nov. 95	Global Environmental Solutions	Marty McCleery, SIOTC-EV	10609
12/4/95	Sites A, D and G Monthly Operations Report for November 1995	Conestoga Rovers Associates	Marty McCleery, SIOTC-EV	10560
12/8/95	Draft Quality Assurance Project Plans (QAPPs) for Remedial Design/Remedial Action and (RD/RA) Performance Monitoring Activities for OU1 and OU3,	EPA	Marty McCleery, SIOTC-EVk, cc: Dagmar Romano/MPCA, Mark Ryan/CofE, Omaha	10906
12/11/95	Site A Incident Report	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10566
12/11/95	TRGS Shutdown Incident Report	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10568
12/12/95	Army appears to shift gears on future reuse of arsenal land	TCAAP	Distribution	10572

Date	Title	Author	Recipient	Ref #
12/12/95	Restoration Advisory Board Selection Panel	City of New Brighton	Mike Fix, SIOTC-CO	10575
12/13/95	Review of OU-2 FS Army-Preferred Alternatives Meeting	TCAAP	Distribution	10576
12/13/95	L^2SAGIA and Exhibits	Fredrikson & Byron	Gerald Kohns, HQDA, ATTN: DAJA-EL, cc: Marty McCleery/SIOTC-EV, Mark	10618
12/13/95	Technical Memorandum Summary of Human Health Risk Assessment and Determination of Health-Risk Based Preliminary Remediation Goals (PGRS) TCAAP	Montgomery Watson	Marty McCleery, SIOTC-EV	10665
12/14/95	Restoration Advisory Board (RAB)	TCAAP	RAB Members	10583
12/14/95	Site A Incident Report	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10585
12/15/95	TCAAP Restoration Advisory Board	TCAAP	RAB Members	10586
12/18/95	Ecological Assessment of Round Lake at TCAAP	TCAAP	Dave Gosen, Alliant Techsystems Inc. Robin Rockney, ATK Pete Rissell,	10594
12/19/95	Restoration Advisory Board Member Selection	MPCA	Marty McCleery, SIOTC-EV	10600
12/20/95	TRGS Shutdown Incident Report	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA	10601
12/21/95	TCAAP OU-2 Feasibility Study Scenarios and Cleanup Levels	TCAAP	Pete Rissell, U.S. Army Environmental Center Jeff LeBlanc, Montgomery Watson	10603
12/21/95	OU1 and OU3 Draft Quality Assurance Project Plans for Remedial Design/Remedial Action Monitoring Activities	MPCA	Marty McCleery, SIOTC-EV	10604

Date	Title	Author	Recipient	Ref #
12/21/95	TCAAP OU-2 Feasibility Study Meeting at Edgewood Arsenal	TCAAP	Distribution	10616
12/21/95	Site F Closure	TCAAP	Bruce W. Brott MPCA, cc: Robin Rockney/Alliant Techsystems, Jim Persoon/GES	10809
12/21/95	OU1 and OU3 Draft Quality Assurance Project Plans for Remdial Design/Remedial Action Monitoring Acitivities	MPCA	Marty McCleery, SIOTC-EV	10905
12/26/95	Water Tower Area Draft Sampling Plan - Response to MPCA Comments	TCAAP	Dagmar Romano, MPCA	10606
12/26/95	Minnesota Unique Well Number Format	TCAAP	Robin Rockney, ATK Jim Persoon, GES Dave Gosen, Alliant Techsystems Inc. Pete	10607
12/26/95	Newspaper Article - St. Anthony Water Supply	TCAAP	Pete Rissell, U.S. Army Environmental Center Rebecca Goetzke, AMSIO-EQ	10608
12/26/95	TCAAP Data Validation for 1995 Data Set	TCAAP	Pete Rissell, U.S. Army Environmental Center	10617
12/26/95	TCAAP: Future Land Use Scenario	MPCA EPA	Marty McCleery, SIOTC-EV	10909
1/96	Construction Documentation Report PGAC Raw and Waste Water Pipelines	Barr Engineering Company	Marty McCleery, SIOTC-EV	10660
1/2/96	OU1 Alternate Water Supply	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA Dave Gosen, Alliant Techsystems Inc. Les	10621

Date	Title	Author	Recipient	Ref #
1/4/96	Need for a Ground Water Cleanup for the North Side of Building 103, Site K, Twin Cities Army Ammunition Plant	MPCA EPA	Marty McCleery, SIOTC-EV Dave Gosen, Alliant Techsystems Inc.	10624
1/4/96	Need for a Ground Water Cleanup for the North Side of Building 103, Site K, Twin Cities Army Ammunition Plant	MPCA EPA	Dave Gosen, Alliant Techsystems Inc. Marty McCleery, SIOTC-EV	10836
1/5/96	Background Values for Metals in Soils and Groundwater within Operable Unit 2 (OU-2)	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10626
1/5/96	Site F Deed Notice	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA Pete Rissell, U.S. Army Environmental	10627
1/8/96	Analytical Results Sampling of Watchable Wildlife Area	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10630
1/8/96	TRGS Shutdown Incident Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10635
1/8/96	Site A Downtime	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10636
1/10/96	TCAAP Restoration Advisory Board (RAB)	TCAAP	David Tidball	10637
1/10/96	FY 1994 Annual Monitoring Report / FY 1996 Annual Monitoring Plan	TCAAP	Distribution	10639
1/11/96	Twin Cities Army Ammunition Plant (TCAAP) PGRS Environmental Display	TCAAP	Steven Sarkozy, City of Roseville	10644
1/12/96	TCAAP Restoration Advisory Board (RAB)	TCAAP	RAB Members	10657

Date	Title	Author	Recipient	Ref #
1/16/96	Quarterly Submittal of Twin Cities Army Ammunition Plant Administrative Record Index	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10647
1/16/96	Alliant Monthly Sampling Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10648
1/22/96	OU-1 Modifications, Containment/Production Wells, Well 14 Wellhouse Construction, Prefinal Design Submittal	EPA	Marty McCleery, SIOTC-EV	10689
1/22/96	First Revision Quality Assurance Project Plan (QAPP) and Draft QAPPs from Three Different Laboratory Contractors for the Remedial Design/Remedial Action	EPA	Marty McCleery, SIOTC-EV, cc: Dagmar Romano/MPCA, Mark Ryan/CofE, Omaha	10904
1/25/96	TCAAP Restoration Advisory Board Meeting	TCAAP		10695
1/26/96	Prefinal Design Submittal, OU1 Modifications, Well 14	Corps of Engineers, Omaha District	Les Proper, City of New Brighton	10706
1/26/96	EPA Proposes Regulations Under RCRA for Military Munitions	TCAAP	Distribution	10696
1/26/96	Prefinal Design Submittal OU1 Modification, Well 14 Wellhouse for City of New Brighton, Minnesota, December 1995	MPCA	Marty McCleery, SIOTC-EV	10698
1/27/96	TCAAP RAB Operating Policy Development Committee	RAB	TCAAP RAB Members	10707
1/29/96	Twin Cities Army Ammunition Plant - Closure of Site F	TCAAP	Bruce Brott, MPCA Dan Card, MPCA Beth Gawrys, MPCA Jim Persoon, GES Jean	10700
1/31/96	Ou-1 Modifications, Containment/Production Wells, Well 14 Wellhouse Construction, Prefinal Design	EPA	Marty McCleery, SIOTC-EV	10703

Date	Title Submittal	Author	Recipient	Ref #
1/31/96	Operable Unit 2 (OU-2) Feasibility Study (FS) Alternatives Review	EPA	Marty McCleery, SIOTC-EV	10709
1/31/96	First Revision Quality Assurance Project Plan (QAPP) and Draft QAPPs from Three Laboratory Contractors for Remedial Design/Remedial Action Performance	MPCA	Marty McCleery, SIOTC-EV, cc: Mark Ryan/CofE, Omaha District, Tom Barounis/EPA	10903
2/96	City of New Brighton, Improvement Number 93-09 OU1 Modifications Well 14 Wellhouse	Barr Engineering Company	Marty McCleery, SIOTC-EV	10829
2/2/96	Review of OU2 FS Army-Preferred Alternatives, December 6, 1995	MPCA	Marty McCleery, SIOTC-EV Dave Gosen, Alliant Techsystems Inc.	10715
2/6/96	Operable Unit 2 Feasibility Study	TCAAP	Pete Rissell, U.S. Army Environmental Center Jay Hodges, U.S. Army Corps of	10718
2/6/96	TCAAP, PGRS Environmental Display	TCAAP	Northtown Mall, Ms. Connie Connor	10719
2/6/96	RD Work Plan for Sites D & G	TCAAP	Distribution	10771
2/8/96	TGRS Shutdown Incident Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10721
2/9/96	Town Hall Meeting - February 24, 1996	Congress of U.S. - House of Representatives, 4th District	Marty McCleery, SIOTC-EV	10722
2/9/96	Twin Cities Army Ammunition Plant (TCAAP) Environmental Update	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10741

Date	Title	Author	Recipient	Ref #
2/9/96	Notice of Violation - Emergency Notification of the ERC under SARA Title III	TCAAP	Paul Aasen, MN Emergency Response Commission	10742
2/12/96	Monthly Sampling Report - Site A, Sites D and G, Surface Water	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10728
2/12/96	Restoration Advisory Board (RAB) Meeting Minutes	TCAAP	LeEtta Flicker	10746
2/12/96	Quarterly Report and Expense Statement for Second Quarter, First year of Defense & State Memorandum of Agreement, State of Minnesota Account MN 95-1	TCAAP	Gary Eddy, MPCA	10750
2/12/96	Sites D & G - Remedial Design/Remedial Action Work Plan Preparation	MPCA EPA	Marty McCleery, SIOTC-EV, cc: Jay Hodges/CofE, Omaha District, Erv Barrett,	10786
2/12/96	New Brighton PGACWTF	Corps of Engineers, Omaha District	Les Proper, City of New Brighton, cc: Tery Perry/Barr Engineering,	10787
2/13/96	RAB minutes comments	EPA	Marty McCleery, SIOTC-EV	10729
2/13/96	Twin Cities Army Ammunition Plant in Ramsey County, MN	TCAAP	Stephen Froehle, 1805 Lois Drive, Shoreview, MN 55126	10752
2/13/96	Clean Air Act Title V Operation Permit	TCAAP	MPCA	10753
2/14/96	Annual Hazardous Chemical Inventory Reporting for Chemical Storage During 1995	TCAAP	City of Spring Lake Park	10731
2/14/96	Annual Hazardous Chemical Inventory Reporting for Chemical Storage During 1995	TCAAP	MN Emergency Response Commission	10732

Date	Title	Author	Recipient	Ref #
2/15/96	Technical Review Committee Meeting Minutes	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10754
2/15/96	Technical Review Committee (TRC) Meeting	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10755
2/15/96	Installation Restoration Program (IRP) In-Progress Review (IPR) Meeting	TCAAP	Distribution	10756
2/15/96	First Revision Quality Assurance Project Plan (QAPP) and Draft QAPPs from Three Laboratory Contractors for Remedial Design/Remedial Action Performance	MPCA	Marty McCleery, SIOTC-EV, cc: Jay Hodges/CofE, Omaha District, Tom Barnouis/EPA	10901
2/16/96	RAB Meeting, March 4, 1996	TCAAP	Bulletin, Focus, Northeaster newspapers	10734
2/16/96	TCAAP Alternate Water Supply/OU-1 & OU-3	Corps of Engineers, Omaha District	Marty McCleery, SIOTC-EV Jim Persoon, GES	10773
2/19/96	Addendum No. 7, TCAAP Site F Closure Plan	TCAAP	Dan Card/Minnesota Pollution Control Agency, cc: Jim Persoon/GES, Keith	10805
2/20/96	Twin Cities Army Ammunition Plant (TCAAP) Site Visit	TCAAP	Bethel College	10736
2/20/96	Flow Rates/Water Treated	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: HQ, AMC, ATTN: AMCEN-A, Krishna	10766
2/27/96	Consistency Test for the Draft Operable Unit 1 Off-Post Monitoring Well Conceptual Design Report	TCAAP	Jay Hodges, U.S. Army Corps of Engineers, Omaha Dist.	10737
2/27/96	Health-Based Values	TCAAP	Distribution	10738

Date	Title	Author	Recipient	Ref #
2/28/96	Reimbursable Expenses under December 1987 Federal Facility Agreement/DSMOA Cooperative Agreement, Period July 1, 1995 to June 30, 1997	MPCA	Mike Fix, SIOTC-CO Dave Gosen, Alliant Techsystems Inc.	10779
2/29/96	Alliant Monthly Sampling Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10782
2/29/96	Addendum No. 7 and Draft Deed Notice, TCAAP Site F Closure Plan	TCAAP	Dan Card MPCA, cc: Jim Persoon/GES, Keith Benker/Wenck Associates	10808
3/1/96	Information Briefing on the Alternate Water Supply for MPCA and MDH	TCAAP	Distribution	10794
3/1/96	Twin Cities Army Ammunition Plant (TCAAP) PGRS Environmental Display	TCAAP	Har Mar Mall, cc: Robin Rockney/Alliant Techsystems, Jim Persoon/GES, Barbara	10796
3/4/96	U.S. EPA Comments on Tables Regarding the Twin Cities Army Ammunition Plant (TCAAP Operable Unit 2 Feasibility Study: 1) Unadjusted Preliminary	EPA	Marty McCleery, SIOTC-EV, cc: Dagmar Romano/MPCA, Majid Chaudhry/PRC, Jeff	10795
3/4/96	TCAAP Restoration Advisory Board Meeting Agenda	TCAAP	Restoration Advisory Board Members	10804
3/4/96	FY 95 Annual Monitoring Report/FY 97 Annual Monitoring Plan	TCAAP	Distribution	10852
3/4/96	U.S. EPA Comments on Tables Regarding the Twin Cities Army Ammunition Plant (TCAAP) Operable Unit 2 Feasibility Study: 1) Unadjusted Preliniary	EPA	Marty McCleery, SIOTC-EV, cc: Dagmar Romano/MPCA, Majid Chaudhry/PRC, Jeff	11084
3/6/96	Amended Access Agreement for Monitor Wells on MnDOT Property	Global Environmental Solutions	Marty McCleery, SIOTC-EV	10877

Date	Title	Author	Recipient	Ref #
3/7/96	Twin Cities Army Ammunition Plant (TCAAP) Environmental Update	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: Distribution	10815
3/8/96	Oversight Costs	MPCA	Marty McCleery, SIOTC-EV	10816
3/8/96	Meeting Minutes - Review of OU-2 FS Army-Preferred Alternatives	TCAAP	Distribution	10821
3/11/96	Technical Impracticability (TI) Waiver Briefing	TCAAP	Distribution	10817
3/11/96	Inventory of Water Supply Wells in the Vicinity of the Twin Cities Army Ammunition Plant, 1994 Update Report, September 1995	TCAAP	Robin Rockney, ATK cc: Distribution	10830
3/12/96	TCAAP RAB Mission Statement	TCAAP	Patrick Twiss/RAB Member	10818
3/13/96	Monthly Sampling Report, Site A, Sites D & G, Surface Water	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: Robin Rockney/Alliant Techsytems,	10833
3/13/96	TCAAP Restoration Advisory Board Meeting Minutes	TCAAP	Distribution	10834
3/13/96	Request for Change to Surface Water Sampling Schedule and Procedure for TCAAP	Conestoga Rovers Associates	Tom Barounis, EPA Dagmar Romano, MPCA, cc: Marty McCleery/SIOTC-EV, Jim	10984
3/13/96	Request for Change to FY96 TCAAP Annual Monitoring Plan	Conestoga Rovers Associates	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Marty McCleery/SIOTC-EV, Jim	10986
3/13/96	Toxicity Data Used in the Development of Preliminary Remediation Goals, Operable Unit 2 Feasibility Study, Twin Cities Army Ammunition Plant	Montgomery Watson	Tom Barounis, EPA cc: Marty McCleery, TCAAP Pete Rissell, AEC Dave Gosen,	11285

Date	Title	Author	Recipient	Ref #
3/14/96	Technical Review Committee Meeting Minutes	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Distribution	10840
3/14/96	RAB Meeting	TCAAP	Bulletin, Focus, Northeaster	10854
3/18/96	Flow Rates/Water Treated	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Distribution	10856
3/18/96	Alliant Monthly Sampling Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Robin Rockney/Alliant Techsystems,	10857
3/19/96	Request for Change to FY 96 TCAAP Annual Monitoring Plan	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Dave Gosen/Alliant Techsytems,	10985
3/20/96	Add-On-Service Charge for Wastewater Discharged	TCAAP	Metropolitan Council Environmental Services	10860
3/20/96	Release of Untreated Wastewater to the Sanitary Sewer	TCAAP	Mike Pliml, MCES Greg Berger/MPCA Dan Card/MPCA	10861
3/20/96	Hazardous Waste Generator Fee	TCAAP	Ramsey County, St. Paul, MN	10862
3/22/96	TCAAP RAB Operating Policy Development Committee Revised Suggested Operating Policy Content February 10, 1996	TCAAP	Irv Barrett/RAB	10865
3/25/96	Operable Unit 2 Feasibility Study (OU-2 FS)	TCAAP	Distribution	10867

Date	Title	Author	Recipient	Ref #
3/25/96	Technical Review Committee (TRC) Meeting	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10870
3/26/96	1995 Operational Reports, City of New Brighton PGAC Water Treatment Facility PGRS Water Treatment Facility	TCAAP	Robin Rockney, ATK	10873
3/26/96	TCAAP IRP Monitoring Well Ownership, Access, and Abandonment Plan	TCAAP	Tom Barnouis/EPA, Dagmar Romano/MPCA, Rebecca Goetzke/HQ, IOC, ATTN:	10874
3/28/96	Toxicity Data Tables Used in the Development of Preliminary Remediation Goals, Operable Unit 2 Feasibility Study	TCAAP	Distribution	10876
3/29/96	Operable Unit 1 Modifications, PGACWTF Addition, Construction Documentation Report	TCAAP	CofE, Omaha District (Jay Hodges), AEC (Pete Rissell), CHPPM (Keith Williams),	11283
4/1/96	TCAAP Future Land Use Scenario	TCAAP	Dagmar Romano, MPCA, cc: Congressman Bruce F. Vento, Senator Rod Grams, Senator	10908
4/2/96	Twin Cities Army Ammunition Plant (TCAAP) PGRS Environmental Display	TCAAP	Rosedale Center	10896
4/2/96	First Revision Quality Assurance Project Plan (QAPP) and Draft QAPPs from Three Laboratory Contractors for Remedial Design/Remedial Action Performance	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Rebecca Goetzke/HQ, IOC, ATTN:	10898
4/3/96	TCAAP Meeting/RAB	Bulletin newspaper	Marty McCleery, SIOTC-EV	10958
4/4/96	Addendum No. 7 and Draft Property Deed Notice Approval TCAAP Site F Closure Plan	MPCA	Mike Fix, SIOTC-CO	10947

Date	Title	Author	Recipient	Ref #
4/4/96	Long-Term Litigation Settlement Agreement Implementing Agreement (L2SAGIA) for the Operation and Maintenance of the New Brighton Contaminated	Corps of Engineers, Omaha District	Les Proper, City of New Brighton cc: Teri Perry/Barr Engineering, CEMRD-PM,	10956
4/4/96	Sanitary Sewer Discharge Report	Conestoga Rovers Associates	City of Shoreview, cc: Jean Brewster/GES, Brian Boevers/CRA, Marty	10970
4/4/96	Treatment System Monitoring TGRS, Site I and Site K, Groundwater Treatment System - March 1996	Conestoga Rovers Associates	Marty McCleery, SIOTC-EV, cc: Dave Gosen/Alliant Techsystems, Dave	10975
4/9/96	Site A Removal Action Flow Rates	Conestoga Rovers Associates	Jim Persoon/GES, cc: Jean Brewster/GES, Chuck Cooke/CRA	10974
4/10/96	Boiler Plate (Template) for Site F Deed Notice (Affidavit) Please incorporate with Attachment 2 of 2-29-96 Addendum #7	MPCA	Mike Fix, SIOTC-CO	10948
4/10/96	Twin Cities Army Ammunition Plant (TCAAP) Environmental Update	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Distribution	10961
4/10/96	Quarterly Submittal of Twin Cities Army Ammunition Plant Administrative Record Index	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Distribution	10980
4/11/96	FY96 Installation Restoration Program Workplan	TCAAP	Jay Hodges, U.S. Army Corps of Engineers, Omaha Dist. Jim Persoon, GES Mike Fix,	10959
4/11/96	TCAAP: PGRS Display	Rosedale Mall, Roseville, MN	Mike Fix, SIOTC-CO	10971

Date	Title	Author	Recipient	Ref #
4/12/96	Corps Awards Environrnmental Contract To Support TCAAP Cleanup	TCAAP	Media	10943
4/15/96	Flow Rates/Water Treated	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	10973
4/15/96	Agenda for Landfill Visit - TCAAP	TCAAP	Distribution	11217
4/16/96	Request for Change to FY96 TCAAP Annual Monitoring Program Request for Change to Surface Water Sampling Schedule and Procedure at TCAAP	TCAAP	Robin Rockney, ATK	10981
4/16/96	TGRS Extraction Well B7	Alliant Techsystems Inc.	Marty McCleery, SIOTC-EV	11059
4/18/96	none listed (recommend Mayor Benke for the League of Minnesota Cities C.C. Ludwig Award	TCAAP	Matt Fulton, City Manager, City of New Brighton, cc: Marty McCleery, SIOTC-EV	10965
4/18/96	Minnesota Department of Health Well Maintenance Permits	TCAAP	Minnesota Department of Health, Well Management Unit, Minneapolis, MN, cc:	10966
4/18/96	Technical Review Committee Meeting Minutes	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Distribution	10976
4/19/96	TCAAP - Document Transfer to Stone & Webster	Corps of Engineers, Omaha District	Marty McCleery, SIOTC-EV	11064
4/19/96	Long-Term Litigation Settlement Agreement Implementation Agree (L2SIGIA) for the Operation and Maintenance of the New Brighton Contamination	Corps of Engineers, Omaha District	Les Proper, Director Public Works, City of New Brighton, MN	11159

Date	Title	Author	Recipient	Ref #
4/22/96	TGRS	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	11058
4/22/96	U.S. EPA Comments on the Water Tower Area Draft Report, Twin Cities Army Ammunition Plant	EPA	Marty McCleery, SIOTC-EV	11256
4/23/96	IRDMIS NTAM Data	MPCA	Pete Rissell, U.S. Army Environmental Center cc: Marty McCleery, TCAAP,	11023
4/24/96	TCAAP Restoration Advisory Board (RAB)	TCAAP	RAB Members, cc: Distribution	11031
4/25/96	RAB Meeting Notice	TCAAP	Media	11033
4/25/96	Water Tower Area Draft Report, prepared by Federal Cartridge Company, October 1995	MPCA	Marty McCleery, SIOTC-EV, cc: Tom Barounis/EPA	11255
4/26/96	Draft Mission Statements	RAB Member	Marty McCleery, SIOTC-EV	11034
4/26/96	Installation Restoration Program (IRP) In-Process Review (IRP) Meeting	TCAAP	Distribution	11036
4/26/96	MCES Quarterly Monitoring Report	TCAAP	Metropolitan Council Environrnmental Services (MCES)	11037
4/26/96	Site A Removal Action	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	11039
4/26/96	Technical Review Committee (TRC) Meeting	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	11041

Date	Title	Author	Recipient	Ref #
4/26/96	Monthly Sampling Report - April 1996 TGRS, Site I and Site K	Conestoga Rovers Associates	Marty McCleery, SIOTC-EV	11066
4/29/96	RE: May 9 MPCA funding meeting	TCAAP	Rebecca Goetzke, AMSIO-EQ Mike Fix, SIOTC-CO	11044
4/29/96	1995 IRP Goals	TCAAP	Dagmar Romano, MPCA	11045
4/29/96	Use of TCAAP for Storage: Salt/Sand	Five Star Contracting Company	Mike Fix, SIOTC-CO	11068
4/30/96	New Brighton/Arden Hills billing	EPA	Mary Ellen Ryan, EPA cc: Kenneth Tindall	11046
4/30/96	Quarterly Report and Expense Statement for Second Quarter, First Year of Defense and State Memorandum of Agreement, State of Minnesota Account MN95-1.	MPCA	Ms. Janet Wright, U.S. Army Corps of Engineers Washington, D.C. 20314 cc:	11075
4/30/96	New Brighton/Arden Hills billing	EPA	Maryellen Ryan, EPA, cc: Kenneth Tindall	11076
5/3/96	TCAAP - Document Transfer to Stone & Webster	TCAAP	Stone & Webster Environmental Technology & Services, Denver, CO.	11063
5/3/96	Alliant Monthly Sampling Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	11065
5/3/96	Monthly Sampling Report - Site A, Sites D & G, Surface Water	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Robin Rockney/Alliant Techsystems,	11071
5/3/96	TGRS Extraction Well B7 Shutdown Request	EPA MPCA	Marty McCleery, SIOTC-EV cc: Dave Gosen/Alliant Majid	11470

Date	Title	Author	Recipient	Ref #
			Chaudhry, PRC	
5/6/96	Twin Cities Army Ammunition Plant (TCAAP) Environmental Update	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	11073
5/7/96	Consistency Test for the TCAAP IRP Monitoring Well Ownership, Access and Abandonment Plan, October 1995.	MPCA EPA	Marty McCleery, SIOTC-EV	11097
5/10/96	Consistency Test for the TCAAP IRP Monitoring Well Ownership, Access and Abandonment Plan, October 1995	TCAAP	Rebecca Goetzke, HQ, IOC, ATTN: AMSIO-EQ, Tom Jackson, HQ, IOC, ATTN:	11096
5/14/96	Capture Zone Analysis of Proposed B7 Shutdown	Conestoga Rovers Associates	Dave Gosen, Alliant Techsystems Inc.	11145
5/14/96	Annual NPDES/SDS Permit Fee Invoice	MPCA	Mike Fix, SIOTC-CO	11163
5/17/96	Capture Zone Analysis of Proposed B7 Shutdown	Alliant Techsystems Inc.	Mike Fix, SIOTC-CO	11144
5/20/96	Local Libraries	Restoration Advisory Board	Marty McCleery, SIOTC-EV, Army Co-Chair RAB Erv Barrett, Co-Chair for RAB	11233
5/21/96	Quarterly Sampling	TCAAP	Mr. and Mrs. Fred White	11105
5/21/96	TCAAP Restoration Advisory Board (RAB)	TCAAP	Distribution RAB Members	11155
5/23/96	Construction Completion Walk-Through Inspection of the Permanent Granular Activated Carbon Water Treatment Facility (PGACWTF) addition.	Corps of Engineers, Omaha District	Marty McCleery, SIOTC-EV	11221
5/23/96	Fiscal Year 1995 Annual Monitoring Report for Twin Cities Army Ammunition Plant	EPA	Marty McCleery, SIOTC-EV, cc: Dagmar Romano/MPCA,	11226

Date	Title	Author	Recipient	Ref #
			Majid Chaudhry/PRC, Jay	
5/24/96	Installation Restoration Program (IRP) In-Progress Review (IRP) Meeting	TCAAP	Distribution	11150
5/24/96	Technical Review Committee (TRC) Meeting	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	11153
5/28/96	TGRS Shutdown Incident Report	TCAAP	Dagmar Romano, MPCA, Tom Barounis, EPA, cc: Rebecca Goetzke, HQ, IOC,	11218
5/29/96	Draft Well Advisory	TCAAP	Distribution	11213
5/31/96	MPCA Meeting - June 5, 1996	Biko Associates, Inc., Minneapolis, MN	Marty McCleery, SIOTC-EV	11206
5/31/96	TGRS Shutdown Incident Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, Rebecca Goetzke, HQ, IOC, ATTN:	11207
6/4/96	Annual NPDES/SDS Permit Fee Invoice	TCAAP	Robin Rockney, ATK	11270
6/6/96	Arden Manor Trailer Park	TCAAP	Robin Rockney, ATK, cc: SIOTC-CO, SIOTC-EV	11246
6/13/96	Remediation of Contaminated Army Sites: Utility of Natural Attenuation April 1995	MPCA	Fix, Mike SIOTC-CO	11375
6/13/96	Site A Removal Action Operations and Maintenance Manual, October 1995	MPCA	Marty McCleery, SIOTC-EV, cc: Tom Barnouis, EPA	11539
6/13/96	RD/RA QAPP, Final, May 1996	MPCA	Marty McCleery, SIOTC-EV, cc: Jay Hodges, Cof E,	11665

Date	Title	Author	Recipient	Ref #
			Omaha District, Tom	
6/14/96	Retrievable Monitored Containment Structure (RMCS) -- Soil EE/CA Public Comment Period Completion	Alliant Techsystems Inc.	Dagmar Romano, MPCA Tom Barounis, EPA cc: distribution	11374
6/14/96	Consistency Test for the TCAAP Water Tower Area Report, October 1995 Prepared by Federal Cartridge Company	MPCA EPA	Marty McCleery, SIOTC-EV cc: Jim Persoon/GES	11442
6/14/96	Water Tower Area Draft Report	MPCA	Marty McCleery, SIOTC-EV cc: Jim Persoon/GES Tom Barnouis/EPA	11443
6/17/96	Conduct limited data collection of selected parameters on selected wells	MPCA	Marty McCleery, SIOTC-EV	11387
6/18/96	Fiscal Year 1995 Annual Monitoring Report for the Twin Cities Army Ammunition Plant Draft Report, April 1996	MPCA	Marty McCleery, SIOTC-EV, cc: Jay Hodges/CofE, Omaha District, Keith Benker/Wenck	12018
6/24/96	TGRS Source Control Well SC 1- Air Stripper	Alliant Techsystems Inc.	Dagmar Romano, MPCA Tom Barounis, EPA cc: Marty McCleery, SIOTC-EV Pete	11403
6/24/96	OU-2 Feasibility Study Schedule	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: Pete Rissell, AEC	11407
7/2/96	Community Relations Plan	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: Linda James, HQ, IOC, ATTN:	11440
7/2/96	Water Tower Area Report	TCAAP	Distribution cc: MPCA/Dagmar Romano Tom Barnouis/EPA Jim	11441

Date	Title	Author	Recipient	Ref #
7/2/96	Fiscal Year 1995 Annual Monitoring Report, TCAAP	MPCA	Marty McCleery, SIOTC-EV, cc: Jay Hodges, CofE, Omaha District, Keith Benker/Wenck	12011
7/9/96	TCAAP FY 95 AMR Comments Resolution on Draft Report	TCAAP	Tom Barounis/ EPA, Keith Benker/Wenck Associates, Brian Boevers/CRA, Edward	12007
7/11/96	RAB Questions	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA Dave Gosen, Alliant Techsystems Inc.	11578
7/12/96	TGRS Extraction Well B 7 Shutdown Request	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: Rebecca Goetzke, HQ, IOC, ATTN:	11467
7/12/96	Hazardous Waste Indentification Rule (HWIR), "Brighton Line" Numbers for Soils	EPA	Marty McCleery, SIOTC-EV cc: Dagmar Romano, MPCA	11482
7/12/96	Hazardous Waste Identification Rule (HWIR), "Brighton Line" Numbers for Soils	EPA	Marty McCleery, SIOTC-EV	11483
7/16/96	TCAAP Landfill Site Visit - April 15, 1996	MPCA	Marty McCleery, SIOTC-EV, Tom Barnouis/EPA	11877
7/16/96	March 8, 1996, Meeting Minutes for the OU2 Feasibility Study Army-Preferred Alternatives	MPCA	Marty McCleery, SIOTC-EV, cc: Tom Barnouis/EPA	11880
7/17/96	TCAAP FY95 AMR Comment Resolution on Draft Report	TCAAP	Conference Call Roster: Barb Gnabasik, Luke Charpentier, Erick Porcher, and Mark	12008
7/19/96	FY 95 Annual Monitoring Report/FY 97 Annual Monitoring Plan	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA, cc: Rebecca Goetzke, HQ, IOC, ATTN:	12009

Date	Title	Author	Recipient	Ref #
7/22/96	Abandonment of Wells 117A and 117B and Designation of the Building 116 Potable Water as the TCAAP CERCLA Clean Water Source	TCAAP	Dagmar Romano, MPCA cc: Marty McCleery, SIOTC-EV, Scott Lantz, SIOTC-EN	11566
7/22/96	Responses to Questions Presented by the TCAAP Restoration Advisory Board Presented at the Meetings of July 8, 1996	EPA MPCA	Erv Barrett, CO-Chair Restoration Advisory Board Marty McCleery, SIOTC-EV	11577
7/23/96	Comments on the Operable Unit 1 and Operable Unit 3, TCAAP QAPP	Montgomery Watson	Dagmar Romano, MPCA cc: Marty McCleery, SIOTC-EV, Jay Hodges, CofE, Omaha	11541
7/23/96	Aquatic Ecological Risk Assessment Schedule	TCAAP	United States Department of the Interior, Fish and Wildlife Service, Minnesota Valley	11543
7/26/96	Draft, Tier I Screening Risk Assessment of Aquatic Ecosystems, No. 39-26-1396-96, Twin Cities Army Ammunition Plant, New Brighton, Minnesota October	TCAAP	Dagmar Romano, MPCA, Tom Barounis, EPA, Tom Balcom, MN Dept. of Natural	11719
7/31/96	Aquatic Ecological Risk Assessment Report	MPCA	Marty McCleery, SIOTC-EV cc: Tom Barnouis/EPA	11428
7/31/96	none listed (Natural Attenuation Symposium Dallas, TX, September 11-13, 1996)	MPCA	Marty McCleery, SIOTC-EV cc: EPA (Tom Barounis)	12522
8/1/96	Community Relations Plan	MPCA	Kristi Maitland, GES	11615
8/8/96	Army Policy for Approving Decision Documents	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	11628
8/9/96	U.S. EPA Review of the Operable Unit 2 Feasibility Study Report, July 1996	EPA	cc: Dagmar Romano/MPCA Majid Chaudhry/PRC Environmental	12265

Date	Title	Author	Recipient	Ref #
8/12/96	Federal Register Publication of Restoration Advisory Board Proposed Rule and Department of Defense Request for Comments	Office of the Under Secretary of Defense, Washington, D.C.	Army Distribution	11934
8/15/96	none listed (Status of Round Lake in relations to proposed expansion of Highway 96)	MPCA	Jim Tolaas, Project Manager, Ramsey County Public Works, Shoreview, MN cc: Marty	11711
8/15/96	June 1996 Sampling Data	MPCA	Marty McCleery, SIOTC-EV, cc: Dave Gosen/Alliant, Tom Barnouis/EPA	11840
8/15/96	TCAAP Fiscal Year 1996 Third Quarter (Q51) Monitoring Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	11841
8/19/96	none listed (Region V Tier 2 facilitated partnering team)	MPCA EPA	Rebecca Goetzke, AMSIO-EQ cc: Hugh McAlear, US AEC, Chicago, IL., Tom Barnouis,	11705
8/20/96	Operable Unit 2 Feasibility Study	TCAAP	cc: Montgomery Watson (Jeff LeBlanc) HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12263
8/21/96	Minnesota Federal Facility Sites funding meeting	MPCA	Marty McCleery, SIOTC-EV	11679
8/23/96	Cleanup goals at TCAAP	EPA	David Tidball, Member of TCAAP Restoration Advisory Board, Roseville, MN cc: Erv	11649
8/28/96	Operable Unit 2 Feasibility Study, July 1996	MPCA	cc: Tom Barounis/EPA	12267
8/29/96	Outdoor Firing Range, Phase II - Investigation Report, June 1996	MPCA	Marty McCleery, SIOTC-EV cc: EPA (Tom Barounis)	12639

Date	Title	Author	Recipient	Ref #
9/1/96	Draft Work Plan, Draft Sampling and Analysis Plan, Draft Site Safety and Health Plan, Sites D & G Pilot Study, Twin Cities Army Ammunition Plant	Stone & Webster Environmental Technology & Services	cc: EPA/Tom Barounis MPCA/Dagmar Romano HQ, IOC, ATTN: AMSIO-EQ	12210
9/3/96	Open Detonation of Grenades from CERCLA Characterization and UXO Removal Project - Sites B, C, E, 129-3, Final Summary Report, October 1995	TCAAP	Dagmar Romano, MPCA cc: Tom Barnouis, EPA, Jim Persoon/GES	11644
9/5/96	none listed (Tier I Screening Risk Assessment of Aquatic Ecosystems, No. 39-26-1396-96)	U. S. Department of Interior, Fish & Wildlife Service, Minnesota	Marty McCleery, SIOTC-EV cc: Dave Warburton/USFWS/TCFO,	11718
9/9/96	U.S. EPA Review of the Twin Cities Army Ammunition Plant Operable Unit 2 Feasibility Study (OU-2 FS)	EPA	Marty McCleery, SIOTC-EV	12268
9/10/96	Tier 1 Screening Risk Assessment of Aquatic Ecosystems, Draft Report	MPCA	Marty McCleery, SIOTC-EV cc: Tom Barnouis, EPA	11717
9/16/96	Abandonment of TCAAP Wells 117A & 117B and CERCLA Clean Water Source	TCAAP	Dagmar Romano, MPCA	11867
9/17/96	U.S. EPA Comments on the Draft Tier I Screening Risk Assessment of Aquatic Ecosystems, Twin Cities Army Ammunition Plant, New Brighton, Minnesota, October	EPA	Marty McCleery, SIOTC-EV, cc: Dagmar Romano, MPCA, Majid Chaudhry, PRC, Ken	11715
9/18/96	Community Leaders Tour/Meeting at Twin Cities Army Ammunition Plant (TCAAP)	TCAAP	Tom Barounis, EPA	11750
9/24/96	TCAAP Schedule	MPCA, EPA	Marty McCleery, SIOTC-EV	11826
9/25/96	RE: Army letter to MPCA dated September 16, 1996 MPCA letter to Army dated August 28, 1996 Army letter to MPCA dated July 22, 1996	MPCA	Fix, Mike SIOTC-CO, cc: Martin McCleery, SIOTC-EV, Tom Barnouis, EPA	11866

Date	Title	Author	Recipient	Ref #
9/25/96	U.S. EPA Review Comments on the Twin Cities Army Ammunition Plant Operable Unit 2 Feasibility Study (OU-2 FS), Final Report, July 1996	EPA	Marty McCleery, SIOTC-EV cc: Dargmar Romano/MPCA Majid Chaudhry/PRC Ken	12269
9/27/96	Twin Cities Army Ammunition Plant Operable Unit 2 Feasibility Study Prepared by Montgomery Watson and Conestoga Rovers	MPCA	cc: Erv Barrett/RAB Co-Chair Tom Barounis/EPA	12271
10/96	Consistency Test for the Fiscal Year 1995 Annual Monitoring Report/Fiscal Year 1997 Annual Monitoring Plan for the Twin Cities Army Ammunition Plant, Final	MPCA EPA	Marty McCleery, SIOTC-EV	11911
10/1/96	Consistency Test for the Fiscal Year 1995 Annual Monitoring Report/Fiscal Year 1997 Annual Monitoring Plan for the Twin Cities Army Ammunition Plant, Final	EPA MPCA	Marty McCleery, SIOTC-EV	12006
10/1/96	Well Inventory - 1996 Update	TCAAP	EPA, ATTN: Tom Barounis MPCA, ATTN: Dagmar Romano AEC (Pete Rissell)	12661
10/2/96	none listed (Ground Water Protection Council (GWPC) field trip to New Brighton Water Treatment Plant, September 25, 1996	MPCA	Marty McCleery, SIOTC-EV, cc: Barbara Gertsema/GES, Paul Jehn, Ground Water	11916
10/2/96	Correction to U.S. EPA/PRC Comments dated September 24, 1996 on the Operable Unit 2 Feasibility Study, Twin Cities Army Ammunition Plant, July 1996	EPA	cc: Dagmar Romano/MPCA Majid Chaudhry/PRC	12275
10/10/96	Quarterly Submittal of Twin Cities Army Ammunition Plant Administrative Record Index	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	11921
10/14/96	Twin Cities Army Ammunition Plant Operable Unit 2 Feasbiility Study, July 1996	Restoration Advisory Board	Marty McCleery cc: Dagmar Romano/MPCA Tom Barounis/EPA Dave	12273

Date	Title	Author	Recipient	Ref #
10/15/96	Operable Unit 2 Feasibility Study, July 1996: Appendix C - Assessment of Applicable or Relevant and Appropriate Requirements and To-Be-Considered	MPCA	cc: Erv Barrett/CO-Chair Restoration Advisory Board Tom Barounis/EPA	12274
10/17/96	U.S. EPA Comments on the Draft Phase III Investigation Workplan, Outdoor Firing Range for Twin Cities Army Ammunition Plant, September 1996	EPA	Marty McCleery, SIOTC-EV cc: Dagmar Romano/MPCA, Dave Gosen/Alliant	12185
10/18/96	Ecological Risk Assessment of Aquatic Systems	TCAAP	Tom Barnouis/EPA, MPCA: Dagmar Romano, Steve Hennes, Mark Ferrey, Pete	11931
10/22/96	Well Inventory Report Meeting	TCAAP	Tom Barnouis/EPA, Dagmar Romano/MPCA, Barbara Gnabasik/MPCA, Eric	11944
10/24/96	Natural Attenuation Conference	MPCA	Marty McCleery, SIOTC-EV, cc: Tom Barnouis, EPA	11967
10/31/96	none listed (Final OU1/OU3 RD/RA QAPP	Corps of Engineers, Omaha District	Marty McCleery, SIOTC-EV	11965
10/31/96	Final Design Report OU1 Modfications, Control System Integration	TCAAP	EPA: Tom Barounis MPCA: Dagmar Romano HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12178
10/31/96	Site A Removal Action Operations and Maintenance Manual, October 1995	MPCA	Marty McCleery, SIOTC-EV, cc: Tom Barounis/EPA	12111
10/31/96	TCAAP Well Inventory - 1996 Update Prepared by Conestoga-Rovers & Associates, October 1996	MPCA	Marty McCleery, SIOTC-EV cc: EPA (Tom Barounis)	12660
11/4/96	none (natural attenuation) EPA's Beta Testing Program	MPCA	Dr. Jerry N. Jones, U.S. Environmental Protection	11998

Date	Title	Author	Recipient	Ref #
			Agency, Robert S. Kerr	
11/8/96	MPCA Staff Sampling at TCAAP	MPCA	Marty McCleery, SIOTC-EV, cc: Tom Barnouis/EPA, Jim Persoon/GES	12047
11/8/96	Comments to the Draft Work Plan, Draft Sampling and Analysis Plan, Draft Site Safety and Health Plan, Sites D & G Pilot Study, Twin Cities Army Ammunition Plant,	MPCA	cc: Tom Barounis/EPA	12204
11/12/96	MPCA Staff Sampling at TCAAP	TCAAP	Dagmar Romano, MPCA, cc: Robin Rockney/Alliant Techsystems	12056
11/12/96	TCAAP Well Inventory - 1996 Update, October 1996	EPA	Marty McCleery, SIOTC-EV, cc: Dagmar Romano/MPCA, Majid Chaudhry/PRC	12067
11/12/96	Site A Removal Action Operations and Maintenance Manual, October 1995	TCAAP	cc: Dagmar Romano/MPCA Tom Barounis/EPA Pete Rissell/AEC Jay Hodges/CofE,	12110
11/13/96	OU-2 FS	TCAAP	USAEC, ATTN: SFIM-AEC-RPO (Pete Rissell) Alliant Techsystems (Dave	13001
11/14/96	TCAAP Well Inventory - 1996 Update	EPA	Marty McCleery, SIOTC-EV, cc: Dagmar Romano/MPCA	12066
11/15/96	U.S. EPA Comments on the Draft Work Plan, Draft Sampling and Analysis Plan and Draft Site Safety and Health Plan, Sites D & G Pilot Study	EPA	Marty McCleery, SIOTC-EV cc: Dagmar Romano/MPCA Majid Chaudhry/PRC Jay	12115
11/15/96	Responses to Comments on OU-2 FS	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA Restoration	12212

Date	Title	Author	Recipient	Ref #
			Advisory Board (Erv Barrett)	
11/15/96	U.S. EPA Comments on the Draft Work Plan, Draft Sampling and Analysis Plan and Draft Site Safety and Health Plan, Sites D and G Pilot Study	EPA	cc: Dagmar Romano/MPCA, Majid Chaudhry/PRC, Jay Hodges, CofE, Omaha District	12203
11/21/96	Site D and G Pilot Study, Draft Quality Assurance Project Plan, Twin Cities Army Ammunition Plant, September 1996	MPCA	Marty McCleery, SIOTC-EV cc: CofE, Omaha District (Jay Hodges) EPA (Tom Barounis)	12233
11/25/96	Tier I Screening Risk Assessment of Aquatic Ecosystems	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA Dave Warbuton/U.S. Fish &	12164
11/25/96	Field Validation for Best Management Practices Case Study: Site F Twin Cities Army Ammunition Plant	MPCA	Mr. Subijoy Dutta, U.S. Environmental Protection Agency, Washington, D.C. cc:	12386
12/96	Federal Facilities Streamlined Oversight Directive	EPA	Director, EPA, Superfund Division, Region V	12671
12/2/96	Site A Removal Action Operation & Maintenance Manual, October 1995	TCAAP	Dagmar Romano/MPCA Tom Barounis/EPA Jay Hodges/CofE, Omaha District	12108
12/5/96	TCAAP RD/RA QAPP Addendum for Soils and Other Non-Water Media	EPA MPCA	Marty McCleery, SIOTC-EV cc: CofE, Omaha District, (Jay Hodges)	12837
12/9/96	Revised Deep Groundwater Alternate	Montgomery Watson	AEC (Pete Rissell) HQ, IOC, ATTN: AMSIO-EQ (Rebecca Goetzke) TCAAP, SIOTC-EV	12607
12/13/96	Headquarter Consultation for Dioxin Sites	EPA, Washington, D.C.	Tom Barounis, EPA	12334

Date	Title	Author	Recipient	Ref #
12/17/96	Draft Community Relations Plan	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12817
12/23/96	Ecological Risk Assessment Update - Conference Call	TCAAP	Tom Barounis/EPA Dagmar Roman/MPCA Dave Warburton/U.S. Fish &	12133
12/23/96	Draft Work Plan - Site A Investigation	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12869
12/27/96	TCAAP Site F Special Discharge Approval Extension Request	Global Environmental Solutions	Metropolitan Council Environmental Services, ATTN: Mr. Rorbert	12211
1/2/97	EPA and MPCA Revisions to the Revised Text for the Deep Groundwater (Source Containment) Alternative, Operable Unit 2 Feasibility Study	EPA MPCA	Marty McCleery, SIOTC-EV cc: CofE, Omaha District (Jay Hodges) Montgomery Watson	12603
1/3/97	Off-Post Well Inventory Report Comments Resolution Meeting	TCAAP	MPCA (Dagmar Romano) EPA (Tom Barounis) Alliant (Jim Persoon) CRA (Jason	12301
1/6/97	none listed (Draft Community Relations Plan)	EPA	Fix, Mike SIOTC-CO cc: EPA (Tom Barounis)	12815
1/8/97	TCAAP RD/RA QAPP Addendum for the Sites D and G Pilot Study	EPA	Jay Hodges, U.S. Army Corps of Engineers, Omaha Dist. cc: TCAAP, ATTN: SIOTC-EV	12953
1/10/97	Final OU-2 FS Comments Review Meeting Minutes	TCAAP	MPCA, Dagmar Romano EPA, Tom Barounis Restoration Advisory Board,	12319

Date	Title	Author	Recipient	Ref #
1/13/97	Community Relations Plan, Draft. Prepared for Twin Cities Army Ammunition Plant by Alliant Techsystems, Inc./Global Environmental Solutions, December 13, 1996	MPCA	Marty McCleery, SIOTC-EV cc: EPA (Tom Barounis) Restoration Advisory Board	12816
1/14/97	Army Science Board Review of TCAAP Soil Vapor Extraction Systems and Groundwater Pump and Treat System	TCAAP	MPCA (Eric Porcher) EPA (Tom Barounis) Restoration Advisory Board (Erv Barrett)	12327
1/14/97	Final Work Plan, Sampling and Analysis Plan, Site Safety and Health Plan, Sites D & G Pilot Study	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12396
1/15/97	Dioxin Meeting - Minutes	TCAAP	MPCA (Dagmar Romano) EPA (Tom Barounis) AEC (Pete Rissell) Montgomery	12332
1/15/97	RD/RA QAPP Addendum for Soil Sites A, D, and G	TCAAP Corps of Engineers, Omaha District	EPA (Tom Barounis) MPCA (Dagmar Romano) MPCA (Barb Gnabasik) HQ, IOC,	12951
1/17/97	Operable Unit 2 Feasibility Study (OU-2 FS) Final Report	TCAAP	MPCA (Dagmar Romano) MPCA (Barb Gnabsik) EPA (Tom Barounis) HQ, IOC,	12601
1/17/97	Operable Unit 2 Feasibility Study - Page Changes	Montgomery Watson	TCAAP, SIOTC-EV (Marty McCleery) MPCA (Dagmar Romano) MPCA (Barb	12602
1/17/97	Draft Work Plan, Draft Sampling of Analysis Plan, Draft Site Safety and Health Plan: Site A Investigation, Twin Cities Army Ammunition Plant, Arden Hills, Minnesota,	MPCA	Marty McCleery, SIOTC-EV cc: CofE, Omaha District (Jay Hodges) Restoration Advisory	12872
1/21/97	U.S. EPA Review of the Draft Work Plan, Site A Investigation, December 1996	EPA	Marty McCleery, SIOTC-EV cc: MPCA (Dagmar Romano) CofE, Omaha District (Jay	12876

Date	Title	Author	Recipient	Ref #
1/22/97	Approval of Site F Risk-Based Cleanup Level for Antimony, Copper, and Mercury, and Explosive Analysis Twin Cities Army Ammunition Plant	MPCA	Fix, Mike SIOTC-CO cc: GES (Jim Persoon)	13152
1/23/97	Suggested changes to IRP Schedule, TCAAP	Montgomery Watson	Tom Barounis/EPA Dagmar Romano/MPCA cc: Marty McCleery/SIOTC-EV AEC	12349
1/24/97	U.S. EPA Comments on; the Draft Work Plan, Draft Sampling and Analysis Plan (SAP), and Draft Site Safety and Health for the Site A Investigation, Twin Cities	EPA	Marty McCleery, SIOTC-EV CofE, Omaha District (Jay Hodges) MPCA (Dagmar	12875
1/28/97	Community Relations Plan	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: GES (Jim Persoon) GES (Kristi	12813
2/3/97	Approval of Treated and Untreated Soils Explosive Testing at Site F Twin Cities Army Ammunition Plant	MPCA	Fix, Mike SIOTC-CO	12452
2/3/97	none listed natural attenuation	U.S. Environmental Protection Agency, National Risk	Tom Barounis, EPA cc: MPCA (Dagmar Romano) TCAAP, SIOTC-EV (Marty	12467
2/4/97	January 23, 1997, Letter Regarding the Operable Unit 1 Alternate Water Supply Plan List of Wells	MPCA	Marty McCleery, SIOTC-EV cc: Tom Barounis/EPA	12491
2/5/97	Consistency Test for the Final Work Plan and Final Sampling and Analysis Plan, Sites D & G Pilot Study, January 1997	EPA MPCA	Marty McCleery, SIOTC-EV	12394
2/5/97	OU-2 FS	Montgomery Watson	Marty McCleery, SIOTC-EV Dagmar Romano, MPCA Tom Barounis, EPA	12447

Date	Title	Author	Recipient	Ref #
2/7/97	Assessment of ARARs, TBC for OU-2 at TCAAP	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	12802
2/10/97	TCAAP Fiscal Year 1997 First Quarter (Q53) Monitoring Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: Alliant Techsytems (Robin Rockney)	12510
2/14/97	Draft OU-2 Proposed Plan	Montgomery Watson	Tom Barounis, EPA Dagmar Romano, MPCA Pete Rissell, U.S. Army Environmental	12456
2/14/97	Addendum 1 Remedial Design/Remedial Action Quality Assurance Project Plan, Twin Cities Army Ammunition Plant. Prepared by	MPCA	Marty McCleery, SIOTC-EV cc: CofE, Omaha District (Jay Hodges) EPA (Tom Barounis)	12955
2/19/97	Draft Work Plan - Site A Investigation	TCAAP Corps of Engineers, Omaha District	Dagmar Romano, MPCA Tom Barounis, EPA cc: HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12878
2/19/97	Review of the Draft Addendum 1 to the Remedial Design/Remedial Action (RD/RA) Quality Assurance Project Plan (QAPP), Twin Cities Army Ammunition	EPA	Marty McCleery, SIOTC-EV cc: MPCA (Dagmar Romano) CofE, Omaha District (Jay	12956
2/20/97	Corrective Action Management Unit - Conceptual Design (Revised) Prepared by Montgomery Watson	MPCA	Marty McCleery, SIOTC-EV cc: Tom Barounis/EPA	12464
2/20/97	TCAAP	MPCA	Judy Melander, MPCA Dagmar Romano, MPCA cc: Ralph Pribble/MPCA Barb	12554
2/20/97	Site F Meeting- Status of Addendum No. 7	TCAAP	Dan Card/MPCA Beth Gawzs/MPCA Marty McCleery/TCAAP Jim	12586

Date	Title	Author	Recipient	Ref #
2/21/97	Assessment of Applicable or Relevant and Appropriate Requirements and To-Be-Considered Guidance for Operable Unit 2, TCAAP, Final Regulatory Report	MPCA	Marty McCleery, SIOTC-EV cc: Montgomery Watson (Jeff LeBlanc) Oak Ridge National	12799
2/21/97	Draft Proposed Plan for Soil and Groundwater Cleanup at Operable Unit 2 of the New Brighton/Arden Hills Superfund Site	TCAAP Montgomery Watson	EPA (Tom Barounis) MPCA (Dagmar Romano) HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12996
2/24/97	TCAAP Alternate Water Supply Plan	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: MPCA, (Barb Gnabasik) HQ, IOC,	12489
2/24/97	(none listed) Outlines QAPP responsibilities	Stone & Webster	Dagmar Romano, MPCA cc: EPA (Tom Barounis) TCAAP, SIOTC-EV (Marty McCleery)	12957
2/25/97	Minn. Rules ch. 7045 and Institutional Control Modifications, Assessment of Applicable or Relevant and Appropriate Requirements (ARARs) and	MPCA	Marty McCleery, SIOTC-EV cc: Montgomery Watson (Jeff LeBlanc) Oak Ridge National	12800
2/25/97	Community Relations Plan for TCAAP - February 1997	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: Alliant Techsystems (Kristi Maitland)	12808
2/25/97	Addendum 1 Remedial Design/Remedial Action Quality Assurance Project Plan for Sites A, D, and G	TCAAP Corps of Engineers, Omaha District	Dagmar Romano, MPCA Tom Barounis, EPA cc: CofE, Omaha District (Jay Hodges)	12958
2/26/97	Draft UPDATE - Alternate Water Supply and Well Abandonment	TCAAP	EPA (Tom Barounis) EPA (Sue Pastor) MPCA (Dagmar Romano) MPCA (Emmy	12572
2/27/97	Site F Conference Call	TCAAP	Dan Card/MPCA	12543

Date	Title	Author	Recipient	Ref #
2/27/97	Agenda for Teleconference Regarding Site F Closure Requirements MPCA/Army	TCAAP	Dan Card/MPCA Beth Gawys/MPCA Marty McCleery/TCAAP Jim	12587
2/27/97	TCAAP Conference Call with Army	MPCA	Marty McCleery, SIOTC-EV	12614
2/28/97	Operable Unit 2 Feasibility Study (OU-2 FS) Final Report - February 1997	TCAAP U.S. Army Environmental Center	Dagmar Romano, MPCA Tom Barounis, EPA cc: HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12794
3/97	Demonstration Bulletin Cognis Terramet Lead Extraction Process Twin Cities Army Ammunition Plant	EPA, National Risk Management Research Laboratory, Edison, N.J.	Marty McCleery, SIOTC-EV	12905
3/3/97	none listed (Natural Attenuation)	MPCA	Marty McCleery, SIOTC-EV	12619
3/6/97	Draft Public Meeting Notice for Operable Unit 2	TCAAP	EPA (Tom Barounis) MPCA (Dagmar Romano) HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12716
3/6/97	Addendum 1 Remedial Design/Remedial Action Quality Assurance Project Plan for Sites A, D & G - Response to Comments/Comments Resolution Meeting, March 4,	EPA MPCA	Marty McCleery, SIOTC-EV	12960
3/7/97	Administrative Record File for New Brighton/Arden Hills NPL Site Operable Unit 2 Draft Record of Decision Index, Volumes 1 and 2,	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA Dave Gosen, Alliant Techsystems Inc. cc:	12900
3/8/97	Quarterly Submittal of the Twin Cities Army Ammunition Plant Administrative Record Index	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12738
3/11/97	none listed (TCAAP Sites D & G Natural Attenuation)	MPCA	Ms. Patricia Darrah, Stone & Webster, Englewood, CO	13011

Date	Title	Author	Recipient	Ref #
3/13/97	none listed (Natural Attenuation)	MPCA	Dr. John Wilson, U.S. Environmental Protection Agency, Subsurface Processes	12631
3/13/97	Proposed Plan for Soil and Groundwater Cleanup at Operable Unit 2 of the New Brighton/Arden Hills Superfund Site	MPCA	Marty McCleery, SIOTC-EV	12856
3/13/97	U.S. EPA Comments on the Draft Proposed Plan for Soil and Groundwater Cleanup at Operable Unit 2 of the New Brighton/Arden Hills Superfund Site	EPA	Marty McCleery, SIOTC-EV cc: MPCA (Dagmar Romano) Montgomery Watson (Jeff	12857
3/18/97	none listed (Public Meeting/Comment Sought on Proposed Plan for OU-2 at TCAAP)	MPCA	Marty McCleery, SIOTC-EV cc: GES (Jim Persoon) EPA (Tom Barounis)	12667
3/19/97	Administrative Record File for the New Brighton/Arden Hills NPL Site Operable Unit 2 Draft Record of Decision Index, Volumes 1 & 2,	MPCA	Marty McCleery, SIOTC-EV cc: EPA (Tom Barounis)	12896
3/20/97	Inventory of Wells in the Vicinity of TCAAP, 1995 Update, March 1997	TCAAP	EPA (Tom Barounis) MPCA (Dagmar Romano) Minnesota Dept. of Health (Mike	12936
3/21/97	OU-02 ARARs Section of Final Report	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: Montgomery Watson (Jeff	12624
3/21/97	Request for Cost Information related to BMPs used at Site F	MPCA	Marty McCleery, SIOTC-EV	12785
3/21/97	Alternate Water Supply and Well Abandonment Program	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA	13205

Date	Title	Author	Recipient	Ref #
3/24/97	Consistency Test for the Operable Unit 2 Feasibility Study, Twin Cities Army Ammunition Plant, Final Report, March 1997	EPA MPCA	Marty McCleery, SIOTC-EV	12792
3/26/97	Comments on March 18, 1997 Phase II Operations Plan for Disposal of Site F Hazardous Soils	MPCA	Jean Brewster/Alliant Techsystems	13079
3/28/97	Alternate Water Supply and Well Abandonment Program	MPCA	Marty McCleery, SIOTC-EV	13207
3/31/97	Consistency Test for the Community Relations Plan for Twin Cities Army Ammunition Plant, Arden Hills, Minnesota. Prepared by Alliant Techsystems, Inc/Global	MPCA EPA	Marty McCleery, SIOTC-EV	12807
4/97	none listed (Response OU-2 Proposed Plan Cleanup)	Bernard Manka, Isle, MN	Tom Barounis, EPA	12974
4/3/97	Documents for the Operable Unit 2 Administrative Record	EPA	Marty McCleery, SIOTC-EV cc: MPCA (Dagmar Romano)	12897
4/4/97	Draft Workplan, Draft Sampling and Analysis Plan Draft Site Safety and Health Plan, Site A Investigation TCAAP, December 1996	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12879
4/4/97	Addendum 1 to the RD/RA Quality Assurance Plan (QAPP) TCAAP	TCAAP	HQ, IOC, ATTN: AMSIO-EQ (Rebecca Goetzke) USAEC, ATTN:	12962
4/4/97	Addendum to April 2, 1997 Memorandum	Oak Ridge National Laboratory, Oak Ridge, TN	Pete Rissell, USAEC, ATTN: SFIM-AEC-RPO cc: TCAAP, ATTN: SIOTC-EV (Marty	13159
4/7/97	Approval of Appendix C, Assessment of Applicable or Relevant and Appropriate Requirements (ARARs) To-Be-Considered (TBC) Guidance, Operable Unit 2	EPA MPCA	Marty McCleery, SIOTC-EV	12788

Date	Title	Author	Recipient	Ref #
4/8/97	TCAAP Operable Unit 2 Record of Decision - Preliminary Draft, March 1997	TCAAP	EPA (Tom Barounis) MPCA (Dagmar Romano) MPCA (Barb Gnabsik) HQ, IOC,	12907
4/8/97	U.S. EPA Review of the Final Work Plan, Final Sampling and Analysis Plan Final Site Safety and Health Plan, Site A Investigation,	EPA	Marty McCleery, SIOTC-EV cc: MPCA (Dagmar Romano) CofE, Omaha District (Jay	12963
4/9/97	Public Meeting/Comment Sought. The U.S. Environmental Protection Agency (EPA) and the Minnesota Pollution Control Agency (MPCA) seek	Bulletin Newspaper	Marty McCleery, SIOTC-EV cc: MPCA (Dagmar Romano) EPA (Tom Barounis)	12852
4/9/97	Operable Unit 2 (OU-2) Public Meeting	TCAAP	Dagmar Romano, MPCA Kathy Carlson, MPCA EPA, Tom Barounis USAEC,	13111
4/10/97	Alternate Water Supply and Well Abandonment Program	TCAAP	EPA (Tom Barounis) MPCA (Dagmar Romano) HQ, IOC, ATTN: AMSIO-IRG (Paul	13208
4/14/97	none listed (TCAAP Slide Show/Video)	MPCA	Marty McCleery, SIOTC-EV cc: EPA (Tom Barounis)	12735
4/14/97	Operable Unit 2 Feasibility Study (OU-2 FS) Final Report, March 1997	TCAAP	EPA (Tom Barounis) MPCA (Dagmar Romano) HQ, IOC, ATTN: AMSIO-EQ (Rebecca	12790
4/14/97	Addendum 1, Remedial Design/Remedial Action Quality Assurance Project Plan, April 1997 Site A Investigation: Final Work Plan, Final Sampling	MPCA	Marty McCleery, SIOTC-EV cc: EPA (Tom Barounis)	12964
4/17/97	Twin Cities Army Ammunition Plant (TCAAP) Letter Dated April 8, 1997	MPCA	David Gosen/Alliant Techsystems cc: TCAAP, SIOTC-CO (Mike Fix)	12741

Date	Title	Author	Recipient	Ref #
4/17/97	Inventory of Wells in the Vicinity of TCAAP: 1995 Update. Prepared by Conetstoga Rovers & Associates, March	MPCA	Marty McCleery, SIOTC-EV cc: Tom Barounis, EPA	13117
4/21/97	Twin Cities Army Ammunition Plant, Site F: Affidavit Concerning Real Property Contaminated With Hazardous Substances	Attorney General State of MN	Fix, Mike SIOTC-CO cc: TCAAP, SIOTC-EV (Marty McCleery) MPCA (Dan Card)	13125
4/24/97	Consistency Approval, Addendum 1, Remedial Design/Remedial Action Quality Assurance Project Plan, Twin Cities Army Ammunition Plant, April 1997	EPA MPCA	Marty McCleery, SIOTC-EV	12965
4/25/97	Final Workplan, Final Sampling and Analysis Plan, Final Site Safety and Health Plan, Site A Investigation, Twin Cities Army Ammunition Plant, April 1997	MPCA EPA	Marty McCleery, SIOTC-EV	12882
4/29/97	Addendum 8 Site F Closure Plan Approval Twin Cities Army Ammunition Plant MN7213810908	MPCA	Fix, Mike SIOTC-CO	12928
4/29/97	Incident Report and Sampling Plan for 720-Ton Pil Inadvertently Returned to Site F Twin Cities Army Ammunition Plant	MPCA	Fix, Mike SIOTC-CO	12932
4/29/97	none listed (Response to Public Comment Period for OU-2) Reponse to OU-2 Public Comment)	Carl Johnson, Shoreview, MN	Tom Barounis, EPA	12975
4/29/97	none listed (Reponse to Comments for OU-2 Public Meeting)	Lee Trotta, Mounds View, MN	Tom Barounis, EPA	12976
4/30/97	Mobile Laboratory Audit at the Twin Cities Army Ammunition Plant	MPCA	Dagmar Romano, MPCA	12993

Date	Title	Author	Recipient	Ref #
5/2/97	Approval of the Site A Investigation, Twin Cities Army Ammunition Plant, Arden Hills, Minnesota: Appendix A - Field Sampling Plan Standard Operating Procedures.	EPA MPCA	Marty McCleery, SIOTC-EV	12881
5/2/97	Request to Discontinue Storm Water Release Controls and Monitoring at the 503 Pad Closure of Site F	MPCA	Fix, Mike SIOTC-CO	12927
5/2/97	Comments on April 28, 1997, Phase II Operations Plan for Dispoal of Site F Hazardous Soils	MPCA	Jean Brewster, Global Environmental Solutions	13078
5/6/97	Proposed Cleanup Plan for Operable Unit 2 at TCAAP	City of Arden Hills, MN	Tom Barounis, EPA cc: TCAAP, SIOTC-CO (Mike Fix) Restoration Advisory	12885
5/6/97	Proposed Cleanup Plan for Operable Unit 2 at TCAAP	City of Arden Hills	Tom Barounis, EPA cc: TCAAP, SIOTC-CO (Mike Fix) Restoration Advisory	12973
5/7/97	Matrix Mobile Laboratory Audit	MPCA	Marty McCleery, SIOTC-EV cc: Matrix Laboratories (Jim Bzubay) EPA (Tom Barounis)	12991
5/16/97	TCAAP Operable Unit 2 Record of Decision - Draft May 1997	TCAAP	Dagmar Romano, MPCA Tom Barounis, EPA cc: HQ, IOC, ATTN: AMSIO-EQ (Rebecca	13029
5/22/97	none listed (revised data from natural attenuation groundwater sampling of November/December 1996)	MPCA	Marty McCleery, SIOTC-EV cc: EPA (Tom Barounis)	13096
6/3/97	none listed (MPCA requested that 110V service be available on site during the natural attenuation sampling the week of June	MPCA	Marty McCleery, SIOTC-EV cc: EPA (Tom Barounis)	13132

Date	Title	Author	Recipient	Ref #
6/4/97	RD/RA Attachment 5 FFA	TCAAP	Tom Barounis, EPA Dagmar Romano, MPCA Jay Hodges, U.S. Army Corps of	13141
6/9/97	Twin Cities Army Ammunition Plant Site F: Affidavit Concerning Real Property Contaminated With Hazardous Substances	TCAAP	Jocelyn F. Olson, Assistant Attorney General State of Minnesota cc: MPCA (Dan	13122
6/9/97	Ground Water Sampling with U.S. Environmental Protection Agency and the Minnesota Pollution Control Agency at Twin Cities Army Ammunition Plant	MPCA	Marty McCleery, SIOTC-EV Persoon, Jim GES cc: EPA (Tom Barounis)	13127
6/11/97	Draft Responsiveness Summary	TCAAP	Tom Barounis, EPA	13164
6/16/97	Twin Cities Army Ammunition Plant, Site F: Affidavit Concerning Real Property Contaminated with Hazardous Waste	State of Minnesota, Office of the Attorney General, St. Paul	Scott Lantz, Acting Commander's Representative TCAAP cc: TCAAP,	13231
6/18/97	TCAAP RD/RA QAPP, September 1996	TCAAP	EPA (Tom Barounis) MPCA (Dagmar Romano) HQ, IOC, ATTN: AMSIO-EQ (Rebecca	13251
6/26/97	Operable Unit 2 Public Meeting Minutes	TCAAP	EPA (Tom Barounis) MPCA (Dagmar Romano) HQ, IOC, ATTN: AMSIO-EQ (Rebecca	13256
undated	Operable Unit 2 Feasibility Study Response To Comments Twin Cities Army Ammunition Plant	Montgomery Watson	Distribution	10162

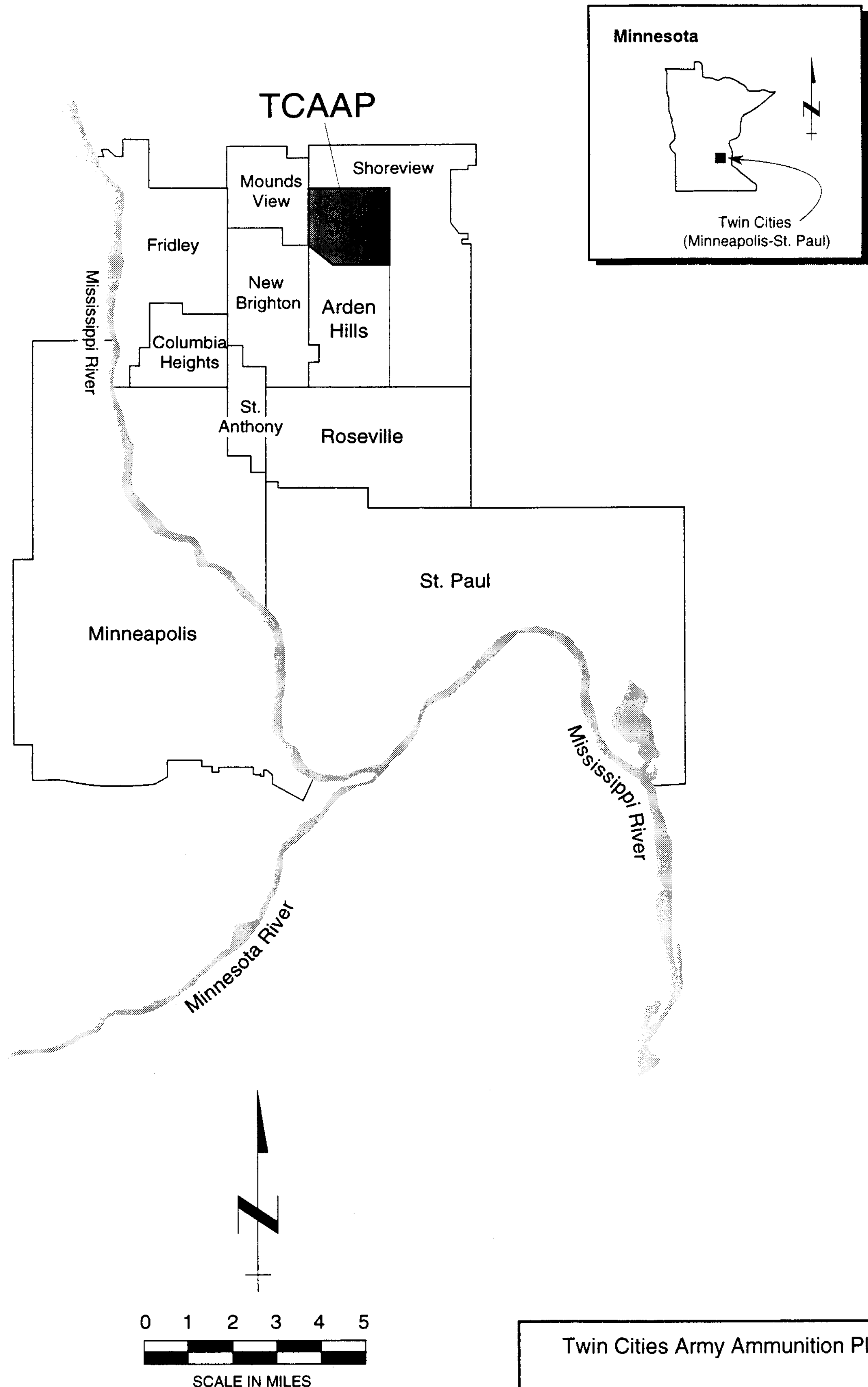
Date	Title	Author	Recipient	Ref #
UNDATED Received November 7,	Twin Cities Army Ammunition Plant: Future Land Use	MPCA EPA	Marty McCleery, SIOTC-EV Dave Gosen/Alliant Techsystems, cc: Tim	10911

Appendix A

MONTGOMERY WATSON

APPENDIX A

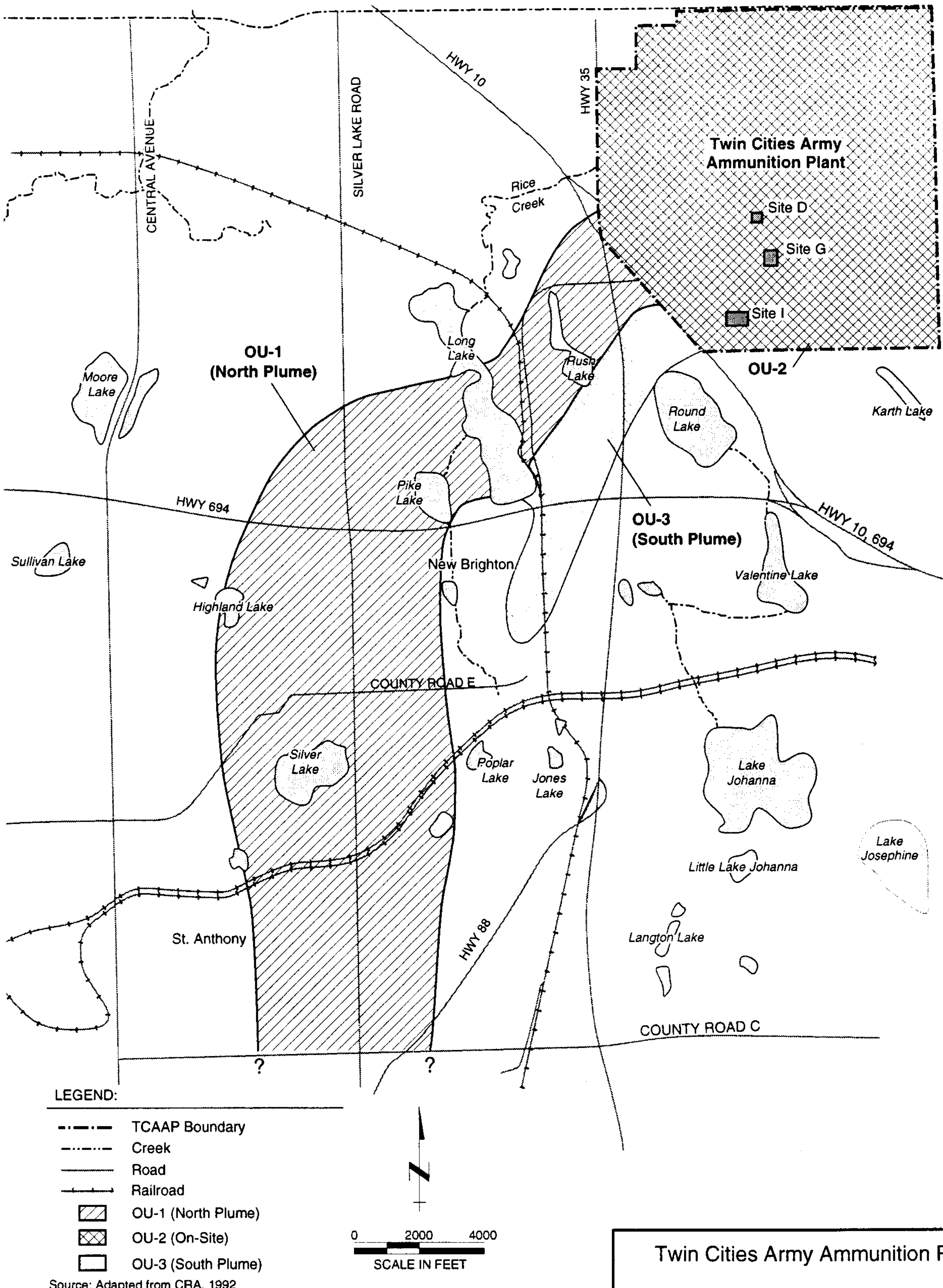
LIST OF FIGURES



Twin Cities Army Ammunition Plant

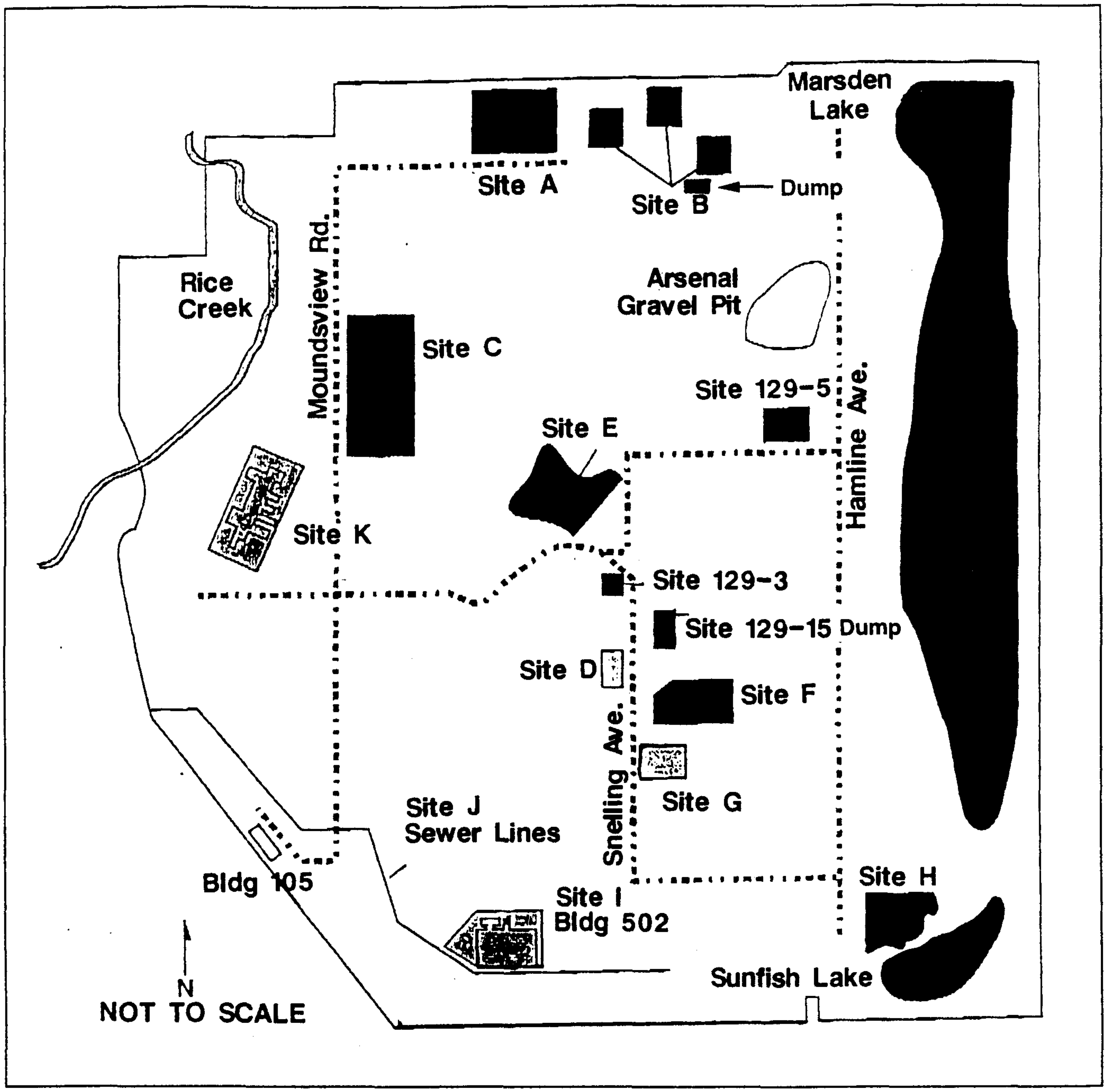
Figure 1
Location Map

Source: Modified from ANL, 1988



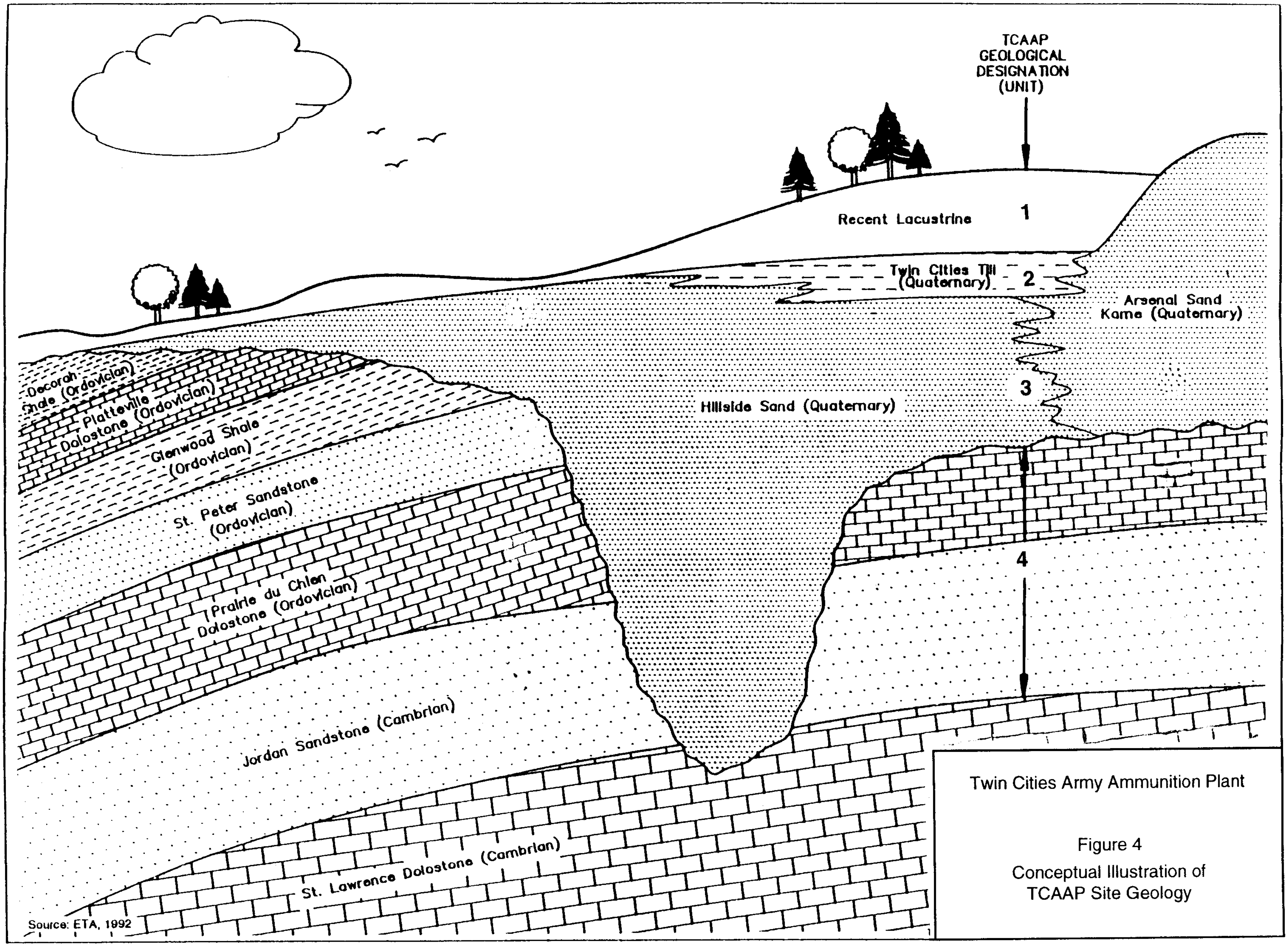
Twin Cities Army Ammunition Plant

Figure 2
Operable Units 1, 2 and 3



Twin Cities Army Ammunition Plant

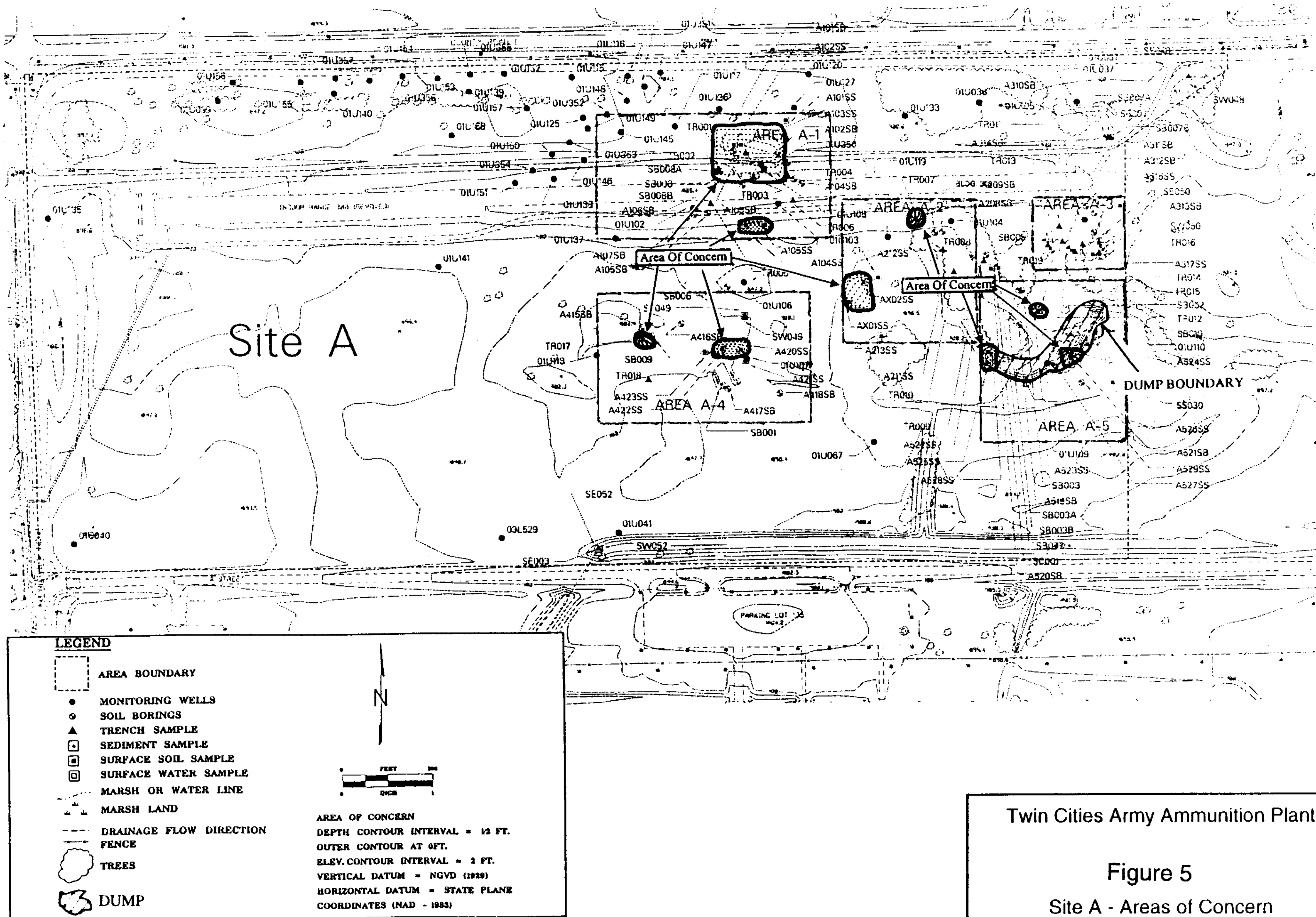
Figure 3
OU-2 Site Locations



Twin Cities Army Ammunition Plant

Figure 4

Conceptual Illustration of TCAAP Site Geology

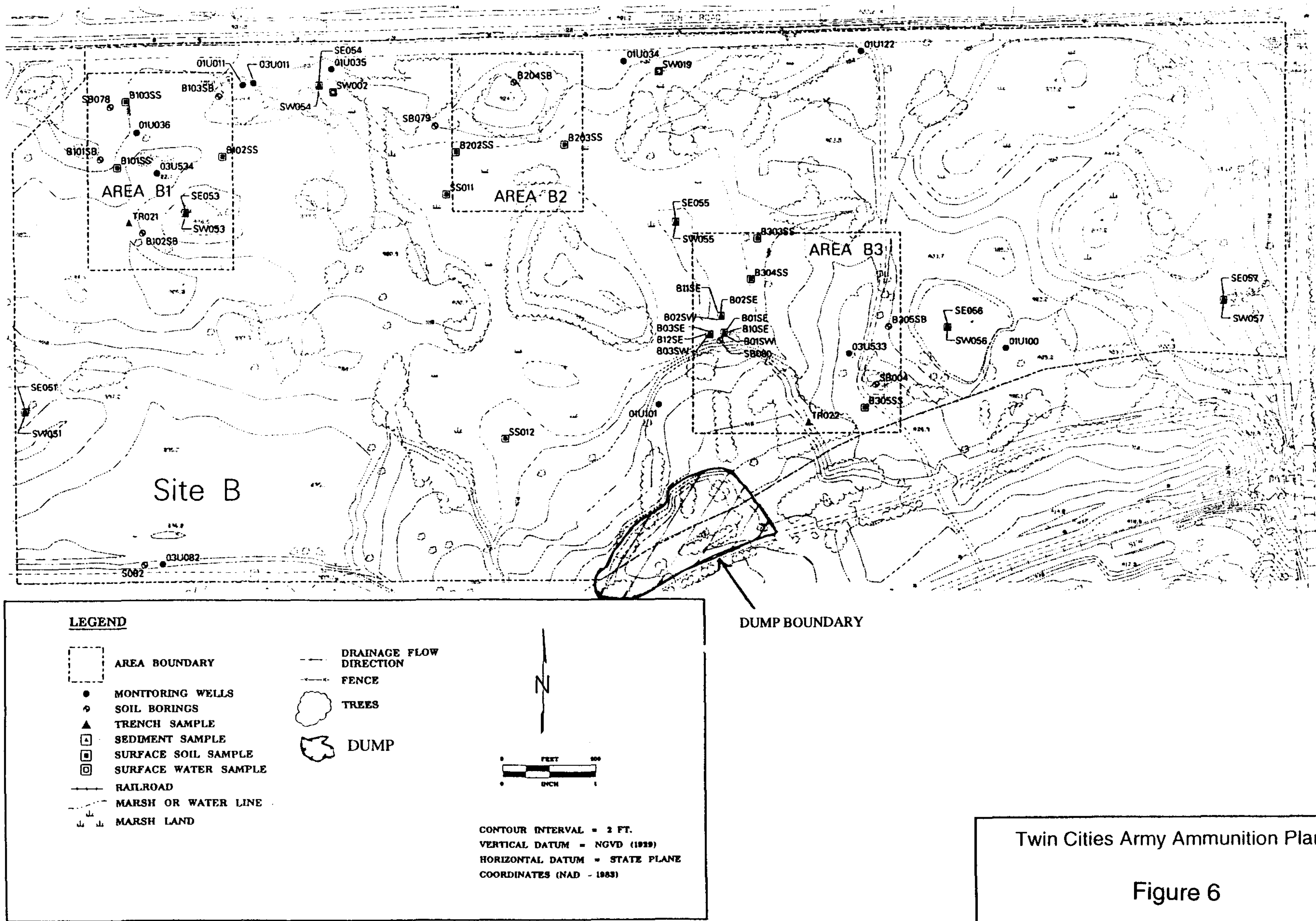


Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 5

Site A - Areas of Concern

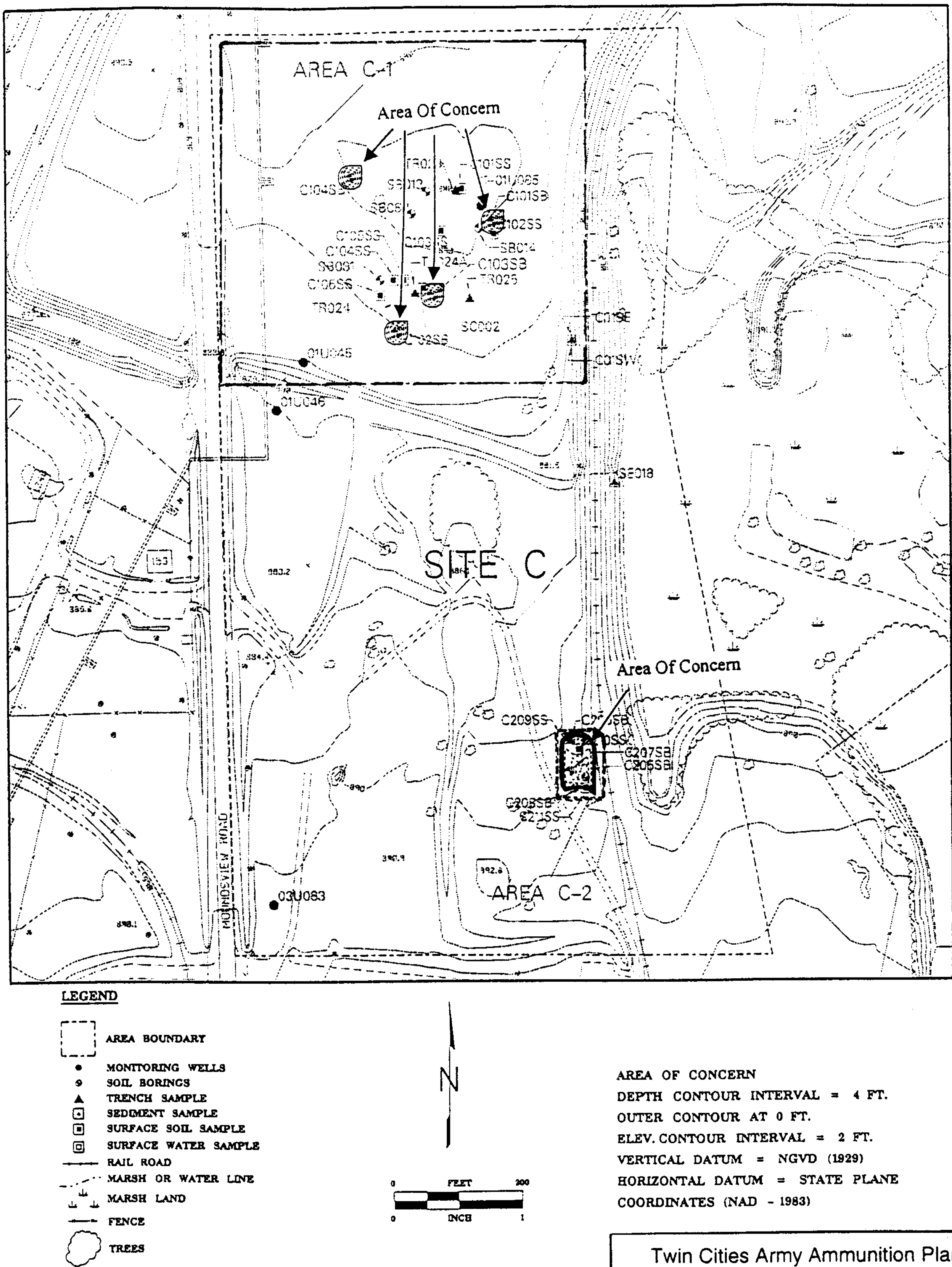


Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 6

Site B - Dump

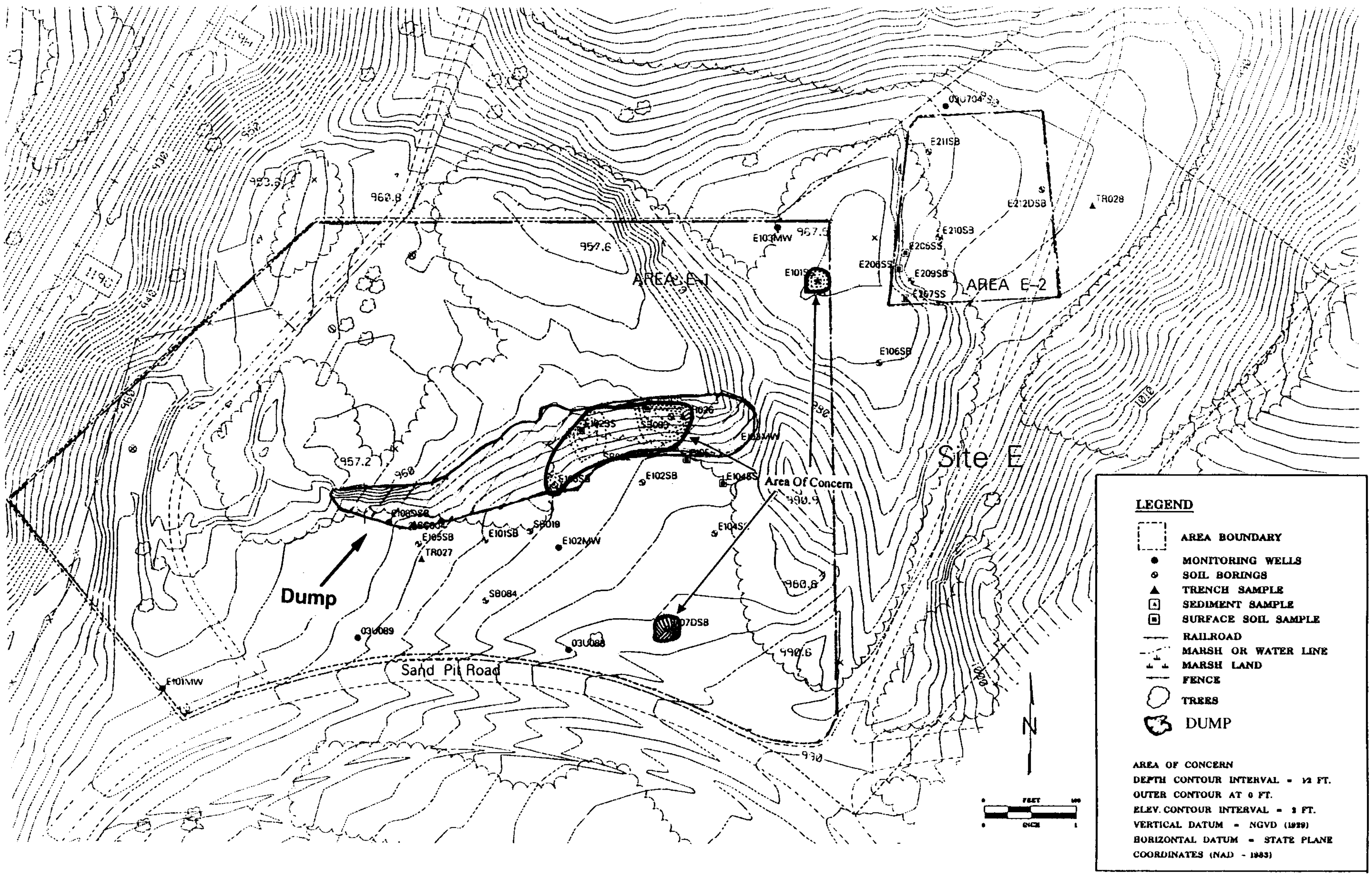


Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 7

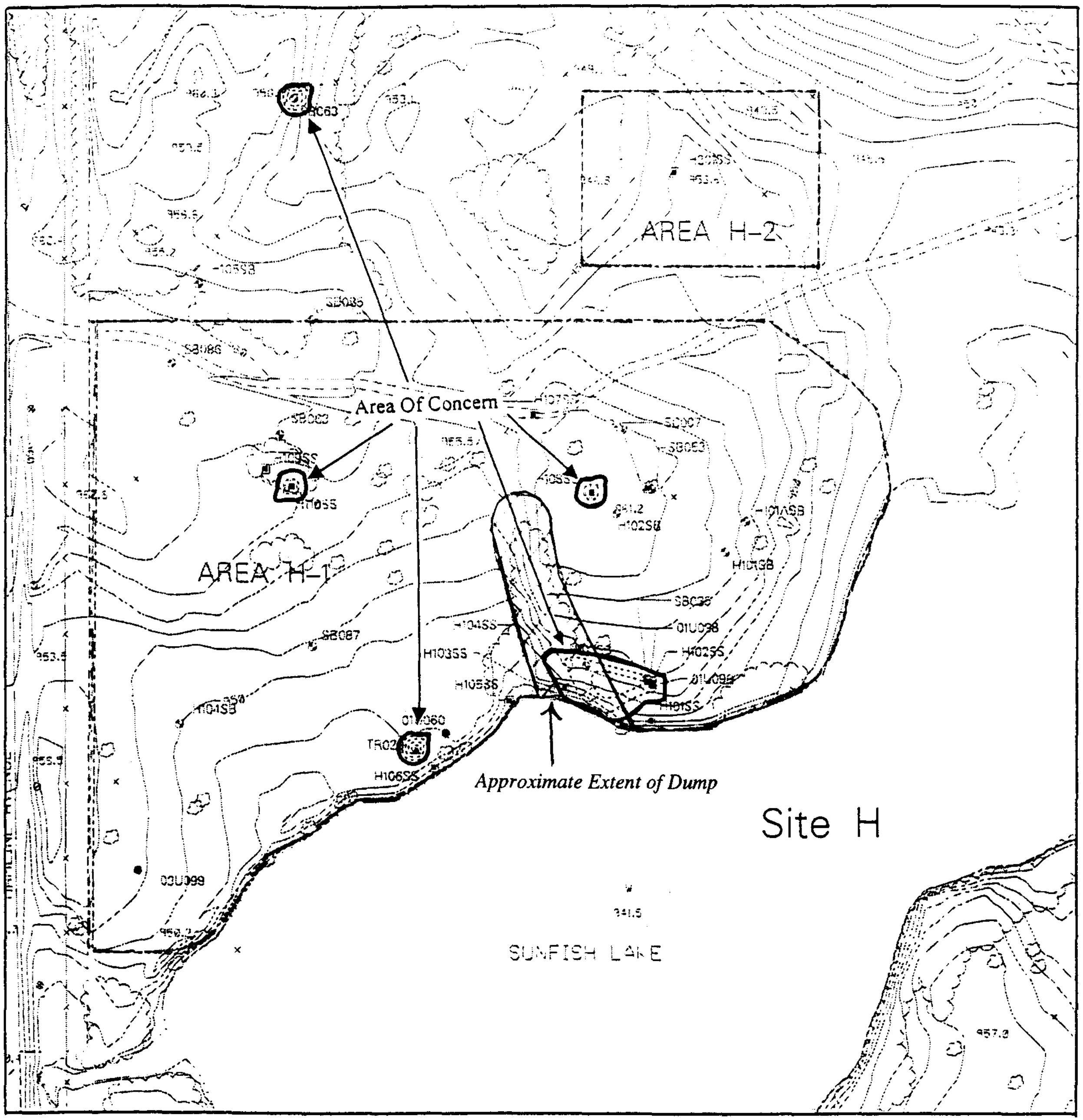
Site C- Areas of Concern



Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 8
Site E- Areas of Concern



LEGEND

- AREA BOUNDARY
- MONITORING WELLS
- SOIL BORINGS
- TRENCH SAMPLE
- SEDIMENT SAMPLE
- SURFACE SOIL SAMPLE
- SURFACE WATER SAMPLE
- MARSH LAND
- FENCE
- TREES
- DUMP BOUNDARY

N

0 FEET 180
0 INCH 1

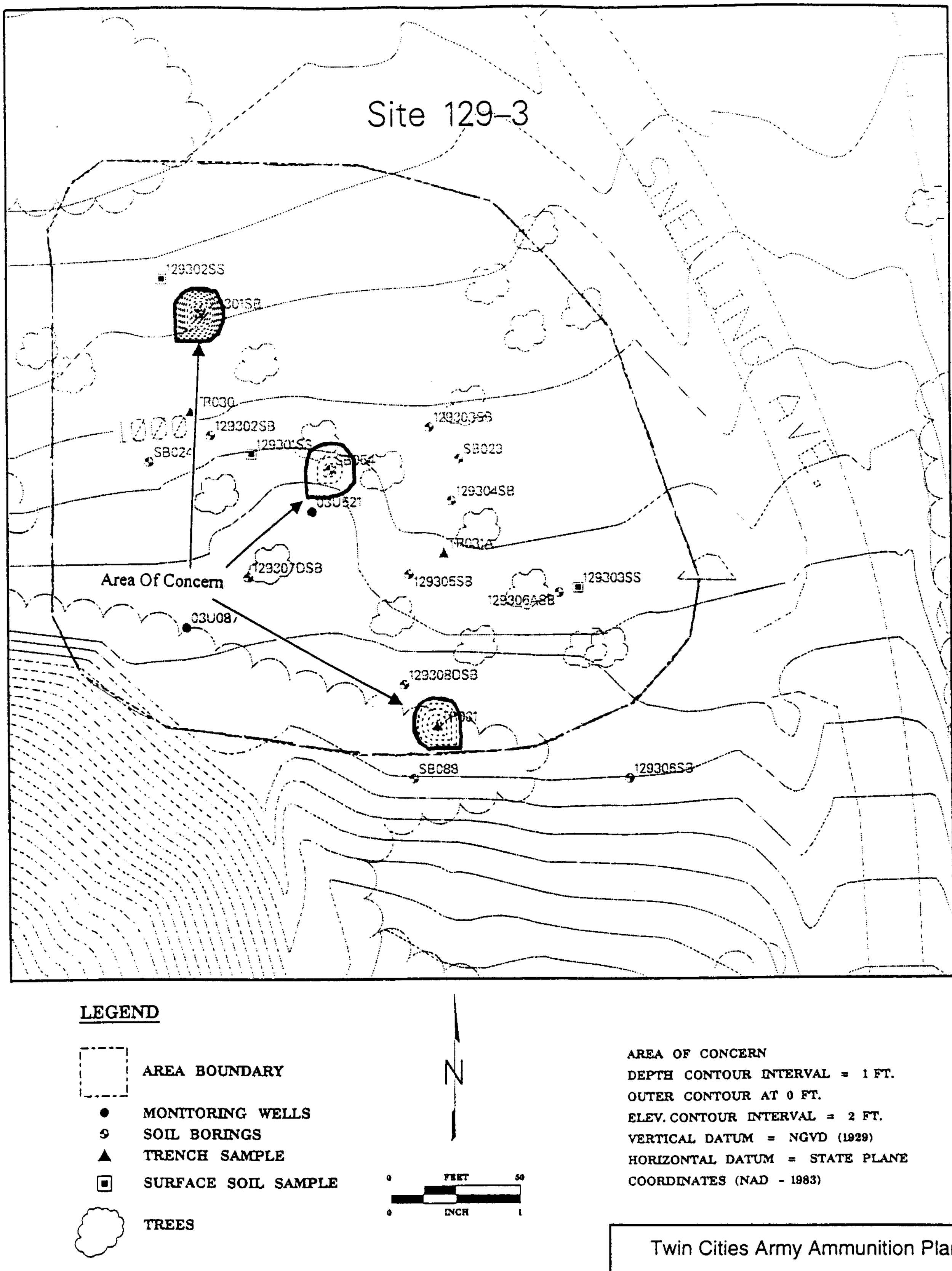
AREA OF CONCERN
DEPTH CONTOUR INTERVAL = 1 FT.
OUTER CONTOUR AT 0 FT.
ELEV. CONTOUR INTERVAL = 2 FT.
VERTICAL DATUM = NGVD (1929)
HORIZONTAL DATUM = STATE PLANE COORDINATES (NAD - 1983)

Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 9

Site H - Areas of Concern

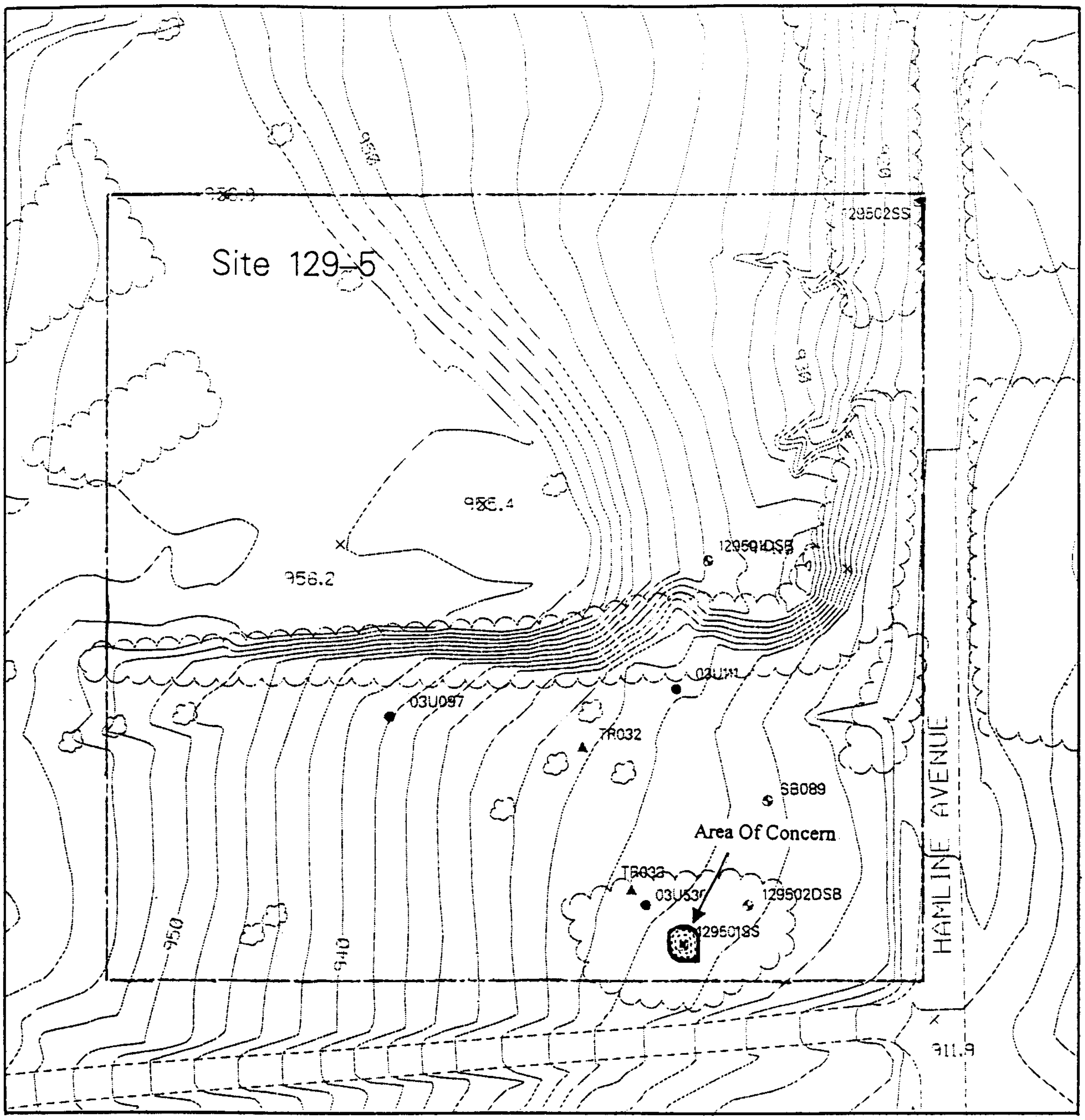


Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 10

Site 129-3 - Areas of Concern



LEGEND

- AREA BOUNDARY
- ● MONITORING WELLS
- SOIL BORINGS
- ▲ TRENCH SAMPLE
- SURFACE SOIL SAMPLE
- TREES

N

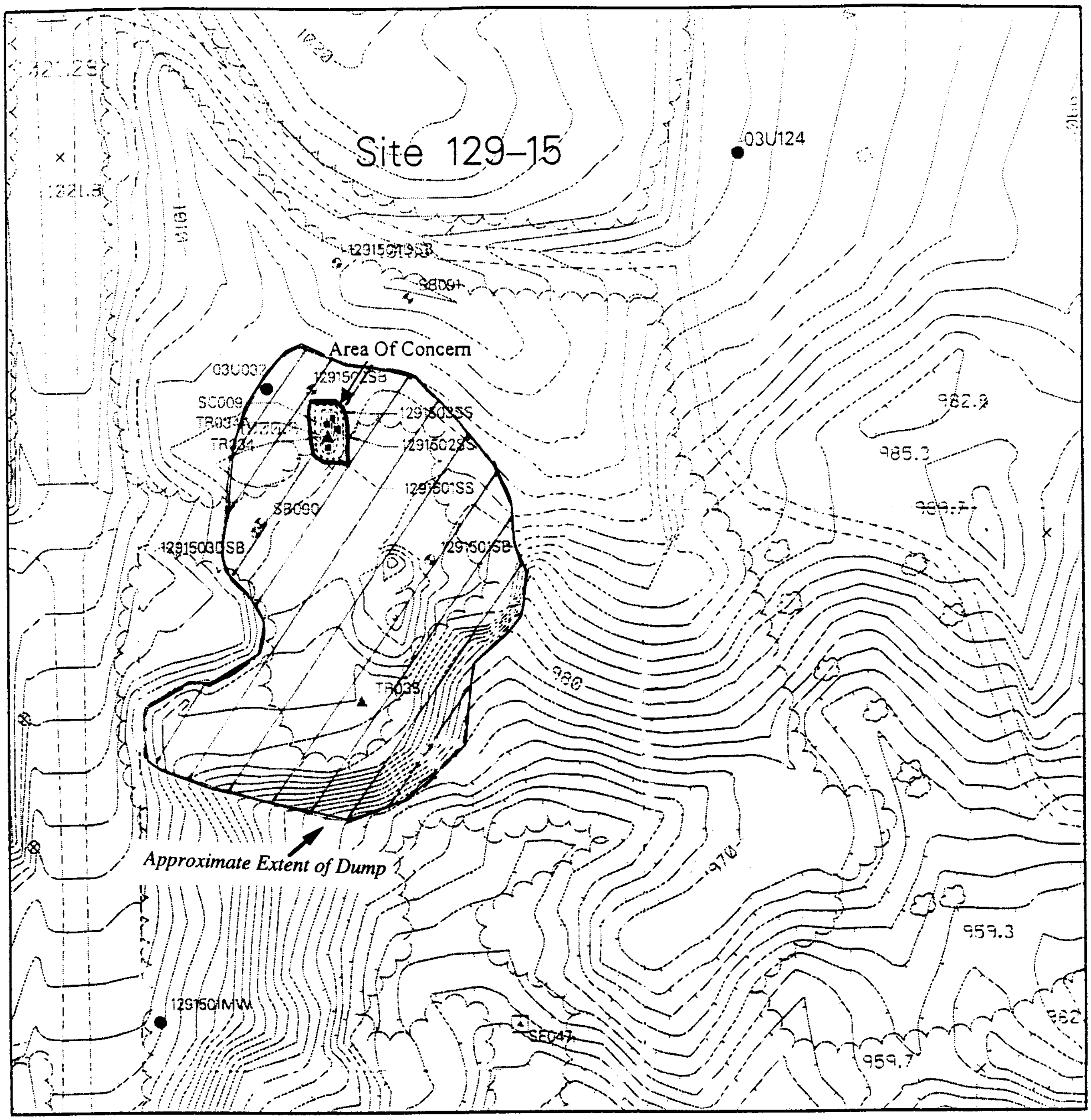
0 FEET 100
0 INCH 1

AREA OF CONCERN
DEPTH CONTOUR INTERVAL = 1/2 FT.
OUTER CONTOUR AT 0 FT.
ELEV. CONTOUR INTERVAL = 2 FT.
VERTICAL DATUM = NGVD (1929)
HORIZONTAL DATUM = STATE PLANE COORDINATES (NAD - 1983)

Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 11
Site 129-5 - Areas of Concern



LEGEND

AREA BOUNDARY
MONITORING WELLS
SOIL BORINGS
TRENCH SAMPLE
SEDIMENT SAMPLE
SURFACE SOIL SAMPLE
TREES
DUMP BOUNDARY

N

0 FEET 100
0 INCH 1

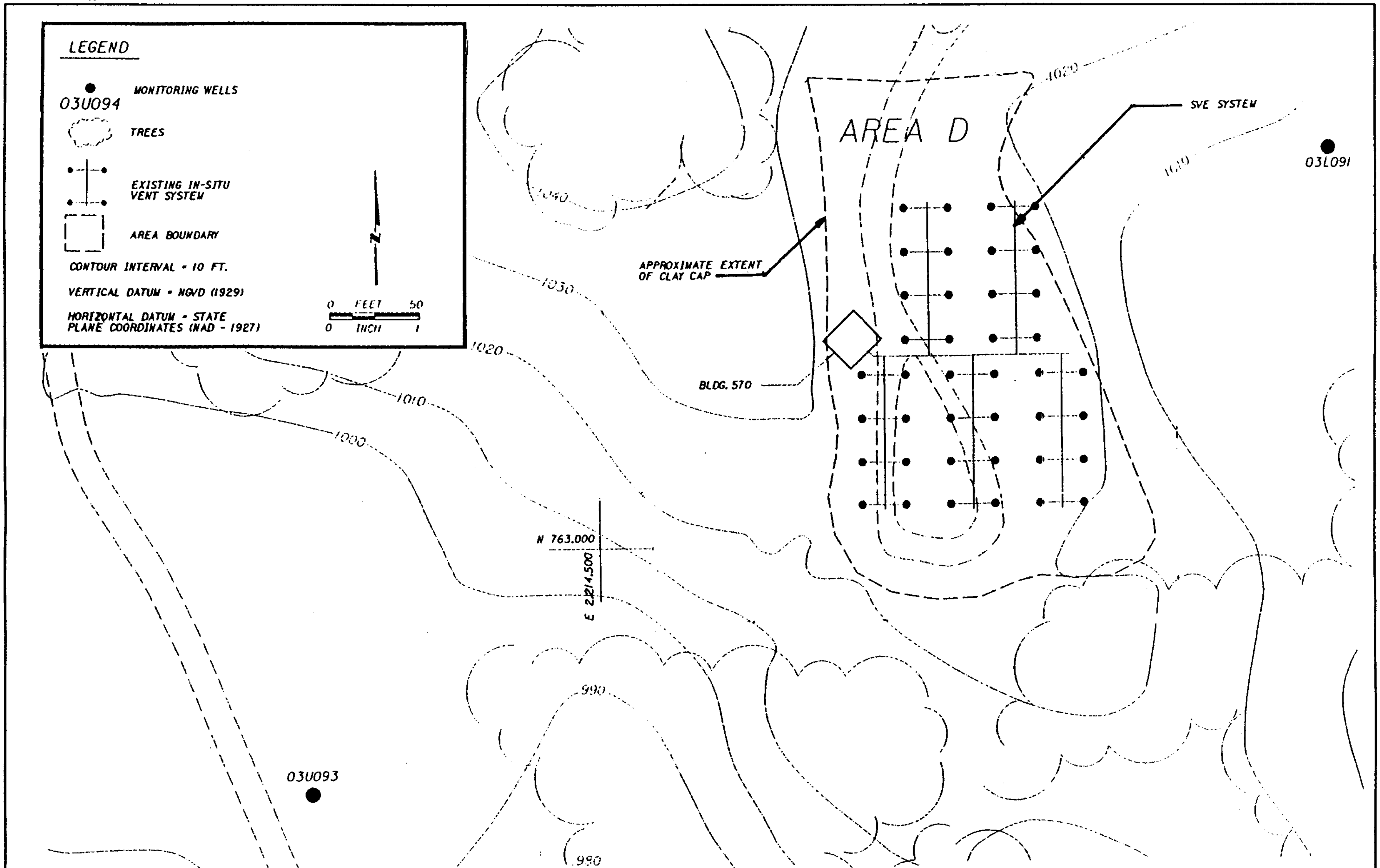
AREA OF CONCERN
DEPTH CONTOUR INTERVAL = 2 FT.
OUTER CONTOUR AT 0 FT.
ELEV. CONTOUR INTERVAL = 2 FT.
VERTICAL DATUM = NGVD (1929)
HORIZONTAL DATUM = STATE PLANE
COORDINATES (NAD - 1983)

Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 12

Site 129-15 - Landfill Area

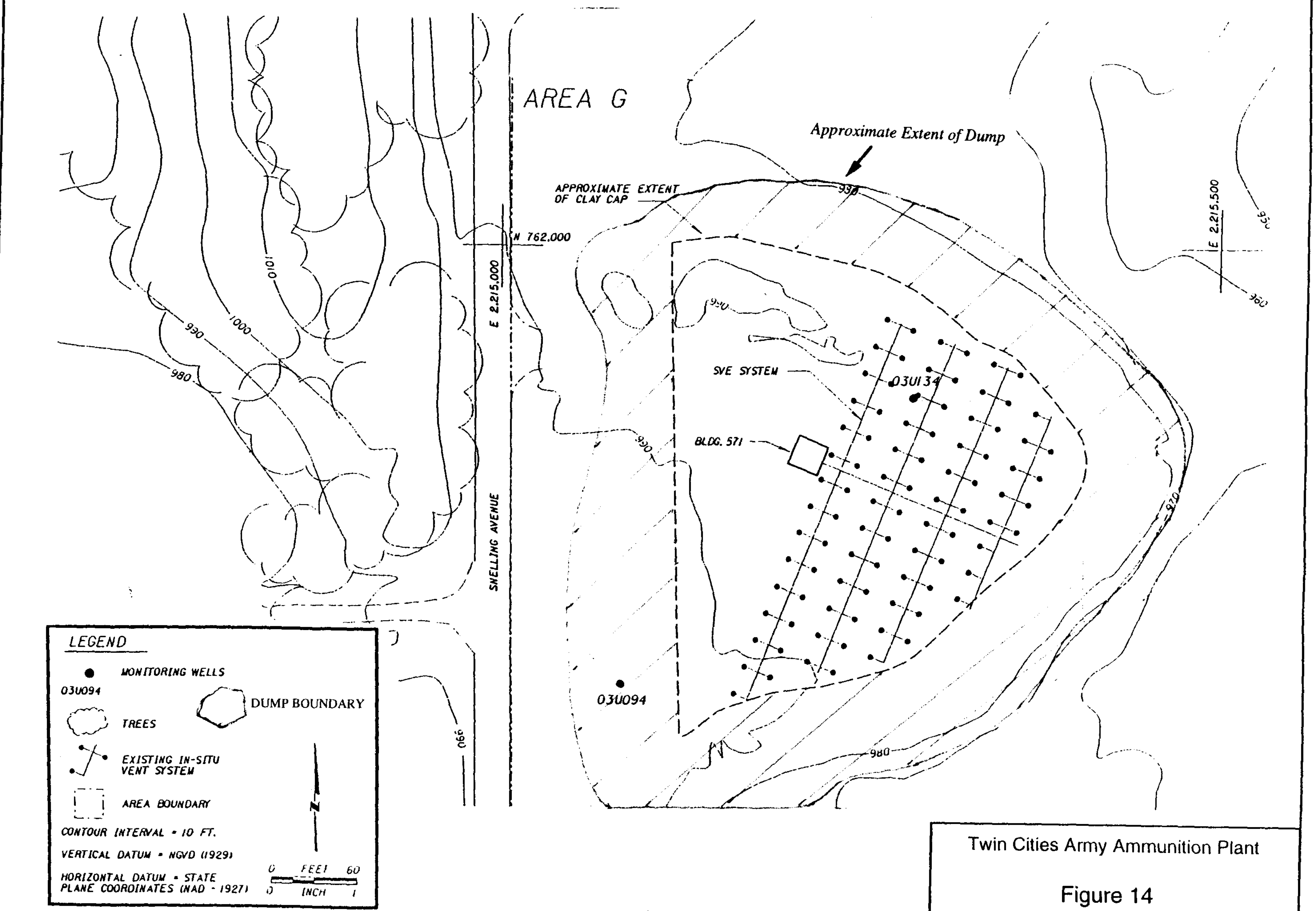


Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 13

Site D- SVE System

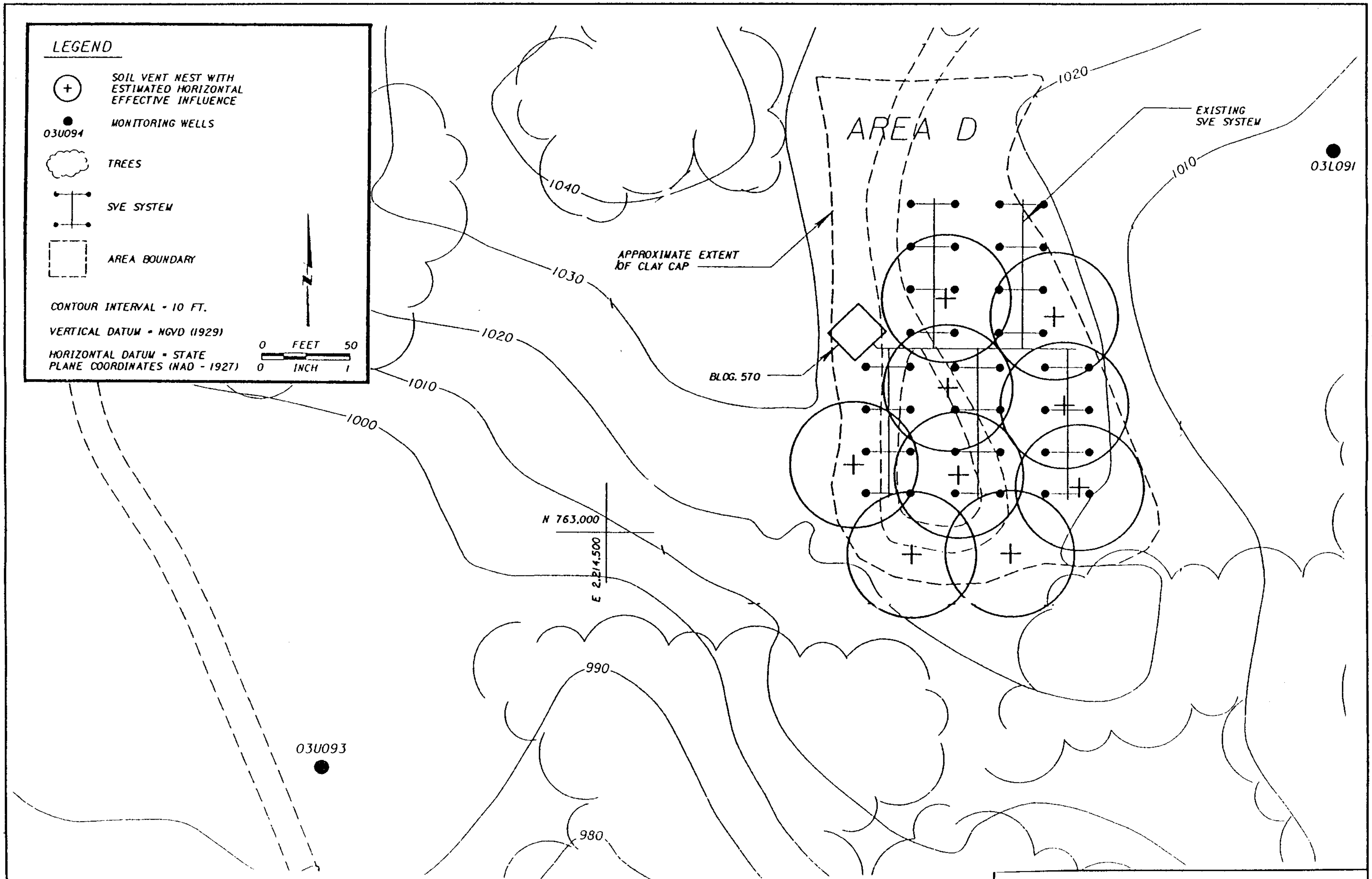


Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 14

Site G- SVE System

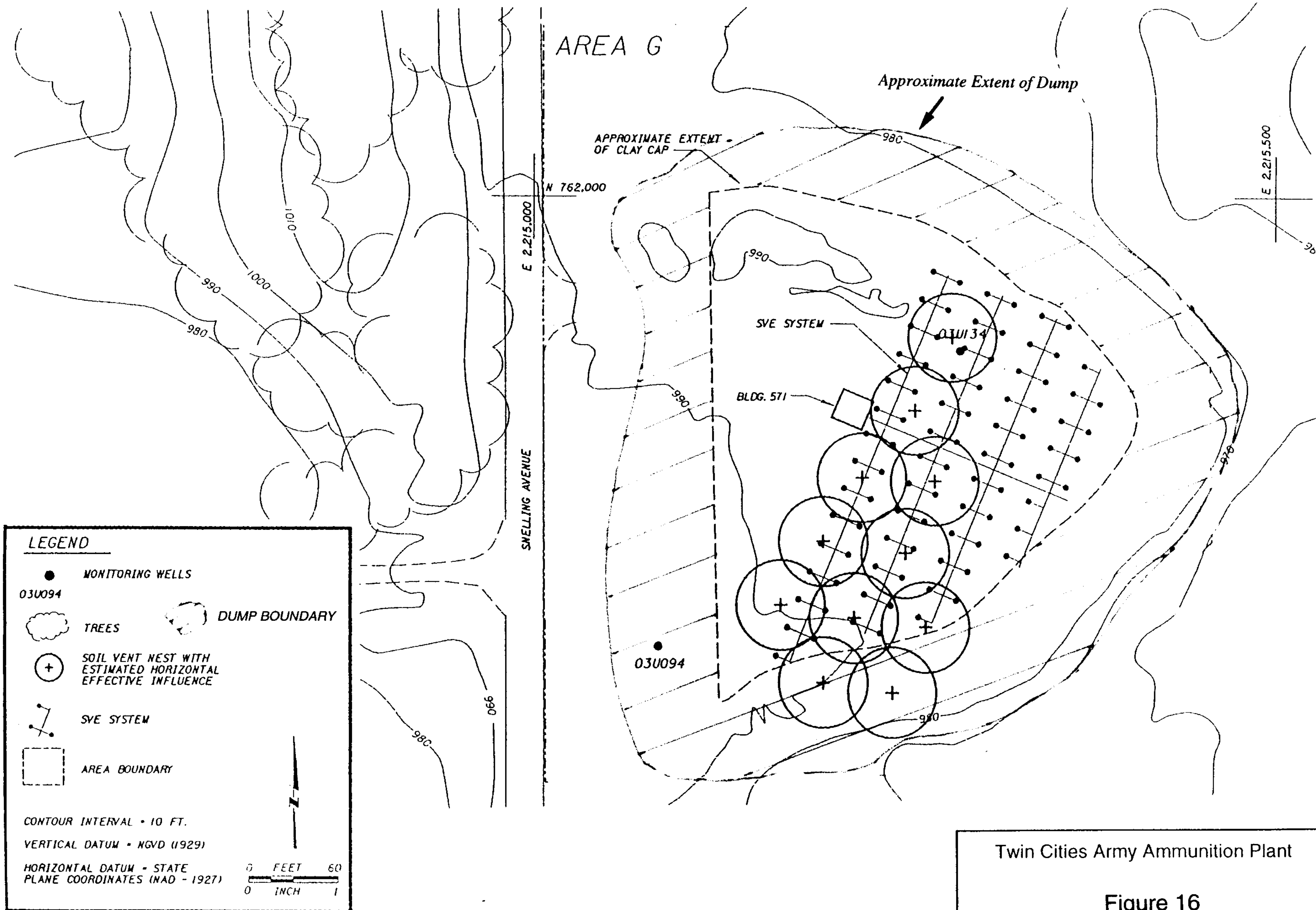


Twin Cities Army Ammunition Plant

Figure 15

Site D Expanded SVE System

Source: Montgomery Watson

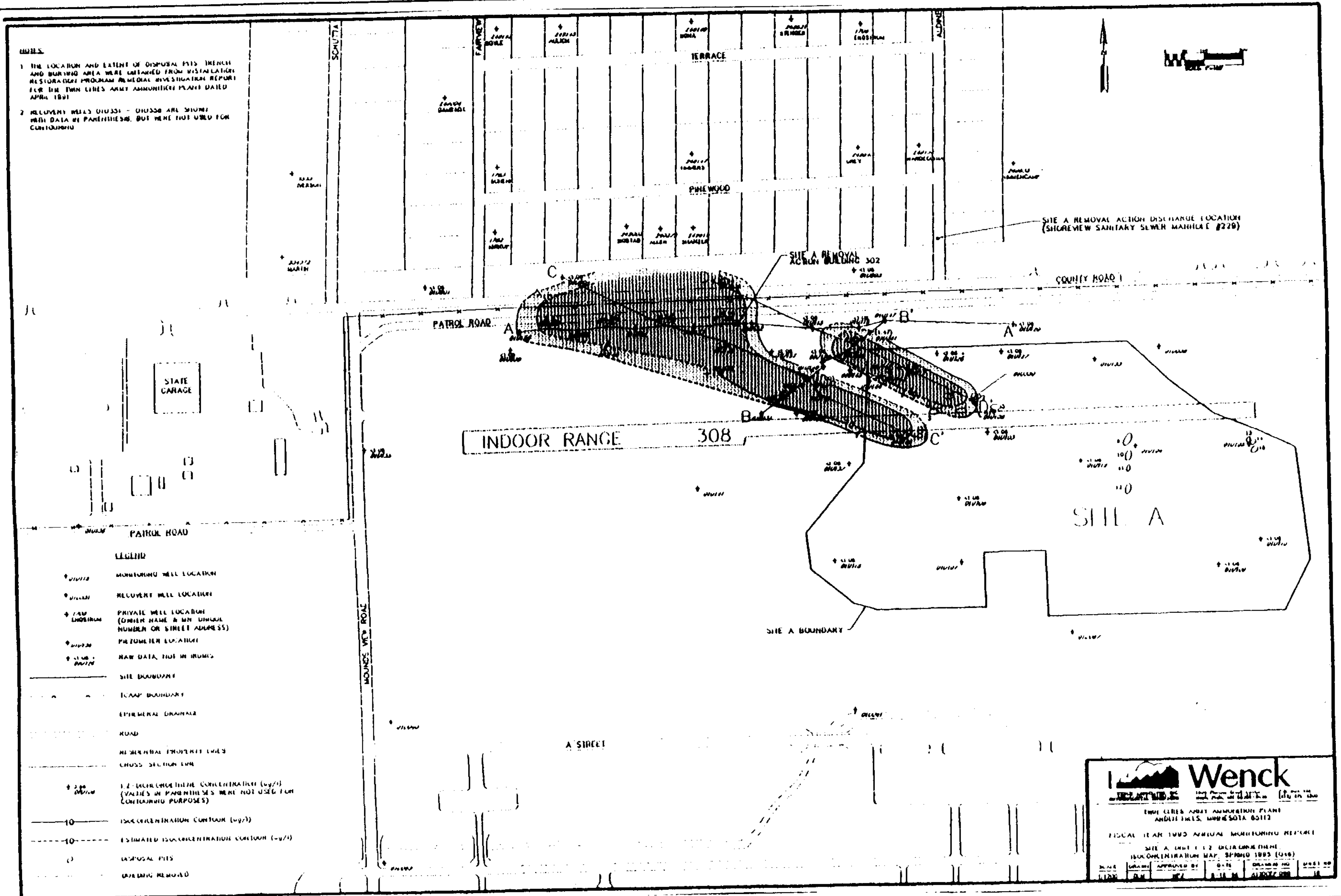


Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 16

Site G Expanded SVE System

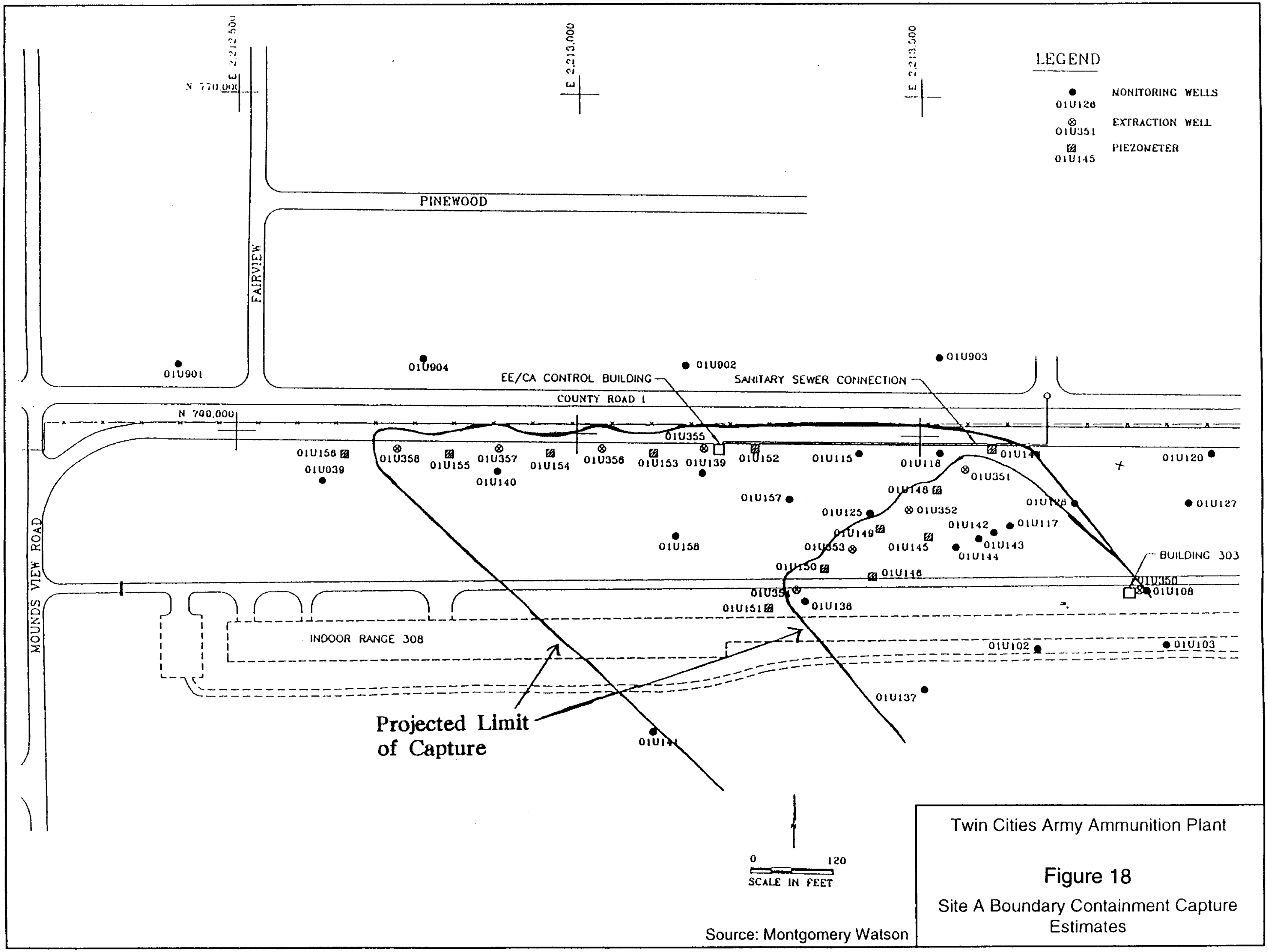


Source: Wenck, 1996

Twin Cities Army Ammunition Plant

Figure 17

Site A 1,2-DCE Plume

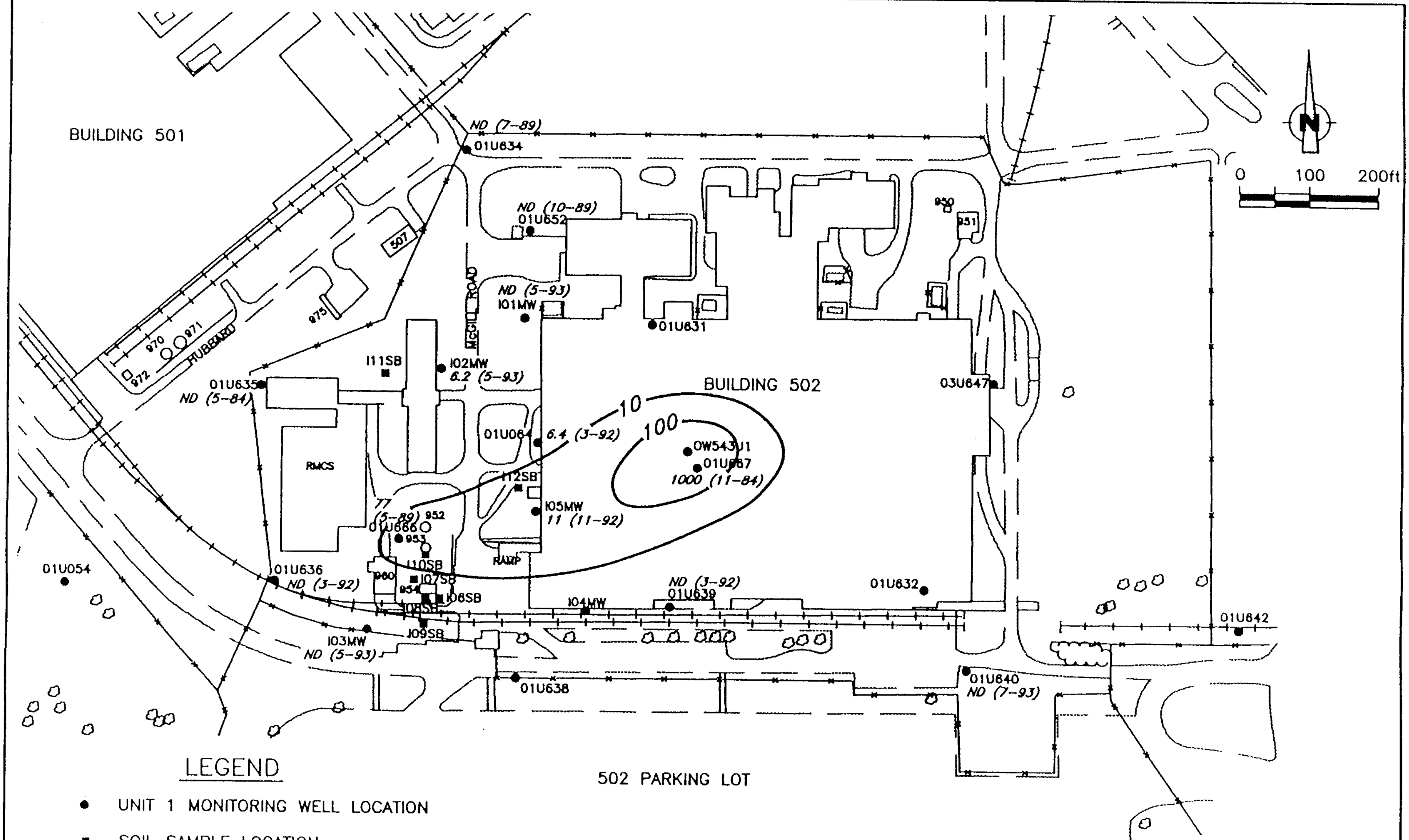


Twin Cities Army Ammunition Plant

Figure 18

Site A Boundary Containment Capture Estimates

Source: Montgomery Watson



LEGEND

- ● UNIT 1 MONITORING WELL LOCATION
- ■ SOIL SAMPLE LOCATION (SURFACE/BORING)

6.2 (5-93) TRICHLOROETHENE CONCENTRATION IN ug/L (LATEST SAMPLING DATE)

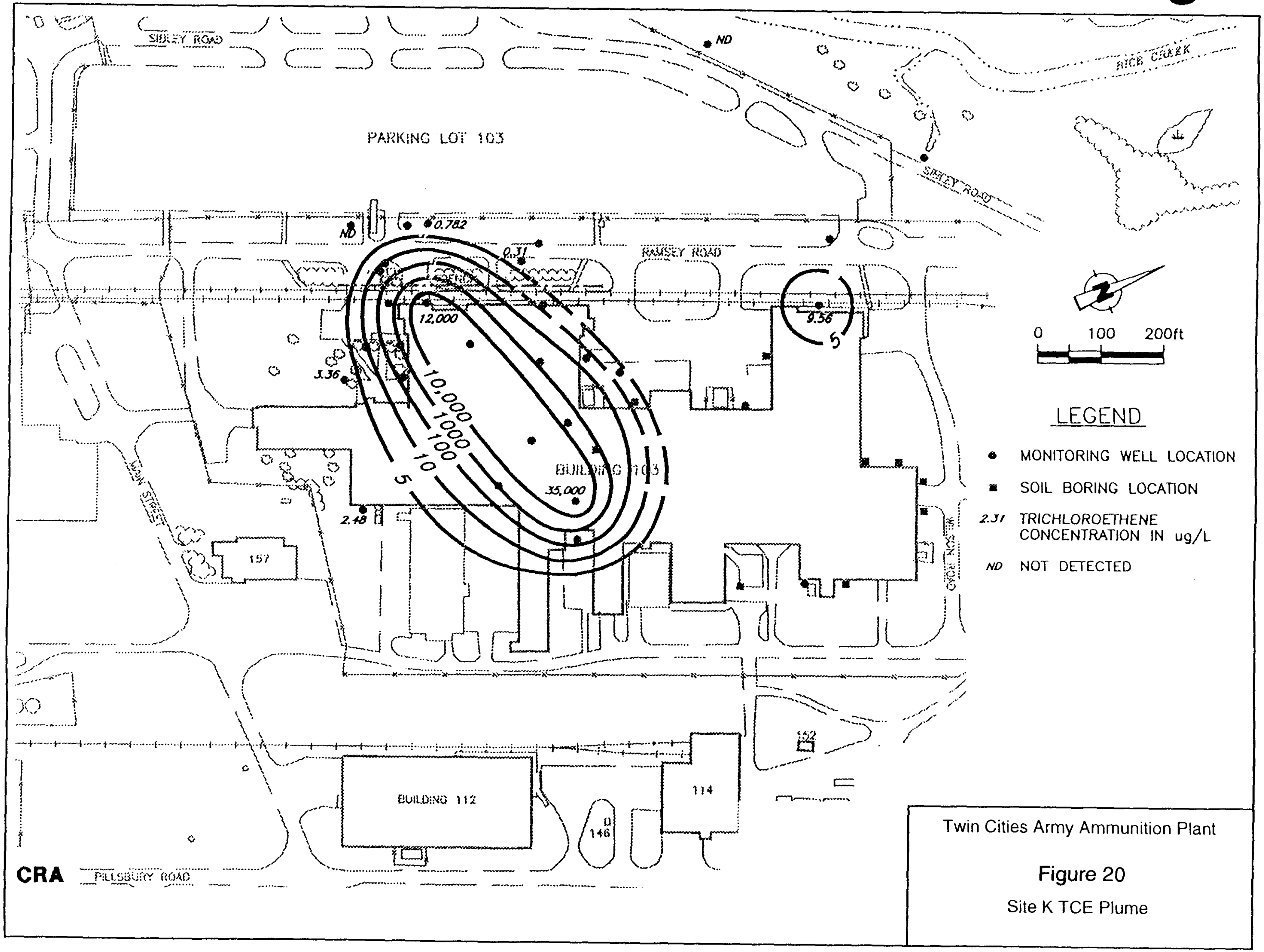
ND NOT DETECTED

CRA

Twin Cities Army Ammunition Plant

Figure 19

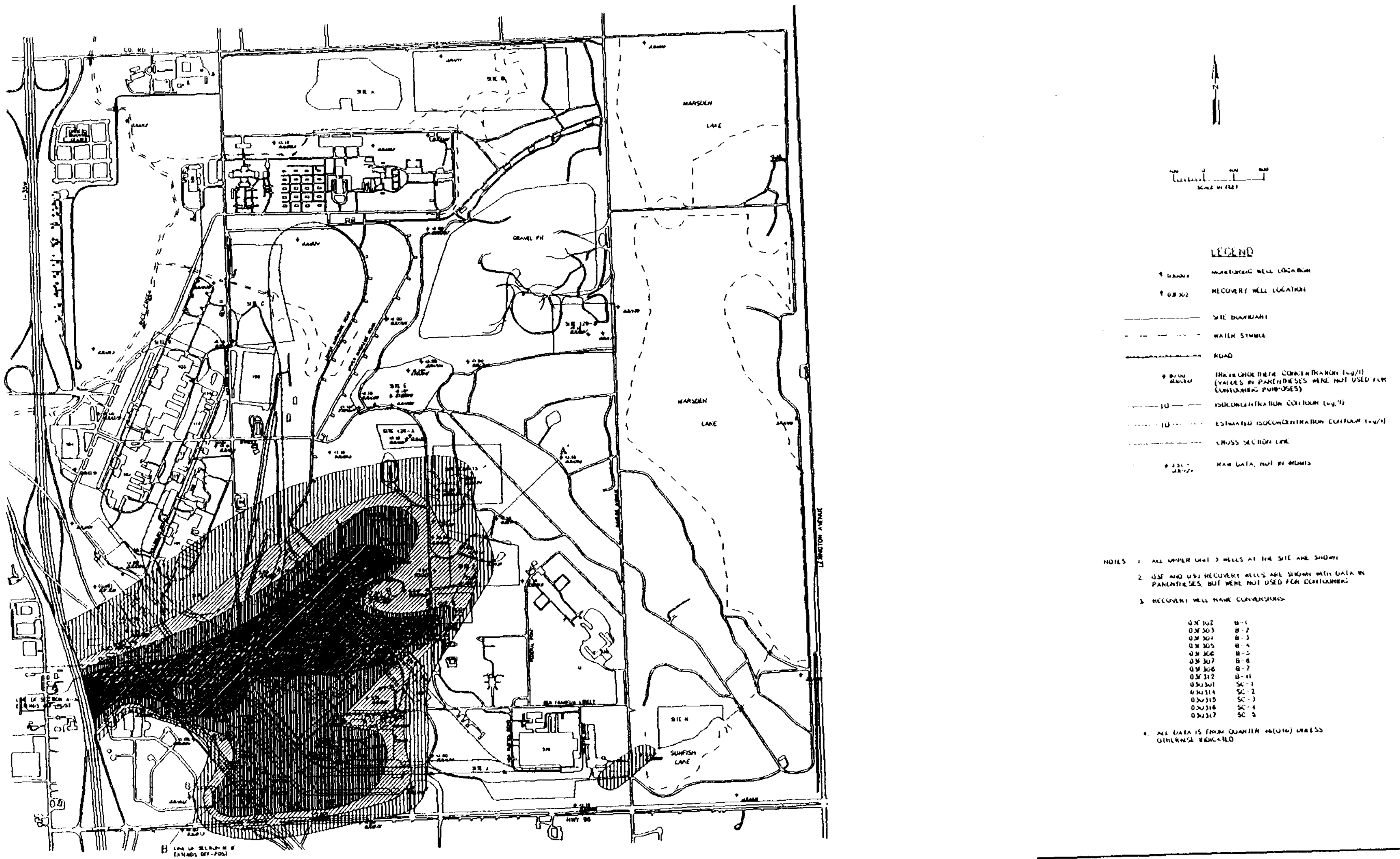
Site I TCE Plume



Twin Cities Army Ammunition Plant

Figure 20

Site K TCE Plume

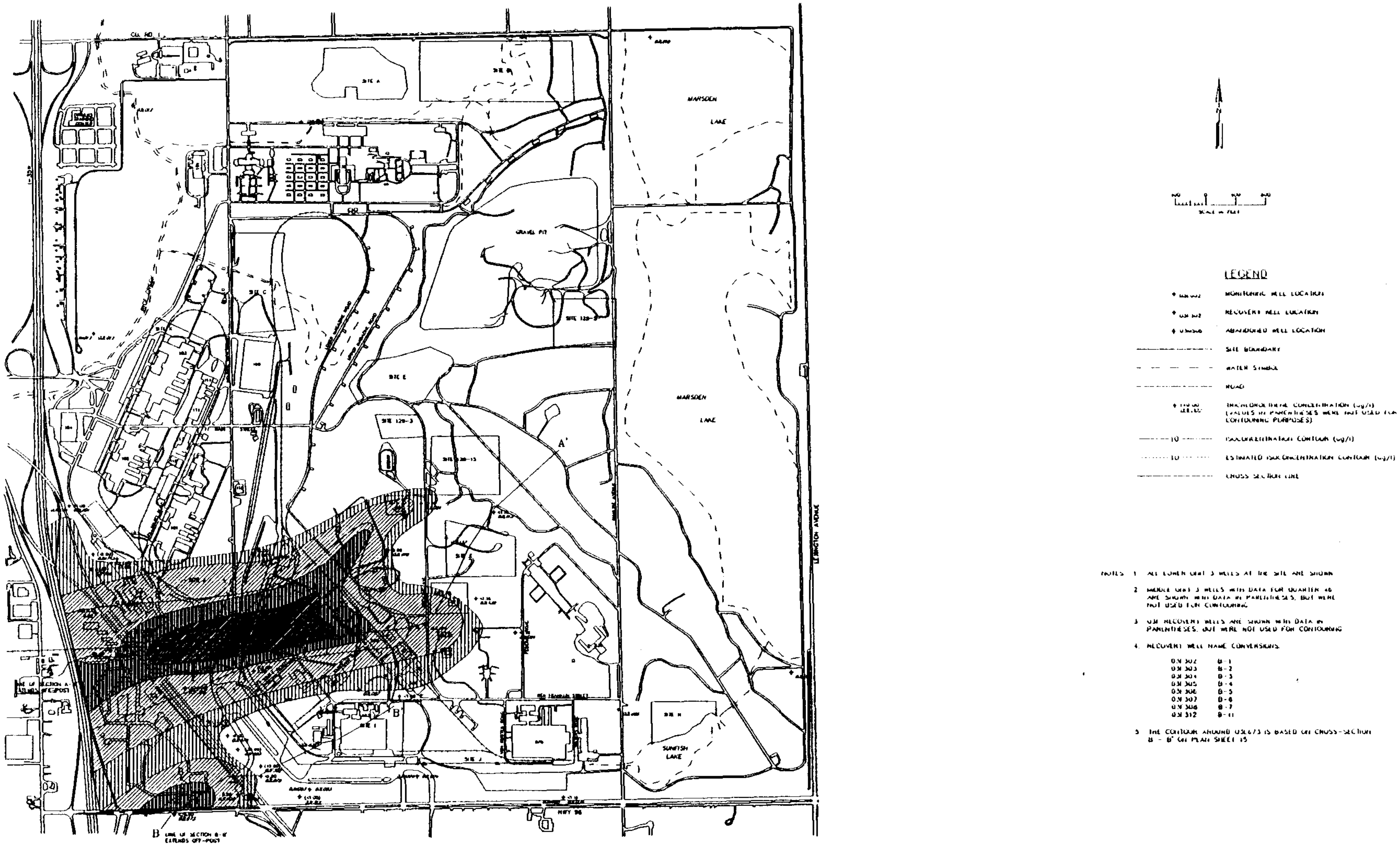


Source: Wenck, 1996

Twin Cities Army Ammunition Plant

Figure 21

Deep Groundwater TCE in Upper Unit 3

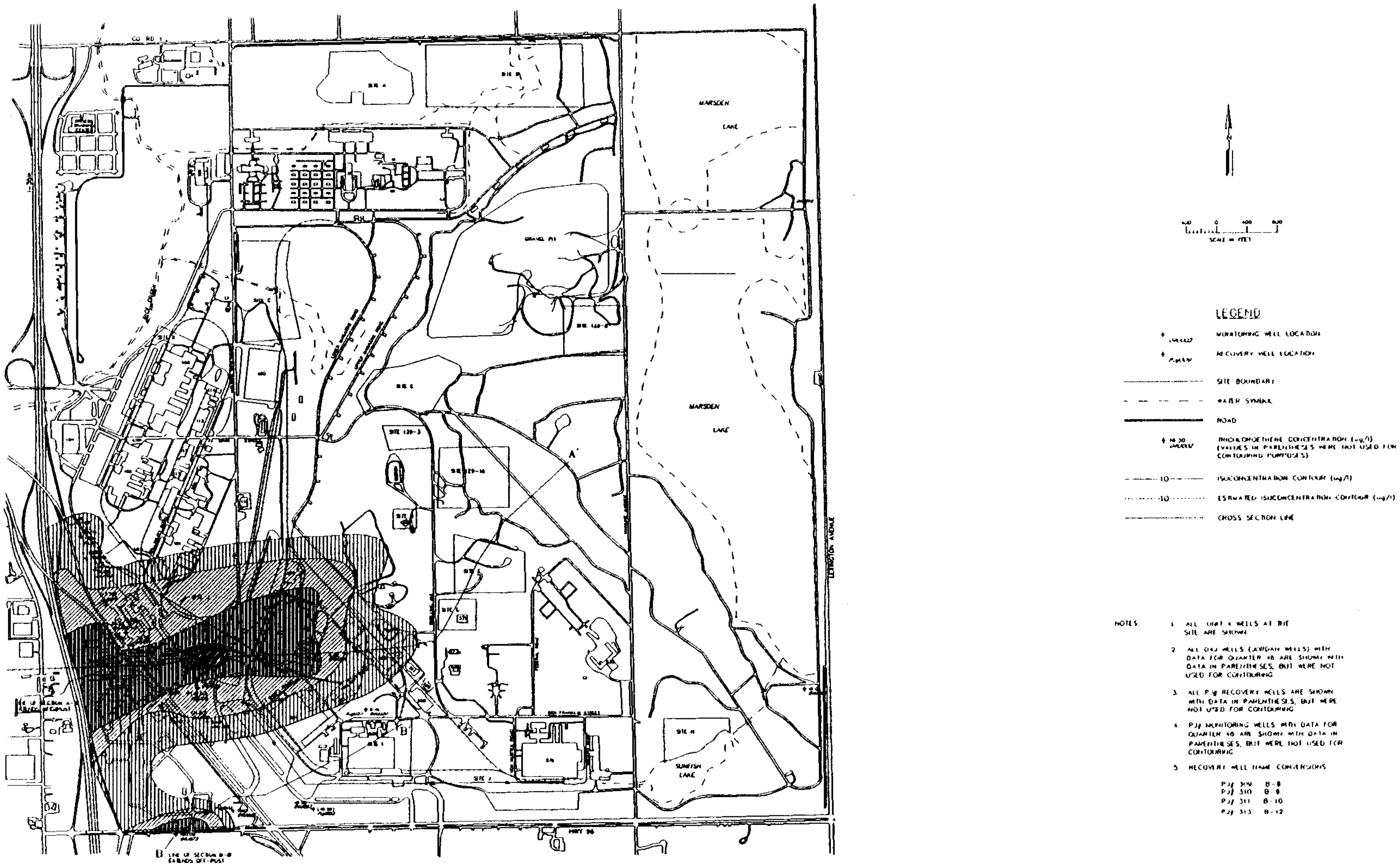


Source: Wenck, 1996

Twin Cities Army Ammunition Plant

Figure 22

Deep Groundwater TCE in Lower Unit 3

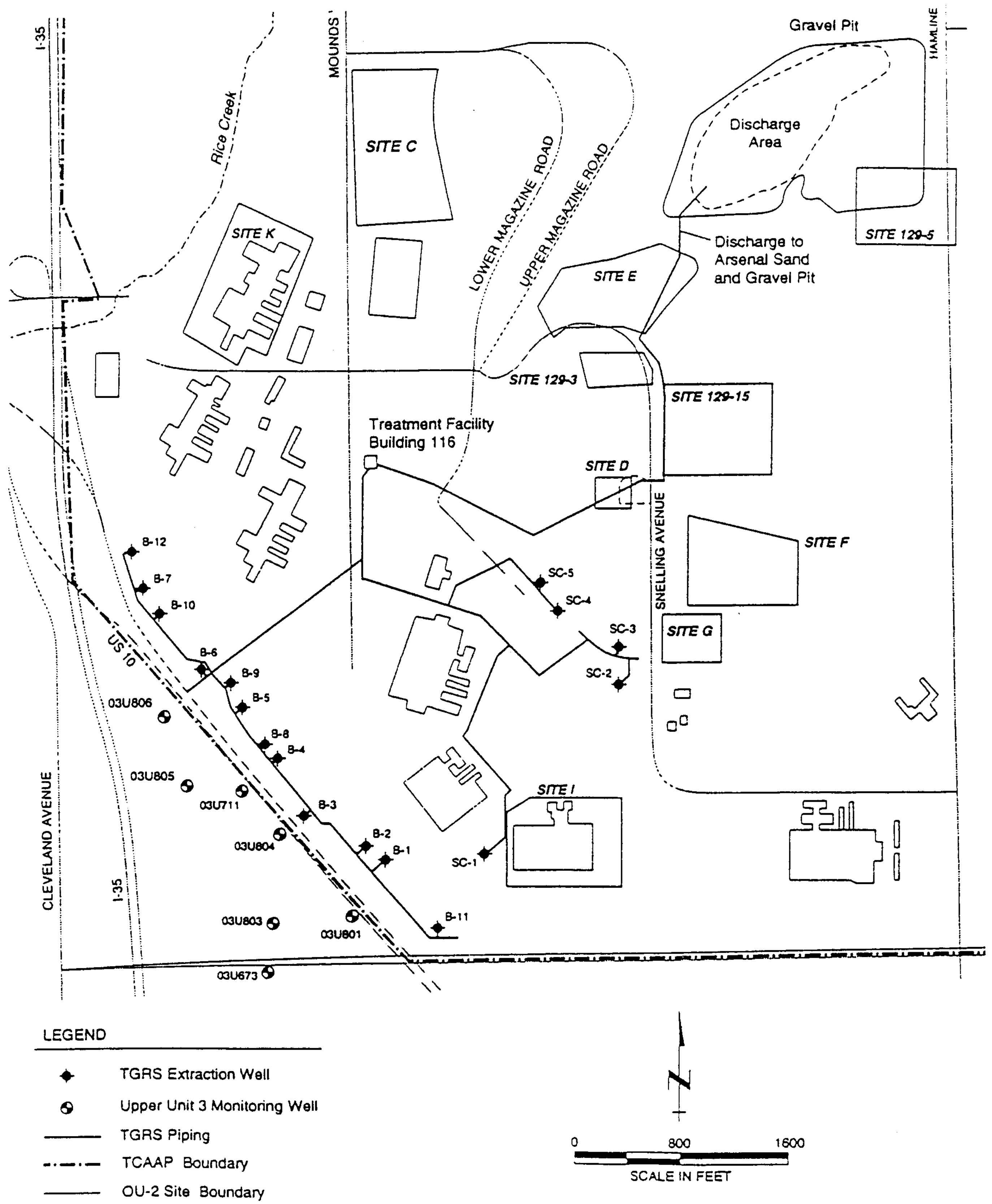


Source: Wenck, 1996

Twin Cities Army Ammunition Plant

Figure 23

Deep Groundwater TCE in Unit 4

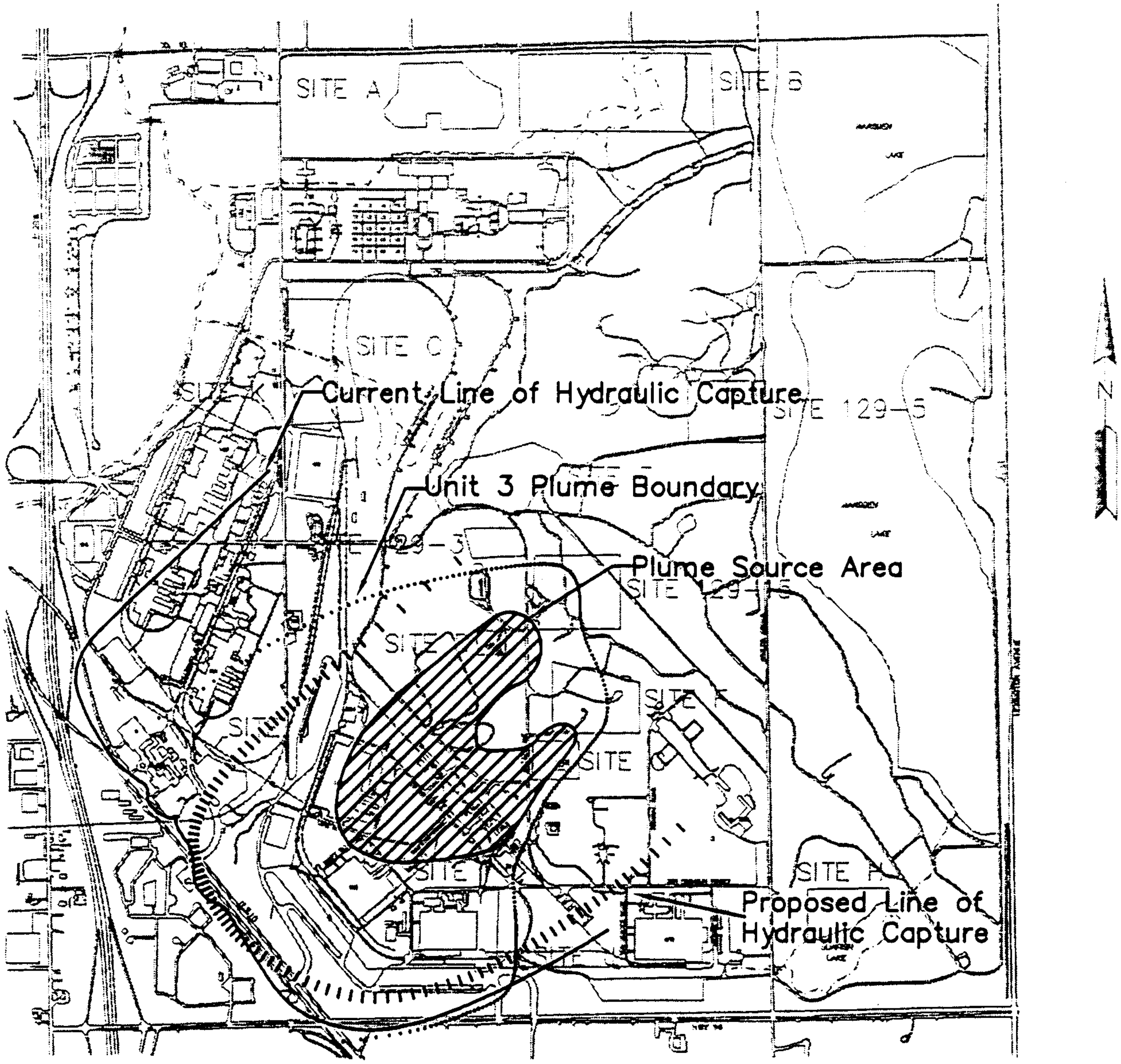


Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 24

TGRS Layout



Modified from Wenck, 1996

Legend

- Plume Source Area
- Unit 3 Plume Boundary
- Proposed Line of Hydraulic Capture
- Current Line of Hydraulic Capture

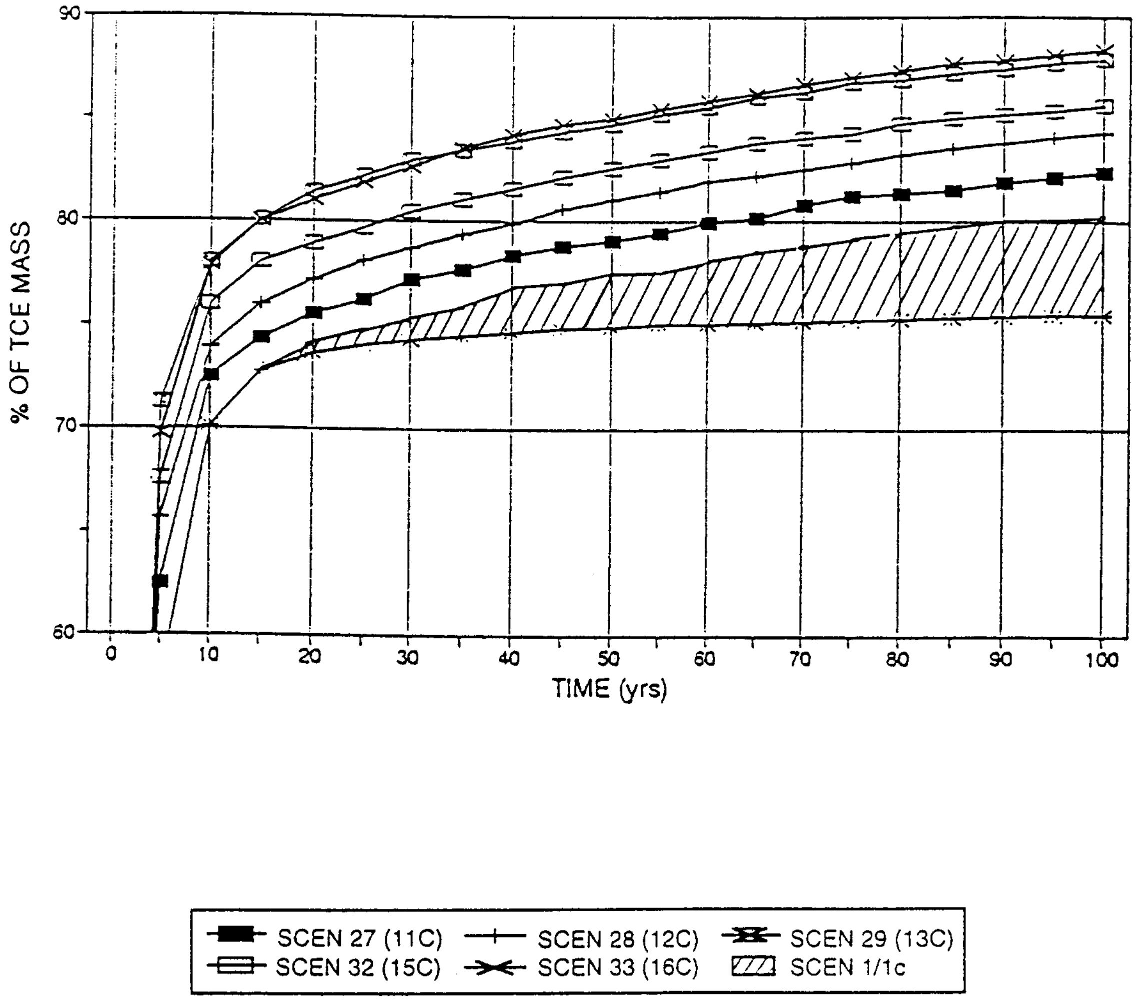
Scale: 1 inch=1870 feet

Source: Montgomery Watson

Twin Cities Army Ammunition Plant

Figure 25

Deep Groundwater Source Containment

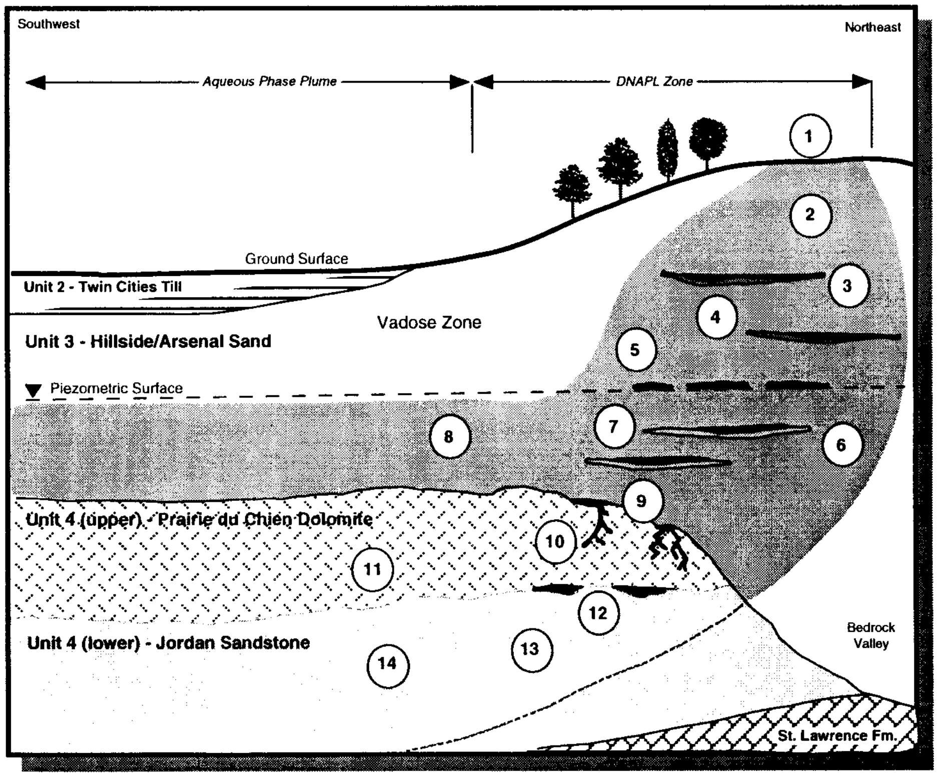


Twin Cities Army Ammunition Plant

Figure 26

Groundwater Mass Removal Estimates

POTENTIAL DNAPL OCCURRENCES AND TARGETS FOR CHARACTERIZATION / REMEDIATION WITHIN OPERABLE UNIT 2 TWIN CITIES ARMY AMMUNITION PLANT



Generalized Geologic Cross-Section Through OU-2 Deep Groundwater Plume
(not to scale)

LEGEND

1. SOURCE AREA (Sites D and G)
   Surface Disposal of Up to 46,000 gals/month Spent Solvents
2. VADOSE ZONE - UNCONSOLIDATED SEDIMENT MATRIX:
   Residual and Vapor Phase DNAPL; Isolated ganglia/globs
3. VADOSE ZONE - FINE GRAINED LENSES:
   DNAPL Saturated Silts and Clays
4. VADOSE ZONE - FINE GRAINED LENSES:
   Accumulations of Free Phase DNAPLs
5. CAPILLARY FRINGE:
   Accumulations of Free Phase and Residual DNAPLs
6. UNIT 3 UNCONSOLIDATED AQUIFER:
   Residual DNAPL within Aquifer Matrix; Isolated ganglia/globs
7. UNIT 3 UNCONSOLIDATED AQUIFER - FINE GRAINED LENSES:
   Accumulations of Free Phase DNAPLs
8. UNIT 3 UNCONSOLIDATED AQUIFER:
   Dissolved Phase Plume in Groundwater
9. UPPER UNIT 4 PRAIRIE DU CHIEN BEDROCK SURFACE:
   Accumulations of DNAPL within Topographic Lows
10. UPPER UNIT 4 PRAIRIE DU CHIEN BEDROCK AQUIFER:
    Accumulations of DNAPLs within Bedrock Fractures
11. UPPER UNIT 4 PRAIRIE DU CHIEN BEDROCK AQUIFER:
    Dissolved Phase Plume in Groundwater
12. UPPER/LOWER UNIT 4 BEDROCK INTERFACE:
    Free Phase DNAPLs within Topographic Lows of Bedrock Interface
13. LOWER UNIT 4 JORDAN SANDSTONE AQUIFER:
    Residual DNAPLs within Aquifer Matrix
14. LOWER UNIT 4 JORDAN SANDSTONE AQUIFER:
    Dissolved Phase Plume in Groundwater

Twin Cities Army Ammunition Plant

Figure 27

Potential DNAPL Occurrences Within OU-2

Appendix B

MONTGOMERY WATSON

APPENDIX B

LIST OF TABLES

TABLE 1

CHEMICALS OF CONCERN AND SELECTED CLEANUP LEVELS OPERABLE UNIT 2, TWIN CITIES ARMY AMMUNITION PLANT

SITE	SOIL COC	CLEANUP LEVEL (mg/kg)	GROUNDWATER COC	CLEANUP LEVEL (ug/L)
A	Antimony	**33.6**	Antimony	**6.0**
	Barium	**21,745.0**	1,1-Dichloroethene	**6.0**
	Copper	**19,593.0**	1,2-Dichloroethane	**4.0**
	Lead	**1,200.0**	Benzene	**10.0**
			Chloroform	**60.0**
			cis-1,2-Dichloroethene	**70.0**
			Tetrachloroethene	**7.0**
			Trichloroethene	**30.0**
B	*None*		*None*	
C	Antimony	**67.2**	*None*	
	Arsenic	**4.0**		
	Beryllium	**0.7**		
	Lead	**1,200.0**		
	Manganese	**2,503.0**		
	Thallium	**11.8**		
D	Trichloroethene	**4.16E-01**	*None*	
E	Antimony	**22.4**	*None*	
	Barium	**21,745.0**		
	Copper	**13,062.0**		
	Lead	**1,200.0**		
	Manganese	**834.0**		
G	Trichloroethene	**3.95**	*None*	
H	Antimony	**33.6**	*None*	
	Arsenic	**4.0**		
	Copper	**19,593.0**		
	Lead	**1,200.0**		
	Manganese	**2,503.0**		
I	*None*		1,2-Dichloroethene (cis and trans)	**70.0**
			Trichloroethene	**30.0**
			Vinyl Chloride	**0.2**
K	*None*		1,2-Dichloroethene (cis and trans)	**70.0**
			Trichloroethene	**30.0**
129-3	Antimony	**22.4**	*None*	
	Lead	**1,200.0**		
	Manganese	**834.0**		
	Nitroglycerine	**Not Established**		
	Trichloroethene	**4.43**		
129-5	Antimony	**67.2**	*None*	
	Barium	**21,745.0**		
	Lead	**1,200.0**		
129-15	Arsenic	**4.0**	*None*	
	Benzo[a]anthracene	**0.22**		
	Benzo[a]pyrene	**0.02**		
Deep Groundwater	*None*		1,1,1-Trichloroethane	**200.0**
			1,1-Dichloroethane	**70.0**
			1,1-Dichloroethene	**6.0**
			1,2-Dichloroethane	**4.0**
			cis-1,2-Dichloroethene	**70.0**
			Tetrachloroethene	**5.0**
			Trichloroethene	**5.0**

TABLE 2

Summary of Shallow Soil Site Contaminated Soil Volumes And Dump Volumes Operable Unit 2 Twin Cities Army Ammunition Plant

Site		Volumes (bulk cubic yards)
A		
	Area of Concern	1,400
	Dump	4,400
B		
	Dump	12,400
C		
	Area of Concern	2,600
E		
	Area of Concern	300
	Dump	12,200
H		
	Area of Concern	500
	Dump	9,500
129-3		
	Area of Concern	100
129-5		
	Area of Concern	15
129-15		
	Dump	53,000

TABLE 3

UNIT 1 GROUNDWATER COCs AND SELECTED CLEANUP LEVELS
OPERABLE UNIT 2, TWIN CITIES ARMY AMMUNITION PLANT

Constituent	Maximun Groundwater Concentration [a] (ug/l)	Relevant or Appropriate Requirements: Federal MCL [b] (ug/l)	Federal MCLG [c] (ug/l)	Minnesota MCL [d] (ug/l)	Minnesota SMCL [e] (ug/l)	Minnesota HRL [f] (ug/l)	Action Levels [g] (ug/l)	TBC: Health Advisories [h] (ug/l)	SELECTED CLEANUP LEVELS (ug/l)
Site A									
Antimony	54.8	6.0	6.0	6.0	--	6.0	--	3.0	6.0
1,1-Dichloroethene	56.0	7.0	7.0	7.0	--	6.0	--	7.0	6.0
1,2-Dichloroethane	14.0	5.0	0.0	5.0	--	4.0	--		4.0
Benzene	270.0	5.0	0.0	5.0	--	10.0	--	--	10.0
Chloroform	120.0	100/80[i]	--	100/80[i]	--	60.0	--	--	60.0
cis-1,2-Dichloroethene	190.0	70.0	70.0	70.0	--	70.0	--	70.0	70.0
Tetrachloroethene	1000.0	5.0	0.0	5.0	--	7.0	--	--	7.0
Trichloroethene	750.0	5.0	0.0	5.0	--	30.0	--	--	30.0
Site I									
1,2-Dichloroethenes (cis and trans)	430.00	--	--	--	--	70.0	--	--	70.0
Trichloroethene	77.00	5.0	0.0	5.0	--	30.0	--	--	30.0
Vinyl chloride (chloroethane)	18.00	2.0	0.0	2.0	--	0.2	--	--	0.2
Additional TBE Compounds:									
Nickel [j]									
Site K									
1,2-Dichloroethenes (cis and trans)	3,900.00	--	--	--	--	70.0	--	--	70.0
Trichloroethene	200,000.00	5.0	0.0	5.0	--	30.0	--	--	30.0
Additional TBE compounds:									
Nickel									
Lead [k]									
Zinc									

Footnotes:

a Data used for statistical analysis obtained from IRDMIS, November 1994.
b Federal MCLs are the current federal maximum contaminant levels for drinking water as established under the Safe Drinking Water Act (40 CFR Part 141).
c Federal MCLGs are the current federal maximum contaminant level goals for drinking water as established under the Safe Drinking Water Act (40 CFR Part 141).
d Minnesota MCLs are the current state maximum contaminant levels for drinking water as established in the Minnesota Rules Chapter 4720.
e Minnesota SMCLs are the current state secondary maximum contaminant levels for drinking water as established in the Minnesota Rules Chapter 4720.
f Minnesota HRLs are the state health risk limits for substances found to degrade Minnesota groundwater as established in Minnesota Rules Chapter 4717; HRL is recommended remediation goals for Unit 1 groundwater (non-municipal water supply aquifer). Additivity of multiple contaminants for carcinogens and by receptor for systemics also apply as defined in HRLs.
g The action levels for lead and copper were promulgated under the Safe Drinking Water Act; the state of Minnesota has also adopted these as MCLs.
h Health Advisories are the federal lifetime advisories from the USEPA Office of Water (November 1994).
i 100 μg/l is current MCL. Total for all trihalomethanes combined cannot exceed 80 μg/l level.
j Nickel included as TBE based on inconsistent data
k Lead and zinc are included as TBE based on additivity in monitoring well 01U604 on December 7, 1987.

TABLE 4

UNIT 3 AND 4 DEEP GROUNDWATER COCs AND SELECTED CLEANUP LEVELS
OPERABLE UNIT 2, TWIN CITIES ARMY AMMUNITION PLANT

		Relevant or Appropriate Requirements						TBC	
Constituent	Maximum Groundwater Concentration [a] (ug/l)	Federal MCL [b] (ug/l)	Federal MCLG [c] (ug/l)	Minnesota MCL [d] (ug/l)	Minnesota SMCL [e] (ug/l)	Minnesota HRL [f] (ug/l)	Action Levels [g] (ug/l)	Health Advisories [h] (ug/l)	**SELECTED CLEANUP LEVELS (ug/l)**
1,1,1-Trichloroethane	16200.0	200.0	200.0	200.0	--	600.0	--	200.0	**200.0**
1,1-Dichloroethane	740.0	--	--	--	--	70.0	--	--	**70.0**
1,1-Dichloroethene	1800.0	7.0	7.0	7.0	--	6.0	--	7.0	**7.0**
1,2-Dichloroethane	50.0	5.0	0.0	5.0	--	4.0	--	--	**5.0**
cis-1,2-Dichloroethene	440.0	70.0	70.0	70.0	--	70.0	--	70.0	**70.0**
Tetrachloroethene	58.0	5.0	0.0	5.0	--	7.0	--	--	**5.0**
Trichloroethene	65400.0	5.0	0.0	5.0	--	30.0	--	--	**5.0**

Footnotes:

a Data used for statistical analysis obtained from IRDMIS, November 1994.

b Federal MCLs are the current federal maximum contaminant levels for drinking water as established under the Safe Drinking Water Act (40 CFR Part 141).

c Federal MCLGs are the current federal maximum contaminant level goals for drinking water as established under the Safe Drinking Water Act (40 CFR Part 141).

d Minnesota MCLs are the current state maximum contaminant levels for drinking water as established in the Minnesota Rules Chapter 4720.

e Minnesota SMCLs are the current state secondary maximum contaminant levels for drinking water as established in the Minnesota Rules Chapter 4720.

f Minnesota HRLs are the state health risk limits for substances found to degrade Minnesota groundwater as established in Minnesota Rules Chapter 4717; Additivity of multiple contaminants for carcinogens and by receptor for systemics also apply as defined in HRLs.

g The action levels for lead and copper were promulgated under the Safe Drinking Water Act; the state of Minnesota has also adopted these as MCLs.

h Health Advisories are the federal lifetime advisories from the USEPA Office of Water (November 1994).

TABLE 5

SUMMARY OF TECHNOLOGY AND PROCESS OPTIONS SCREENING

Technology	Treatment Effectiveness	Implementability	Cost	Result of Initial Screening	Comments
Groundwater					
INSTITUTIONAL CONTROLS					
Groundwater Monitoring	None	Easy	Low	Consider	Extensive monitoring program already exists
Alternate Water Supply	None	Easy	Low	Consider	Includes hook-up to municipal system
Well Abandonment	None	Easy	Low	Consider	Prevents exposure through existing wells
Drilling Advisories	None	Easy	Low	Consider	Restrictions easy to enforce within TCAAP
CONTAINMENT					
Extraction Wells	None	Easy	Low	Consider	Existing wells conform to design specifications
Interceptor Trenches	None	Easy	Moderate	Consider	Existing trench performs as designed
Subsurface Barriers	None	Difficult	High	Eliminate	Requires impermeable substrate
GROUNDWATER TREATMENT - ORGANICS					
Air Sparging	High	Moderate		Consider	Consider for shallow groundwater unit
Air Stripping	High	Easy	Low	Consider	Retain based on current success at site
Carbon Adsorption	High	Easy	Moderate	Eliminate	Eliminate for remedial applications
Photochemical Oxidation	High	Moderate	High	Eliminate	Eliminate based on cost and system performance
Bioremediation	High	Moderate	High	Consider	Limited full scale installation history
Abiotic Reductive Dechlorination	Moderate	Moderate	Moderate	Eliminate	Implementability problems and high cost
UVB (Vacuum Vaporizer) Wells	Moderate	Difficult	Moderate	Eliminate	Implementability problems and high cost
GROUNDWATER TREATMENT - INORGANICS					
Electrokinetic Migration	Moderate	Difficult	High	Eliminate	Implementability problems and high cost
Polymeric Sponge Absorption	Moderate	Difficult	High	Eliminate	Implementability problems and high cost
DISPOSAL/DISCHARGE					
Municipal Water Usage	None	Difficult	High	Eliminate	No current needs
POTW Discharge	High	Easy	Low	Consider	Currently viable for groundwater discharge
Rice Creek Discharge	None	Moderate	Low	Consider	Currently viable for groundwater discharge
On-Site Groundwater Recharge	None	Easy	Low	Consider	Currently viable for groundwater discharge
Storm Sewer/Round Lake Discharge	None	Easy	Low	Consider	Implementable if discharge requires no treatement
Marsden Lake Discharge	None	Moderate	High	Eliminate	Potential ecological impacts and high cost

TABLE 5

(continued)

SUMMARY OF TECHNOLOGY AND PROCESS OPTIONS SCREENING

Technology	Treatment Effectiveness	Implementability	Cost	Result of Initial Screening	Comments
SOILS					
INSTITUTIONAL CONTROLS					
Groundwater Monitoring	None	Easy	Low	Consider	Extensive monitoring program already exists
Access Restrictions	None	Easy	Low	Consider	Restrictions easy to enforce within TCAAP
Use Restrictions	None	Easy	Low	Consider	Restrictions easy to enforce within TCAAP
CONTAINMENT					
Capping	None	Easy	Low	Consider	Eliminates exposure and reduces infiltration
Surface Controls	None	Easy	Low	Consider	Implementable and low cost
SOIL TREATMENT - ORGANICS					
Soil Vapor Extraction	High	Easy	Low	Consider	Retain based on current success at site
Bioremediation	Moderate	Easy	Moderate	Consider	Potential to expedite site cleanup
Surfactant Mobilization	Moderate	Difficult	High	Eliminate	Mobilization of contaminants may impede recovery
Thermal Desorption	High	Easy	High	Eliminate	Limited applicability to site specific contaminants
Incineration	High	Easy	High	Consider	Effective for dioxin-furan contaminants
SOIL TREATMENT - INORGANICS					
Fixation	Moderate	Moderate	Low	Consider	Reduces contaminant mobility
Vitrification	Moderate	Difficult	High	Eliminate	Difficult to implement and costly
Electrokinetic Migration	Low	Difficult	High	Eliminate	Not yet demonstrated for full-scale remediation
Soil Washing/Soil Leaching	High	Easy	Moderate	Consider	Previously effective for site remediation
REMOVAL/DISPOSAL					
Backfilling	None	Easy	Low	Consider	Treated soils returned to site
On-Site Landfill	None	Difficult	High	Eliminate	Not consistent with future site use
Off-Site Landfill	None	Easy	Moderate	Consider	Cost-effective option for site wastes
Metal Recycling	None	Easy	Low	Consider	Beneficial use of recovered metals
Ordnance Disposal	None	Moderate	High	Consider	Previously implemented at site

TABLE 6

REMEDIAL TECHNOLOGIES AND RESPONSE ACTIONS
RETAINED FOR ALTERNATIVES DEVELOPMENT

Medium Of Concern	General Response Action Category	Remedial Technology / Specific Response Action
Groundwater	**Institutional Controls**	Groundwater Monitoring Alternate Water Supply Well Abandonment Drilling Advisories
	Containment	Gradient Control/Extraction Wells
	Aboveground Treatment	Air Stripping
	Disposal/Discharge	POTW Discharge Rice Creek Discharge On-Site Groundwater Recharge Storm Sewer/Round Lake Discharge
	***In Situ* Treatment**	<u>Technologies for Organic Contaminants</u> Air Sparging Bioremediation
Soil	**Institutional Controls**	Groundwater Monitoring Access Restrictions Use Restrictions
	Containment	Capping Surface Controls
	***In Situ* Treatment**	<u>Technologies for Organic Contaminants</u> Soil Vapor Extraction / with options Bioremediation <u>Technologies for Inorganic Contaminants</u> Fixation
	Aboveground Treatment	<u>Technologies for Organic Contaminants</u> Incineration Soil Vapor Extraction Bioremediation <u>Technologies for Inorganic Contaminants</u> Soil Washing/Soil Leaching Fixation
	Removal/Disposal	Backfilling Off-Site Disposal Metal Recycling Ammunition Disposal

TABLE 7

Summary of Alternative Costs
Shallow Soil Sites (A, C, E, H, 129-3 and 129-5) and Dumps at Sites B and 129-15
Operable Unit 2
Twin Cities Army Ammunition Plant

Site	Volumes (bcy)	Alternatives 1 No Action	2 In Situ Fixation	3 Soil Washing/ Soil Leaching	4 Excavation/ Disposal	Landfill Characterization	Landfill Removal*
A							
Area of Concern	1,400	$192,700	$1,403,300	$2,158,800	$1,388,000		
Dump	4,400						$484,500 - $1,970,000
B							
Dump	12,400	NA	NA	NA	NA	$126,900	
C							
Area of Concern	2,600	$435,700	NA	NA	$5,574,500		
E							
Area of Concern	300	$192,700	$653,300	$1,064,500	$503,500		
Dump	12,200						$1,232,800 - $5,155,300
H							
Area of Concern	500	$204,800	$793,100	$1,188,400	$671,700		
Dump	9,500						$966,000 - $4,026,900
129-3							
Area of Concern	100	$228,500	$758,000	$892,500	$416,000		
129-5							
Area of Concern	15	$217,000	$517,400	$725,800	$198,600		
129-15							
Dump	53,000	NA	NA	NA	NA	$371,500	

* *Range of costs are based on disposal of dump materials to either a demolition landfill (low end) or a subtitle D landfill (high end).*

TABLE 8
Soil COCs, TBEs and Selected Cleanup Levels
Operable Unit 2
Twin Cities Army Ammunition Plant

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Preliminary Remediation Goals Carcinogen (mg/kg)	ARAR/TBC [1] (mg/kg)	Background (mg/kg)	COC	**Selected Cleanup Level (mg/kg)**
Site A							
Antimony	1650	33.6	NA [2]	400	2.0	Antimony	**33.6**
Barium	64000	21745	NA	-	345	Barium	**21745**
Chromium	1400	35985.9	NA	-	8.6	--	
Copper	78000	19593	NA	-	19	Copper	**19593**
Cyanide	15.8	9546	NA	-	--	--	
Lead	57000	NA	NA	1200	45	Lead	**1200**
Manganese	1900	2503	NA	-	282	--	
Nickel	420	6213	NA	-	34	--	
Silver	42.6	1553	NA	-	4.0	--	
Vanadium	39.8	252	NA	-	16	--	
Zinc	10000	289792	NA	-	24	--	
Xylene	8.58	578609	NA	-		--	
Additional TBE [3] Compounds							
Benzene							
Chloroform							
cis-1,2-Dichloroethene							
1,2-Dichloroethane							
1,1-Dichloroethene							
Tetrachloroethene							
Trichloroethene							
1,3,5-Trinitrobenzene							
bis(2-ethylhexyl)phthalate							
ethylbenzene							
Site B							
Chromium	14	35986	NA	-	8.6	--	
Manganese	440	1251	NA	-	282	--	
Vanadium	25	126	NA	-	16	--	
Zinc	57	289792	NA	-	24	--	
Site C							
Antimony	9200	67.2	NA	-	2.0	Antimony	**67.2**
Arsenic	19.5	222	1.38	-	4.0	Arsenic	**4.0**
Barium	2070	21745	NA	-	345	--	
Beryllium	1.72	180	2.34E-02	-	0.7	Beryllium	**0.7**
Cadmium	5.14	99.2	NA	-	0.7	--	
Chromium	65.8	35986	NA	-	8.6	--	
Copper	5300	39185	NA	-	19	--	
Lead	49000	NA	NA	1200	45	Lead	**1200**
Manganese	6320	2503	NA	-	282	Manganese	**2503**
Molybdenum	42.2	840	NA	-	4.0	--	
Thallium	44.8	11.8	NA	-	10	Thallium	**11.8**
Vanadium	41.7	252	NA	-	16	--	
Zinc	628	289792	NA	-	24	--	

TABLE 8
Soil COCs, TBEs and Selected Cleanup Levels
Operable Unit 2
Twin Cities Army Ammunition Plant

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Carcinogen (mg/kg)	ARAR/TBC [1] (mg/kg)	Background (mg/kg)	COC	**Selected Cleanup Level (mg/kg)**
Acetone	5.00E-01	31064	NA	-		--	
Site D							
Chromium	18.5	35986	NA	-	8.6	--	
PCB 1260	0.996	5.68	5.16E-02	10		--	
Trichloroethene	2600	743	15.8	4.16E-01		Trichloroethene	**4.16E-01**
Additional TBE Compounds							
1,1,1-Trichloroethane							
1,1-Dichloroethane							
1,2-Dichloroethane							
1,1-Dichloroethene							
cis-1,2-Dichloroethene							
Tetrachloroethene							
1,1,2-Trichloroethane							
Xylenes							
Site E							
Antimony	851	22.4	NA	-	2.0	Antimony	**22.4**
Barium	34000	21745	NA	-	345	Barium	**21745**
Cadmium	6.87	99.2	NA	-	0.7	--	
Chromium	111	35985.9	NA	-	8.6	--	
Copper	72000	13062	NA	-	19	Copper	**13062**
Lead	140000	NA	NA	1200	45	Lead	**1200**
Manganese	2500	834	NA	-	282	Manganese	**834**
Mercury	1.07	93.2	NA	-	0.16	--	
Nickel	100	6213	NA	-	34	--	
Silver	13.4	1553	NA	-	4.0	--	
Vanadium	121	252	NA	-	16	--	
Zinc	10000	289792	NA	-	24	--	
PCB 1260	3.53E-01	5.68	1.03E-01	10		--	
Additional TBE Compounds							
1,1,1-Trichloroethane							
1,1-Dichlorethane							
1,2-Dichlorethane							
1,1-Dichlorethene							
cis-1,2-Dichlorethene							
Tetrachloroethene							
Trichloroethene							
Dichloromethane (Methylene Chloride)							
Site G							
Chromium	16.3	35985.9	NA	-	8.6	--	
Copper	77.0	13062	NA	-	19	--	
Lead	98.0	NA	NA	1200	45	--	

TABLE 8
Soil COCs, TBEs and Selected Cleanup Levels
Operable Unit 2
Twin Cities Army Ammunition Plant

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Preliminary Remediation Goals Carcinogen (mg/kg)	ARAR/TBC [1] (mg/kg)	Background (mg/kg)	COC	**Selected Cleanup Level (mg/kg)**
Nickel	34.4	2071	NA	-	34	--	
Trichloroethene	7.47	248	31.5	3.95		Trichloroethene	**3.95**
Additional TBE Compounds							
1,1,1-Trichloroethane							
1,1-Dichloroethane							
1,2-Dichloroethane							
1,1-Dichloroethene							
cis-1,2-Dichloroethene							
Tetrachloroethene							
1,1,2-Trichloroethane							
trans-Dichloroethene							
Dichloromethane (Methylene Chloride)							
Site H							
Antimony	4300	33.6	NA	-	2.0	Antimony	**33.6**
Arsenic	17.1	222	1.4	-	4.0	Arsenic	**4.0**
Barium	13000	21745	NA	-	345	--	
Cadmium	19	99.2	NA	-	0.7	--	
Chromium	340	35986	NA	-	8.6	--	
Copper	140000	19593	NA	-	19	Copper	**19593**
Cyanide	80	9546	NA	-		--	
Lead	330000	NA	NA	1200	45	Lead	**1200**
Manganese	3600	2503	NA	-	282	Manganese	**2503**
Mercury	0.495	93.2	NA	-	0.16	--	
Molybdenum	40	840	NA	-	4.0	--	
Nickel	246	6213	NA	-	34	--	
Silver	24	1553	NA	-	4.0	--	
Vanadium	39	252	NA	-	16	--	
Zinc	59000	289792	NA	-	24	--	
p,p-DDE	1.92E-01	NA	5.53	-		--	
p,p-DDT	2.07E-01	177	2.92	-		--	
Site I							
Cadmium	109	33.1	NA[4]	-	0.7	--	**NA[5]**
Chromium	262	36000	NA	-	8.6	--	**NA**
Copper	78.1	39200	NA	-	19	--	**NA**
Lead	75.2	NA	NA	1200	45	--	**NA**
Manganese	870	834	NA	-	282	--	**NA[5]**
Molybdenum	11.7	840	NA	-	4	--	**NA**
Nickel	43.3	6210	NA	-	34	--	**NA**
Silver	9.17	1550	NA	-	4	--	**NA**
Vanadium	46.1	84	NA	-	16	--	**NA**
Zinc	196	290000	NA	-	24	--	**NA**

TABLE 8
Soil COCs, TBEs and Selected Cleanup Levels
Operable Unit 2
Twin Cities Army Ammunition Plant

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Carcinogen (mg/kg)	ARAR/TBC [1] (mg/kg)	Background (mg/kg)	COC	Selected Cleanup Level (mg/kg)
1,1,1-Trichloroethane	0.0042	11100	NA	383	--	--	**NA**
Acetone	0.1	31100	NA	45	--	--	**NA**
cis-1,2-Dichloroethene	0.042	1240	NA	22	--	--	**NA**
Methylene chloride	0.026	8200	51	8	--	--	**NA**
Methyl ethyl ketone / 2-Butanone	0.015	101000	NA	255	--	--	**NA**
Trichloroethene	1	743	31.5	19	--	--	**NA**
Additional TBE Compounds							
Cadmium							
Manganese							
1,1-Dichloroethene							
Tetrachloroethene							
Trichloroethene							
Vinyl chloride (chloroethane)							
1,1,2-Trichloroethane							
Site K							
Cadmium	34.8	33.1	NA	-	0.7	--	**NA[5]**
Chromium	77.2	36000	NA	-	8.6	--	**NA**
Copper	837	42400	NA	-	19	--	**NA**
Cyanide	4.47	9550	NA	-	--	--	**NA**
Lead	543	NA	NA	1200	45	--	**NA**
Manganese	1300	834	NA	-	282	--	**NA[5]**
Molybdenum	275	840	NA	-	4	--	**NA**
Silver	4.39	1550	NA	-	4	--	**NA**
Vanadium	25.8	84	NA	-	16	--	**NA**
Zinc	825	290000	NA	-	24	--	**NA**
1,1,1-Trichloroethane	0.0093	11100	NA	-	--	--	**NA**
Methylene chloride	0.019	8200	25.5	0.4	--	--	**NA**
Trichloroethene	0.0032	743	15.8	1	--	--	**NA**
Additional TBE Compounds							
Cadmium							
Manganese							
Lead							
Nickel							
Zinc							
cis-1,2-Dichloroethene							
trans-1,2-Dichloroethene							
Trichloroethene							
Site 129-3							
Antimony	362	22.4	NA	-	2.0	Antimony	**22.4**
Chromium	130	35985.9	NA	-	8.6	--	

TABLE 8
Soil COCs, TBEs and Selected Cleanup Levels
Operable Unit 2
Twin Cities Army Ammunition Plant

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Carcinogen (mg/kg)	ARAR/TBC [1] (mg/kg)	Background (mg/kg)	COC	**Selected Cleanup Level (mg/kg)**
Copper	4700	39185	NA	-	19	--	
Lead	3700	NA	NA	1200	45	Lead	**1200**
Manganese	1100	834	NA	-	282	Manganese	**834**
Mercury	6.70	93.2	NA	-	0.16	--	
Vanadium	22.8	252	NA	-	16	--	
Zinc	72.7	289792	NA	-	24	--	
Nitroglycerine	72.5	NA	NA	-		Nitroglycerine	**Not Established**
Trichloroethene	120	248	31.5	4.43		Trichloroethene	**4.43**
Additional TBE Compounds							
1,1,1-Trichloroethane							
1,1-Dichloroethane							
1,2-Dichloroethane							
1,1-Dichloroethene							
cis-1,2-Dichloroethene							
Tetrachloroethene							
Cyanide							
Site 129-5							
Antimony	1510	67.2	NA	-	2.0	Antimony	**67.2**
Barium	27000	21745	NA	-	345	Barium	**21745**
Copper	17000	39185	NA	-	19	--	
Cyanide	7.86	9546	NA	-	--	--	
Lead	160000	NA	NA	1200	45	Lead	**1200**
Zinc	2310	289792	NA	-	24	--	
Additional TBE Compounds							
Benzene							
Dichloromethane (Methylene Chloride)							
Trichloroethene							
Site 129-15							
Arsenic	5.0	111	0.460	-	4.0	Arsenic	**4.0**
Cadmium	0.89	99.2	NA	-	0.7	--	
Chromium	23.8	35985.9	NA	-	8.6	--	
Copper	28.8	39185	NA	-	19	--	
Manganese	620	1251	NA	-	282	--	
Vanadium	29.0	126.0	NA	-	16.0	--	
Zinc	52.3	289792	NA	-	24	--	
Anthracene	0.220	50428	NA	-		--	
Benzo[a]anthracene	0.430	NA	0.215	-		Benzo[a]anthracene	**0.215**
Benzo[a]pyrene	0.370	NA	0.021	-		Benzo[a]pyrene	**0.021**
Bis (2-ethylhexyl) phthalate	0.480	1070	10.7	3.98		--	
Chrysene	0.50	NA	64.5	-		--	
Di-n-butyl phthalate	4.20	2839	NA	>1000		--	
Fluoranthene	0.59	6724	NA	-		--	
Indeno[1,2,3-C,D]pyrene	0.250	NA	0.645	-		--	

TABLE 8
Soil COCs, TBEs and Selected Cleanup Levels
Operable Unit 2
Twin Cities Army Ammunition Plant

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals		ARAR/TBC[1] (mg/kg)	Background (mg/kg)	COC	**Selected Cleanup Level (mg/kg)**
		Noncarcinogen (mg/kg)	Carcinogen (mg/kg)				
p,p-DDD	0.063	NA	7.83	-		--	
p,p-DDE	0.108	NA	5.53	-		--	
p,p-DDT	0.054	177	2.92	-		--	
Pyrene	0.550	5043	NA	-		--	
Additional TBE Compounds							
1,1,1-Trichloroethane							
1,1-Dichloroethane							
1,2-Dichloroethane							
1,1-Dichloroethene							
cis-1,2-Dichloroethene							
Tetrachloroethene							
Trichloroethene							
Carbon Tetrachloride (Tetrachloromethane)							
Di-n-Octyl Phthalate							

Notes:
ARAR/TBC[1] Clean-up goals for Lead and PCBs are based on Health Standards; All other goals based on groundwater protection from leaching
NA[2]- Not Applicable
TBE[3]- To Be Evaluated: TBE Compounds were not included in PRG calculations; these compounds will be considered during remedial actions
4 - Cadmium and manganese are TBEs because they each have a single anomalous detection above the PRG.

Table 9 - Summary of Alternative Costs, Deep Soil Sites D and G

Site	Alternatives		
	1	2	3
	No Action	No Further Action	Expand SVE
D	$166,200	$353,700	$670,800
G	$229,300	$392,300	$727,200

Table 10 - Summary of Alternative Costs, Shallow Groundwater Site A

Site	Alternatives			
	1	2	3	4
	No Action	Boundary Containment	Boundary Containment with Air Sparging	Boundary Containment with Infiltration
A	$525,000	$2,294,100	$3,076,100	$2,240,200

Table 11 - Summary of Alternative Costs, Shallow Groundwater Site I

Site	Alternatives				
	No Action	Extraction with POTW Discharge	Extraction with Air Stripping	Air Sparging	
				Vertical Wells	Horizontal Wells
I	$142,000	$393,000	$775,000	$482,000	$1,418,000

Table 12 - Summary of Alternative Costs, Shallow Groundwater Site K

Site	Alternatives			
	No Action	Extraction/ Containment with Air Stripping	Extraction/Containment With Air Sparging	
			Vertical Wells	Horizontal Wells
K	$163,000	$734,000	$2,237,000	$3,559,000

TABLE 13

Summary of Alternative Costs
Units 3 and 4 Deep Groundwater

Site	Alternatives			
	1	2	3	4
	No Action	No Further Action	Source Containment	DNAPL Char./ Rem. Plume Containment Aquifer Restoration
Deep Groundwater	$2,315,577	$9,441,000	$9,494,900	$15,000,000 to $40,000,000*

* *Rough order of magnitude cost estimate for all phases of restoration alternative*

TABLE 14
SUMMARY OF SELECTED REMEDY COST ESTIMATES
OPERABLE UNIT 2, TWIN CITIES ARMY AMMUNITION PLANT

Site	Media	Selected Remedy	Cost Estimate
Site A			
	Shallow Soils	Excavate, Stabilize, and Off-Site Disposal	$1,388,000
	Dump	Excavate and Off-Site Disposal	$484,500 - $1,970,000
	Shallow Groundwater	Boundary Containment and Source Remediation	$2,294,100
Site B			
	Dump	Characterization	$126,900
Site C			
	Shallow Soils	Excavate and Off-Site Incineration and Disposal	$5,574,500
Site D			
	Deep Soils	Expand Soil Vapor Extraction System	$670,800
	Shallow Soils	Characterization	*To be determined*
Site E			
	Shallow Soils	Excavate, Stabilize, and Off-Site Disposal	$503,500
	Dump	Excavate and Off-Site Disposal	$1,232,800 - $5,155,300
Site G			
	Deep Soils	Expand Soil Vapor Extraction System	$727,200
	Dump	Characterization	*To be determined*
Site H			
	Shallow Soils	Excavate, Stabilize, and Off-Site Disposal	$671,700
	Dump	Excavate and Off-Site Disposal	$966,000 - $4,026,900
Site I			
	Shallow Groundwater	Extraction with POTW Discharge	$393,000
Site K			
	Shallow Groundwater	Extraction/Containment with Air Stripping Treatment	$734,000
Site 129-3			
	Shallow Soils	Excavate, Stabilize, and Off-Site Disposal	$416,000
Site 129-5			
	Shallow Soils	Excavate, Stabilize, and Off-Site Disposal	$198,600
Site 129-15			
	Dump	Characterization	$371,500
Deep Groundwater		Source Containment and Technology Reviews	$9,494,900
		Total Cost:	$26,248,000 - $34,716,900

Appendix C

APPENDIX C

OPERABLE UNIT 2
CORRESPONDENCE, EQUATIONS, AND SUPPORTING DATA FOR DETERMINING SITE REMEDIATION GOALS

TWIN CITIES ARMY AMMUNITION PLANT

APPENDIX C TABLE OF CONTENTS

Appendix C-1
Determination of Health Risk Based Preliminary Remediation Goals

When ARARs are not available for a contaminant in a specific medium (e.g., soil) or are not sufficiently protective of human health due to multiple contaminants or multiple potential exposure pathways, risk-based remediation goals can be calculated based on the results of a site-specific baseline health risk assessment. Such remediation goals, based on acceptable threshold or nonthreshold health effects, are designed to be preliminary cleanup goals to protect human health and the environment. Technical feasibility and economic limitations must also be considered and the remediation goals modified as appropriate.

Since ARARs exist for most contaminants of concern (COCs) in the groundwater at the TCAAP site, health risk based remediation goals were not developed for this medium. It is noted that the drinking water criteria available for application to TCAAP are not all health risk based. For contaminants in the soils, however, health risk based remediation goals needed to be developed for all contaminants of concern. The soil PRGs do incorporate an evaluation assessing multiple contaminants, but do not take into account multiple potential exposure pathways.

At the completion of the HHRA, EPA began developing health risk based PRGs for the chemicals of potential concern identified at TCAAP. The methodology used to calculate these PRGs is described in correspondence from PRC to USEPA (Chaudhry 1993). Using a slightly modified version of this methodology, health risk based PRGs were calculated for the preliminary COCs (PCOCs) at each of the sites on TCAAP. The formulas, data, and calculations used in this procedure are presented in Appendix C-1.

The land use scenario considered in developing the PRGs is described in the HHRA as:

- **Current and probable future land use conditions,** where the Army maintains ownership of TCAAP and access to the site remains restricted. This scenario also assumes that only industrial activities will take place at the site.

PRGs for each contaminant were calculated assuming an acceptable excess cancer risk (ECR) of $1x10^{-6}$ and an acceptable hazard index (HI) of 1.0. For contaminants that are both carcinogenic and toxic, the more stringent of the concentrations calculated based on the ECR and the HI was selected as the PRG.

Since all of the health risk based PRGs were developed based on dermal contact and incidental ingestion of contaminants in the soil, they apply only to accessible soils (to a depth of 12 feet).

Under the industrial scenario, the exposure group used for PRG calculations is the adult worker. Slope factors and reference doses utilized in the PRG calculations were obtained from several sources. The primary source for oral toxicity values was the Oak Ridge National Laboratory document (1995) summarizing toxicity data from the Integrated Risk Information System (IRIS) and the Health Effects Assessment Summary Table (HEAST). The USEPA Region IX PRG Table (Smucker 1995) was referenced for additional toxicity information when necessary. Finally, some toxicity data was obtained from the HHRA for OU-2 (PRC 1991) and from PRC's letter to USEPA dated September 14, 1993.

Dermal reference doses were calculated simply by multiplying the oral reference dose by the absorption efficiency, as referenced in Appendix A of the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part A (USEPA 1989b). Dermal slope factors were calculated by dividing the oral slope factor by the absorption efficiency factor, also referenced in Appendix A of the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part A (USEPA 1989b).

The contaminant specific oral reference dose (RfDo) for manganese was not obtained from the IRIS database. A less conservative value was back-calculated from the critical RfDo and the suggested content of manganese in the normal U.S. diet. A preliminary RfDo of 10 mg/day (0.14 mg/kg-day for a 70 kg adult) was used as a base line. This value, the *NOAEL*, is based on the chronic human consumption of manganese in the diet obtained from several studies. The preliminary RfDo was modified to take into account the manganese consumed in the normal U.S. diet. The Food and Nutrition Board of the National Research Council (NRC 1989) determined the safe and adequate daily dietary intake of manganese to range from 2 mg/day to 5 mg/day for adults. A value of 5 mg/day was subtracted from the preliminary RfDo of 10 mg/day. A modifying factor (MF) of 3 was applied to account for non-dietary exposures. The difference, 5 mg/day, was divided by the MF of 3 and a body weight of 70 kg, leaving an adjusted RfDo of 0.024 mg/kg-day. This value represents the additional exposure to manganese in soil. The preliminary remediation goal calculated using this method is 2500 mg/kg.

The compound PRGs were adjusted to account for exposure to multiple compounds at each site. Noncarcinogenic PRGs were adjusted for multiple exposures to constituents that affect the same target organ. Likewise, carcinogenic PRGs were adjusted for multiple exposures to carcinogenic constituents. The adjustment factors are based on the number of constituents with similar endpoints which are primarily responsible (≥95%) for the risk at an individual site.

The percent contribution of each constituent to either the noncarcinogenic hazard or carcinogenic risk at a site was determined using equations similar to those described in the US EPA Region IX PRG Table (Smucker 1995). Constituents contributing the greatest percentage of risk were selected in decreasing order until they totaled ≥ 95% of risk, either noncarcinogenic or carcinogenic. Only the compounds contributing the greatest risk were then adjusted for multiple endpoints (additivity).

For Site C, one PRG was calculated for the mixture of dioxin and furan compounds (polychlorodibenzo-p-dioxins and polychlorodibenzofurans) detected in soils at the site. Toxicity Equivalency Factors (TEFs) have been developed which are used to adjust the concentrations of the other less toxic dioxin/furan compounds so they can be evaluated using the toxicity data for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) (USEPA 1989a).

Appendix C-2
Determination of Leaching Based Remediation Goals

In establishing remediation goals for site soils, consideration must be given to the likelihood that contaminants will migrate to the groundwater in significant quantities. Since the ARARs and health risk based PRGs were not developed to address this pathway, an alternative approach was used at those sites with evidence of leaching or where future leaching is likely. Accurately modeling the transport of contaminants, particularly inorganics, in the unsaturated zone is difficult due to the heterogeneity and uncertainties of the subsurface environment. An attempt was made by the MPCA to calculate remediation goals which protected the leaching pathway. The remediation goals calculated using this method will be considered for those constituents for which evidence of leaching exists, specifically if the constituent exists in groundwater above drinking water or health risk standards. The process by which the MPCA evaluated leaching and the goals calculated by this method are presented in Appendix C-2.

Appendix C-3
COC Development

COCs were generated through a stepwise process of screening all the possible contaminants at TCAAP. The COC development process occurred over an extended time period and involved both the regulatory agencies and the Army. Pre-screening to obtain a list of specific analytes was done for all the data. Because of the varying degrees of availability of background data, Safe Drinking Water Act (SDWA) data, and other sources for screening, the process for evaluating the soil data was different from the groundwater data. The screening processes for both data sets are summarized in this section. Data tables that correspond to the steps in the screening process are presented in this Appendix.

List Of Possible Analytes. The first step was to identify all constituents which were included in the analytical work from all previous investigations. This list was generated by querying the Installation Restoration Data Management Information System (IRDMIS) database for all analytes present within the database. The total list of analytes for soil was 440 individual analytes (Appendix C-3, Table 1). For both Unit 1 and Units 3 and 4 groundwater at TCAAP, 319 individual analytes were identified (Appendix C-3, Table 2). Upon review of the entire database, it was determined that for some analytes the total number of samples for which analyses were actually performed was zero. In addition, some compounds were detected as TICs (tentatively identified compounds) (Appendix C-3, Table 3). A tentatively identified compound is an analyte which cannot be positively identified by its chromatogram. The TICs and constituents which were never analyzed for (zero samples) were removed from the list of preliminary chemicals of concern.

List Of Site Specific Analytes. After the removal of data as described above, a list of all soil and monitoring well samples was compiled on a site-specific basis to determine where a particular analyte was both sampled and detected (Appendix C-3, Tables 4 {soil sites A, B, C, D, E, H, 129-3, 129-5 and 129-15}, 6 {Unit 1 groundwater at Sites A, B, C and H}, 7 {Units 3 and 4 groundwater}, 8 {soil at Sites I and K}, and 10 {Unit 1 groundwater at Sites I and K}).

Data Evaluation

A screening methodology was developed for both soil and groundwater COC generation. Soil analytes were initially screened against toxicological data, sample population statistics, comparison to background and an engineering evaluation to determine the initial or preliminary chemicals of concern (PCOCs). The PCOC list was then evaluated against HRB PRGs and ARARs/TBCs to determine the final COCs. Groundwater COCs were developed by screening the analytical data against sample population statistics, ARARs, and an engineering evaluation. The following sections discuss the process used for developing COCs in soil and groundwater at TCAAP.

Preliminary Chemicals Of Concern - Soil. Soil analytical data at the individual sites were evaluated using the following criteria to determine the PCOCs (Appendix C-3, Table 4):

- *Toxicity Data.* A constituent that is considered nontoxic was not retained for consideration as a chemical of concern.
- *Detection frequency.* A constituent detected in 5% or more of the soil samples was retained for consideration as a PCOC.
- *Concentrations greater than background.* For metals which were detected in 5 percent or more of the soil samples, the concentration range for each metal was compared to the TCAAP site specific background concentrations. For organic compounds, any detection was considered a detection above background.

Analytes with concentrations greater than background and were detected above background in at least 5 percent of the samples were retained for further consideration. Some analytes detected in less than 5 percent of the samples but exhibited high concentrations were retained for further consideration.

The criterion titled "Engineering Evaluation" was used to screen potential chemicals of concern. This evaluation was performed to remove constituents that may meet or exceed the previously described criteria of comparison to site specific background and detection frequency but may not be indicative of contamination at the site. The engineering evaluation took into account the following parameters and conditions:

- *Groundwater chemical of concern.* In those cases where a compound had been identified as a groundwater COC but did not exceed the soil screening criteria, then that compound was retained for consideration either as a soil PCOC (if previously sampled for and detected in the soil) or as a compound designated as "to be evaluated" (TBE) during remedial design/remedial action (RD/RA) of the site.
- *Suspected lab or field contaminant.* For those situations where the only organics that are present in a sample population at a site include methylene chloride, methylethyl ketone, or acetone, and the concentrations are low (parts per billion range), these constituents were not retained as PCOCs because of the likelihood of being lab or field-borne contaminants. Detections of these chemicals were within ten times the concentrations of field or quality assurance samples.

Final Chemicals Of Concern. The approach used to determine the final COCs for soil and groundwater differ. The following sections more fully describe the methodology for determining final COCs for site soil and groundwater.

<u>Soils</u>. To develop the final COC list, the PCOCs for soil were evaluated using the following criteria (Appendix C-3, Tables 5 and 9):

- *Comparison to health risk based PRGs.* The maximum constituent concentrations were compared to HRB PRGs. Any PCOCs not at concentrations above the PRGs were dropped from the COC list. However, if a leaching number or ARAR was exceeded, the PCOC was retained even if the PRG was not exceeded.
- *Comparison with existing ARARs and TBCs.* Constituent concentrations were compared to federal and state ARARs. ARARs are environmental requirements with which a remedial action at a CERCLA site must comply. The more stringent of the state or federal requirements will control, but only those state requirements that are legally enforceable and consistently enforced statewide may be established as ARARs. State or local requirements that are not legally enforceable may also be considered in the evaluation (referred to as to-be-considered [TBC] criteria).

  An assessment of ARARs for the TCAAP site has been conducted by the Chemical Hazard Evaluation Group in the Health and Safety Research Division at Oak Ridge National Laboratory (ORNL). ORNL divided the ARARs into three classifications: chemical-specific, action-specific, and location-specific ARARs. ARARs documentation prepared by ORNL is provided in the text of this report.

  The only potential ARAR for establishing remediation goals for contaminants in soil at the TCAAP site is the lead abatement standard of 100 parts per million (ppm) established in Part 4760.0020 of the Minnesota Rules. The standard applies to bare soil on residential property or playgrounds. This standard is not considered applicable for TCAAP under the current and probable future land use scenario.

USEPA's Technical Review Workgroup (TRY) for Lead has been evaluating methodologies for assessing risks associated with non-residential adult exposure to lead at NPL sites since 1994. Although USEPA has not yet sanctioned a particular methodology, the TRY has recently developed an approach which is conceptually similar to a slope factor approach for deriving risk-based remediation goals which was adapted for use at the California Gulch NPL Site in Region 8. This approach has subsequently been used at several other sites within and outside EPA Region 5 as a basis for determining industrial lead cleanup levels.

The approach utilizes a biokinetics slope factor to relate soil lead intake to blood lead concentrations in adults (for specific details on the slope factor approach and its application to TCAAP soils, see Appendix C-4). Based upon USEPA's assessment, as detailed in Appendix C-4, the selected soil lead cleanup level of 1200 ppm is considered appropriate for the site.

In the EPA guidance report for remedial actions at Superfund sites concerning PCBs (USEPA 1990), preliminary remediation goals for PCBs are set at 10 to 25 ppm for industrial or remote areas.

Any PCOCs not at concentrations above the ARARs or TBCs were dropped from the COC list.

Table 5 of this ROD summarizes the list of COCs and TBEs developed for the soil sites within OU-2. Included in this table for the COCs are the maximum constituent concentrations at the site, adjusted carcinogen and noncarcinogen PRG values, ARARs and TBCs, and background concentrations. The final column in Table 5 identifies the recommended constituent remediation goal on a site specific basis. The recommendations were developed based on the following hierarchy of precedence:

- The background level takes precedence as the minimum remediation goal;
- ARARs take precedence over the remaining criteria;
- The more stringent of the health risk based or leaching based goals takes precedence.

Groundwater. Separate COCs were generated for Unit 1 (Appendix C-3, Tables 6 and 10) and Units 3 and 4 groundwater (Appendix C-3 Table 7) at TCAAP. Groundwater analytical data were evaluated using the following criteria to determine the final chemicals of concern:

- *Detection frequency*. The criteria used here is the same as what was applied to the soil data.
- *Concentration comparison against background*. The criteria used here is the same as what was applied to the soil data.
- *Comparison with ARARs and TBCs*. Maximum constituent concentrations were compared to ARARs and TBCs. There are no standards that are directly **applicable** as remediation goals for contaminated groundwater. There are, however, several standards that are considered **relevant and appropriate** to use as potential remediation goals. These include the following:

  - Federal Maximum Contaminant Levels (MCLs)
  - Federal and Maximum Contaminant Level Goals (MCLGs)
  - State of Minnesota MCLs
  - State of Minnesota Secondary MCLs
  - State of Minnesota Health Risk Limits (HRLs)
  - Federal Action Levels for copper and lead

Other TBC criteria for establishing remediation goals include the federal Health Advisories Levels (HALs) issued by the USEPA Office of Water and the Minnesota Department of Health's Health Based Values (HBVs). Surface water standards will be applied to the well closest to the point of groundwater discharge to surface water. An in-depth discussion of the relevancy of all of these standards can be found in the ORNL document previously referenced.

Constituents with concentrations exceeding ARARs were retained as COCs.

The criterion titled "Engineering Evaluation" was also used to screen potential chemicals of concern. This evaluation was performed to remove constituents that meet or exceed the previously described criteria of comparison to background and detection frequency but may not be indicative of contamination at the site. The engineering evaluation took into account the following parameters and conditions:

- *Consistency of detection*. Historic detections of constituents in Unit 1 groundwater that have not been confirmed in more recent samplings were not retained as chemicals of concern. The intent of this screening was aimed toward identifying those constituents that are truly present in groundwater and not an artifact of either laboratory or field-derived sample contamination.

Table 8 of this ROD summarizes the Unit 1 groundwater COCs on a site specific basis. Included in this table are the maximum analyte concentrations detected, background level, and the ARARs and TBCs. Table 12 of this ROD summarizes the Units 3 and 4 groundwater COCs, and contains much the same information as Table 8 of the ROD.

APPENDIX C-1

EQUATIONS AND SUPPORTING DATA FOR CALCULATING PRELIMINARY REMEDIATION GOALS

TWIN CITIES ARMY AMMUNITION PLANT

TABLE 1

EQUATIONS FOR DETERMINING PRELIMINARY REMEDIATION GOALS

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Average Soil Intake via Ingestion

$$Io = [IR \times EF \times YE \times CF]/[BW \times AT]$$

where: Io = Average soil intake via ingestion, kg soil/kg body weight-day
IR = Soil ingestion rate, mg/day
EF = Exposure frequency, days/year
YE = Years of exposure, years
CF = Conversion factor, 1E-06 kg/mg
BW = Body weight, kg
AT = Averaging time, days

Average Soil Adherence via Dermal Contact

$$Ad = [SA \times CF1 \times AdF \times CF2 \times EF \times YE]/[BW \times AT]$$

where: Ad = Average soil adherence, kg/kg-day
SA = Body surface area exposed to soil, square meters/day
CF1 = Conversion factor, 1E+04 square centimeters/square meter
AdF = Soil to skin adherence factor, 0.9 mg/cm^2 (PRC 1991)
CF2 = Conversion factor, 1E-06 kg/mg
EF = Exposure frequency, days/year
YE = Years of exposure, years
BW = Body weight, kg
AT = Averaging time, days

Total Lifetime Average Soil Intake

$$Io_t = Io_1 + Io_2 + ... + Io_n \quad \text{or} \quad Io_t = Io(adj)$$

where: Io_n = Average soil intake via ingestion per age group (e.g., child, adult), kg soil/kg body weight-day
Io(adj) = Age-adjusted (6 yrs as child, 24 yrs as nonchild) average soil intake via ingestion, kg soil/kg body weight-day
Io_t = Total lifetime average soil intake, kg soil/kg body weight-day

Total Lifetime Soil Adherence via Dermal Contact

$$Ad_t = Ad_1 + Ad_2 + ... + Ad_n \quad \text{or} \quad Ad_t = Ad(adj)$$

where: Ad_n = Average soil adherence per age group (e.g., child, adult), kg/kg-day
Ad(adj) = Age-adjusted (6 yrs as child, 24 yrs as nonchild) average soil adherence, kg/kg-day
Ad_t = Total lifetime soil adherence via dermal contact, kg/kg-day

Noncarcinogenic PRG (mg/kg)

$$PRG_n = \frac{TR_n}{[(Io*(1/RfDo))+(Ad*AbF*(1/RfDd))]}$$

where: PRG_n = Noncarcinogenic PRG, mg/kg
TR_n = Total acceptable noncarcinogenic risk (HI), 1 (unitless) (EPA, 1991)
Io = Age group-specific average soil ingestion, kg/kg-day
Ad = Age group-specific average soil adherence, kg/kg-day
AbF = Chemical-specific dermal absorption factor, unitless
RfDo = Chemical-specific oral reference dose, mg/kg-day
RfDd = Chemical-specific dermal reference dose, mg/kg-day

Carcinogenic PRG (mg/kg)

$$PRG_c = \frac{TR_c}{[(Io_t*SFo)+(Ad_t*AbF*SFd)]}$$

where: PRG_c = Carcinogenic PRG, mg/kg
TRc = Excess acceptable carcinogenic risk, 1e-06 (unitless) (EPA 1991)
Io_t = Total lifetime average soil intake via ingestion, kg/kg-day
SFo = Chemical-specific oral carcinogenic slope factor, $(mg/kg\text{-}day)^{-1}$
Ad_t = Total lifetime average soil adherence via dermal contact, kg/kg-day
AbF = Chemical-specific dermal absorption factor, unitless
SFd = Chemical Specific dermal carcinogenic slope factor, $(mg/kg\text{-}day)^{-1}$

TABLE 2

INPUT PARAMETERS FOR DETEMINING PRELIMINARY REMEDIATION GOALS

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Age Group-Specific Values Used in Estimating Chemical-Specific Soil PRGs for Industrial Exposure Scenario

Industrial Exposure Scenario

	Age Group (years)	IR (mg/day)	EF (days/yr)	YE (years)	BW (kg)	Noncarcinogenic AT (days)	Carcinogenic AT (days)	SA (m^2)
1	Adult	50	250	25	70	9125	25550	0.31

Calculation of Values for Industrial Exposure Scenario

Noncarcinogenic		Carcinogenic	
Io1 =	4.89E-07	Io1 =	1.75E-07
Ad1 =	2.73E-05	Ad1 =	9.75E-06

Age Group-Specific Values Used in Estimating Chemical-Specific Soil PRGs Residential Exposure Scenario

Residential Exposure Scenario

	Age Group (years)	IR (mg/day)	EF (days/yr)	YE (years)	BW (kg)	Noncarcinogenic AT (days)	Carcinogenic AT (days)	SA (m^2)
1	0 to 6	200	350	6	15	2190	25550	0.2
2	7 to 30	100	350	24	57	8760	25550	0.41
adj	Age Adjusted	120	350	30	50	10950	25550	0.368

Calculation of Values for Residential Exposure Scenario

Noncarcinogenic		Carcinogenic	
Io1=	1.28E-05	Io1 =	1.10E-06
Io2=	1.68E-06	Io2 =	5.77E-07
Ad1=	1.15E-04	Io(adj) =	9.86E-07
Ad2=	6.21E-05		
		Ad1 =	9.86E-06
		Ad2 =	2.13E-05
		Ad(adj) =	2.72E-05
		Iot = Io(adj) =	9.86E-07
		Adt = Ad(adj) =	2.72E-05

TABLE 3
TOXICITY DATA USED IN PRG CALCULATIONS
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Notes	Constituent	Sfo (mg/kg/day)-1	Absorption Efficiency (unitless)	Absorption Factor (unitless)	Sfd (mg/kg/day)-1	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn (mg/kg)	PRGc (mg/kg)
IRIS May 95	Acetone	NA	1	0.1	NA	1.00E-01	1.00E-01	3.11E+04	NA
IRIS May 95	Anthracene	NA	0.5	0.1	NA	3.00E-01	1.50E-01	5.04E+04	NA
IRIS May 95	Antimony	NA	0.05	0.01	NA	4.00E-04	2.00E-05	6.72E+01	NA
IRIS Sep 95	Arsenic	1.50E+00	0.95	0.03	1.58E+00	3.00E-04	2.85E-04	2.22E+02	1.38E+00
IRIS May 95	Barium	NA	0.1	0.01	NA	7.00E-02	7.00E-03	2.17E+04	NA
IRIS May 95	Benzo[a]anthracene	7.30E-01	0.5	0.1	1.46E+00	NA	NA	NA	6.45E-01
IRIS May 95	Benzo[a]pyrene	7.30E+00	0.5	0.1	1.46E+01	NA	NA	NA	6.45E-02
IRIS May 95	Beryllium	4.30E+00	0.01	0.01	4.30E+02	5.00E-03	5.00E-05	1.80E+02	2.34E-02
IRIS May 95	Bis (2-ethylhexyl) phthalate	1.40E-02	0.15	0.1	9.33E-02	2.00E-02	3.00E-03	1.07E+03	1.07E+01
IRIS Sep 95	Cadmium	NA	0.06	0.01	NA	5.00E-04	3.00E-05	9.92E+01	NA
IRIS Sep 95 - Cr III	Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA
IRIS May 95	Chrysene	7.30E-03	0.5	0.1	1.46E-02	NA	NA	NA	6.45E+01
IRIS May 95	Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	3.92E+04	NA
IRIS May 95	Cyanide	NA	0.17	0.01	NA	2.00E-02	3.40E-03	9.55E+03	NA
IRIS May 95	Di-n-butyl phthalate	NA	0.9	0.1	NA	1.00E-01	9.00E-02	2.84E+04	NA
IRIS May 95	Dioxins/Furans	1.50E+05	0.1	0.25	1.50E+06	NA	NA	NA	2.72E-07
IRIS May 95	Fluoranthene	NA	0.5	0.1	NA	4.00E-02	2.00E-02	6.72E+03	NA
IRIS May 95	Indeno[1,2,3-C,D]pyrene	7.30E-01	0.5	0.1	1.46E+00	NA	NA	NA	6.45E-01
IRIS May 95	Lead	NA	NA	NA	NA	NA	NA	NA	NA
IRIS Sep 95	Manganese	NA	0.03	0.01	NA	2.40E-02	7.20E-04	2.50E+03	NA
IRIS May 95	Mercury	NA	0.1	0.01	NA	3.00E-04	3.00E-05	9.32E+01	NA
IRIS May 95	Molybdenum	NA	0.05	0.01	NA	5.00E-03	2.50E-04	8.40E+02	NA
IRIS May 95	Nickel	NA	0.1	0.01	NA	2.00E-02	2.00E-03	6.21E+03	NA
IRIS May 95	Nitroglycerine	NA	--	--	NA	NA	NA	NA	NA
IRIS May 95	p,p-DDD	2.40E-01	0.9	0.033	2.67E-01	NA	NA	NA	7.83E+00
IRIS May 95	p,p-DDE	3.40E-01	0.9	0.033	3.78E-01	NA	NA	NA	5.53E+00
IRIS May 95	p,p-DDT	3.40E-01	0.9	0.077	3.78E-01	5.00E-04	4.50E-04	1.77E+02	2.92E+00
IRIS May 95	PCB 1260	7.70E+00	0.9	0.1	8.56E+00	2.00E-05	1.80E-05	5.68E+00	1.03E-01
IRIS May 95	Pyrene	NA	0.5	0.1	NA	3.00E-02	1.50E-02	5.04E+03	NA
IRIS May 95	Silver	NA	0.1	0.01	NA	5.00E-03	5.00E-04	1.55E+03	NA

TABLE 3
TOXICITY DATA USED IN PRG CALCULATIONS
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Notes	Constituent	Sfo (mg/kg/day)-1	Absorption Efficiency (unitless)	Absorption Factor (unitless)	Sfd (mg/kg/day)-1	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn (mg/kg)	PRGc (mg/kg)
IRIS May 95	Thallium	NA	0.05	0.01	NA	7.00E-05	3.50E-06	1.18E+01	NA
IRIS May 95	Trichloroethene	1.10E-02	0.9	0.25	1.22E-02	6.00E-03	5.40E-03	7.43E+02	3.15E+01
IRIS May 95	Vanadium	NA	0.01	0.01	NA	7.00E-03	7.00E-05	2.52E+02	NA
IRIS May 95	Xylenes, total combined	NA	0.92	0.1	NA	2.00E+00	1.84E+00	5.79E+05	NA
IRIS May 95	Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA

SFo = Chemical specific oral carcinogen slope factor
SFd = Chemical specific dermal carcinogen slope factor
RfDo = Chemical specific oral reference dose
RfDd = Chemical specific dermal reference dose
PRGn and PRGc = Unadjusted Preliminary Remediation Goals: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

TABLE 4

EQUATIONS FOR DETERMINING CONSTITUENT CONTRIBUTION TO TOTAL RISK AT A SITE [1]

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Noncarcinogenic Hazard Estimates

HI = CONC / PRG

where: HI = Noncarcinogenic hazard index (≤ 1 generally considered safe)
CONC = maximum concentration or 95% UCL of compound, mg/kg
PRG = preliminary remediation goal calculated for compound, mg/kg

Percent Contribution to Noncarcinogenic Hazard

$\% = [\, HI_i / \Sigma\, (HI_i)\,] \times 100$

where: % = percent contribution of constituent to total noncarcinogenic hazard at site
HI_i = Constituent noncarcinogenic hazard
$\Sigma\, (HI_i)$ = Total noncarcinogenic hazard of all constituents at site

Carcinogenic Hazard Estimates

RISK = [CONC / PRG] x 1E-06

where: RISK = Carcinogenic risk ($\leq$ 1E-06 generally considered acceptable)
CONC = maximum concentration or 95% UCL of compound, mg/kg
PRG = preliminary remediation goal calculated for compound, mg/kg

Percent Contribution to Carcinogenic Risk

$\% = [\, RISK_i / \Sigma\, (RISK_i)\,] \times 100$

where: % = percent contribution of constituent to total carcinogenic risk at site
$RISK_i$ = Constituent carcinogenic risk
$\Sigma\, (RISK_i)$ = Total carcinogenic risk of all constituents at site

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[1] Equations from US EPA Region IX PRG Table (Second Half 1995).

TABLE 5

CONSTITUENT ADJUSTMENT FACTORS [1]
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Carcinogen	Central Nervous System	Liver	Kidney	Reproduction
Antimony	–	–	X	–	–
Arsenic	X	X	–	–	–
Barium	–	–	–	–	–
Beryllium	X	–	–	–	–
Cadmium	–	–	X	X	–
Chromium	–	–	X	X	–
Copper	–	X	X	–	–
Cyanide	–	X	–	–	–
Lead	–	X	–	–	X
Manganese	–	–	X	X	–
Mercury	–	X	–	X	–
Molybdenum	–	–	–		–
Nickel	–	–	X	X	–
Silver	–	–	–		–
Thallium	–	X	X	X	–
Vanadium	–	X	–	X	–
Zinc	–	–	–	–	–
1,1,1-Trichloroethane	–	X	X	X	–
1,1-Dichloroethane	–	X	X	X	–
1,1-Dichloroethene	X	X	–	–	–
1,2-Dichloroethane	X	X	X	X	–
1,2-Dichloroethene (cis and trans isomers)	–	X	X	X	–
1,2,3-Trichloropropane	X	–	X	X	–
1,3,5-Trinitrobenzene	–	–	–	–	–
2,3,7,8-Tetrachlorodibenzo-p-dioxin	X	–	–	–	–
2,4-Dimethylphenol	–	X	–	–	–
2,4-Dinitrotoluene	X	–	–	–	–
2-Methylphenol / 2-cresol	–	X	–	–	–
Acetone	–	X	–	–	–
Anthracene	–	–	X	X	–
Benzene	X	X	X	X	–
Benzo[a]anthracene	X	–	X	X	–
Benzo[a]pyrene	X	–	X	X	–
Bis (2-ethylhexyl) phthalate	X	X	–	–	–
Carbon tetrachloride	X	X	X	X	–
Chloroform	X	X	X	X	–
Chrysene	X	–	X	X	–
cis-1,2-Dichloroethene	–	X	X	X	–
Di-n-butyl phthalate	–	X	–	–	–
Ethylbenzene	–	X	–	–	–
Fluoranthene	–	–	X	X	–
Indeno(1,2,3-C,D)pyrene	X	–	X	X	–
Methylene chloride	X	X	X	X	–
Methylethyl ketone / 2-Butanone	–	–	–	–	–
Napthalene	–	–	X	X	–
Nitroglycerine	–	–	–	–	–
p,p-DDD	X	–	–	–	–
p,p-DDE	X	–	–	–	–
p,p-DDT	X	–	X	–	–
PCB 1260	X	–	X	–	X
Phenol	–	X	X	X	–
Pyrene	–	–	X	X	–
Tetrachloroethene	X	X	X	X	–
trans-1,2-Dichloroethene	–	X	X	X	–
Trichloroethene	X	X	X	X	–
Vinyl Chloride	X	X	X	–	–
Xylenes, total combined	–	X	X	–	–

[1] References:

PRC. 1991. Final Report Human Health Risk Assessment New Brighton/Arden Hills Superfund Site Including the Twin Cities Army Ammunition Plant, Ramsey County, Minnesota.

PRC. 1992. Preliminary Remediation Goals for Soils at the New Brighton/Arden Hills Superfund Site, Including the Twin Cities Army Ammunition Plant, Ramsey County, Minnesota. Letter plus attachments from Majid Chaudry (PRC) to Tom Barounis (US EPA), December 18.

TABLE 6

DIOXIN/FURAN TEFs AND MAXIMUM CONCENTRATIONS AT SITE C
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Dioxins/Furans	Maximum Concentration (mg/kg)	TEF [1]	Adjusted Maximum Concentration (mg/kg)
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.00E-04	1	1.00E-04
2,3,7,8-Tetrachlorodibenzofuran	4.00E-05	0.1	4.00E-06
Total Tetrachlorodibenzo-p-dioxins	1.00E-03	0	0.00E+00
Total Pentachlorodibenzo-p-dioxins	2.00E-04	0.5	1.00E-04
Total Pentachlorodibenzofurans	2.00E-04	0.5	1.00E-04
Total Hexachlorodibenzo-p-dioxins	9.00E-04	0.1	9.00E-05
Total Hexachlorodibenzofurans	1.00E-04	0.1	1.00E-05
Total Heptachlorodibenzo-p-dioxins	3.10E-03	0.01	3.10E-05
Total Heptachlorodibenzofurans	1.00E-04	0.01	1.00E-06
Total Octachlorodibenzo-p-dioxins	8.50E-03	0.001	8.50E-06
Total Octachlorodibenzofurans	6.00E-04	0.001	6.00E-07
TOTAL DIOXINS/FURANS	1.48E-02		**4.45E-04**

[1] US EPA 1989a

TABLE 1-1

PRELIMINARY REMEDIATION GOALS INDUSTRIAL SCENARIO
SITE A
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)$^{-1}$	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	Sfd (mg/kg/day)$^{-1}$	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn[a] (mg/kg)	PRGc[a] (mg/kg)	Max. Concen. (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Adjustment Factor (adjusted based on % risk) Noncarcinogens	Carcinogens	Adjusted PRGn[b] (mg/kg)	Adjusted PRGc[c] (mg/kg)
Antimony	NA	0.05	0.01	NA	4.00E-04	2.00E-05	6.72E+01	NA	1.65E+03	24.54011742	80.30%	NA	NA	2.00E+00	--	3.36E+01	NA
Barium	NA	0.1	0.01	NA	7.00E-02	7.00E-03	2.17E+04	NA	6.40E+04	2.943248532	9.63%	NA	NA	1.00E+00	--	2.17E+04	NA
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	1.40E+03	0.03890411	0.13%	NA	NA	1.00E+00	--	3.60E+04	NA
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	3.92E+04	NA	7.80E+04	1.990532607	6.51%	NA	NA	2.00E+00	--	1.96E+04	NA
Cyanide	NA	0.17	0.01	NA	2.00E-02	3.40E-03	9.55E+03	NA	1.58E+01	0.001655117	0.01%	NA	NA	1.00E+00	--	9.55E+03	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	5.70E+04	NA	NA	NA	NA	NA	--	NA	NA
Manganese	NA	0.03	0.01	NA	2.40E-02	7.20E-04	2.50E+03	NA	1.90E+03	0.75913242	2.48%	NA	NA	1.00E+00	--	2.50E+03	NA
Nickel	NA	0.1	0.01	NA	2.00E-02	2.00E-03	6.21E+03	NA	4.20E+02	0.06760274	0.22%	NA	NA	1.00E+00	--	6.21E+03	NA
Silver	NA	0.1	0.01	NA	5.00E-03	5.00E-04	1.55E+03	NA	4.26E+01	0.027427397	0.09%	NA	NA	1.00E+00	--	1.55E+03	NA
Vanadium	NA	0.01	0.01	NA	7.00E-03	7.00E-05	2.52E+02	NA	3.98E+01	0.157998323	0.52%	NA	NA	1.00E+00	--	2.52E+02	NA
Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA	1.00E+04	0.034507502	0.11%	NA	NA	1.00E+00	--	2.90E+05	NA
Xylenes, total combined	NA	0.92	0.1	NA	2.00E+00	1.84E+00	5.79E+05	NA	8.58E+00	1.48287E-05	0.00%	NA	NA	1.00E+00	--	5.79E+05	NA
									Total Risk =	30.56114099	96.44%	NA	NA				

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

NA: Not Available

TABLE I-2

PRELIMINARY REMEDIATION GOALS INDUSTRIAL SCENARIO
SITE B
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)[a]	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	Sfd (mg/kg/day)[a]	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn[a] (mg/kg)	PRGc[a] (mg/kg)	Max. Concen. (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Adjustment Factor (adjusted based on % risk) Noncarcinogens	Carcinogens	Adjusted PRGn[b] (mg/kg)	Adjusted PRGc[c] (mg/kg)
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	1.41E+01	0.00039182	0.14%	NA	NA	1.00E+00	--	3.60E+04	NA
Manganese	NA	0.03	0.01	NA	2.40E-02	7.20E-04	2.50E+03	NA	4.40E+02	0.175799087	**63.87%**	NA	NA	2.00E+00	--	1.25E+03	NA
Vanadium	NA	0.01	0.01	NA	7.00E-03	7.00E-05	2.52E+02	NA	2.49E+01	0.098848197	**35.91%**	NA	NA	2.00E+00	--	1.26E+02	NA
Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA	5.67E+01	0.000195658	0.07%	NA	NA	1.00E+00	--	2.90E+05	NA
									Total Risk =	0.275234761	99.79%	0	NA				

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

NA: Not Available

TABLE I-3

PRELIMINARY REMEDIATION GOALS INDUSTRIAL SCENARIO
SITE C
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)[1]	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	Sfd (mg/kg/day)[1]	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn[a] (mg/kg)	PRGc[a] (mg/kg)	Max. Concen. (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Adjustment Factor (adjusted based on % risk) Noncarcinogens	Carcinogens	Adjusted PRGn[b] (mg/kg)	Adjusted PRGc[c] (mg/kg)
Antimony	NA	0.05	0.01	NA	4.00E-04	2.00E-05	6.72E+01	NA	9.20E+03	136.8297456	**95.18%**	NA	NA	1.00E+00	--	6.72E+01	NA
Arsenic	1.50E+00	0.95	0.03	1.58E+00	3.00E-04	2.85E-04	2.22E+02	1.38E+00	1.95E+01	0.087836028	0.06%	1.41E-05	0.82%	1.00E+00	1.00E+00	2.22E+02	1.38E+00
Barium	NA	0.1	0.01	NA	7.00E-02	7.00E-03	2.17E+04	NA	2.07E+03	0.095195695	0.07%	NA	NA	1.00E+00	--	2.17E+04	NA
Beryllium	4.30E+00	0.01	0.01	4.30E+02	5.00E-03	5.00E-05	1.80E+02	2.34E-02	1.72E+00	0.009559295	0.01%	7.34E-05	4.25%	1.00E+00	1.00E+00	1.80E+02	2.34E-02
Cadmium	NA	0.06	0.01	NA	5.00E-04	3.00E-05	9.92E+01	NA	5.14E+00	0.051802348	0.04%	NA	NA	1.00E+00	--	9.92E+01	NA
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	6.58E+01	0.001828493	0.00%	NA	NA	1.00E+00	--	3.60E+04	NA
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	3.92E+04	NA	5.30E+03	0.135254139	0.09%	NA	NA	1.00E+00	--	3.92E+04	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	4.90E+04	NA	NA	NA	NA	1.00E+00	--	NA	NA
Manganese	NA	0.03	0.01	NA	2.40E-02	7.20E-04	2.50E+03	NA	6.32E+03	2.525114155	1.76%	NA	NA	1.00E+00	--	2.50E+03	NA
Molybdenum	NA	0.05	0.01	NA	5.00E-03	2.50E-04	8.40E+02	NA	4.22E+01	0.050210568	0.03%	NA	NA	1.00E+00	--	8.40E+02	NA
Thallium	NA	0.05	0.01	NA	7.00E-05	3.50E-06	1.18E+01	NA	4.48E+01	3.807436399	2.65%	NA	NA	1.00E+00	--	1.18E+01	NA
Vanadium	NA	0.01	0.01	NA	7.00E-03	7.00E-05	2.52E+02	NA	4.17E+01	0.165540956	0.12%	NA	NA	1.00E+00	--	2.52E+02	NA
Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA	6.28E+02	0.002167071	0.00%	NA	NA	1.00E+00	--	2.90E+05	NA
Acetone	NA	1	0.1	NA	1.00E-01	1.00E-01	3.11E+04	NA	5.00E-01	1.60959E-05	0.00%	NA	NA	1.00E+00	--	3.11E+04	NA
									Total Risk =	143.7617068	95.18%	1.73E-03	94.93%				

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

d: Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans maximum concentrations for congener groups tetra, penta, hexa, hepta, and octa were adjusted for toxicity compared to 2,3,7,8-TCDD using Toxicity Equivalency Factors (TEFs) and summed to arrive at the Total Dioxins/Furans maximum concentration used in the table.

NA: Not Available

TABLE I-4

PRELIMINARY REMEDIATION GOALS INDUSTRIAL SCENARIO
SITE D
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)[a]	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	Sfd (mg/kg/day)[a]	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn[a] (mg/kg)	PRGc[a] (mg/kg)	Max. Concen. (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Adjustment Factor (adjusted based on % risk) Noncarcinogens	Adjustment Factor (adjusted based on % risk) Carcinogens	Adjusted PRGn[b] (mg/kg)	Adjusted PRGc[c] (mg/kg)
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	1.85E+01	0.00051409	0.01%	NA	NA	1.00E+00	--	3.60E+04	NA
PCB 1260	7.70E+00	0.9	0.1	8.56E+00	2.00E-05	1.80E-05	5.68E+00	1.03E-01	9.96E-01	0.175420744	4.77%	9.65E-06	10.5%	1.00E+00	2.00E+00	5.68E+00	5.16E-02
Trichloroethene	1.10E-02	0.9	0.25	**1.22E-02**	**6.00E-03**	**5.40E-03**	**7.43E+02**	**3.15E+01**	**2.60E+03**	**3.498043053**	**95.21%**	**8.25E-05**	**89.5%**	1.00E+00	2.00E+00	7.43E+02	1.58E+01
									Total Risk =	3.673977886	95.21%	9.2102E-05	100.0%				

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

NA: Not Available

TABLE 1-5

PRELIMINARY REMEDIATION GOALS INDUSTRIAL SCENARIO
SITE E
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)[1]	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	Sfd (mg/kg/day)[1]	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn[a] (mg/kg)	PRGc[a] (mg/kg)	Max. Concen. (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Adjustment Factor (adjusted based on % risk) Noncarcinogens	Carcinogens	Adjusted PRGn[b] (mg/kg)	Adjusted PRGc[c] (mg/kg)
Antimony	NA	0.05	0.01	NA	4.00E-04	2.00E-05	6.72E+01	NA	8.51E+02	12.65675147	71.34%	NA	NA	3.00E+00	--	2.24E+01	NA
Barium	NA	0.1	0.01	NA	7.00E-02	7.00E-03	2.17E+04	NA	3.40E+04	1.563600783	8.81%	NA	NA	1.00E+00	--	2.17E+04	NA
Cadmium	NA	0.06	0.01	NA	5.00E-04	3.00E-05	9.92E+01	NA	6.87E+00	0.069237769	0.39%	NA	NA	1.00E+00	--	9.92E+01	NA
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	1.11E+02	0.00308454	0.02%	NA	NA	1.00E+00	--	3.60E+04	NA
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	3.92E+04	NA	7.20E+04	1.837414714	10.36%	NA	NA	3.00E+00	--	1.31E+04	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	1.40E+05	NA	NA	NA	NA	--	--	NA	NA
Manganese	NA	0.03	0.01	NA	2.40E-02	7.20E-04	2.50E+03	NA	2.50E+03	0.998858447	5.63%	NA	NA	3.00E+00	--	8.34E+02	NA
Mercury	NA	0.1	0.01	NA	3.00E-04	3.00E-05	9.32E+01	NA	1.07E+00	0.011481735	0.06%	NA	NA	1.00E+00	--	9.32E+01	NA
Nickel	NA	0.1	0.01	NA	2.00E-02	2.00E-03	6.21E+03	NA	1.00E+02	0.01609589	0.09%	NA	NA	1.00E+00	--	6.21E+03	NA
Silver	NA	0.1	0.01	NA	5.00E-03	5.00E-04	1.55E+03	NA	1.34E+01	0.008627397	0.05%	NA	NA	1.00E+00	--	1.55E+03	NA
Vanadium	NA	0.01	0.01	NA	7.00E-03	7.00E-05	2.52E+02	NA	1.21E+02	0.480346659	2.71%	NA	NA	1.00E+00	--	2.52E+02	NA
Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA	1.00E+04	0.034507502	0.19%	NA	NA	1.00E+00	--	2.90E+05	NA
PCB 1260	7.70E+00	0.9	0.1	8.56E+00	2.00E-05	1.80E-05	5.68E+00	1.03E-01	3.53E-01	0.062172211	0.35%	3.41947E-06	100.00%	1.00E+00	1.00E+00	5.68E+00	1.03E-01
									Total Risk =	17.74217912	96.14%	3.42E-06	100.00%				

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

NA: Not Available

TABLE 1-6

PRELIMINARY REMEDIATION GOALS INDUSTRIAL SCENARIO
SITE G
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)[c]	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	Sfd (mg/kg/day)[c]	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn[a] (mg/kg)	PRGc[a] (mg/kg)	Max. Concen. (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Adjustment Factor (adjusted based on % risk) Noncarcinogens	Carcinogens	Adjusted PRGn[b] (mg/kg)	Adjusted PRGc[c] (mg/kg)
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	1.63E+01	0.000452955	2.52%	NA	NA	1.00E+00	--	3.60E+04	NA
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	3.92E+04	NA	7.70E+01	0.001965013	**10.91%**	NA	NA	3.00E+00	--	1.31E+04	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	9.80E+01	NA	NA	NA	NA	--	--	NA	NA
Nickel	NA	0.1	0.01	NA	2.00E-02	2.00E-03	6.21E+03	NA	3.44E+01	0.005536986	**30.75%**	NA	NA	3.00E+00	--	2.07E+03	NA
Trichloroethene	1.10E-02	0.9	0.25	1.22E-02	6.00E-03	5.40E-03	7.43E+02	3.15E+01	7.47E+00	0.010050147	**55.82%**	2.37E-07	**100.0%**	3.00E+00	1.00E+00	2.48E+02	3.15E+01
									Total Risk =	0.018005101	97.48%	2.36896E-07	100.0%				

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

NA: Not Available

TABLE I-7

PRELIMINARY REMEDIATION GOALS INDUSTRIAL SCENARIO
SITE H
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)$^{-1}$	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	SfJ (mg/kg/day)$^{-1}$	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn [a] (mg/kg)	PRGc [a] (mg/kg)	Max. Concen. (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Adjustment Factor (adjusted based on % risk) Noncarcinogens	Carcinogens	Adjusted PRGn [b] (mg/kg)	Adjusted PRGc [c] (mg/kg)
Antimony	NA	0.05	0.01	NA	4.00E-04	2.00E-05	6.72E+01	NA	4.30E+03	63.95303327	**90.95%**	NA	NA	2.00E+00	--	3.36E+01	NA
Arsenic	1.50E+00	0.95	0.03	1.58E+00	3.00E-04	2.85E-04	2.22E+02	1.38E+00	1.71E+01	0.07702544	0.11%	1.24E-05	**99.15%**	1.00E+00	1.00E+00	2.22E+02	1.38E+00
Barium	NA	0.1	0.01	NA	7.00E-02	7.00E-03	2.17E+04	NA	1.30E+04	0.597847358	0.85%	NA	NA	1.00E+00	--	2.17E+04	NA
Cadmium	NA	0.06	0.01	NA	5.00E-04	3.00E-05	9.92E+01	NA	1.94E+01	0.195518591	0.28%	NA	NA	1.00E+00	--	9.92E+01	NA
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	3.40E+02	0.009448141	0.01%	NA	NA	1.00E+00	--	3.60E+04	NA
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	3.92E+04	NA	1.40E+05	3.572750833	**5.08%**	NA	NA	2.00E+00	--	1.96E+04	NA
Cyanide	NA	0.17	0.01	NA	2.00E-02	3.40E-03	9.55E+03	NA	8.00E+01	0.008380338	0.01%	NA	NA	1.00E+00	--	9.55E+03	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	3.30E+05	NA	NA	NA	NA	--	--	NA	NA
Manganese	NA	0.03	0.01	NA	2.40E-02	7.20E-04	2.50E+03	NA	3.60E+03	1.438356164	2.05%	NA	NA	1.00E+00	--	2.50E+03	NA
Mercury	NA	0.1	0.01	NA	3.00E-04	3.00E-05	9.32E+01	NA	4.95E-01	0.005311644	0.01%	NA	NA	1.00E+00	--	9.32E+01	NA
Molybdenum	NA	0.05	0.01	NA	5.00E-03	2.50E-04	8.40E+02	NA	4.00E+01	0.047592955	0.07%	NA	NA	1.00E+00	--	8.40E+02	NA
Nickel	NA	0.1	0.01	NA	2.00E-02	2.00E-03	6.21E+03	NA	2.46E+02	0.03959589	0.06%	NA	NA	1.00E+00	--	6.21E+03	NA
Silver	NA	0.1	0.01	NA	5.00E-03	5.00E-04	1.55E+03	NA	2.37E+01	0.015258904	0.02%	NA	NA	1.00E+00	--	1.55E+03	NA
Vanadium	NA	0.01	0.01	NA	7.00E-03	7.00E-05	2.52E+02	NA	3.91E+01	0.155219458	0.22%	NA	NA	1.00E+00	--	2.52E+02	NA
Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA	5.90E+04	0.20359426	0.29%	NA	NA	1.00E+00	--	2.90E+05	NA
p,p-DDE	3.40E-01	0.9	0.033	3.78E-01	NA	NA	NA	5.53E+00	1.92E-01	NA	NA	3.47E-08	0.28%	--	1.00E+00	NA	5.53E+00
p,p-DDT	3.40E-01	0.9	0.077	3.78E-01	5.00E-04	4.50E-04	1.77E+02	2.92E+00	2.07E-01	0.001169489	0.00%	7.10E-08	0.57%	1.00E+00	1.00E+00	1.77E+02	2.92E+00
									Total Risk =	70.32010273	96.03%	1.24848E-05	99.15%				

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

NA: Not Available

TABLE I-8

PRELIMINARY REMEDIATION GOALS INDUSTRIAL SCENARIO
SITE 129-3
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)[c]	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	Sfd (mg/kg/day)[c]	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn[a] (mg/kg)	PRGc[a] (mg/kg)	Max. Concen. (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Adjustment Factor (adjusted based on % risk) Noncarcinogens	Carcinogens	Adjusted PRGn[b] (mg/kg)	Adjusted PRGc[c] (mg/kg)
Antimony	NA	0.05	0.01	NA	4.00E-04	2.00E-05	6.72E+01	NA	3.62E+02	5.383953033	85.85%	NA	NA	3.00E+00	--	2.24E+01	NA
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	1.30E+02	3.61E-03	0.06%	NA	NA	1.00E+00	--	3.60E+04	NA
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	3.92E+04	NA	4.70E+03	1.20E-01	1.91%	NA	NA	1.00E+00	--	3.92E+04	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	3.70E+03	NA	NA	NA	NA	--	--	NA	NA
Manganese	NA	0.03	0.01	NA	2.40E-02	7.20E-04	2.50E+03	NA	1.10E+03	4.39E-01	7.01%	NA	NA	3.00E+00	--	8.34E+02	NA
Mercury	NA	0.1	0.01	NA	3.00E-04	3.00E-05	9.32E+01	NA	6.70E+00	7.19E-02	1.15%	NA	NA	1.00E+00	--	9.32E+01	NA
Vanadium	NA	0.01	0.01	NA	7.00E-03	7.00E-05	2.52E+02	NA	2.28E+01	9.05E-02	1.44%	NA	NA	1.00E+00	--	2.52E+02	NA
Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA	7.27E+01	2.51E-04	0.00%	NA	NA	1.00E+00	--	2.90E+05	NA
Nitroglycerine	NA	--	--	NA	NA	NA	NA	NA	7.25E+01	NA	NA	NA	NA	--	--	NA	NA
Trichloroethene	1.10E-02	0.9	0.25	1.22E-02	6.00E-03	5.40E-03	7.43E+02	3.15E+01	1.20E+02	1.61E-01	2.57%	3.81E-06	100%	3.00E+00	1.00E+00	2.48E+02	3.15E+01
									Total Risk =	6.27E+00	95.44%	3.81E-06	100%				

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

NA: Not Available

TABLE I-9

PRELIMINARY REMEDIATION GOALS INDUSTRIAL SCENARIO
SITES 129-5
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)[a]	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	Sfd (mg/kg/day)[a]	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn[a] (mg/kg)	PRGc[a] (mg/kg)	Max. Concen. (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Adjustment Factor (adjusted based on % risk) Noncarcinogens	Carcinogens	Adjusted PRGn[b] (mg/kg)	Adjusted PRGc[c] (mg/kg)
Antimony	NA	0.05	0.01	NA	4.00E-04	2.00E-05	6.72E+01	NA	1.51E+03	22.45792564	93.02%	NA	NA	1.00E+00	--	6.72E+01	NA
Barium	NA	0.1	0.01	NA	7.00E-02	7.00E-03	2.17E+04	NA	2.70E+04	1.241682975	5.14%	NA	NA	1.00E+00	--	2.17E+04	NA
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	3.92E+04	NA	1.70E+04	0.43383403	1.80%	NA	NA	1.00E+00	--	3.92E+04	NA
Cyanide	NA	0.17	0.01	NA	2.00E-02	3.40E-03	9.55E+03	NA	7.86E+00	0.000823368	0.00%	NA	NA	1.00E+00	--	9.55E+03	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	1.60E+05	NA	NA	NA	NA	--	--	NA	NA
Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA	2.31E+03	0.007971233	0.03%	NA	NA	1.00E+00	--	2.90E+05	NA
									Total Risk =	24.14223724	98.17%	0	NA				

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

NA: Not Available

TABLE I-10

PRELIMINARY REMEDIATION GOALS INDUSTRIAL SCENARIO
SITES 129-15
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)[a]	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	Sfd (mg/kg/day)[a]	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn[a] (mg/kg)	PRGc[a] (mg/kg)	Max. Concen. (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Adjustment Factor (adjusted based on % risk) Noncarcinogens	Carcinogens	Adjusted PRGn[b] (mg/kg)	Adjusted PRGc[c] (mg/kg)
Arsenic	1.50E+00	0.95	0.03	1.58E+00	3.00E-04	2.85E-04	2.22E+02	1.38E+00	5.00E+00	0.022522059	5.67%	3.62E-06	34.43%	2.00E+00	3.00E+00	1.11E+02	4.60E-01
Cadmium	NA	0.06	0.01	NA	5.00E-04	3.00E-05	9.92E+01	NA	8.93E-01	0.008999902	2.27%	NA	NA	1.00E+00	--	9.92E+01	NA
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	2.38E+01	0.00066137	0.17%	NA	NA	1.00E+00	--	3.60E+04	NA
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	3.92E+04	NA	2.88E+01	0.000734966	0.19%	NA	NA	1.00E+00	--	3.92E+04	NA
Manganese	NA	0.03	0.01	NA	2.40E-02	7.20E-04	2.50E+03	NA	6.20E+02	0.247716895	62.39%	NA	NA	2.00E+00	--	1.25E+03	NA
Vanadium	NA	0.01	0.01	NA	7.00E-03	7.00E-05	2.52E+02	NA	2.90E+01	0.115124406	29.00%	NA	NA	2.00E+00	--	1.26E+02	NA
Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA	5.23E+01	0.000180474	0.05%	NA	NA	1.00E+00	--	2.90E+05	NA
Anthracene	NA	0.5	0.1	NA	3.00E-01	1.50E-01	5.04E+04	NA	2.20E-01	4.36269E-06	0.00%	NA	NA	1.00E+00	--	5.04E+04	NA
Benzo[a]anthracene	7.30E-01	0.5	0.1	1.46E+00	NA	NA	NA	6.45E-01	4.30E-01	NA	NA	6.67E-07	6.34%	--	3.00E+00	NA	2.15E-01
Benzo[a]pyrene	7.30E+00	0.5	0.1	1.46E+01	NA	NA	NA	6.45E-02	3.70E-01	NA	NA	5.74E-06	54.59%	--	3.00E+00	NA	2.15E-02
Bis (2-ethylhexyl) phthalate	1.40E-02	0.15	0.1	9.33E-02	2.00E-02	3.00E-03	1.07E+03	1.07E+01	4.80E-01	0.000448532	0.11%	4.49E-08	0.43%	1.00E+00	1.00E+00	1.07E+03	1.07E+01
Chrysene	7.30E-03	0.5	0.1	1.46E-02	NA	NA	NA	6.45E+01	5.00E-01	NA	NA	7.76E-09	0.07%	--	1.00E+00	NA	6.45E+01
Di-n-butyl phthalate	NA	0.9	0.1	NA	1.00E-01	9.00E-02	2.84E+04	NA	4.20E+00	0.000147945	0.04%	NA	NA	1.00E+01	--	2.84E+03	NA
Fluoranthene	NA	0.5	0.1	NA	4.00E-02	2.00E-02	6.72E+03	NA	5.90E-01	8.77495E-05	0.02%	NA	NA	1.00E+00	--	6.72E+03	NA
Indeno[1,2,3-C,D]pyrene	7.30E-01	0.5	0.1	1.46E+00	NA	NA	NA	6.45E-01	2.50E-01	NA	NA	3.88E-07	3.69%	--	1.00E+00	NA	6.45E-01
p,p-DDD	2.40E-01	0.9	0.033	2.67E-01	NA	NA	NA	7.83E+00	6.25E-02	NA	NA	7.98E-09	0.08%	--	1.00E+00	NA	7.83E+00
p,p-DDE	3.40E-01	0.9	0.033	3.78E-01	NA	NA	NA	5.53E+00	1.08E-01	NA	NA	1.95E-08	0.19%	--	1.00E+00	NA	5.53E+00
p,p-DDT	3.40E-01	0.9	0.077	3.78E-01	5.00E-04	4.50E-04	1.77E+02	2.92E+00	5.35E-02	0.000302259	0.08%	1.84E-08	0.17%	1.00E+00	1.00E+00	1.77E+02	2.92E+00
Pyrene	NA	0.5	0.1	NA	3.00E-02	1.50E-02	5.04E+03	NA	5.50E-01	0.000109067	0.03%	NA	NA	1.00E+00	--	5.04E+03	NA
									Total Risk =	0.397039988	97.06%	1.05E-05	95.37%				

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

NA: Not Available

TABLE I-11

PRELIMINARY CLEAN-UP GOALS INDUSTRIAL SCENARIO
SITE I
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo $(mg/kg/day)^{-1}$	Oral absorption Efficiency (unitless)	Dermal Absorption Factor (Unitless)	Sfd $(mg/kg/day)^{-1}$	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn [a] (mg/kg)	PRGc [a] (mg/kg)	Max. Concen. mg/kg	Hazard Indices Concen/PRGn	% of Noncan Risk	Cancer Risk Concen/PRGc	% of Cancer Risk	Adjustment Factor for Noncarcinogens	Adjustment Factor for Carcinogens	Adjusted PRGn [b] (mg/kg)	Adjusted PRGc [c] (mg/kg)
Cadmium	NA	0.06	0.01	NA	5.00E-04	3.00E-05	9.92E+01	NA	1.09E+02	1.10E+00	65.89%	NA	NA	3.00E+00	--	3.31E+01	NA
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	2.62E+02	7.28E-03	0.44%	NA	NA	1.00E+00	--	3.60E+04	NA
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	3.92E+04	NA	7.81E+01	1.99E-03	0.12%	NA	NA	1.00E+00	--	3.92E+04	NA
Manganese	NA	0.03	0.01	NA	2.40E-02	7.20E-04	2.50E+03	NA	8.70E+02	3.48E-01	20.85%	NA	NA	3.00E+00	--	8.34E+02	NA
Molybdenum	NA	0.05	0.01	NA	5.00E-03	2.50E-04	8.40E+02	NA	1.17E+01	1.39E-02	0.83%	NA	NA	1.00E+00	--	8.40E+02	NA
Nickel	NA	0.1	0.01	NA	2.00E-02	2.00E-03	6.21E+03	NA	4.33E+01	6.97E-03	0.42%	NA	NA	1.00E+00	--	6.21E+03	NA
Silver	NA	0.1	0.01	NA	5.00E-03	5.00E-04	1.55E+03	NA	9.17E+00	5.90E-03	0.35%	NA	NA	1.00E+00	--	1.55E+03	NA
Vanadium	NA	0.01	0.01	NA	7.00E-03	7.00E-05	2.52E+02	NA	4.61E+01	1.83E-01	10.98%	NA	NA	3.00E+00	--	8.40E+01	NA
Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA	1.96E+02	6.76E-04	0.04%	NA	NA	1.00E+00	--	2.90E+05	NA
1,1,1-Trichloroethane	NA	0.9	0.25	NA	9.00E-02	8.10E-02	1.11E+04	NA	4.20E-03	3.77E-07	0.00%	NA	NA	1.00E+00	--	1.11E+04	NA
Acetone	NA	1	0.1	NA	1.00E-01	1.00E-01	3.11E+04	NA	1.00E-01	3.22E-06	0.00%	NA	NA	1.00E+00	--	3.11E+04	NA
cis-1,2-Dichloroethene	NA	0.9	0.25	NA	1.00E-02	9.00E-03	1.24E+03	NA	4.20E-02	3.39E-05	0.00%	NA	NA	1.00E+00	--	1.24E+03	NA
Methylene chloride	7.50E-03	1	0.25	7.50E-03	6.00E-02	6.00E-02	8.20E+03	5.10E+01	2.60E-02	3.17E-06	0.00%	5.09E-10	1.58%	1.00E+00	1.00E+00	8.20E+03	5.10E+01
Methylethyl ketone / 2-Butanone	NA	0.5	0.1	NA	6.00E-01	3.00E-01	1.01E+05	NA	1.50E-02	1.49E-07	0.00%	NA	NA	1.00E+00	--	1.01E+05	NA
Trichloroethene	1.10E-02	0.9	0.25	1.22E-02	6.00E-03	5.40E-03	7.43E+02	3.15E+01	1.00E+00	1.35E-03	0.08%	3.17E-08	98.42%	1.00E+00	1.00E+00	7.43E+02	3.15E+01
									Total Risk =	1.67E+00	97.71%	3.22E-08	98.42%				

Notes: Toxicology data from Oak Ridge Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRG adjusted to consider multiple exposures to constituents creating 95% of the risk that affect the same target organ.

c: Carcinogenic PRG adjusted to consider multiple exposures to carcinogenic constituents creating 95% of the carcinogenic risk

TABLE I-12

PRELIMINARY CLEAN-UP GOALS INDUSTRIAL SCENARIO
SITE K
TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Constituent	Sfo (mg/kg/day)$^{-1}$	Oral absorption Efficiency (unitless)	Dermal Absorption Factor (Unitless)	Sfd (mg/kg/day)$^{-1}$	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn [a] (mg/kg)	PRGc [a] (mg/kg)	Max. Concen. mg/kg	Hazard Indices Concen/PRGn	% of Noncan Risk	Cancer Risk Concen/PRGc	% of Cancer Risk	Adjustment Factor for Noncarcinogens	Adjustment Facto for Carcinogens	Adjusted PRGn [b] (mg/kg)	Adjusted PRGc [c] (mg/kg)
Cadmium	NA	0.06	0.01	NA	5.00E-04	3.00E-05	9.92E+01	NA	3.48E+01	3.51E-01	26.41%	NA	NA	3.00E+00	--	3.31E+01	NA
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	3.60E+04	NA	7.72E+01	2.15E-03	0.16%	NA	NA	1.00E+00	--	3.60E+04	NA
Copper	NA	0.6	0.01	NA	4.00E-02	2.40E-02	4.24E+04	NA	8.37E+02	1.98E-02	1.49%	NA	NA	1.00E+00	--	4.24E+04	NA
Cyanide	NA	0.17	0.01	NA	2.00E-02	3.40E-03	9.55E+03	NA	4.47E+00	4.68E-04	0.04%	NA	NA	1.00E+00	--	9.55E+03	NA
Manganese	NA	0.03	0.01	NA	2.40E-02	7.20E-04	2.50E+03	NA	1.30E+03	5.19E-01	39.12%	NA	NA	3.00E+00	--	8.34E+02	NA
Molybdenum	NA	0.05	0.01	NA	5.00E-03	2.50E-04	8.40E+02	NA	2.75E+02	3.27E-01	24.64%	NA	NA	1.00E+00	--	8.40E+02	NA
Silver	NA	0.1	0.01	NA	5.00E-03	5.00E-04	1.55E+03	NA	4.39E+00	2.83E-03	0.21%	NA	NA	1.00E+00	--	1.55E+03	NA
Vanadium	NA	0.01	0.01	NA	7.00E-03	7.00E-05	2.52E+02	NA	2.58E+01	1.02E-01	7.71%	NA	NA	3.00E+00	--	8.40E+01	NA
Zinc	NA	0.5	0.01	NA	3.00E-01	1.50E-01	2.90E+05	NA	8.25E+02	2.85E-03	0.21%	NA	NA	1.00E+00	--	2.90E+05	NA
1,1,1-Trichloroethane	NA	0.9	0.25	NA	9.00E-02	8.10E-02	1.11E+04	NA	9.30E-03	8.34E-07	0.00%	NA	NA	1.00E+00	--	1.11E+04	NA
Methylene chloride	7.50E-03	1	0.25	7.50E-03	6.00E-02	6.00E-02	8.20E+03	5.10E+01	1.90E-02	2.32E-06	0.00%	3.72E-10	78.58%	1.00E+00	2.00E+00	8.20E+03	2.55E+01
Trichloroethene	1.10E-02	0.9	0.25	1.22E-02	6.00E-03	5.40E-03	7.43E+02	3.15E+01	3.20E-03	4.31E-06	0.00%	1.01E-10	21.42%	1.00E+00	2.00E+00	7.43E+02	1.58E+01
									Total Risk =	1.33E+00	97.89%	4.74E-10	100.00%				

Notes: Toxicology data from Oak Ridge Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the US EPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goals" (EPA 1991).

b: Noncarcinogenic PRG adjusted to consider multiple exposures to constituents creating 95% of the risk that affect the same target organ.

c: Carcinogenic PRG adjusted to consider multiple exposures to carcinogenic constituents creating 95% of the carcinogenic risk

APPENDIX C-2

REGULATORY CORRESPONDENCE FOR DETERMINING LEACHING-BASED REMEDIATION GOALS

TWIN CITIES ARMY AMMUNITION PLANT

Minnesota Pollution Control Agency

October 24, 199

Mr. Martin McCleery
Remedial Project Manager
Twin Cities Army Ammunition Plant
4700 Highway 10, Suite A
Arden Hills, Minnesota 55112-3928

RE: 1) Leaching Numbers for Organics and 2) Exceptions to PCOCs.

Dear Mr. McCleery:

As discussed at the meeting on October 4, 1995, to discuss the OU2 Feasibility Study (FS), the Minnesota Pollution Control Agency (MPCA) staff and U.S. Environmental Protection Agency are providing:

1. Leaching numbers for organics based on modifications to the MPCA's soil leaching model; and

2. Exceptions to the Preliminary Contaminants of Concern (PCOCs) developed by Montgomery Watson.

Be advised that we have not received a revised PCOC list as discussed by John Seaberg and Jeff LeBlanc, nor have we received the revised data set.

Note that the lower of the HRLs or MCLs apply for the Units 3/4 aquifer and the HRLs apply to the Unit 1 aquifer. Additive effects will need to be included as part of the leaching numbers and ground water remediation. Refer to the HRL for additivity, Mn. Rules 4717.7500 to 4717.7800 for end points and equations.

Please be aware of the following assumptions underlying the enclosed leaching numbers for organics:

1. Since the Kd values used previously are deemed to have been excessively conservative, higher Kd values have been substituted. The effect of this has been to generate higher clean-up numbers; and

2. Since biodegradation is low with higher Kd values, a biodegradation rate of zero has been used in running the model.

Both assumptions can be readily supported. We will be pleased to discuss any aspect of this correspondence with you as requested.

Sincerely

Dagmar Romano

Dagmar Romano
Project Manager
Site Response Section

Dagmar Romano for Tom Barounis
Remedial Project Manager
U.S Environmental Protection Agency

DR/TB:ch

Enclosure

cc: Jeff LeBlanc, Montgomery Watson ✓
Jason Twaddle, Conestoga-Rovers & Associates
Dave Gosen, Alliant Techsystems, Inc.

ATTACHMENT 1

TWIN CITIES ARMY AMMUNITION PLANT
ORGANIC LEACHING NUMBERS FOR OPERABLE UNIT 2

The Minnesota Pollution Control Agency (MPCA) staff has applied the Minnesota MPCA Soil Model to develop model-based clean-up goals for organic compounds that will be protective of ground water beneath the sites at the Twin Cities Army Ammunition Plant (TCAAP). The final clean-up numbers are provided for each site in the *Results* section of this Attachment. In addition to the model-derived values, a number of criteria that may be useful in determining if chemicals are contaminants of concern for the leaching pathway are also summarized.

MODEL ASSUMPTIONS

The MPCA Soil Model couples chemical distribution and degradation processes into a single-term equation. The model is very sensitive to the partitioning coefficient (K_d) and half-life for a particular chemical. Attenuation in ground water is not considered and the drinking water criteria (e.g., HRL) is applied at the point of leachate.

Appropriate application of the model should consider the physical and chemical forces affecting contaminant fate and transport in the unsaturated zone. The organic contaminants of concern at TCAAP are chemicals which typically have low distribution coefficients ($K_d < 1$). Chemical therefore preferentially partitions into the dissolved phase. However, after several years contaminants in the dissolved phase will disperse, degrade, or leach into ground water. Chemical remaining in soil is relatively resistant to desorption and microbial degradation (Allen-King et al., 1995; ES&T 29:148-153). Consequently, appropriate K_d and half-life terms must be applied.

There is relatively little data in the literature which may be used in deriving appropriate K_d terms. A summary of some literature studies is provided below.

- 1,1,2,2-Tetrachloroethene : K_d of 0.26 to 8.00 (ES&T, 28:1650);
- 1,1,2,2-Tetrachloroethene : K_d of 8.7 to 166 (ES&T, 29:148);
- Benzene : K_d of 27.29 to 94.97 (Haz. Waste and Haz. Mat. 11:227);
- Xylene : K_d of 5.73 to 222 (ES&T 28:1929); and
- Toluene : K_d of 2.72 to 82.8 (ES&T 28:1929).

In applying K_d values from the range of the above values, concentrations of organics in the dissolved phase in subsoil are well below the range that is considered adequate to support microbial growth. Consequently, biodegradation of aged contaminants is assumed to be negligible.

The major model assumptions are summarized below:

1. Use of literature-supported distribution coefficients;

2. Biodegradation rates of zero;

3. No chemical attenuation in ground water;

4. Use of drinking water standards and criteria, where appropriate, for leachate below the contamination source;

5. Distribution coefficients are constant with depth; and

6. Travel times are based on piston-type displacement of water in the unsaturated profile.

MODEL INPUTS

The inputs for the model are summarized in Tables 1, 2, and 3 for site data, model constants, and chemical parameters, respectively.

TABLE 1: Site inputs used in the model.

Site/Unit	Depth to Water (ft)	Depth to Contaminant Center (ft)	Travel Time (years)	Contaminants of Concern
A	7.9	3.95	2.40	Benzene, Tetrachloroethene, Trichloroethene, cis-1,2-Dichloroethene, 1,1-Dichloroethene, Bis(2-ethylhexyl)phthalate, 1,3,5-Trinitrobenzene, Xylenes
B	2.7	1.35	---	None
D	136.4	130.0	2.40	Trichloroethene, 1,1,1-Trichloroethane, 1,1-Dichloroethene, cis-1,2-Dichloroethene, 1,1-Dichloroethane, Tetrachloroethene, 1,1,2-Trichloroethane, 1,2-Dichloroethane
E	113.4	56.7	34.45	Trichloroethene, Methylene chloride
129-3	145.7	72.85	44.26	Trichloroethene, Nitroglycerin

Site/Unit	Depth to Water (ft)	Depth to Contaminant Center (ft)	Travel Time (years)	Contaminants of Concern
129-15	145.4	72.7	44.17	Trichloroethene, Carbon tetrachloride, Bis(2-ethylhexyl)phthalate, Di-n-octyl phthalate
K	5.2	2.6	1.58	Trichloroethene, cis-1,2-Dichloroethene, trans-1,2-Dichloroethene, Methylene chloride
G	130	65	39.49	1,1,1-Trichloroethane, cis-1,2-Dichloroethene, Methylene chloride, Trichloroethene, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, tetrachloroethene, trans-dichloroethene.
H	15.5	7.8		None
C	6.2	2.5	4.98	Acetone, Ethylbenzene, Methyl ethyl ketone
I	105	52.5	31.90	1,1,1-Trichloroethane, Acetone, cis-1,2-Dichloroethane, Methylene Chloride, Methyl ethyl ketone, Trichloroethene, 1,1-dichloroethene, tetrachloroethene, vinyl chloride
129-5	146	140	3.65	Benzene, Methylene chloride, Trichloroethene

TABLE 2: Constants used in the model.

Parameter	Value Used in Model
Soil bulk density	1.50 g/cm^3
Recharge	15 cm/y
Soil porosity	(2.65-bulk density)/2.65
Biodegradation rate constant	0.00 1/y

TABLE 3: Chemical parameters used in the model. Drinking water standards are HRLs except for those compounds with MCLs lower than the HRLs, in which case both standards are listed.

Chemical	Distribution Coefficient (cm^3/g)	Drinking Water Standard (ug/l)
Ethylbenzene	10	700
Acetone	2	700
Methyl ethyl ketone	2	4000
1,1,2-Trichloroethene	20	30 or 5
Methylene chloride	5	50 or 5
cis-1,2-Dichloroethene	10	70
1,1,1-Trichloroethane	20	600 or 200
trans-1,2-Dichloroethene	10	100
1,1,2,2-Tetrachloroethene	30	7 or 5
1,1-Dichloroethene	10	6
Benzene	20	10 or 5
1,3,5-Trinitrobenzene	10	0.30
bis(2-ethylhexyl)phthalate	15	20 or 6
1,1,2-Trichloroethane	20	3
1,1-Dichloroethane	10	70
1,2-Dichloroethane	10	4
Carbon tetrachloride	10	3
Di-n-octyl phthalate	500000	---
Xylene	12	10000
Vinyl chloride	5	0.2
Nitroglycerin	---	---

RESULTS AND DISCUSSION

Model-derived clean-up goals are summarized in Table 4. The following points should be noted

1. Distribution coefficients of 30, 20, and 10 were assigned for tetra-, tri-, and di-chlorinated ethenes and ethanes, respectively. Distribution coefficients of 10 and 5 were assigned for tetra- and di-chlorinated methanes, respectively.

2. A drinking water standard does not exist for Di-n-octyl phthalate. The very high K_d value is likely to preclude it being a contaminant of concern in ground water unless the drinking standard is less than approximately 0.01 micrograms per liter (µg/l).

3 There is no information concerning distribution coefficients for nitroglycerin. Since the compound is an ester, it is likely to be relatively mobile in soil. A K_d value similar to the ethyl- and methyl phthalate esters may be warranted (10 to 20 cm^3/g).

4 Clean-up goals represent mean concentrations. Not-to-exceed clean-up goals are typically the upper 95 percent confidence value for a normally distributed population.

5. Additive health-risk effects for chemicals with similar endpoints have not been considered in deriving the clean-up goals.

TABLE 4: Model-derived clean-up goals, by site.

Chemical	Clean-up goal using HRL (mg/kg)	Clean-up goal using MCL (mg/kg)	Endpoint
SITE C			
Ethylbenzene	34.90	---	kidney, liver
Acetone	6.98	---	kidney
2-Butanone (methyl ethyl ketone)	39.90	---	developmental effects
SITE E			
1,1,2-Trichloroethene	20.70	3.44	cancer
Dichloromethane (Methylene chloride)	8.61	0.861	liver
SITE G			
1,1,2-Trichloroethene	23.70	3.95	cancer
cis-1,2-Dichloroethene	27.60	---	hematological system
1,1,1-Trichloroethane	474.00	158.00	liver
1,1-Dichloroethane	27.6	---	kidney
1,2-Dichloroethane	1.58	---	cancer
1,1-Dichloroethene	2.37	---	liver
1,1,2,2-Tetrachloroethene	8.29	5.92	cancer
1,1,2-Trichloroethane	2.37	---	immune system
trans-Dichloroethene	39.5	---	
Dichloromethane (Methylene chloride)	9.87	0.987	liver

SITE I			
1,1,2-Trichloroethene	19.10	3.19	cancer
cis-1,2-Dichloroethene	22.30	---	hematological system
1,1,1-Trichloroethane	383.00	128.00	liver
Dichloromethane (Methylene chloride)	7.97	0.797	liver
Acetone	44.70	---	kidney
1,1-Dichloroethene	1.91	---	liver
1,1,2,2-Tetrachloroethene	6.7	4.78	cancer
Vinyl chloride	0.001	---	cancer
Methyl ethyl ketone	255.00	---	developmental effects
1,1,2-Trichloroethane	1.91	---	immune system
SITE K			
1,1,2-Trichloroethene	0.95	0.158	cancer
cis-1,2-Dichloroethene	1.11	---	hematological system
trans-1,2-Dichloroethene	1.58	---	---
Dichloromethane (Methylene chloride)	0.40	0.0395	liver
SITE A			
1,1,2,2-Tetrachloroethene	0.50	0.36	cancer
1,1,2-Trichloroethene	1.44	0.24	cancer
1,1-Dichloroethene	0.144	---	liver
cis-1,2-Dichloroethene	1.68	---	hematological system
Benzene	0.48	0.24	cancer
1,3,5-Trinitrobenzene	0.007	---	---
Xylene	288	---	nervous system
bis(2-ethylhexyl) phthalate	0.72	0.216	cancer

TABLE 4.

SITE D			
1,1,2,2-Tetrachloroethene	0.873	0.623	cancer
1,1,2-Trichloroethene	2.49	0.416	cancer
1,1-Dichloroethene	0.249	---	liver
cis-1,2-Dichloroethene	2.91	---	hematological system
1,1,1-Trichloroethane	49.9	16.6	liver
1,1,2-Trichloroethane	0.249	---	immune system
1,1-Dichloroethane	2.91	---	kidney
1,2-Dichloroethane	0.166	---	cancer

SITE 129-15			
1,1,2-Trichloroethene	26.50	4.42	cancer
Carbon tetrachloride	1.33	---	cancer
bis(2-ethylhexyl) phthalate	13.3	3.98	cancer
Di-n-octyl phthalate	very high (> 1000)	---	---
SITE 129-3			
1,1,2-Trichloroethene	26.60	4.43	cancer
Nitroglycerin	---	---	---
Site 129-5			
Trichloroethene	2.19	0.365	cancer
Methylene chloride	0.911	0.091	liver
Benzene	0.729	0.365	cancer

ATTACHMENT 2

CHANGES TO THE LIST OF PRELIMINARY CONTAMINANTS OF CONCERN, OPERABLE UNIT 2 TWIN CITIES ARMY AMMUNITION PLANT

The Minnesota Pollution Control Agency (MPCA) staff has reviewed the list of Preliminary Contaminants of Concern (PCOCs) generated by Montgomery-Watson (MW) and Conestoga-Rovers & Associates, Inc. (CRA) on behalf of the Army. Based on the review, the following changes are needed to the list of PCOCs for Sites A, B, D, E, G, I, K, 129-3, 129-15 and Units 3/4 Ground Water. These changes concern differences in choosing contaminants for applying the leaching models and other changes that are specific to Site D.

CHANGES DUE TO LEACHING NUMBERS

Based on the review, there are several differences between the list of organics and metals used for leaching and the list of PCOCs. There are some site-specific reasons for the differences and these are discussed below. However, the primary reason is that criteria used to consider a contaminant for leaching are not the same as the criteria used by MW and CRA to choose PCOCs. The differences include:

1. Water quality standards (e.g, MCLs or HRLs) for a contaminant must be exceeded in ground water samples collected from downgradient wells located near or at the source area using the MPCA leaching criteria. The list of PCOCs from MW and CRA does not include this criterion;

2. Many contaminants have exceeded the water quality standard in ground water but were not detected in soils. For organics, leaching of these contaminants was evaluated using the soil leaching model and, as agreed previously with Army, these contaminants will not be Contaminants of Concern (COCs) for leaching but will be retained as PCOCs for which soil will need to be analyzed further;

3. The MPCA staff did not strictly apply the five percent detection frequency for several reasons. These reasons include:

   a. Soil sampling procedures for volatile organic compounds (VOCs) allow for volatilization and false-negatives; With additional soil sampling during excavation, the VOCs found in ground water above water quality standards or criteria may be detected and the leaching numbers will be available. Also, VOCs detected in ground water above drinking water standards or criteria leaching from particular source areas will likely still have some concentrations adsorbed or in pore spaces in the vadose zone.

b. Some sites, such as Site A, do not have a metals plume but have localized leaching of metals above drinking water standards, criteria, and background values. For example, antimony was detected in well 01U103 and the aquifer will still need to be remediated to below drinking water standards and criteria. See the metals discussion below.

LIST OF ADDITIONAL SITE-SPECIFIC ORGANIC CONTAMINANTS

SITE	ORGANIC CONTAM. DETECTED AT CONCS. EXCEED. DRINK. WATER STDS.	REASON	ACTION
A	1,1-Dichloroethene	1.a., f., i	2.b.
	Bis(2-ethylhexyl)phthalate	1.a., b.	2.b.
	1,3,5-Trinitrobenzene	1.a., h	2.c.
D	1,1,1-Trichloroethane	1.a., b.	2.b.
	1,1-Dichloroethene	1.a., b.	2.b.
	Cis-1,2-Dichloroethene	1.a., b.	2.b.
	1,1-Dichloroethane	1.a., b.	2.b.
	Tetrachloroethene	1.a., b.	2.b.
	1,1,2-Trichloroethane	1.a., b.	2.b.
	1,2-Dichloroethane	1.a., b.	2.b.
E	Methylene Chloride	1.a., b.	2.b.
G	1,2-Dichloroethane	1.a., b.	2.b.
	1,1,2-Trichloroethane	1.a., b.	2.b.
129-3	Trichloroethene	1.a., b.	2.b.
	Nitroglycerine	1.c., e.	2.e.
129-15	Carbon Tetrachloride	1.a., b.	2.b.
	Bis(2-ethylhexyl)phthalate	1.a., c.	2.b.
	Di-n-octyl phthalate	1.j.	2.d.
I	1,1-Dichloroethene	1.a., b.	2.b.
	Tetrachloroethene	1.a.,b.	2.b.
	1,1,2-Trichloroethane	1.a., b.	2.b.
	Vinyl Chloride	1.a., b.	2.b.
K	Cis-1,2-Dichloroethene	1.a., d.	2.b.
	Trans-1,2-Dichloroethene	1.a., d.	2.b.

NOTES:

1. Reasons for including:

   a. Exceeds drinking water standard (e.g., lower of HRL or MCL) or water quality criterion, as applicable;
   b. Not detected in soil;
   c. Detected in soil;
   d. Unknown if present in soil - sampling of vadose zone for this analyte was not performed in area of release;
   e. Detected in soil and not analyzed in ground water. May or may not be of concern;
   f. Additional testing of ground water needed;
   g. Soil sampling data not made available to date;
   h. Analysis performed by Army and waiting for results. Previous highest concentration was 2.4 micrograms per liter (µg/l);
   i. Well 01U115 during 1994 -results of two sampling events - new release? and
   j. Water Quality Criterion needs to be generated, if possible. Unknown if a concern at this time. Highest concentration is 15 µg/l.

2. Action based on Reasons

   a. Add as a COC;
   b. Add as a PCOC and as a contaminant to be monitored further to determine if this contaminant is impacting soil and if a response action may be necessary;
   c. Waiting for results;
   d. Determine clean-up number, if any. Based on this information, decide the need for further sampling; and
   e. Add as a PCOC and as a contaminant to be monitored further to determine if this contaminant is impacting ground water and if a response action may be necessary.

CHANGES TO THE METALS LEACHING NUMBER PCOCS

Additions to the PCOCs list for metals or comments on this list due to leaching include:

1. Retain antimony as a PCOC for detections in well 01U103 at Site A. The concentration has continued to increase to 127 µg/l as of September 1994 in this well. It is likely that antimony will be a final COC based on leaching. Antimony also was detected in wells 01U127 and 01U133 at Site A at concentrations of 10.80 and 12.30 µg/l.

2. Retain lead due to detections above drinking water standards and the background concentration in wells 01U350, 01U351, 01U354, 01U356, 01U358 at Site A. Lead also was detected above background concentrations in the soils.

3. Six metals were consistently analyzed at detection limits that exceeded drinking water standards or criteria, where applicable, and background for Site A wells. These metals are: antimony; selenium; thallium; lead; cadmium; and beryllium. These metals will need to be analyzed at lower detection limits, where feasible, during the Remedial Design phase of Operable Unit 2 (OU-2) to determine if they are of concern or to determine the extent of the metals leaching problem, as applicable.

4. An additional confirmatory sampling event for metals analysis from Site K wells needs to be performed during the remedial design phase. This is particularly true for nickel, which was detected very close to the drinking water standard of 100 µg/l, and zinc, which was used in Building 103 and has been detected at high concentrations in the pre-November 1987 data. Analyses for cobalt and vanadium need to be performed and have not been to date, based on the IRDMIS data.

5. Thallium was detected in well 01U128 located in Site K at 5.00 µg/l, which exceeds the drinking water standard of 0.6 µg/l and the background number of 3.94 µg/l. While a leaching number should be generated for this metal, a confirmatory sampling event is needed as this represents a single detection. Similarly, nickel was detected in well K04MW at Site K at a concentration of 170 µg/l. The drinking water standard is 100 µg/l. and background is 14.5 µg/l This is also a one time sampling event.

6. Detection limits for water samples collected from wells open to or screened within the Unit 3/4 Aquifers and analyzed for antimony (<10 µg/l) and beryllium (<1 47 µg/l) were greater than background levels and drinking water standards. The background number for both of these analytes are not established but are known to be <10 and <1.47 ug/l, respectively. The drinking water standards are 6 and 0.08 µg/l, respectively. Confirmation that neither of these metals are COCs at the drinking water standards or background, as discussed in previous correspondence, needs to be performed during the Remedial Design phase for OU-2.

7. The lead drinking water action level of 15 µg/l continue to be exceeded in a few Unit 3 wells. This will need to continue to be tracked but no response actions or leaching numbers need to be generated. The source of the lead problem is unknown.

OTHER CHANGES TO THE PCOCS THAN CHANGES DUE TO LEACHING

At Site D, many semi-volatile organic, polychlorinated biphenyl (PCB), and metal contaminants are documented as having been detected prior to November 1987 in soil. This includes PCBs up to 23 milligrams per kilogram (mg/kg) which are documented in the On-TCAAP Remedial Investigation Report as having been used as backfill. Also, PCBs with concentrations of up to 7 mg/kg were not excavated and treated during the

PCBs with concentrations of up to 7 mg/kg were not excavated and treated during the PCB contaminated soil incineration response action. During the Remedial Investigation and the Feasibility Study, additional sampling was only performed for VOC contaminants as physical access is limited due to the ISV system and there was general agreement that, as the VOCs are the most mobile, it would be best to remediate them first, then remove the ISV system and remediate the other contaminants. Therefore, it needs to be noted for Site D, that many other soil contaminants exist, but that their definition will be provided and they will be remediated at a later date.

Similarly, shallow soils at Site G contain contaminants other than VOCs at concentrations of concern. As an example, early sampling indicated high concentrations of lead (2,200 mg/kg) and cadmium (31 mg/kg). These contaminants are likely associated with the mixed waste and fill material buried at Site G. As with Site D, Site G will be further characterized and, if necessary, remediated following removal of the ISV system.

Minnesota Pollution Control Agency

February 6, 1996

Mr. Martin McCleery
Remedial Project Manager
Twin Cities Army Ammunition Plant
4700 Highway 10, Suite A
Arden Hills, Minnesota 55112-3928

RE: Leaching Numbers for Inorganics

Dear Mr. McCleery:

Enclosed please find a memorandum from Mike Trojan, Minnesota Pollution Control Agency (MPCA) staff, outlining the modeling that he conducted and the leaching numbers for metals that are the outcome of that effort. The MPCA staff considers these numbers to be reasonable and it is our expectation that these numbers will be included in the Operable Unit 2 Feasibility Study.

Please contact Mike Trojan at (612) 296-8112 or Mark Ferry at (612) 296-7775, if there are questions or you need additional information.

Sincerely,

Dagmar Romano

Dagmar Romano
Project Manager
Response Unit I
Site Response Section
Ground Water and Solid Waste Division

DR:ch

Enclosure

cc: Jeff LeBlanc, Montgomery Watson
Tom Barounis, U.S. Environmental Protection Agency

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA SF-00006-05 (4/86)

Office Memorandum

DATE: February 1, 1996

TO: Dagmar Romano, Barb Gnabasik,
Mark Ferrey and Eric Porcher
Site Response Section
Ground Water and Solid Waste Division

FROM: Mike Trojan MDT
Response Unit III
Site Response Section
Ground Water and Solid Waste Division

PHONE: 296-8112

SUBJECT: TCAAP Inorganic Leaching Numbers

Additional modeling has been conducted for selected inorganic chemicals at the Twin Cities Army Ammunition Plant (TCAAP). The chemicals were retained because of their presence in ground water at a concentration exceeding the Unit 1 clean-up standards. The Unit 1 clean-up standards are the higher of the health risk limit (HRL) or background concentration. If a HRL does not exist, then the Minnesota Department of Health advisory number or the maximum contaminant level (MCL) is compared to background concentrations and the higher value used.

Summary of Previous Work

In July 1995, contaminant transport modeling was conducted for a wide range of inorganic chemicals at TCAAP. A number of sites were modeled, but results indicated that, unless there were significant differences in soils between sites, modeling could be conducted for a single, idealized site. A description of the model, inputs, and results are contained in my memorandum of July 27, 1995. Clarifications to the model and additional information concerning inputs are discussed in my memorandum of September 20, 1995.

On September 13, 1995, a meeting was held between the Minnesota Pollution Control Agency (MPCA) staff, Army and Alliant Techsystems. One issue discussed at that meeting was a particular technique employed in the model. During the modeling exercise, it was noted that use of background concentrations would cause exceedances of the clean-up standards in ground water during the first time step. To avoid this problem, a one foot buffer zone of 'clean' soil was placed at the bottom of the unsaturated zone. The exceedance during the initial time step was primarily due to a lack of consideration for attenuation of chemical in ground water.

At the meeting of September 13, 1995, two modifications to the model were discussed. Army and Alliant Techsystems felt that the ground water clean-up standards should be adjusted to prevent the exceedance at the initial time step. MPCA staff believes this is an artificial correction that lacks adequate justification. I proposed that the model be run in a forward direction so that leaching concentrations could be predicted irrespective of ground water clean-up standards. This would allow for calibration of the model prior to attempting to derive a final clean-up value.

Army and Alliant Techsystems later requested that the model be run considering their technique - i.e., adjusting the ground water clean-up standards. This was done and results are contained in my memorandum of October 13, 1995. For several metals, the results indicate higher clean-up levels compared to the initial results. It is important to note that the results of this modeling effort are still based on the assumption of one foot of 'clean' soil above the water table.

Model Adjustments

In response to Army's and Alliant Techsystems' concerns regarding the original numbers provided by the MPCA, additional modeling was conducted for chemicals of concern in ground water. The model utilized a similar approach to that employed in earlier efforts, with the following adjustments:

- The model was run in a forward direction to predict leachate concentrations over time. With this approach, the model will not go through iterations to prevent exceedances of the Unit 1 clean-up standards in ground water.
- Adsorption to soil was allowed below the water table.
- The model was calibrated with TCAAP background soil and ground water concentrations to arrive at a more accurate value for distribution coefficients deeper in soil.
- The model was calibrated with actual site soil concentrations. The predicted leachate concentrations were compared to measured site values.
- Additivity, a HRL, was calculated using the equations and endpoints provided in Minn. R. pts. 4717.7600 to 4717.7000 with one exception. Background was substituted for the HRL in the equations in Minn. R. pts 4717.7700 and 4717.7750 if it was less stringent for a particular contaminant.

Depending on the fit with the two calibrations (background and actual soil concentrations), the distribution coefficient was adjusted with depth. Decreases in the distribution coefficient with depth were consistent with data from the literature which support lower coefficients as organic matter decreases. Once the model was calibrated, several runs were conducted until a concentration profile was established which would be protective of ground water. With this approach, the buffer zone is no longer needed.

Results

The calibration results are summarized in Table 1. As a first approximation, soil and ground water background concentrations cited in the September 29, 1995, letter from MPCA to Mr. Martin McCleery were used. Partitioning coefficients were adjusted and the predicted concentration in ground water was compared to the background concentration. The maximum detected soil concentration was then entered in the lowest depth cell (cell 1) and the predicted concentration in ground water compared to the highest detected concentration. This calibration procedure was successful for lead, zinc, cadmium, and cobalt. The background ground water concentration for antimony is unknown but is less than 0.10 micrograms per liter (µg/l). The calibration was carried out for the high concentration and the resulting predicted concentration for background conditions was 0.07 µg/l. Consequently, the calibration was considered to be successful. A concentration profile, developed from site data, was required for cadmium at the high concentration. This is because the distribution coefficient for cadmium is relatively low and the model is sensitive to the initial soil concentration profile. For nickel, a background concentration of 2.5 milligrams per kilogram (mg/kg) was used in model calibration. This compares to the value of 34 mg/kg cited in the MPCA letter of September 29, 1995. The lower background concentration was based on site data and calibrations were successful using the adjusted value.

Table 1: Calibration Results for the Model.

Metal	Site	Calibration Point	Soil Concentration (mg/kg)	Ground Water Concentration (ug/l) Predicted	Ground Water Concentration (ug/l) Measured
		Background	2	0.07	Unknown
Antimony	A	Site Maximum	1650	54.1	54.8
		Background	7.5	0.51	0.50
Cobalt	A	Site Maximum	26.8	1.82	2 to 7
		Background	0.3	0.91	0.88
Cadmium	I	Site Maximum	variable[1]	13.7	12.0
		Background	45	2.6	4.1
Lead	I	Site Maximum	75.2	4.3	5.0
		Background	2.5	16.5	14.5
Nickel	I	Site Maximum	variable[2]	172	164
		Background	45	2.6	4.1
Lead	K	Site Maximum	112	6.4	5.1
		Background	2.5	16.5	14.5
Nickel	K	Site Maximum	26	171	178
		Background	18.1	36.5	35.6
Zinc	K	Site Maximum	800	1594	1400

[1] Concentration ranged from 110 at 2 feet to 0.50 mg/kg above water table
[2] Concentration ranged from 43.3 at 2 feet to 25.5 mg/kg above water table

Table 2: Distribution coefficients (Kd) used in the model. Kd values are in cm^3/g.

Metal	Site	Feet above the Water Table				
		0 to 1	1 to 2	2 to 3	3 to 4	4 to 5
Antimony	A	400	500	600	800	1000
Cobalt	A	275	500	1100	1600	1735
Cadmium	I	40	50	60	70	80
Lead	I	300	600	1000	1500	2000
Nickel	I	25	40	100	120	140
Lead	K	300	600	1000	1500	2000
Nickel	K	25	40	100	120	140
Zinc	K	50	60	80	100	100

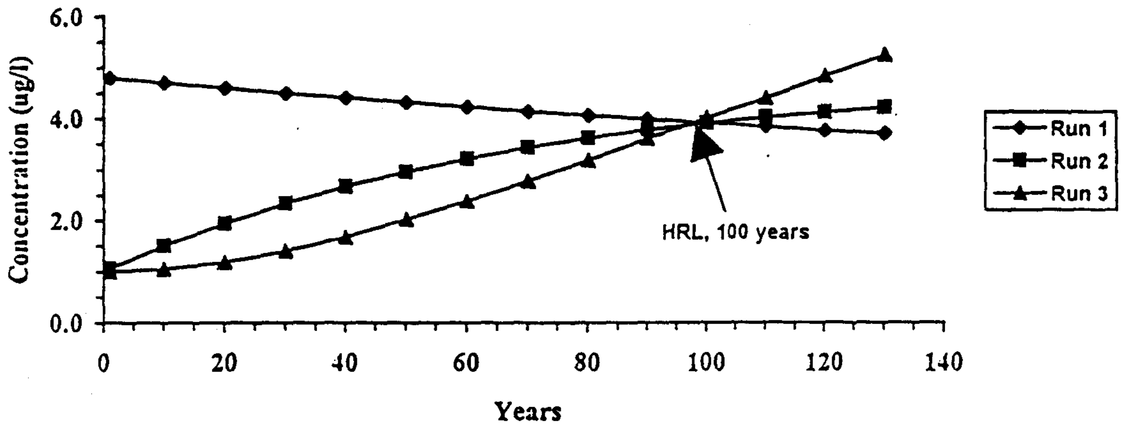
The final distribution coefficients used in the model are illustrated in Table 2. The depths shown in the table represent the distance, in feet, above the top of the water table. These correspond to cells 1 (closest to the water table) through 5. The distribution coefficients decrease with depth as expected because of decreased organic matter content with depth. The distribution coefficient for ground water was the same as that used for cell 1.

Table 3: Clean-up goals for the soil leaching pathway for the three one-foot cells above the water table. Concentrations are in mg/kg.

Metal	0 to 1 feet		1 to 2 feet		2 to 3 feet
	New value	Old value	New value	Old value	
Antimony	185	Background	2200	2000	40000
Cadmium	1.4	Background	2.3	0.3	7.0
Cobalt	60	Background	650	330	35000
Lead	270	Background	3300	2000	150000
Nickel	17	Background	75	75	130
Zinc	1050	Background	2000	1500	9000

The clean-up goals are summarized in Table 3. Differences between sites were insignificant (less than 10 percent) and the values for a particular chemical are applicable at all sites. Clean-up levels are provided for each of the three one-foot cells above the top of the water table. For cells 1 and 2, the previous clean-up goals are included for comparison. For cells 2 and 3, it assumed that chemical concentrations below these cells are at background. If they are not, model simulations suggest that clean-up goals should be decreased by approximately 10 percent. For example, if antimony were present at a concentration of 2200 mg/kg in cell 2 (1 to 2 feet above the water table) and the concentration below this (cell 1) was at background, no cleanup would be required. If, however, the concentration in cell 1 was 185 mg/kg, the clean-up goals for each of the last two cells would be reduced by ten percent to 167 mg/kg for cell 1and 1980 mg/kg for cell 2. It should also be noted that when high concentrations of chemical are located in cells 2 and 3 above lower concentrations in cell 1, concentrations in ground water increase over time. The Unit 1 ground water clean-up standards were compared to predicted concentrations at 100 years. Results beyond this time were not considered even though ground water concentrations may have been predicted to increase. Example output data is illustrated in Figure 1.

Figure 1: Predicted cadmium leachate concentrations (ug/l) in ground water under three soil concentration scenarios.



Run 1 - Soil concentration throughout profile was 1.4 mg/kg;
Run 2 - 0.3 and 2.3 mg/kg of cadmium in cells 1 and 2, respectively;
Run 3 - 0.3, 0.3, and 7.0 mg/kg of cadmium in cells 1, 2, and 3, respectively.

MT:ch

APPENDIX C-3

DEVELOPMENT OF CHEMICALS OF CONCERN (COCs)

TWIN CITIES ARMY AMMUNITION PLANT

TABLE 1

TCAAP OU-2 FS
COMPLETE LIST OF ANALYTES - SOIL

(2-Chloroethoxy) ethene / 2-Chloroethylvinyl ether	Benzo[a]anthracene
1,1,1,2-Tetrachloroethane	Benzo[a]phenanthrene
1,1,1-Trichloroethane	Benzo[a]pyrene
1,1,2,2-Tetrachloroethane	Benzo[b]fluoranthene
1,1,2,2-Tetramethylcyclopropane	Benzo[b]naphtho[1,2-d]thiophene
1,1,2-Trichloro-1,2,2-trifluoroethane	Benzo[c]phenanthrene
1,1,2-Trichloroethane	Benzo[g,h,i]perylene
1,1,3-Trimethylcyclohexane (TIC)	Benzo[j]fluoranthene
1,1-Dichloro-1-propene	Benzo[k]fluoranthene
1,1-Dichloroethane	Benzyl alcohol
1,1-Dichloroethene	Beryllium
1,1-Diphenylhydrazine	Beta gross
1,2,3,4-Tetrachlorobenzene	Beta gross - lab
1,2,3,4-Tetramethylbenzene	beta-Benzenehexachloride / beta-Hexachlorocyclohexane
1,2,3-Trichlorobenzene	beta-Endosulfan / Endosulfan II
1,2,3-Trichloropropane	Bis (2-chloroethoxy) methane
1,2,3-Trimethylcyclohexane	Bis (2-chloroethyl) ether
1,2,4,5-Tetrachlorobenzene	Bis (2-chloroisopropyl) ether
1,2,4-Trichlorobenzene	Bis (2-ethylhexyl) phthalate
1,2,4-Trimethylbenzene (TIC)	Bromobenzene
1,2,4-Trimethylcyclohexane	Bromochloromethane
1,2-Benzenedicarboxylic acid / Phthalic acid	Bromodichloromethane
1,2-Dibromo-3-chloropropane	Bromoform
1,2-Dibromoethane / Ethyl dibromide	Bromomethane
1,2-Dichlorobenzene	Butanedioic acid, dimethyl ester
1,2-Dichloroethane	Butylbenzene
1,2-Dichloroethenes (cis and trans)	Butylbenzyl phthalate
1,2-Dichloropropane	Butylmethyl phthalate
1,2-Diphenylbenzene	Cadmium
1,2-Diphenylhydrazine	Calcium
1,3,5-Trimethylbenzene	Carbon disulfide
1,3,5-Trimethylcyclohexane	Carbon tetrachloride
1,3,5-Trinitrobenzene	Cesium 134
1,3-Cyclopentadione	Cesium 137
1,3-Dichlorobenzene	Chlordane
1,3-Dichlorobenzene-D4	Chlorobenzene
1,3-Dichloropropane	Chlorocyclohexane
1,3-Dichloropropene	Chloroethane
1,3-Dimethylcyclohexane	Chloroform
1,3-Dimethylnaphthalene	Chloromethane
1,3-Dinitrobenzene	Chromium

TABLE 1

TCAAP OU-2 FS
COMPLETE LIST OF ANALYTES - SOIL

1,4-Dichlorobenzene
1,4-Dichlorobutane
1,4-Dihydro-1,4-methanonaphthalene
1,4-Dimethyl-2-ethylbenzene
1,4-Dimethylcyclohexane
1,5-Dimethylnaphthalene
1,6,7-Trimethylnaphthalene
1,6-Dimethylindan
1-Chloronaphthalene
1-Ethyl-2,4-dimethylbenzene
1-Ethylpropylbenzene
1-Heptadecanol
1-Methyl-2-(2-propenyl) cyclopentane
1-Methyl-7-(1-methylethyl) naphthalene
1-Methyl-9h-fluorene
1-Methylcyclopentene
1-Methylethylcyclohexane
1-Methylpyrene
1-Naphthylamine
1-Phenylnaphthalene
1-Propenylcyclohexane
10-Methylundecanoic acid, methyl ester
10-Octadecenoic acid, methyl ester
12-Methyltetradecanoic acid, methyl ester
14-Methylpentadecanic acid, methyl ester
15-Methylhexadecanoic acid, methyl ester
16-Methylheptadecanoic acid, methyl ester
17-Pentatriacontene
1h-Indene, octahydro- / Hydrindane
2,10-Dimethylundecane
2,2',3,3',4,4',5,5'-Octachlorobiphenyl
2,2',4,5,5'-Pentachlorobiphenyl
2,2,3,3-Tetramethylpentane
2,2,6-Trimethyloctane
2,2-Dichloropropane
2,2-Oxybis[ethanol] / Diethylene glycol
2,3,4,6-Tetrachlorophenol
2,3,6-Trimethylnaphthalene
2,3,7,8-Tetrachlorodibenzo-p-dioxin
2,3,7,8-Tetrachlorodibenzofuran
2,3,7-Trimethyloctane

Chrysene
cis-1,2-Dichloroethene
cis-1,3-Dichloropropylene / cis-1,3-Dichloropropene
Cobalt
Cobalt 60
Copper
Cumene / Isopropylbenzene
Cyanide
Cyclododecane
Cyclonite (RDX)
Cyclotetramethylenetetranitramine (HMX)
Cymene / (1-Methylethyl)methylbenzene
Decane
delta-Benzenehexachloride / delta-Hexachlorocyclohexane
Di-n-butyl phthalate
Di-n-octyl phthalate
Di-n-octyl phthalate-D4
Diacetone alcohol (TIC)
Dibenzofuran
Dibenzothiophene
Dibenz[A,H]anthracene
Dibenz[aj]acridine
Dibromochloromethane
Dibromomethane / Methylene bromide
Dichlorobiphenyls
Dichlorodifluoromethane
Dicyclohexyl phthalate
Dieldrin
Diethyl ether
Diethyl phthalate
Diethyl phthalate-D4
Diisobutyl phthalate
Diisooctyl phthalate
Dimethyl isophthalate
Dimethyl phthalate
Dimethylundecanes
Dioctyl adipate (TIC)
Diphenyl
Diphenylamine
Dodecane (TIC)
Endosulfan sulfate

TABLE 1

TCAAP OU-2 FS
COMPLETE LIST OF ANALYTES - SOIL

2,3-Dimenthylnaphthalene	Endrin
2,3-Dimethylphenol	Endrin aldehyde
2,4'-Dichlorobiphenyl	Endrin ketone
2,4,5-Trichlorophenol	Ethanol
2,4,6-Trichlorophenol	Ethyl methacrylate
2,4,6-Trimethyloctane	Ethyl methanesulfonate
2,4,6-Trimethylpyridine	Ethylbenzene
2,4,6-Trinitrotoluene	Fluoranthene
2,4-Dichlorophenol	Fluorene
2,4-Dimethyl-2-pentanol	Freon / Dichlorofluoromethane
2,4-Dimethyldecane	Gamma gross
2,4-Dimethylphenol	gamma-Chlordane
2,4-Dinitrophenol	Hendecane
2,4-Dinitrotoluene	Heneicosane
2,5-Dimethylphenanthrene	Heptachlor
2,5-Dimethylphenol	Heptachlor epoxide
2,6,10,14-Tetramethylheptadecane	Heptachlorobiphenyls
2,6,10,14-Tetramethylpentadecane (TIC)	Heptadecane (TIC)
2,6,11-Trimethyldodecane	Heptadecanoic acid, methyl ester
2,6-Dichlorophenol	Hexachlorobenzene
2,6-Dimethyloctane	Hexachlorobutadiene / Hexachloro-1,3-butadiene
2,6-Dimethylphenol	Hexachlorocyclopentadiene
2,6-Dimethylundecane (TIC)	Hexachloroethane
2,6-Dinitrotoluene	Hexacosane
2,7-Dimethylnaphthalene	Hexadecane (TIC)
2-(1-Methylethyl) naphthalene	Hexadecanoic acid, bis (2-ethylhexyl) ester
2-(T-butyl)-4-methylfuran	Hexanedioic acid, bis (2-ethylhexyl) ester
2-Chloro-6-methoxy-10h-phenothiazine	Hexanedioic acid, dibutyl ester / dibutyl adipate
2-Chlorobiphenyl	Hexanedioic acid, dimethyl ester / dimethyl adipate
2-Chloronaphthalene	Indeno[1,2,3-C,D]pyrene
2-Chlorophenol	Iron
2-Chlorotoluene	Isophorone
2-Ethyl-1-hexanol	Isoquinoline
2-Ethyl-4-methyl-1-pentanol	Lead
2-Ethylphenol	Lindane / gamma-Benzenehexachloride
2-Hydroxybiphenyl	Magnesium
2-Methoxy-2,3,3-trimethylbutane	Manganese
2-Methyl-2-propenoic acid, 1,2-ethanediyl ester	Mercury
2-Methyl-4,6-dinitrophenol / 4,6-Dinitro-2-cresol	Mesityl oxide / 4-Methyl-3-penten-2-one
2-Methyl-4-(t-butyl) phenol / 4-t-butyl-2-cresol	Methoxychlor
2-Methyl-5-(1-methylethyl)-2-cyclohexen-1-one	Methyl iodide / Iodomethane

TABLE 1

TCAAP OU-2 FS
COMPLETE LIST OF ANALYTES - SOIL

2-Methyldecane
2-Methyldodecane
2-Methylnaphthalene
2-Methylphenol / 2-cresol
2-Methylpyrene
2-Methyltetradecane
2-Naphthylamine
2-Nitro-n-nitrosodiphenylamine
2-Nitroaniline
2-Nitrophenol
2-Nitrotoluene (TIC)
2-Phenylbutane / sec-Butylbenzene
2-Phenylnaphthalene
2-Picoline
2-Propanol
3,3-Dichlorobenzidine
3,4,5,6-Tetramethylphenanthrene
3,4-Dimethyl-1-decene
3,4-Dimethylphenol
3,5,24-Trimethyltetracontane
3,5,5-Trimethyl-2-cyclohexen-1-one
3,5-Dimethyl-2-cyclohexen-1-one
3,5-Dimethyl-3-hexanol
3,5-Dimethylphenol
3,7-Dimethylnonane
3,8-Dimethylundecane
3-Ethyl-2,5-dimethyl-3-hexene
3-Ethyl-5-(2-ethylbutyl) octadecane
3-Ethylphenol
3-Methoxytoluene
3-Methyl-2-cyclohexen-1-one
3-Methyl-4-chlorophenol / 4-Chloro-m-cresol
3-Methyl-5-propylnonane
3-Methylcholanthrene
3-Methylchrysene
3-Methylphenanthrene
3-Methylphenol / 3-cresol
3-Methylundecane
3-Nitroaniline
3-Nitrotoluene
3-Propyltoluene

Methyl methanesulfonate
Methyl-N-butyl ketone / 2-Hexanone
Methylcyclodecane
Methylene chloride
Methylethyl ketone / 2-Butanone
Methylisobutyl ketone
Molybdenum
N-Nitrosodi-n-butylamine
N-Nitrosodi-N-propylamine
N-Nitrosodimethylamine
n-Nitrosodiphenylamine
N-Nitrosopiperidine
n-Propylbenzene / Propylbenzene
Napthalene
Nickel
Nitramine (Tetryl)
Nitrobenzene
Nitroglycerine
Nonadecane (TIC)
Nonadecanoic acid
Nonanedioic acid, dimethyl ester
o-Xylene / 1,2-Dimethylbenzene
Octadecane (TIC)
Octadecanoic acid, methyl ester
Octanedioic acid, dimethyl ester
p,p-DDD
p,p-DDE
p,p-DDT
p-Dimethylaminoazobenzene / Methyl yellow
PCB 1016
PCB 1221
PCB 1232
PCB 1242
PCB 1248
PCB 1254
PCB 1260
Pentachlorobenzene
Pentachlorobiphenyls
Pentachloronitrobenzene
Pentachlorophenol
Pentacosane

TABLE 1

TCAAP OU-2 FS
COMPLETE LIST OF ANALYTES - SOIL

4,7-Dimethylundecane
4,8-Dimethylhendecane
4-(1-Methylethyl) heptane
4-Aminobiphenyl
4-Bromophenylphenyl ether
4-Butoxy-3-pentene-2-one
4-Chloroaniline
4-Chlorophenylphenyl ether
4-Chlorotoluene
4-Methyl-9h-fluorene
4-Methylbiphenyl
4-Methyldibenzofuran
4-Methylphenanthrene
4-Methylphenol / 4-Cresol / p-Cresol
4-Methylpyrene
4-Nitroaniline
4-Nitrophenol
4-Nitrotoluene
5-Ethyl-2-methylheptane
5-Propyltridecane
6-Methyl-3-heptanol
6-Methyltridecane
7,12-Dimethylbenz[a]anthracene
7-Methyltridecane
8-Methyl-1,8-nonanediol
9,10-Anthracenedione / Athraquinone
9-Anthracenecarbonitrile
9-Fluorenone
9-Methylbenz[a]anthracene
9h-carbazole (TIC)
Acenaphthene
Acenaphthylene
Acetic acid, vinyl ester / Vinyl acetate
Acetone
Acetophenone
Acrolein
Acrylonitrile
Aldrin
Aliphatic hydrocarbons
Allyl chloride / 3-Chloro-1-propene
Alpha gross
Pentadecane (TIC)
Pentaerythritol tetranitrate (TIC)
Phenacetin / N-(4-Ethoxyphenyl) acetamide
Phenanthrene
Phenol
Phosphoric acid, octyldiphenyl ester
Phosphoric acid, triphenyl ester
Potassium
Potassium 40
Pronamid / Propyzamide
Pyrene
Radium 226
Selenium
Silver
Sodium
Squalene
Strontium 90
Styrene
Tert-butyl methyl ether / Methyl tert-butyl ether
tert-Butylbenzene / 2-Methyl-2-phenylpropane
Tetrachlorobiphenyls
Tetrachloroethene
Tetradecane (TIC)
Tetradecanoic acid, methyl ester
Tetrahydrofuran / Diethylene oxide / Tetramethylene oxide
Thallium
Toluene
Total Heptachlorodibenzo-p-dioxins
Total Heptachlorodibenzofurans
Total Hexachlorodibenzo-p-dioxins
Total Hexachlorodibenzofurans
Total Octochlorodibenzo-p-dioxins
Total Octochlorodibenzofurans
Total Organic Carbon
Total pentachlorodibenzo-p-dioxins
Total Pentachlorodibenzofurans
Total Tetrachlorodibenzo-p-dioxins
Total tetrachlorodibenzofurans
Toxaphene
trans-1,2-Dichloroethene
trans-1,3-Dichloropropene

TABLE 1

TCAAP OU-2 FS
COMPLETE LIST OF ANALYTES - SOIL

Alpha gross - lab	Trichlorobiphenyls
alpha,alpha-Dimethylphenethylamine	Trichloroethene
alpha-Benzenehexachloride / alpha-Hexachlorocyclohexane	Trichlorofluoromethane
alpha-Chlordane	Trichlorotrifluoroethane
alpha-Endosulfan / Endosulfan I	Tridecane (TIC)
Aluminum	Triethylene glycol
Aniline	Trimethylbenzenes
Anthracene	Trimethyldecanes
Antimony	Trimethylundecanes
Arsenic	Triphenylene
Barium	Vanadium
Benzanthrone	Vinyl chloride (chloroethane)
Benzene	Xylenes
Benzidine	Xylenes, total combined
Benzoic acid	Zinc

Note: List of analytes as downloaded from the IRDMIS database, November 1994.

TABLE 2

TCAAP OU-2 FS
COMPLETE LIST OF ANALYTES - GROUNDWATER

(2-Chloroethoxy) ethene / 2-Chloroethylvinyl ether
1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloro-1,2,2-trifluoroethane
1,1,2-Trichloroethane
1,1-Dichloro-1-propene
1,1-Dichloroethane
1,1-Dichloroethene
1,1-Diphenylhydrazine
1,2,3,4-Tetrachlorobenzene
1,2,3-Trichlorobenzene
1,2,3-Trichloropropane
1,2,4,5-Tetrachlorobenzene
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene (TIC)
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane / Ethyl dibromide
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloroethenes (cis and trans)
1,2-Dichloropropane
1,2-Diphenylhydrazine
1,3,5-Trimethylbenzene
1,3,5-Trinitrobenzene
1,3-Dichlorobenzene
1,3-Dichloropropane
1,3-Dichloropropene
1,3-Dimethylbenzene / m-Xylene
1,3-Dinitrobenzene
1,4-Diacetylbenzene / 1,1'-(1,4-Phenylene)bis(ethanone)
1,4-Dichlorobenzene
1,4-Dichlorobutane
1-Acetyl-4-(1-hyroxy-1-methylethyl)benzene
1-Chloro-2,4-hexadiene
1-Chloronaphthalene
1-Methyl-1,3-cyclopentadiene
1-Methylethylcyclopropane
1-Naphthylamine
1-Octanol
2,2',3,3',4,4',5,5'-Octachlorobiphenyl
2,2-Dichloropropane

Cobalt
Copper
Cumene / Isopropylbenzene
Cyanide
Cyclohexane
Cyclohexanone (TIC)
Cyclonite (RDX)
Cyclotetramethylenetetranitramine (HMX)
Cymene / (1-Methylethyl)methylbenzene
delta-Benzenehexachloride / delta-Hexachlorocyclohexane
Di-n-butyl phthalate
Di-n-octyl phthalate
Dibenzofuran
Dibenz[A,H]anthracene
Dibenz[aj]acridine
Dibenz[a]anthracene
Dibromochloromethane
Dibromomethane / Methylene bromide
Dichloroacetonitrile
Dichlorodifluoromethane
Dieldrin
Diethyl ether
Diethyl phthalate
Diisobutyl phthalate
Diisooctyl phthalate
Dimethyl phthalate
Dioctyl adipate (TIC)
Diphenyl ether
Diphenylamine
Diseleno diindole
Endosulfan sulfate
Endrin
Endrin aldehyde
Endrin ketone
Ethanol
Ethyl methacrylate
Ethyl methanesulfonate
Ethylbenzene
Fluoranthene
Fluorene
Fluoride
Freon / Dichlorofluoromethane

TABLE 2

TCAAP OU-2 FS
COMPLETE LIST OF ANALYTES - GROUNDWATER

2,3,4,6-Tetrachlorophenol
2,3,7,8-Tetrachlorodibenzo-p-dioxin
2,3-Dichloro-1-propene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4,6-Trinitrotoluene
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,5-Dimethyltetrahydrofuran
2,6-Dichlorophenol
2,6-Dinitrotoluene
2,Butyltetrahydrofuran
2-Chloronaphthalene
2-Chlorophenol
2-Chlorotoluene
2-Ethyl-1-hexanol
2-Ethyl-4-methyl-1-pentanol
2-Methyl-1-pentene
2-Methyl-4,6-dinitrophenol / 4,6-Dinitro-2-cresol
2-Methylnaphthalene
2-Methylphenol / 2-cresol
2-Naphthylamine
2-Nitroaniline
2-Nitrophenol
2-Nitrotoluene (TIC)
2-Phenylbutane / sec-Butylbenzene
2-Picoline
3,3-Dichlorobenzidine
3-(tert-Butyl)-pentane / 3-Ethyl-2,2-dimethylpentane
3-Methyl-4-chlorophenol / 4-Chloro-m-cresol
3-Methylcholanthrene
3-Methylpentane (TIC)
3-Nitroaniline
3-Nitrotoluene
3-Phenylpropanol
3-Phenylpropanoyl chloride / Hydrocinnamyl chloride
4-Acetylmorpholine
4-Aminobiphenyl
4-Bromophenylphenyl ether
4-Chloroaniline
Gamma scan / Gamma screen
gamma-Chlordane
Heptachlor
Heptachlor epoxide
Heptadecanoic acid, methyl ester
Hexachlorobenzene
Hexachlorobutadiene / Hexachloro-1,3-butadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexacosane
Hexadecanoic acid / Palmitic acid (TIC)
Hexane (TIC)
Indeno[1,2,3-C,D]pyrene
Indole / 2,3-Benzopyrrole
Iron
Isophorone
Ketoendrin
Lead
Lindane / gamma-Benzenehexachloride
Magnesium
Manganese
Mercury
Methoxychlor
Methyl iodide / Iodomethane
Methyl methanesulfonate
Methyl pentyl ketone / 2-Heptanone
Methyl pentyl ketone / Heptanone
Methyl-N-butyl ketone / 2-Hexanone
Methylcyclohexane
Methylcyclopentane (TIC)
Methylene chloride
Methylethyl ketone / 2-Butanone
Methylisobutyl ketone
Methylphenols
Molybdenum
N-(2-Hydroxyethyl)-decanamide
N-Butyl-4-methylbenzenesulfonamide
N-Nitrosodi-n-butylamine
N-Nitrosodi-N-propylamine
N-Nitrosodimethylamine
n-Nitrosodiphenylamine
N-Nitrosopiperidine

TABLE 2

TCAAP OU-2 FS
COMPLETE LIST OF ANALYTES - GROUNDWATER

4-Chlorophenylphenyl ether	n-Propylbenzene / Propylbenzene
4-Chlorotoluene	Napthalene
4-Methylbenzene sulfonamide	Nickel
4-Methylphenol / 4-Cresol / p-Cresol	Nitramine (Tetryl)
4-Nitroaniline	Nitrate
4-Nitrophenol	Nitrite, nitrate - nonspecified
4-Nitrotoluene	Nitrobenzene
7,12-Dimethylbenz[a]anthracene	Nitroglycerine
8-Methyldecanoic acid methyl ester	Nitrosodi-n-propylamine
a,a-Dimethylbenzenemethanol	o-Xylene / 1,2-Dimethylbenzene
Acenaphthene	Octadecyl stearate / Octadecanoic acid octadecyl ester
Acenaphthylene	Orthophosphate
Acetic acid, vinyl ester / Vinyl acetate	p,p-DDD
Acetone	p,p-DDE
Acetophenone	p,p-DDT
Acrolein	p-Dimethylaminoazobenzene / Methyl yellow
Acrylonitrile	p-Xylene / 1,4-Dimethylbenzene
Aldrin	PCB 1016
Allyl chloride / 3-Chloro-1-propene	PCB 1221
Alpha gross	PCB 1232
alpha,alpha-Dimethylphenethylamine	PCB 1242
alpha-Benzenehexachloride / alpha-Hexachlorocyclohexan	PCB 1248
alpha-Chlordane	PCB 1254
alpha-Endosulfan / Endosulfan I	PCB 1260
Aluminum	Pentachlorobenzene
Ammonia nitrogen	Pentachloroethane
Aniline	Pentachloronitrobenzene
Anthracene	Pentachlorophenol
Antimony	Pentacosane
Arsenic	Pentaerythritol tetranitrate (TIC)
Barium	pH
Benzene	Phenacetin / N-(4-Ethoxyphenyl) acetamide
Benzfluoranthene	Phenanthrene
Benzidine	Phenol
Benzobifluoroanthene	Phosphorus
Benzoic acid	Potassium
Benzo[a]anthracene	Pronamid / Propyzamide
Benzo[a]pyrene	Propanoic acid 2-methylbutyl ester
Benzo[b]fluoranthene	Pyrene
Benzo[g,h,i]perylene	Radium
Benzo[k]fluoranthene	Selenium
Benzyl alcohol	Silver

TABLE 2

TCAAP OU-2 FS
COMPLETE LIST OF ANALYTES - GROUNDWATER

Beryllium	Sodium
Beta gross	Strontium
beta-Benzenehexachloride / beta-Hexachlorocyclohexane	Styrene
beta-Endosulfan / Endosulfan II	Sulfate
Bis (2-chloroethoxy) methane	Sulfur
Bis (2-chloroethyl) ether	Tert-butyl methyl ether / Methyl tert-butyl ether
Bis (2-chloroisopropyl) ether	tert-Butylbenzene / 2-Methyl-2-phenylpropane
Bis (2-ethylhexyl) phthalate	Tetrachloroethene
Bis(pentafluorophenyl) phenyl phosphine	Tetrahydrofuran / Diethylene oxide / Tetramethylene oxide
Bromobenzene	Thallium
Bromochloromethane	Tin
Bromodichloromethane	Toluene
Bromoethane / Ethyl bromide	Total dissolved solids
Bromoform	Total hardness
Bromomethane	Total phosphates
Butyl ethyl ether	Total Suspended Solids
Butylbenzene	Total value of all DDT, DDE, DDD isomers
Butylbenzyl phthalate	Toxaphene
C18H30O Unknown	TPH, diesel fraction
C22h40O Unknown	trans-1,2-Dichloroethene
Cadmium	trans-1,3-Dichloropropene
Calcium	Trichloroethene
Carbon disulfide	Trichlorofluoromethane
Carbon tetrachloride	Trichloropropenes
Chlordane	Trichlorotrifluoroethane
Chloride	Triethyl phosphate / Ethyl phosphate
Chlorobenzene	Trimethylbenzenes
Chloroethane	Trimethylhexanes
Chloroform	Vanadium
Chloromethane	Vinyl chloride (chloroethane)
Chromium	Xylenes
Chrysene	Xylenes, total combined
cis-1,2-Dichloroethene	Zinc
cis-1,3-Dichloropropylene / cis-1,3-Dichloropropene	

Note: List of analytes as downloaded from IRDMIS database, November 1994.

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
BORE	SB054	5	SOIL	05-NOV-87	LM06	Di-n-butyl phthalate	3.3	UGG
BORE	SB054	60	SOIL	05-NOV-87	LM06	Di-n-butyl phthalate	2.8	UGG
BORE	SB054	120	SOIL	06-NOV-87	LM06	Di-n-butyl phthalate	1.2	UGG
PLUG	TR031	3	SOIL	12-NOV-87	99	2,4-Dinitrotoluene	6.6	UGG
PLUG	TR031	3	SOIL	12-NOV-87	99	Bis (2-ethylhexyl) phthalate	9.6	UGG
PLUG	TR031	3	SOIL	12-NOV-87	99	Di-n-butyl phthalate	520	UGG
PLUG	TR031	3	SOIL	12-NOV-87	LM05	Trichloroethene	38	UGG
PLUG	TR031	3	SOIL	12-NOV-87	99	n-Nitrosodiphenylamine	5.9	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1,1,3-Trimethylcyclohexane (TIC)	50	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1,2,3-Trimethylcyclohexane	100	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1,2,4-Trimethylcyclohexane	3	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1,3,5-Trimethylcyclohexane	4	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1,3-Dimethylcyclohexane	1	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1,4-Dimethyl-2-ethylbenzene	20	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1,4-Dimethylcyclohexane	1	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1,6-Dimethylindan	20	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1-Ethylpropylbenzene	5	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1-Methyl-2-(2-propenyl) cyclopentane	70	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1-Methylcyclopentene	2	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1-Methylethylcyclohexane	20	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1-Propenylcyclohexane	20	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	1h-Indene, octahydro- / Hydrindane	80	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	2,2,6-Trimethyloctane	7	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	2,6-Dimethyloctane	70	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	3,7-Dimethylnonane	60	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	3-Ethyl-2,5-dimethyl-3-hexene	60	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	3-Methylundecane	30	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	3-Propyltoluene	20	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	4-(1-Methylethyl) heptane	100	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	5-Ethyl-2-methylheptane	200	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	6-Methyltridecane	80	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	Aliphatic hydrocarbons	200	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	Decane	200	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	Hendecane	200	UGG
BORE	SB008A	5	SOIL	29-NOV-83	9J	Trimethylbenzenes	70	UGG
PLUG	TR005	8	SOIL	11-NOV-87	LM06	Hendecane	7.4	UGG
COMP	SS012	3	SOIL	16-NOV-83	9J	10-Methylundecanoic acid, methyl ester	3	UGG
COMP	SS012	3	SOIL	16-NOV-83	9J	12-Methyltetradecanoic acid, methyl ester	10	UGG
COMP	SS012	3	SOIL	16-NOV-83	9J	15-Methylhexadecanoic acid, methyl ester	2	UGG
COMP	SS012	3	SOIL	16-NOV-83	9J	Aliphatic hydrocarbons	6	UGG
COMP	SS012	3	SOIL	16-NOV-83	9J	Dimethyl isophthalate	1	UGG
COMP	SS012	3	SOIL	16-NOV-83	9J	Heptadecanoic acid, methyl ester	30	UGG
COMP	SS012	3	SOIL	16-NOV-83	9J	Hexanedioic acid, dimethyl ester / dimethyl adipate	2	UGG
COMP	SS012	3	SOIL	16-NOV-83	9J	Nonanedioic acid, dimethyl ester	2	UGG
COMP	SS012	3	SOIL	16-NOV-83	9J	Octanedioic acid, dimethyl ester	1	UGG
COMP	SS012	3	SOIL	16-NOV-83	9J	Tetradecanoic acid, methyl ester	7	UGG
BORE	SB013	5	SOIL	18-NOV-83	9J	1,4-Dihydro-1,4-methanonaphthalene	60	UGG
BORE	SB013	5	SOIL	18-NOV-83	9J	1,4-Dimethyl-2-ethylbenzene	10	UGG
BORE	SB013	5	SOIL	18-NOV-83	9J	2,7-Dimethylnaphthalene	2	UGG
BORE	SB013	5	SOIL	18-NOV-83	9J	2-Ethyl-4-methyl-1-pentanol	40	UGG
BORE	SB013	5	SOIL	18-NOV-83	9J	Benzo[a]anthracene	2	UGG
PLUG	TR023	4	SOIL	12-NOV-87	99	Fluoranthene	5	UGG
PLUG	TR023	4	SOIL	12-NOV-87	99	Pyrene	5.8	UGG
PLUG	TR024	1	SOIL	12-NOV-87	99	Benzo[a]anthracene	6.6	UGG
PLUG	TR024	1	SOIL	12-NOV-87	99	Benzo[a]pyrene	9.3	UGG
PLUG	TR024	1	SOIL	12-NOV-87	99	Benzo[b]fluoranthene	11	UGG
PLUG	TR024	1	SOIL	12-NOV-87	99	Benzo[k]fluoranthene	6.9	UGG
PLUG	TR024	1	SOIL	12-NOV-87	99	Chrysene	8.2	UGG
PLUG	TR024	1	SOIL	12-NOV-87	99	Fluoranthene	16	UGG

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
PLUG	TR024	1	SOIL	12-NOV-87	99	Pyrene	19	UGG
BORE	D102DSB	145	SOIL	20-OCT-92	LM05	Trichloroethene	500	UGG
BORE	D102DSB	145	SOIL	20-OCT-92	LM05	Xylenes, total combined	20	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	1,2,3,4-Tetramethylbenzene	40	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	1,2,3-Trichlorobenzene	10	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	1,4-Dihydro-1,4-methanonaphthalene	3	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	1-Ethyl-2,4-dimethylbenzene	2	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	1-Heptadecanol	7	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	2,3-Dimethylphenol	5	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	2,4,6-Trimethylpyridine	3	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	2,7-Dimethylnaphthalene	1	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	2-Ethylphenol	4	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	2-Methylnaphthalene	2	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	2-Methylphenol / 2-cresol	90	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	3,4-Dimethylphenol	20	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	3-Methoxytoluene	3	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	3-Propyltoluene	70	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	Acetophenone	2	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	Dichlorobiphenyls	200	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	Dimethyl isophthalate	5	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	Heptachlorobiphenyls	1	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	Heptadecanoic acid, methyl ester	50	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	Octadecanoic acid, methyl ester	40	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	Pentachlorobiphenyls	7	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	Tetrachlorobiphenyls	100	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	Tetradecanoic acid, methyl ester	20	UGG
BORE	SB020B	20	SOIL	18-NOV-83	9J	Trichlorobiphenyls	200	UGG
BORE	SB020E	49	SOIL	18-NOV-83	9J	Aliphatic hydrocarbons	3	UGG
BORE	SB020E	49	SOIL	18-NOV-83	9J	Dichlorobiphenyls	2	UGG
BORE	SB020E	49	SOIL	18-NOV-83	9J	Pentachlorobiphenyls	1	UGG
BORE	SB020E	49	SOIL	18-NOV-83	9J	Tetrachlorobiphenyls	20	UGG
BORE	SB020E	49	SOIL	18-NOV-83	9J	Trichlorobiphenyls	20	UGG
BORE	SB020R	170	SOIL	23-NOV-83	9J	3,4-Dimethyl-1-decene	8	UGG
BORE	SB020R	170	SOIL	23-NOV-83	9J	Aliphatic hydrocarbons	2	UGG
BORE	SB059	20	SOIL	04-NOV-87	LM06	Di-n-butyl phthalate	1.2	UGG
BORE	SB030B	19	SOIL	09-NOV-83	9J	2-Ethyl-1-hexanol	20	UGG
BORE	SB030B	19	SOIL	09-NOV-83	9J	Benzo[a]anthracene	2	UGG
BORE	SB030B	19	SOIL	09-NOV-83	9J	Benzo[a]phenanthrene	2	UGG
BORE	SB030B	19	SOIL	09-NOV-83	9J	Butanedioic acid, dimethyl ester	10	UGG
BORE	SB030B	19	SOIL	09-NOV-83	9J	Chlorocyclohexane	2	UGG
BORE	SB030B	19	SOIL	09-NOV-83	9J	Diisooctyl phthalate	30	UGG
BORE	SB030B	19	SOIL	09-NOV-83	9J	Hendecane	2	UGG
BORE	SB030B	19	SOIL	09-NOV-83	9J	Hexanedioic acid, dimethyl ester / dimethyl adipate	3	UGG
BORE	SB030B	19	SOIL	09-NOV-83	9J	Phenanthrene	3	UGG
BORE	SB030E	49	SOIL	09-NOV-83	9J	Aliphatic hydrocarbons	4	UGG
BORE	I04MW	14	SOIL	16-JUL-92	LM05	Trichloroethene	.92	UGG
BORE	K08SB	6	SOIL	13-JUL-92	LM05	Trichloroethene	15	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	1,1-Diphenylhydrazine	3	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	1,6-Dimethylindan	2	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	1-Methyl-7-(1-methylethyl) naphthalene	3	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	1-Methyl-9h-fluorene	1	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	2,3,6-Trimethylnaphthalene	4	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	2,6,11-Trimethyldodecane	2	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	2-(1-Methylethyl) naphthalene	1	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	2-Ethyl-1-hexanol	1	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	3,4,5,6-Tetramethylphenanthrene	9	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	Diisobutyl phthalate	20	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	8	UGG
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	Tetradecane (TIC)	2	UGG

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LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
BORE	CBD001	27.5	SOIL	03-FEB-84	9J	Tridecane (TIC)	2	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	2,5-Dimethylphenol	30	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	2,6,10,14-Tetramethylheptadecane	3	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	2,6,11-Trimethyldodecane	2	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	2-Ethyl-1-hexanol	3	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	3-Ethylphenol	20	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	3-Methylphenol / 3-cresol	2	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	4,7-Dimethylundecane	6	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	Cyclododecane	3	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	Dichlorobiphenyls	4	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	Heneicosane	3	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	Heptadecane (TIC)	20	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	Tetradecane (TIC)	8	UGG
BORE	CBD002	87.8	SOIL	18-FEB-84	9J	Trichlorobiphenyls	30	UGG
BORE	CBD003	28	SOIL	03-FEB-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	4	UGG
BORE	CBD004	82.8	SOIL	20-FEB-84	9J	1-Heptadecanol	2	UGG
BORE	CBD004	82.8	SOIL	20-FEB-84	9J	2,2-Oxybis[ethanol] / Diethylene glycol	30	UGG
BORE	CBD004	82.8	SOIL	20-FEB-84	9J	2,4,6-Trimethyloctane	2	UGG
BORE	CBD004	82.8	SOIL	20-FEB-84	9J	2,4-Dimethyldecane	1	UGG
BORE	CBD004	82.8	SOIL	20-FEB-84	9J	2-Ethyl-1-hexanol	10	UGG
BORE	CBD004	82.8	SOIL	20-FEB-84	9J	2-Methyldecane	1	UGG
BORE	CBD004	82.8	SOIL	20-FEB-84	9J	Di-n-butyl phthalate	1	UGG
BORE	CBD004	82.8	SOIL	20-FEB-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	10	UGG
BORE	CBD005	28	SOIL	29-FEB-84	9J	2-Ethyl-1-hexanol	3	UGG
BORE	CBD005	28	SOIL	29-FEB-84	9J	Cyclododecane	2	UGG
BORE	CBD005	28	SOIL	29-FEB-84	9J	Heptadecane (TIC)	4	UGG
BORE	CBD005	28	SOIL	29-FEB-84	9J	Heptadecanoic acid, methyl ester	2	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	1,2-Diphenylbenzene	5	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	1-Methylpyrene	20	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	2,5-Dimethylphenanthrene	2	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	2-Methylpyrene	20	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	2-Phenylnaphthalene	6	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	3-Methylchrysene	7	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	3-Methylphenanthrene	10	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	4-Methylpyrene	10	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	9,10-Anthracenedione / Athraquinone	6	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	9-Anthracenecarbonitrile	10	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	9-Fluorenone	6	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	9-Methylbenz[a]anthracene	7	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	9h-carbazole (TIC)	20	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Acenaphthene	8	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Benzanthrone	10	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Benzo[a]anthracene	30	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Benzo[b]naphtho[1,2-d]thiophene	5	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Benzo[c]phenanthrene	10	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Benzo[j]fluoranthene	60	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Dibenzofuran	5	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Dibenzothiophene	5	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Fluorene	8	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Phenanthrene	60	UGG
BORE	CBG001	42.5	SOIL	07-FEB-84	9J	Pyrene	40	UGG
BORE	CBG002	27.5	SOIL	07-FEB-84	9J	1,3-Cyclopentadione	2	UGG
BORE	CBG002	27.5	SOIL	07-FEB-84	9J	1-Heptadecanol	1	UGG
BORE	CBG002	27.5	SOIL	07-FEB-84	9J	2-Ethyl-1-hexanol	5	UGG
BORE	CBG002	27.5	SOIL	07-FEB-84	9J	Di-n-butyl phthalate	2	UGG
BORE	CBG002	27.5	SOIL	07-FEB-84	9J	Dicyclohexyl phthalate	1	UGG
BORE	CBG002	27.5	SOIL	07-FEB-84	9J	Diisobutyl phthalate	1	UGG
BORE	CBG002	27.5	SOIL	07-FEB-84	9J	Heptadecane (TIC)	20	UGG
BORE	CBG002	27.5	SOIL	07-FEB-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	20	UGG

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TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
BORE	CBG002	27.5	SOIL	07-FEB-84	9J	Tetradecane (TIC)	4	UGG
BORE	CBG1BF3	70.3	SOIL	14-FEB-84	9J	1-Heptadecanol	2	UGG
BORE	CBG1BF3	70.3	SOIL	14-FEB-84	9J	2,4,6-Trimethyloctane	1	UGG
BORE	CBG1BF3	70.3	SOIL	14-FEB-84	9J	2-Ethyl-1-hexanol	2	UGG
BORE	CBG1BF3	70.3	SOIL	14-FEB-84	9J	4,7-Dimethylundecane	1	UGG
BORE	CBG1BF3	70.3	SOIL	14-FEB-84	9J	Dicyclohexyl phthalate	1	UGG
BORE	CBG1BF3	70.3	SOIL	14-FEB-84	9J	Dicyclohexyl phthalate	2	UGG
BORE	CBG1BF3	70.3	SOIL	14-FEB-84	9J	Diisobutyl phthalate	2	UGG
BORE	CBG1BF3	70.3	SOIL	14-FEB-84	9J	Heptadecane (TIC)	2	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	10-Octadecenoic acid, methyl ester	9	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	2,6,10,14-Tetramethylheptadecane	10	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Dichlorobiphenyls	10	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Diisobutyl phthalate	60	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Heneicosane	40	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Heptadecane (TIC)	20	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Heptadecanoic acid, methyl ester	10	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	20	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Pentachlorobiphenyls	1	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Pentachlorophenol	1	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Phosphoric acid, octyldiphenyl ester	1	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Phosphoric acid, triphenyl ester	7	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Tetrachlorobiphenyls	20	UGG
BORE	CDS2DS3	8	SOIL	17-JAN-84	9J	Trichlorobiphenyls	20	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	2,6,10,14-Tetramethylheptadecane	30	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	2,6,10,14-Tetramethylpentadecane (TIC)	9	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	2,6-Dimethylundecane (TIC)	20	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	2-Methylnaphthalene	6	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	2-Methyltetradecane	6	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	6-Methyltridecane	9	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	7-Methyltridecane	30	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	Dichlorobiphenyls	10	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	Dodecane (TIC)	50	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	Hendecane	50	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	Heptadecane (TIC)	30	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	9	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	Pentadecane (TIC)	30	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	Tetrachlorobiphenyls	20	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	Tetradecane (TIC)	40	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	Trichlorobiphenyls	40	UGG
BORE	CDS6DS7	8	SOIL	17-JAN-84	9J	Tridecane (TIC)	40	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	1,1,2,2-Tetramethylcyclopropane	60	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	2,2-Oxybis[ethanol] / Diethylene glycol	20	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	2,4-Dimethyl-2-pentanol	2	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	2-(T-butyl)-4-methylfuran	1	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	2-Methoxy-2,3,3-trimethylbutane	30	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	2-Methyl-4-(t-butyl) phenol / 4-t-butyl-2-cresol	2	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	2-Methyl-5-(1-methylethyl)-2-cyclohexen-1-one	3	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	2-Propanol	3	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	3,5,5-Trimethyl-2-cyclohexen-1-one	20	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	3,5-Dimethyl-2-cyclohexen-1-one	30	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	3,5-Dimethyl-3-hexanol	20	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	3-Methyl-2-cyclohexen-1-one	3	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	4-Bu[illegible]xy-3-pentene-2-one	1	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	6-Methyl-3-heptanol	30	UGG
BORE	CEW13EW14	8	SOIL	12-JAN-84	9J	Mesityl oxide / 4-Methyl-3-penten-2-one	8	UGG
BORE	CEW1EW2	7.5	SOIL	14-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	1	UGG
BORE	CEW3NS3	8	SOIL	14-JAN-84	9J	Di-n-butyl phthalate	5	UGG
BORE	CEW3NS3	8	SOIL	14-JAN-84	9J	Diisooctyl phthalate	2	UGG
BORE	CEW3NS3	8	SOIL	14-JAN-84	9J	Tetrachlorobiphenyls	4	UGG

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
BORE	CEW4EW5	13	SOIL	13-JAN-84	9J	Diisooctyl phthalate	1	UGG
BORE	CEW4EW5	13	SOIL	13-JAN-84	9J	Heptadecanoic acid, methyl ester	1	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	1,1-Diphenylhydrazine	1	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	1-Heptadecanol	5	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	10-Octadecenoic acid, methyl ester	2	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	2,6,10,14-Tetramethylheptadecane	2	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	2,6,10,14-Tetramethylpentadecane (TIC)	30	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	2,6-Dimethylundecane (TIC)	20	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	2,7-Dimethylnaphthalene	3	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	3,5,24-Trimethyltetracontane	1	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	5-Propyltridecane	3	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	7-Methyltridecane	40	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Diisobutyl phthalate	3	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Diisooctyl phthalate	9	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Dodecane (TIC)	40	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Heneicosane	20	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Heptadecanoic acid, methyl ester	5	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Hexadecane (TIC)	7	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	3	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Nonadecane (TIC)	3	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Octadecane (TIC)	4	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Pentacosane	5	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Pentadecane (TIC)	20	UGG
BORE	CEW6EW7	8	SOIL	13-JAN-84	9J	Tridecane (TIC)	100	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	1-Heptadecanol	4	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	2,10-Dimethylundecane	1	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	2,2-Oxybis[ethanol] / Diethylene glycol	20	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	2,3,7-Trimethyloctane	5	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	2,6,10,14-Tetramethylheptadecane	2	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	2-Ethyl-1-hexanol	5	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	2-Methyldodecane	2	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	4,7-Dimethylundecane	20	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	6-Methyltridecane	1	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	Di-n-butyl phthalate	5	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	Dicyclohexyl phthalate	4	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	Diisobutyl phthalate	20	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	Dodecane (TIC)	7	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	Heptadecane (TIC)	2	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	Heptadecanoic acid, methyl ester	2	UGG
BORE	CEW8EW9	13	SOIL	28-FEB-84	9J	Tetradecane (TIC)	8	UGG
BORE	CFC002	8.5	SOIL	21-FEB-84	9J	1-Heptadecanol	2	UGG
BORE	CFC002	8.5	SOIL	21-FEB-84	9J	2,2-Oxybis[ethanol] / Diethylene glycol	20	UGG
BORE	CFC002	8.5	SOIL	21-FEB-84	9J	2,4,6-Trimethyloctane	3	UGG
BORE	CFC002	8.5	SOIL	21-FEB-84	9J	Di-n-butyl phthalate	10	UGG
BORE	CFC002	8.5	SOIL	21-FEB-84	9J	Heptadecane (TIC)	4	UGG
BORE	CFC002	8.5	SOIL	21-FEB-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	10	UGG
BORE	CFC003	13	SOIL	21-FEB-84	9J	1-Heptadecanol	3	UGG
BORE	CFC003	13	SOIL	21-FEB-84	9J	2-Ethyl-1-hexanol	2	UGG
BORE	CFC003	13	SOIL	21-FEB-84	9J	Di-n-butyl phthalate	30	UGG
BORE	CFC003	13	SOIL	21-FEB-84	9J	Heptadecane (TIC)	6	UGG
BORE	CFC003	13	SOIL	21-FEB-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	20	UGG
BORE	CFC003	13	SOIL	21-FEB-84	9J	Triethylene glycol	1	UGG
BORE	CFC004	13.5	SOIL	21-FEB-84	9J	2,2-Oxybis[ethanol] / Diethylene glycol	10	UGG
BORE	CFC004	13.5	SOIL	21-FEB-84	9J	2,4,6-Trimethyloctane	2	UGG
BORE	CFC004	13.5	SOIL	21-FEB-84	9J	4,7-Dimethylundecane	2	UGG
BORE	CFC004	13.5	SOIL	21-FEB-84	9J	Di-n-butyl phthalate	3	UGG
BORE	CFC004	13.5	SOIL	21-FEB-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	7	UGG
BORE	CFC004	13.5	SOIL	21-FEB-84	9J	Triethylene glycol	2	UGG
BORE	CFC005	8.5	SOIL	22-FEB-84	9J	17-Pentatriacontene	1	UGG

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
BORE	CFC005	8.5	SOIL	22-FEB-84	9J	2,2,3,3-Tetramethylpentane	1	UGG
BORE	CFC005	8.5	SOIL	22-FEB-84	9J	2,2-Oxybis[ethanol] / Diethylene glycol	30	UGG
BORE	CFC005	8.5	SOIL	22-FEB-84	9J	3-Methyl-5-propylnonane	1	UGG
BORE	CFC005	8.5	SOIL	22-FEB-84	9J	Diisobutyl phthalate	20	UGG
BORE	CFC005	8.5	SOIL	22-FEB-84	9J	Heptadecane (TIC)	2	UGG
BORE	CFC006	8	SOIL	22-FEB-84	9J	1-Heptadecanol	3	UGG
BORE	CFC006	8	SOIL	22-FEB-84	9J	2,2-Oxybis[ethanol] / Diethylene glycol	4	UGG
BORE	CFC006	8	SOIL	22-FEB-84	9J	2-Ethyl-1-hexanol	3	UGG
BORE	CFC006	8	SOIL	22-FEB-84	9J	4,7-Dimethylundecane	2	UGG
BORE	CFC006	8	SOIL	22-FEB-84	9J	Di-n-butyl phthalate	3	UGG
BORE	CFC006	8	SOIL	22-FEB-84	9J	Heptadecane (TIC)	3	UGG
BORE	CFS01FS02	7.5	SOIL	18-JAN-84	9J	Butylmethyl phthalate	1	UGG
BORE	CFS01FS02	7.5	SOIL	18-JAN-84	9J	Diacetone alcohol (TIC)	40	UGG
BORE	CFS01FS02	7.5	SOIL	18-JAN-84	9J	Diisobutyl phthalate	20	UGG
BORE	CFS01FS02	7.5	SOIL	18-JAN-84	9J	Diisooctyl phthalate	1	UGG
BORE	CFS01FS02	7.5	SOIL	18-JAN-84	9J	Mesityl oxide / 4-Methyl-3-penten-2-one	5	UGG
BORE	CFS032	12.5	SOIL	26-JAN-84	9J	Di-n-butyl phthalate	1	UGG
BORE	CFS032	12.5	SOIL	26-JAN-84	9J	Diisobutyl phthalate	10	UGG
BORE	CFS032	12.5	SOIL	26-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	10	UGG
BORE	CFS045	13	SOIL	02-MAR-84	9J	Di-n-butyl phthalate	5	UGG
BORE	CFS045	13	SOIL	02-MAR-84	9J	Heptadecane (TIC)	10	UGG
BORE	CFS045	13	SOIL	02-MAR-84	9J	Heptadecanoic acid, methyl ester	3	UGG
BORE	CFS045	13	SOIL	02-MAR-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	10	UGG
BORE	CFS08FS09	13	SOIL	21-JAN-84	9J	Diisobutyl phthalate	10	UGG
BORE	CFS08FS09	13	SOIL	21-JAN-84	9J	Heptadecanoic acid, methyl ester	2	UGG
BORE	CFS12FS19	13	SOIL	06-MAR-84	9J	2,2-Oxybis[ethanol] / Diethylene glycol	10	UGG
BORE	CFS12FS19	13	SOIL	06-MAR-84	9J	2-Ethyl-1-hexanol	3	UGG
BORE	CFS12FS19	13	SOIL	06-MAR-84	9J	Di-n-butyl phthalate	8	UGG
BORE	CFS12FS19	13	SOIL	06-MAR-84	9J	Heptadecane (TIC)	1	UGG
BORE	CFS13FS14	13	SOIL	23-JAN-84	9J	17-Pentatriacontene	6	UGG
BORE	CFS13FS14	13	SOIL	23-JAN-84	9J	3,8-Dimethylundecane	10	UGG
BORE	CFS13FS14	13	SOIL	23-JAN-84	9J	Diisooctyl phthalate	3	UGG
BORE	CFS13FS14	13	SOIL	23-JAN-84	9J	Heptadecane (TIC)	6	UGG
BORE	CFS13FS14	13	SOIL	23-JAN-84	9J	Heptadecanoic acid, methyl ester	9	UGG
BORE	CFS14FS15	13	SOIL	23-JAN-84	9J	16-Methylheptadecanoic acid, methyl ester	1	UGG
BORE	CFS14FS15	13	SOIL	23-JAN-84	9J	3-Ethyl-5-(2-ethylbutyl) octadecane	1	UGG
BORE	CFS14FS15	13	SOIL	23-JAN-84	9J	Di-n-butyl phthalate	2	UGG
BORE	CFS14FS15	13	SOIL	23-JAN-84	9J	Diisobutyl phthalate	2	UGG
BORE	CFS14FS15	13	SOIL	23-JAN-84	9J	Heptadecanoic acid, methyl ester	2	UGG
BORE	CFS14FS15	13	SOIL	23-JAN-84	9J	Hexadecanoic acid, bis (2-ethylhexyl) ester	8	UGG
BORE	CFS16FS17	13	SOIL	07-MAR-84	9J	2,6,10,14-Tetramethylpentadecane (TIC)	3	UGG
BORE	CFS16FS17	13	SOIL	07-MAR-84	9J	4,7-Dimethylundecane	1	UGG
BORE	CFS16FS17	13	SOIL	07-MAR-84	9J	Butylmethyl phthalate	1	UGG
BORE	CFS16FS17	13	SOIL	07-MAR-84	9J	Di-n-butyl phthalate	7	UGG
BORE	CFS16FS17	13	SOIL	07-MAR-84	9J	Di-n-octyl phthalate	1	UGG
BORE	CFS16FS17	13	SOIL	07-MAR-84	9J	Heneicosane	2	UGG
BORE	CFS16FS17	13	SOIL	07-MAR-84	9J	Heptadecane (TIC)	40	UGG
BORE	CFS16FS17	13	SOIL	07-MAR-84	9J	Methylcyclodecane	1	UGG
BORE	CFS22FS24	8	SOIL	24-JAN-84	9J	2,4,6-Trimethyloctane	3	UGG
BORE	CFS22FS24	8	SOIL	24-JAN-84	9J	2-Methyldodecane	2	UGG
BORE	CFS22FS24	8	SOIL	24-JAN-84	9J	Diisooctyl phthalate	3	UGG
BORE	CFS22FS24	8	SOIL	24-JAN-84	9J	Heptadecanoic acid, methyl ester	3	UGG
BORE	CFS22FS24	8	SOIL	24-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	30	UGG
BORE	CFS26FS27	13	SOIL	07-MAR-84	9J	Pentacosane	3	UGG
BORE	CFS28FS29	12.8	SOIL	25-JAN-84	9J	1,2-Benzenedicarboxylic acid / Phthalic acid	2	UGG
BORE	CFS28FS29	12.8	SOIL	25-JAN-84	9J	14-Methylpentadecanic acid, methyl ester	1	UGG
BORE	CFS28FS29	12.8	SOIL	25-JAN-84	9J	2,2-Oxybis[ethanol] / Diethylene glycol	20	UGG
BORE	CFS28FS29	12.8	SOIL	25-JAN-84	9J	2,6,10,14-Tetramethylheptadecane	1	UGG
BORE	CFS28FS29	12.8	SOIL	25-JAN-84	9J	Dicyclohexyl phthalate	1	UGG

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
BORE	CFS28FS29	12.8	SOIL	25-JAN-84	9J	Diisobutyl phthalate	1	UGG
BORE	CFS28FS29	12.8	SOIL	25-JAN-84	9J	Heptadecane (TIC)	3	UGG
BORE	CFS28FS29	12.8	SOIL	25-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	10	UGG
BORE	CFS30FS31	7.8	SOIL	25-JAN-84	9J	Diisooctyl phthalate	6	UGG
BORE	CFS30FS31	7.8	SOIL	25-JAN-84	9J	Heptadecanoic acid, methyl ester	2	UGG
BORE	CFS30FS31	7.8	SOIL	25-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	6	UGG
BORE	CFS35FS36	12.5	SOIL	26-JAN-84	9J	Diisobutyl phthalate	30	UGG
BORE	CFS35FS36	12.5	SOIL	26-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	3	UGG
BORE	CFS37FS39	13	SOIL	08-MAR-84	9J	2,4,6-Trimethyloctane	2	UGG
BORE	CFS37FS39	13	SOIL	08-MAR-84	9J	2-Ethyl-1-hexanol	5	UGG
BORE	CFS37FS39	13	SOIL	08-MAR-84	9J	Di-n-butyl phthalate	3	UGG
BORE	CFS38FS41	12.8	SOIL	26-JAN-84	9J	2,2-Oxybis[ethanol] / Diethylene glycol	30	UGG
BORE	CFS38FS41	12.8	SOIL	26-JAN-84	9J	Diisobutyl phthalate	5	UGG
BORE	CFS38FS41	12.8	SOIL	26-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	3	UGG
BORE	CFS40FS43	12.5	SOIL	27-JAN-84	9J	Dicyclohexyl phthalate	1	UGG
BORE	CFS40FS43	12.5	SOIL	27-JAN-84	9J	Diisobutyl phthalate	20	UGG
BORE	CFS40FS43	12.5	SOIL	27-JAN-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	3	UGG
BORE	CFS42FS44	13	SOIL	02-MAR-84	9J	Dimethylundecanes	2	UGG
BORE	CFS42FS44	13	SOIL	02-MAR-84	9J	Heptadecane (TIC)	1	UGG
BORE	CFS42FS44	13	SOIL	02-MAR-84	9J	Heptadecanoic acid, methyl ester	2	UGG
BORE	CFS42FS44	13	SOIL	02-MAR-84	9J	Hexadecane (TIC)	1	UGG
BORE	CFS42FS44	13	SOIL	02-MAR-84	9J	Trimethyldecanes	1	UGG
BORE	CFS42FS44	13	SOIL	02-MAR-84	9J	Trimethylundecanes	1	UGG
BORE	CFS46FS47	7.5	SOIL	28-JAN-84	9J	Di-n-butyl phthalate	5	UGG
BORE	CFS46FS47	7.5	SOIL	28-JAN-84	9J	Hexanedioic acid, dibutyl ester / dibutyl adipate	4	UGG
BORE	CFS48FS49	12.3	SOIL	28-JAN-84	9J	2-Ethyl-4-methyl-1-pentanol	1	UGG
BORE	CFS48FS49	12.3	SOIL	28-JAN-84	9J	Di-n-butyl phthalate	2	UGG
BORE	CFS48FS49	12.3	SOIL	28-JAN-84	9J	Diisobutyl phthalate	1	UGG
BORE	CFS48FS49	12.3	SOIL	28-JAN-84	9J	Dioctyl adipate (TIC)	7	UGG
BORE	CGS021	7.8	SOIL	02-FEB-84	9J	1-Heptadecanol	2	UGG
BORE	CGS021	7.8	SOIL	02-FEB-84	9J	Di-n-butyl phthalate	2	UGG
BORE	CGS021	7.8	SOIL	02-FEB-84	9J	Heptadecanoic acid, methyl ester	1	UGG
BORE	CGS021	7.8	SOIL	02-FEB-84	9J	Hexanedioic acid, bis (2-ethylhexyl) ester	10	UGG
BORE	CGS021	7.8	SOIL	02-FEB-84	9J	Pyrene	1	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	1-Methyl-9h-fluorene	3	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	2,3-Dimenthylnaphthalene	4	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	2,3-Dimethylphenol	10	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	2,5-Dimethylphenol	10	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	2,6-Dimethylphenol	2	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	2,7-Dimethylnaphthalene	3	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	2-Methylnaphthalene	10	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	2-Methylphenol / 2-cresol	1	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	3-Methylphenol / 3-cresol	1	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	4-Methyl-9h-fluorene	5	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	4-Methyldibenzofuran	8	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	4-Methylphenanthrene	10	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	9-Fluorenone	4	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	9h-carbazole (TIC)	10	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	Acenaphthene	30	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	Benzo[a]anthracene	10	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	Benzo[b]fluoranthene	4	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	Dibenzofuran	1	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	Diphenyl	3	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	Fluorene	20	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	Isoquinoline	2	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	Phenanthrene	20	UGG
BORE	CGS024	12.5	SOIL	02-FEB-84	9J	Pyrene	30	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	1-Methylpyrene	2	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	2,3-Dimethylphenol	1	UGG

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	2-Methylnaphthalene	2	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Benzo(b)naphtho[1,2-d]thiophene	2	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Dibenzofuran	1	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Diisobutyl phthalate	10	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Fluorene	3	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Heneicosane	10	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Hexacosane	8	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Pentadecane (TIC)	3	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Phenanthrene	20	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Pyrene	10	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Tetradecane (TIC)	2	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Tridecane (TIC)	2	UGG
BORE	CGS08GS09	12.5	SOIL	31-JAN-84	9J	Triphenylene	6	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	1-Heptadecanol	1	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	4,7-Dimethylundecane	5	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Anthracene	30	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Benzo[a]pyrene	2	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Benzo[j]fluoranthene	3	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Chrysene	2	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Diisobutyl phthalate	5	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Dimethyl phthalate	10	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Hendecane	3	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Heneicosane	2	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Heptadecanoic acid, methyl ester	10	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Phenanthrene	7	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Pyrene	6	UGG
BORE	CGS15GS16	13	SOIL	03-MAR-84	9J	Tetradecanoic acid, methyl ester	6	UGG
BORE	CGS17GS18	13	SOIL	05-MAR-84	9J	1-Phenylnaphthalene	8	UGG
BORE	CGS17GS18	13	SOIL	05-MAR-84	9J	17-Pentatriacontene	20	UGG
BORE	CGS17GS18	13	SOIL	05-MAR-84	9J	4-Methylbiphenyl	2	UGG
BORE	CGS17GS18	13	SOIL	05-MAR-84	9J	Heptadecane (TIC)	10	UGG
BORE	CGS17GS18	13	SOIL	05-MAR-84	9J	Pyrene	20	UGG
BORE	CGS22GS23	13	SOIL	02-FEB-84	9J	16-Methylheptadecanoic acid, methyl ester	1	UGG
BORE	CGS22GS23	13	SOIL	02-FEB-84	9J	Diisobutyl phthalate	10	UGG
BORE	CGS22GS23	13	SOIL	02-FEB-84	9J	Heneicosane	4	UGG
BORE	CGS22GS23	13	SOIL	02-FEB-84	9J	Heptadecanoic acid, methyl ester	2	UGG
BORE	CGS22GS23	13	SOIL	02-FEB-84	9J	Phenanthrene	2	UGG
BORE	CNS013	8	SOIL	02-MAR-84	9J	4,7-Dimethylundecane	2	UGG
BORE	CNS013	8	SOIL	02-MAR-84	9J	4,8-Dimethylhendecane	1	UGG
BORE	CNS013	8	SOIL	02-MAR-84	9J	Heptadecanoic acid, methyl ester	2	UGG
BORE	CNS01NS02	13	SOIL	29-FEB-84	9J	1-Heptadecanol	3	UGG
BORE	CNS01NS02	13	SOIL	29-FEB-84	9J	2-Ethyl-1-hexanol	4	UGG
BORE	CNS01NS02	13	SOIL	29-FEB-84	9J	Di-n-butyl phthalate	4	UGG
BORE	CNS01NS02	13	SOIL	29-FEB-84	9J	Diisobutyl phthalate	7	UGG
BORE	CNS01NS02	13	SOIL	29-FEB-84	9J	Heptadecane (TIC)	3	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	1,1-Diphenylhydrazine	7	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	1,3-Dimethylnaphthalene	3	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	2,4-Dinitrotoluene	5	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	2,6,10,14-Tetramethylpentadecane (TIC)	20	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	2,7-Dimethylnaphthalene	2	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	2-Chloro-6-methoxy-10h-phenothiazine	2	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	2-Chlorobiphenyl	1	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	2-Hydroxybiphenyl	1	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	2-Methylnaphthalene	2	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	2-Nitro-n-nitrosodiphenylamine	1	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	3,5-Dimethylphenol	4	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	7-Methyltridecane	20	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	Dichlorobiphenyls	70	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	Diisobutyl phthalate	40	UGG

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TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	Dodecane (TIC)	30	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	Hendecane	10	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	Heptachlorobiphenyls	1	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	Pentachlorobiphenyls	8	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	Phosphoric acid, octyldiphenyl ester	30	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	Tetrachlorobiphenyls	40	UGG
BORE	CNS06NS07	8	SOIL	16-JAN-84	9J	Trichlorobiphenyls	80	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	1,1-Diphenylhydrazine	50	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	1,5-Dimethylnaphthalene	20	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	10-Octadecenoic acid, methyl ester	30	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	16-Methylheptadecanoic acid, methyl ester	100	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	2,3,6-Trimethylnaphthalene	20	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	2,4-Dinitrotoluene	30	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	2,6-Dimethylundecane (TIC)	70	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	2,7-Dimethylnaphthalene	40	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	2-Methylnaphthalene	30	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	4,7-Dimethylundecane	20	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	6-Methyltridecane	30	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	7-Methyltridecane	90	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	Diisooctyl phthalate	20	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	Dodecane (TIC)	200	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	Hendecane	70	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	Heptadecane (TIC)	100	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	Heptadecanoic acid, methyl ester	100	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	Pentadecane (TIC)	80	UGG
BORE	CNS09NS10	8	SOIL	16-JAN-84	9J	Tridecane (TIC)	300	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	1,1-Diphenylhydrazine	20	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	1,6,7-Trimethylnaphthalene	6	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	1h-Indene, octahydro- / Hydrindane	6	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	2,3,6-Trimethylnaphthalene	6	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	2,3-Dimenthylnaphthalene	7	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	2,6,10,14-Tetramethylheptadecane	4	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	2,7-Dimethylnaphthalene	4	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	2-Methyl-2-propenoic acid, 1,2-ethanediyl ester	6	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	2-Methylphenol / 2-cresol	4	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	4,7-Dimethylundecane	20	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	8-Methyl-1,8-nonanediol	5	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	Diisobutyl phthalate	20	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	Dodecane (TIC)	4	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	Heptadecane (TIC)	4	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	Heptadecanoic acid, methyl ester	9	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	Nonadecane (TIC)	6	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	Nonadecanoic acid	4	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	Squalene	6	UGG
BORE	CNS11NS12	13	SOIL	29-FEB-84	9J	Tetradecane (TIC)	20	UGG
GROUNDWATER								
OTFL	90100	0	GWATER	27-MAR-89	UM06	Di-n-butyl phthalate	270	UGL
WELL	01L822	0	GWATER	06-MAY-86	99	1,2-Dichloroethenes (cis and trans)	120	UGL
WELL	01L822	0	GWATER	06-MAY-86	99	Trichloroethene	9	UGL
WELL	01L822	0	GWATER	11-AUG-86	99	1,2-Dichloroethenes (cis and trans)	280	UGL
WELL	01L822	0	GWATER	11-AUG-86	99	Trichloroethene	21	UGL
WELL	01L822	0	GWATER	29-JAN-87	99	1,2-Dichloroethenes (cis and trans)	230	UGL
WELL	01L822	0	GWATER	29-JAN-87	99	Trichloroethene	22	UGL
WELL	01U004	14.8	GWATER	06-OCT-83	3W	1-Methylethylcyclopropane	60	UGL
WELL	01U004	14.8	GWATER	06-OCT-83	3W	Di-n-butyl phthalate	2	UGL
WELL	01U004	14.8	GWATER	06-OCT-83	3W	Diisooctyl phthalate	30	UGL
WELL	01U004	14.8	GWATER	06-OCT-83	3W	Hexadecanoic acid / Palmitic acid (TIC)	3	UGL

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OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	01U004	14.8	GWATER	06-OCT-83	3W	Hexane (TIC)	300	UGL
WELL	01U004	14.8	GWATER	06-OCT-83	3W	Indole / 2,3-Benzopyrrole	3	UGL
WELL	01U004	14.8	GWATER	26-OCT-83	2J	Methylene chloride	40	UGL
WELL	01U004	17	GWATER	26-NOV-85	2J	2,5-Dimethyltetrahydrofuran	80	UGL
WELL	01U004	17	GWATER	26-NOV-85	2J	2-Methyl-1-pentene	90	UGL
WELL	01U004	17	GWATER	26-NOV-85	2J	Hexane (TIC)	700	UGL
WELL	01U012	7.1	GWATER	06-OCT-83	3W	Diisooctyl phthalate	30	UGL
WELL	01U012	7.1	GWATER	06-OCT-83	3W	Dioctyl adipate (TIC)	6	UGL
WELL	01U012	7.1	GWATER	06-OCT-83	3W	Propanoic acid 2-methylbutyl ester	1	UGL
WELL	01U012	5	GWATER	26-JUN-85	3W	Di-n-octyl phthalate	7	UGL
WELL	01U045	10.5	GWATER	25-OCT-83	2J	Methylene chloride	70	UGL
WELL	01U054	1.4	GWATER	16-NOV-87	99	Bis (2-ethylhexyl) phthalate	10	UGL
WELL	01U060	1.8	GWATER	19-NOV-87	99	Bis (2-ethylhexyl) phthalate	77	UGL
WELL	01U064	17.5	GWATER	27-OCT-83	2J	1,1,1-Trichloroethane	40	UGL
WELL	01U064	17.5	GWATER	27-OCT-83	2J	1,1-Dichloroethane	40	UGL
WELL	01U064	17.5	GWATER	27-OCT-83	2J	1,2-Dichloroethenes (cis and trans)	600	UGL
WELL	01U064	17.5	GWATER	27-OCT-83	3W	1-Chloro-2,4-hexadiene	3	UGL
WELL	01U064	17.5	GWATER	27-OCT-83	3W	Chloroethane	4	UGL
WELL	01U064	17.5	GWATER	27-OCT-83	3W	Diisooctyl phthalate	10	UGL
WELL	01U064	17.5	GWATER	27-OCT-83	2J	Trichloroethene	30	UGL
WELL	01U064	0	GWATER	05-JUL-84	99	1,1,1-Trichloroethane	45	UGL
WELL	01U064	0	GWATER	05-JUL-84	99	1,1-Dichloroethane	35	UGL
WELL	01U064	0	GWATER	05-JUL-84	99	1,2-Dichloroethenes (cis and trans)	218	UGL
WELL	01U064	0	GWATER	17-MAR-92	UG03	trans-1,2-Dichloroethene	10	UGL
WELL	01U064	0	GWATER	24-MAR-93	UG03	trans-1,2-Dichloroethene	11	UGL
WELL	01U064	0	GWATER	11-MAR-94	UG03	trans-1,2-Dichloroethene	17	UGL
WELL	01U064	0	GWATER	11-MAR-94	UG03	trans-1,2-Dichloroethene	17	UGL
WELL	01U085	12.5	GWATER	17-NOV-88	UM06	Bis (2-ethylhexyl) phthalate	10	UGL
WELL	01U085	12.5	GWATER	17-NOV-88	UM05	Ethylbenzene	6	UGL
WELL	01U085	12.5	GWATER	17-NOV-88	UM05	Toluene	25	UGL
WELL	01U085	12.5	GWATER	17-NOV-88	UM05	Xylenes, total combined	30	UGL
WELL	01U108	13	GWATER	17-NOV-87	UM07	Trichloroethene	200	UGL
WELL	01U108	13	GWATER	17-NOV-87	UM07	trans-1,2-Dichloroethene	500	UGL
WELL	01U115	17	GWATER	11-NOV-87	UM07	trans-1,2-Dichloroethene	45	UGL
WELL	01U117	14	GWATER	11-NOV-87	UM07	Tetrachloroethene	22	UGL
WELL	01U117	14	GWATER	11-NOV-87	UM07	trans-1,2-Dichloroethene	43	UGL
WELL	01U122	5	GWATER	09-DEC-87	UM07	trans-1,2-Dichloroethene	30	UGL
WELL	01U125	20	GWATER	17-NOV-88	UM05	Toluene	14	UGL
WELL	01U125	20	GWATER	17-NOV-88	UM05	Xylenes, total combined	13	UGL
WELL	01U126	14	GWATER	08-DEC-87	UM07	Trichloroethene	31	UGL
WELL	01U128	0	GWATER	24-MAR-93	UG03	trans-1,2-Dichloroethene	2.57	UGL
WELL	01U128	0	GWATER	24-MAR-93	UG03	trans-1,2-Dichloroethene	2.17	UGL
WELL	01U133	9.5	GWATER	11-DEC-87	UM09	Bis (2-ethylhexyl) phthalate	32	UGL
WELL	01U133	9.5	GWATER	11-DEC-87	UM09	Bis (2-ethylhexyl) phthalate	73	UGL
WELL	01U526	1.4	GWATER	20-NOV-87	99	Bis (2-ethylhexyl) phthalate	37	UGL
WELL	01U601	0	GWATER	03-FEB-84	99	Trichloroethene	41	UGL
WELL	01U601	0	GWATER	05-JUL-84	99	1,1,1-Trichloroethane	11	UGL
WELL	01U601	0	GWATER	05-JUL-84	99	Trichloroethene	24	UGL
WELL	01U602	0	GWATER	03-FEB-84	99	1,2-Dichloroethenes (cis and trans)	154	UGL
WELL	01U602	0	GWATER	03-FEB-84	99	Trichloroethene	23000	UGL
WELL	01U605	0	GWATER	12-MAY-93	UM05	Acetone	40	UGL
WELL	01U607	0	GWATER	12-MAY-93	UM05	Acetone	10	UGL
WELL	01U608	0	GWATER	23-FEB-84	99	1,2-Dichloroethenes (cis and trans)	89	UGL
WELL	01U608	0	GWATER	23-FEB-84	99	Trichloroethene	554	UGL
WELL	01U608	0	GWATER	09-JUL-84	99	1,2-Dichloroethenes (cis and trans)	314	UGL
WELL	01U608	0	GWATER	09-JUL-84	99	Trichloroethene	225	UGL
WELL	01U609	0	GWATER	23-FEB-84	99	1,2-Dichloroethenes (cis and trans)	4000	UGL
WELL	01U609	0	GWATER	23-FEB-84	99	Trichloroethene	60000	UGL
WELL	01U610	0	GWATER	09-FEB-84	99	1,1,1-Trichloroethane	19	UGL

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TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	01U610	0	GWATER	09-FEB-84	99	Trichloroethene	35	UGL
WELL	01U611	0	GWATER	23-FEB-84	99	Trichloroethene	205000	UGL
WELL	01U611	0	GWATER	11-JUL-84	99	Trichloroethene	303000	UGL
WELL	01U611	0	GWATER	11-JUL-84	99	Trichloroethene	305000	UGL
WELL	01U611	0	GWATER	11-JUL-84	99	Trichloroethene	362000	UGL
WELL	01U611	0	GWATER	11-JUL-84	99	Trichloroethene	376000	UGL
WELL	01U615	0	GWATER	14-SEP-84	99	1,2-Dichloroethenes (cis and trans)	370	UGL
WELL	01U615	0	GWATER	14-SEP-84	99	Trichloroethene	2050	UGL
WELL	01U615	0	GWATER	11-OCT-84	99	1,2-Dichloroethenes (cis and trans)	270	UGL
WELL	01U615	0	GWATER	11-OCT-84	99	Trichloroethene	1970	UGL
WELL	01U616	0	GWATER	14-SEP-84	99	1,2-Dichloroethenes (cis and trans)	33	UGL
WELL	01U616	0	GWATER	14-SEP-84	99	Trichloroethene	23	UGL
WELL	01U636	0	GWATER	16-MAR-84	99	1,1,1-Trichloroethane	130	UGL
WELL	01U636	0	GWATER	16-MAR-84	99	1,1-Dichloroethane	37	UGL
WELL	01U639	0	GWATER	16-MAR-84	99	Trichloroethene	24	UGL
WELL	01U640	0	GWATER	21-JUL-93	UM05	Acetone	11	UGL
WELL	01U667	0	GWATER	05-OCT-84	99	1,2-Dichloroethenes (cis and trans)	3300	UGL
WELL	01U667	0	GWATER	05-OCT-84	99	Trichloroethene	100	UGL
WELL	01U667	0	GWATER	05-OCT-84	99	Vinyl chloride (chloroethane)	1300	UGL
WELL	01U902	19	GWATER	16-APR-91	UG03	trans-1,2-Dichloroethene	2.8	UGL
WELL	03L004	104	GWATER	28-SEP-83	2J	Tetrahydrofuran / Diethylene oxide / Tetramethylene oxi	20	UGL
WELL	03L004	96.9	GWATER	26-NOV-85	2J	2-Methyl-1-pentene	20	UGL
WELL	03L005	116	GWATER	26-NOV-85	2J	Methylcyclopentane (TIC)	50	UGL
WELL	03L007	44.9	GWATER	22-NOV-85	2J	3-Methylpentane (TIC)	50	UGL
WELL	03L007	44.9	GWATER	22-NOV-85	2J	Methylcyclopentane (TIC)	600	UGL
WELL	03L007	44.9	GWATER	22-NOV-85	2J	Tetrahydrofuran / Diethylene oxide / Tetramethylene oxi	10	UGL
WELL	03L014	1.3	GWATER	23-NOV-87	99	Bis (2-ethylhexyl) phthalate	37	UGL
WELL	03L017	91.1	GWATER	13-OCT-83	2J	1,1,1-Trichloroethane	300	UGL
WELL	03L017	91.1	GWATER	13-OCT-83	3W	1,2-Dichloroethane	10	UGL
WELL	03L017	91.1	GWATER	13-OCT-83	2J	Trichloroethene	400	UGL
WELL	03L020	103.6	GWATER	05-OCT-83	2J	1,1,1-Trichloroethane	400	UGL
WELL	03L020	103.6	GWATER	05-OCT-83	2J	1,1-Dichloroethane	200	UGL
WELL	03L020	103.6	GWATER	05-OCT-83	2J	1,1-Dichloroethene	60	UGL
WELL	03L020	103.6	GWATER	05-OCT-83	2J	1,2-Dichloroethenes (cis and trans)	20	UGL
WELL	03L020	103.6	GWATER	05-OCT-83	3W	2,Butyltetrahydrofuran	2	UGL
WELL	03L020	103.6	GWATER	05-OCT-83	3W	Diisooctyl phthalate	100	UGL
WELL	03L020	103.6	GWATER	05-OCT-83	3W	Propanoic acid 2-methylbutyl ester	2	UGL
WELL	03L020	103.6	GWATER	05-OCT-83	3W	Tetrahydrofuran / Diethylene oxide	900	UGL
WELL	03L020	103.6	GWATER	05-OCT-83	2J	Trichloroethene	800	UGL
WELL	03L029	0	GWATER	03-OCT-84	99	Trichloroethene	9	UGL
WELL	03L077	63	GWATER	05-DEC-85	2J	Trichloroethene	2000	UGL
WELL	03L079	158	GWATER	19-AUG-88	UM05	Methylene chloride	6.6	UGL
WELL	03L084	48.2	GWATER	08-DEC-87	UM07	Trichloroethene	30	UGL
WELL	03L086	118	GWATER	11-DEC-85	2J	Methylcyclopentane (TIC)	100	UGL
WELL	03L091	149.3	GWATER	03-DEC-87	UM07	1,1,1-Trichloroethane	24	UGL
WELL	03L529	0	GWATER	03-OCT-84	99	Trichloroethene	9200	UGL
WELL	03L529	0	GWATER	03-OCT-84	99	trans-1,2-Dichloroethene	600	UGL
WELL	03L806	0	GWATER	11-FEB-85	99	1,1,1-Trichloroethane	260	UGL
WELL	03L806	0	GWATER	11-FEB-85	99	1,1-Dichloroethane	89	UGL
WELL	03L806	0	GWATER	11-FEB-85	99	1,1-Dichloroethene	270	UGL
WELL	03L806	0	GWATER	11-FEB-85	99	Trichloroethene	960	UGL
WELL	03L806	0	GWATER	17-JUN-85	99	1,1,1-Trichloroethane	590	UGL
WELL	03L806	0	GWATER	17-JUN-85	99	1,1-Dichloroethane	180	UGL
WELL	03L806	0	GWATER	17-JUN-85	99	1,1-Dichloroethene	140	UGL
WELL	03L806	0	GWATER	17-JUN-85	99	Trichloroethene	1300	UGL
WELL	03L813	0	GWATER	16-MAY-86	99	Vinyl chloride (chloroethane)	10	UGL
WELL	03L822	0	GWATER	06-MAY-86	99	1,1,1-Trichloroethane	8	UGL
WELL	03L822	0	GWATER	06-MAY-86	99	Trichloroethene	22	UGL
WELL	03L832	0	GWATER	06-JAN-87	99	1,2-Dichloroethenes (cis and trans)	5	UGL

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	03L853	0	GWATER	06-JAN-87	99	1,1,1-Trichloroethane	310	UGL
WELL	03L853	0	GWATER	06-JAN-87	99	1,1-Dichloroethane	45	UGL
WELL	03L853	0	GWATER	06-JAN-87	99	1,1-Dichloroethene	59	UGL
WELL	03L853	0	GWATER	06-JAN-87	99	Chloroform	1	UGL
WELL	03L853	0	GWATER	06-JAN-87	99	Tetrachloroethene	2	UGL
WELL	03L853	0	GWATER	06-JAN-87	99	Trichloroethene	1400	UGL
WELL	03L853	0	GWATER	06-JAN-87	99	trans-1,2-Dichloroethene	10	UGL
WELL	03M004	97.3	GWATER	26-NOV-85	2J	Methylcyclopentane (TIC)	100	UGL
WELL	03M007	44	GWATER	24-JUN-85	3W	Di-n-octyl phthalate	8	UGL
WELL	03M007	42.9	GWATER	22-NOV-85	2J	Methylcyclopentane (TIC)	20	UGL
WELL	03M010	25	GWATER	25-JUN-85	3W	4-Acetylmorpholine	30	UGL
WELL	03M010	25	GWATER	25-JUN-85	3W	N-(2-Hydroxyethyl)-decanamide	6	UGL
WELL	03M017	84.7	GWATER	10-NOV-87	UM07	1,1,1-Trichloroethane	1000	UGL
WELL	03M017	84.7	GWATER	10-NOV-87	UM07	1,1-Dichloroethene	100	UGL
WELL	03M017	84.7	GWATER	10-NOV-87	UM07	Trichloroethene	2000	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	2J	1,1,1-Trichloroethane	2000	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	2J	1,1-Dichloroethane	300	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	2J	1,1-Dichloroethene	200	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	3W	1,2-Dichloroethane	9	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	2J	1,2-Dichloroethenes (cis and trans)	70	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	3W	2-Ethyl-1-hexanol	20	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	3W	4-Nitrophenol	1	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	3W	Acetophenone	1	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	3W	Cyclohexanone (TIC)	20	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	3W	Diisooctyl phthalate	10	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	3W	Methyl pentyl ketone / Heptanone	10	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	2J	Methylene chloride	20	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	3W	Tetrahydrofuran / Diethylene oxide	600	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	2J	Trichloroethene	2000	UGL
WELL	03M020	104.7	GWATER	05-OCT-83	3W	Trimethylbenzenes	2	UGL
WELL	03M020	101.5	GWATER	10-JUL-85	3W	Di-n-butyl phthalate	8	UGL
WELL	03M020	101.5	GWATER	10-JUL-85	3W	Di-n-octyl phthalate	20	UGL
WELL	03M020	101.5	GWATER	10-JUL-85	3W	Diisooctyl phthalate	100	UGL
WELL	03M806	0	GWATER	11-JUN-85	99	1,1,1-Trichloroethane	70	UGL
WELL	03M806	0	GWATER	11-JUN-85	99	1,1-Dichloroethane	140	UGL
WELL	03M806	0	GWATER	11-JUN-85	99	1,1-Dichloroethene	58	UGL
WELL	03M806	0	GWATER	11-JUN-85	99	1,2-Dichloroethenes (cis and trans)	19	UGL
WELL	03M806	0	GWATER	11-JUN-85	99	Trichloroethene	330	UGL
WELL	03M848	0	GWATER	09-JAN-87	99	Trichloroethene	110	UGL
WELL	03M848	0	GWATER	09-JAN-87	99	trans-1,2-Dichloroethene	9	UGL
WELL	03U002	79.1	GWATER	25-OCT-82	2J	1,1,1-Trichloroethane	5	UGL
WELL	03U002	79.1	GWATER	25-OCT-82	2J	1,1,2-Trichloroethane	30	UGL
WELL	03U002	79.1	GWATER	25-OCT-82	2J	1,1-Dichloroethene	2	UGL
WELL	03U002	79.1	GWATER	25-OCT-82	2J	Chloroform	2	UGL
WELL	03U002	79.1	GWATER	25-OCT-82	2J	Methylcyclopentane (TIC)	5	UGL
WELL	03U002	79.1	GWATER	25-OCT-82	2J	Trichloroethene	60	UGL
WELL	03U002	73.9	GWATER	30-SEP-83	3W	Di-n-octyl phthalate	10	UGL
WELL	03U002	73.9	GWATER	30-SEP-83	2J	Trichloroethene	20	UGL
WELL	03U003	108.1	GWATER	20-OCT-82	2J	1,1,1-Trichloroethane	200	UGL
WELL	03U003	108.1	GWATER	20-OCT-82	2J	1,1-Dichloroethane	50	UGL
WELL	03U003	108.1	GWATER	20-OCT-82	2J	1,1-Dichloroethene	60	UGL
WELL	03U003	108.1	GWATER	20-OCT-82	2J	1,2-Dichloroethane	3	UGL
WELL	03U003	108.1	GWATER	20-OCT-82	2J	1,2-Dichloroethenes (cis and trans)	40	UGL
WELL	03U003	108.1	GWATER	20-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	3	UGL
WELL	03U003	108.1	GWATER	20-OCT-82	2J	Trichloroethene	600	UGL
WELL	03U003	108.1	GWATER	20-OCT-82	2J	trans-1,2-Dichloroethene	40	UGL
WELL	03U003	94.5	GWATER	04-OCT-83	2J	1,1,1-Trichloroethane	40	UGL
WELL	03U003	94.5	GWATER	04-OCT-83	2J	1,2-Dichloroethenes (cis and trans)	20	UGL
WELL	03U003	94.5	GWATER	04-OCT-83	3W	Bis (2-ethylhexyl) phthalate	30	UGL

TABLE 3

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TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	03U003	94.5	GWATER	04-OCT-83	2J	Trichloroethene	300	UGL
WELL	03U003	94.5	GWATER	04-OCT-83	3W	Triethyl phosphate / Ethyl phosphate	2	UGL
WELL	03U003	94.5	GWATER	04-OCT-83	3W	Unidentified TIC	10	UGL
WELL	03U003	115.3	GWATER	03-DEC-85	2J	1,1-Dichloroethane	10	UGL
WELL	03U003	115.3	GWATER	03-DEC-85	2J	1,2-Dichloroethenes (cis and trans)	10	UGL
WELL	03U003	115.3	GWATER	03-DEC-85	2J	Trichloroethene	600	UGL
WELL	03U004	96	GWATER	26-NOV-85	2J	3-(tert-Butyl)-pentane / 3-Ethyl-2,2-dimethylpentane	20	UGL
WELL	03U004	96	GWATER	26-NOV-85	2J	Methylcyclopentane (TIC)	200	UGL
WELL	03U005	115.2	GWATER	26-NOV-85	2J	Methylcyclopentane (TIC)	10	UGL
WELL	03U006	110	GWATER	26-NOV-85	2J	Methylcyclopentane (TIC)	90	UGL
WELL	03U007	75.9	GWATER	18-OCT-82	2J	1-Octanol	200	UGL
WELL	03U007	75.9	GWATER	18-OCT-82	2J	3-Methylpentane (TIC)	3	UGL
WELL	03U007	75.9	GWATER	18-OCT-82	2J	Methylcyclopentane (TIC)	7	UGL
WELL	03U007	75.9	GWATER	18-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	8	UGL
WELL	03U007	44	GWATER	24-JUN-85	3W	3-Phenylpropanol	2	UGL
WELL	03U007	44	GWATER	24-JUN-85	3W	3-Phenylpropanoyl chloride / Hydrocinnamyl chloride	2	UGL
WELL	03U007	44	GWATER	24-JUN-85	3W	Diisooctyl phthalate	60	UGL
WELL	03U007	42.3	GWATER	22-NOV-85	2J	3-Methylpentane (TIC)	50	UGL
WELL	03U007	42.3	GWATER	22-NOV-85	2J	Methylcyclopentane (TIC)	500	UGL
WELL	03U010	24.5	GWATER	25-JUN-85	3W	4-Acetylmorpholine	9	UGL
WELL	03U012	79.7	GWATER	20-OCT-82	2J	1-Octanol	80	UGL
WELL	03U012	79.7	GWATER	20-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	2	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	1,1,1-Trichloroethane	9000	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	1,1-Dichloroethane	2000	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	1,1-Dichloroethene	1000	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	1,2-Dichloroethane	40	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	1,2-Dichloroethenes (cis and trans)	2000	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	2-Ethyl-4-methyl-1-pentanol	6	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	Butyl ethyl ether	4	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	Chloroform	20	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	Tetrachloroethene	3	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	300	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	Trichloroethene	8000	UGL
WELL	03U014	155.4	GWATER	21-OCT-82	2J	trans-1,2-Dichloroethene	2000	UGL
WELL	03U014	137	GWATER	05-OCT-83	2J	1,1,1-Trichloroethane	5000	UGL
WELL	03U014	137	GWATER	05-OCT-83	2J	1,1-Dichloroethane	1000	UGL
WELL	03U014	137	GWATER	05-OCT-83	2J	1,1-Dichloroethene	300	UGL
WELL	03U014	137	GWATER	05-OCT-83	2J	1,2-Dichloroethenes (cis and trans)	300	UGL
WELL	03U014	137	GWATER	05-OCT-83	3W	Diisooctyl phthalate	30	UGL
WELL	03U014	137	GWATER	05-OCT-83	3W	Diphenylamine	5	UGL
WELL	03U014	137	GWATER	05-OCT-83	3W	Tetrahydrofuran / Diethylene oxide	2000	UGL
WELL	03U014	137	GWATER	05-OCT-83	2J	Trichloroethene	3000	UGL
WELL	03U014	133.2	GWATER	16-DEC-85	2J	1,1-Dichloroethane	200	UGL
WELL	03U014	133.2	GWATER	16-DEC-85	2J	1,1-Dichloroethene	600	UGL
WELL	03U014	133.2	GWATER	16-DEC-85	2J	1,2-Dichloroethane	200	UGL
WELL	03U014	133.2	GWATER	16-DEC-85	2J	Trichloroethene	6000	UGL
WELL	03U014	131.5	GWATER	04-DEC-87	UM07	1,1,1-Trichloroethane	4000	UGL
WELL	03U014	131.5	GWATER	04-DEC-87	UM07	Trichloroethene	10000	UGL
WELL	03U015	87	GWATER	27-SEP-83	3W	4-Methylbenzene sulfonamide	3	UGL
WELL	03U015	87	GWATER	27-SEP-83	3W	N-Butyl-4-methylbenzenesulfonamide	10	UGL
WELL	03U015	87	GWATER	27-SEP-83	3W	Triethyl phosphate / Ethyl phosphate	3	UGL
WELL	03U016	108.6	GWATER	21-OCT-82	2J	2-Ethyl-4-methyl-1-pentanol	3	UGL
WELL	03U016	108.6	GWATER	21-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	20	UGL
WELL	03U017	109.9	GWATER	25-OCT-82	2J	1,1,1-Trichloroethane	500	UGL
WELL	03U017	109.9	GWATER	25-OCT-82	2J	1,1-Dichloroethene	40	UGL
WELL	03U017	109.9	GWATER	25-OCT-82	2J	Freon / Dichlorofluoromethane	7	UGL
WELL	03U017	109.9	GWATER	25-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	100	UGL
WELL	03U017	109.9	GWATER	25-OCT-82	2J	Trichloroethene	300	UGL
WELL	03U017	92.7	GWATER	04-OCT-83	2J	1,1,1-Trichloroethane	200	UGL

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TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	03U017	92.7	GWATER	04-OCT-83	3W	Cyclohexane	20	UGL
WELL	03U017	92.7	GWATER	04-OCT-83	3W	Hexane (TIC)	200	UGL
WELL	03U017	92.7	GWATER	04-OCT-83	3W	Methylethyl ketone / 2-Butanone	30	UGL
WELL	03U017	92.7	GWATER	04-OCT-83	3W	Tetrahydrofuran / Diethylene oxide	200	UGL
WELL	03U017	92.7	GWATER	04-OCT-83	2J	Trichloroethene	100	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	2J	1,1,1-Trichloroethane	5000	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	2J	1,1-Dichloroethane	200	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	2J	1,1-Dichloroethene	400	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	2J	1,2-Dichloroethenes (cis and trans)	70	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	3W	C18H30O Unknown	10	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	3W	C22h40O Unknown	8	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	2J	Chloroform	8	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	2J	Freon / Dichlorofluoromethane	20	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	2J	Methylcyclopentane (TIC)	2	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	3W	Sulfur	8	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	2J	Tetrachloroethene	2	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	2J	Trichloroethene	8000	UGL
WELL	03U018	155.1	GWATER	27-OCT-82	2J	trans-1,2-Dichloroethene	70	UGL
WELL	03U018	134.3	GWATER	16-DEC-85	2J	Trichloroethene	7000	UGL
WELL	03U018	132.5	GWATER	04-DEC-87	UM07	Trichloroethene	8000	UGL
WELL	03U019	8.5	GWATER	23-NOV-87	99	Bis (2-ethylhexyl) phthalate	33	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	1,1,1-Trichloroethane	8000	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	1,1-Dichloroethane	300	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	1,1-Dichloroethene	1000	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	1,2-Dichloroethane	10	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	1,2-Dichloroethenes (cis and trans)	200	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	Chloroethane	2	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	Chloroform	10	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	Hexane (TIC)	70	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	Methylcyclopentane (TIC)	6	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	Tetrachloroethene	3	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	3	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	Trichloroethene	8000	UGL
WELL	03U020	126.9	GWATER	27-OCT-82	2J	trans-1,2-Dichloroethene	200	UGL
WELL	03U020	103.8	GWATER	05-OCT-83	2J	1,1,1-Trichloroethane	3000	UGL
WELL	03U020	103.8	GWATER	05-OCT-83	2J	1,1-Dichloroethane	200	UGL
WELL	03U020	103.8	GWATER	05-OCT-83	2J	1,1-Dichloroethene	400	UGL
WELL	03U020	103.8	GWATER	05-OCT-83	3W	1,2-Dichloroethane	70	UGL
WELL	03U020	103.8	GWATER	05-OCT-83	2J	1,2-Dichloroethenes (cis and trans)	90	UGL
WELL	03U020	103.8	GWATER	05-OCT-83	3W	Bis (2-ethylhexyl) phthalate	30	UGL
WELL	03U020	103.8	GWATER	05-OCT-83	2J	Trichloroethene	2000	UGL
WELL	03U021	162.4	GWATER	27-OCT-82	2J	1,1,1-Trichloroethane	5	UGL
WELL	03U021	162.4	GWATER	27-OCT-82	2J	Chloroform	6	UGL
WELL	03U021	162.4	GWATER	27-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	200	UGL
WELL	03U021	162.4	GWATER	27-OCT-82	2J	Trichloroethene	80	UGL
WELL	03U021	97.3	GWATER	29-SEP-83	2J	1,1,1-Trichloroethane	30	UGL
WELL	03U021	97.3	GWATER	29-SEP-83	2J	1,1,2-Trichloroethane	20	UGL
WELL	03U021	97.3	GWATER	29-SEP-83	3W	Tetrahydrofuran / Diethylene oxide	50	UGL
WELL	03U021	97.3	GWATER	29-SEP-83	2J	Trichloroethene	60	UGL
WELL	03U022	41	GWATER	27-JUN-85	3W	Di-n-octyl phthalate	9	UGL
WELL	03U026	117.5	GWATER	18-NOV-87	UM07	1,1,1-Trichloroethane	40	UGL
WELL	03U026	117.5	GWATER	18-NOV-87	UM07	Chloroform	20	UGL
WELL	03U027	115.8	GWATER	27-OCT-83	3W	1,1,2-Trichloroethane	20	UGL
WELL	03U027	115.8	GWATER	27-OCT-83	3W	Di-n-butyl phthalate	1	UGL
WELL	03U027	115.8	GWATER	27-OCT-83	3W	Diisooctyl phthalate	20	UGL
WELL	03U027	115.8	GWATER	27-OCT-83	2J	Methylene chloride	90	UGL
WELL	03U027	115.8	GWATER	27-OCT-83	2J	Trichloroethene	40	UGL
WELL	03U028	109.2	GWATER	27-OCT-83	2J	1,1,1-Trichloroethane	40	UGL
WELL	03U028	109.2	GWATER	27-OCT-83	2J	1,2-Dichloroethenes (cis and trans)	40	UGL

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	03U028	109.2	GWATER	27-OCT-83	3W	Di-n-butyl phthalate	1	UGL
WELL	03U028	109.2	GWATER	27-OCT-83	3W	Diisooctyl phthalate	60	UGL
WELL	03U028	109.2	GWATER	27-OCT-83	2J	Trichloroethene	500	UGL
WELL	03U028	109.2	GWATER	27-OCT-83	3W	Triethyl phosphate / Ethyl phosphate	1	UGL
WELL	03U028	0	GWATER	05-JUL-84	99	1,1,1-Trichloroethane	59	UGL
WELL	03U028	0	GWATER	05-JUL-84	99	1,2-Dichloroethenes (cis and trans)	22	UGL
WELL	03U028	0	GWATER	05-JUL-84	99	Trichloroethene	348	UGL
WELL	03U028	128.5	GWATER	22-AUG-88	UM05	1,1,1-Trichloroethane	53	UGL
WELL	03U028	128.5	GWATER	22-AUG-88	UM05	1,2-Dichloroethenes (cis and trans)	21	UGL
WELL	03U028	128.5	GWATER	22-AUG-88	UM05	Acetone	20	UGL
WELL	03U028	128.5	GWATER	22-AUG-88	UM05	Trichloroethene	500	UGL
WELL	03U029	106.5	GWATER	27-OCT-83	2J	1,1,1-Trichloroethane	300	UGL
WELL	03U029	106.5	GWATER	27-OCT-83	2J	1,1-Dichloroethane	20	UGL
WELL	03U029	106.5	GWATER	27-OCT-83	2J	1,1-Dichloroethene	60	UGL
WELL	03U029	106.5	GWATER	27-OCT-83	3W	1,1-Diphenylhydrazine	20	UGL
WELL	03U029	106.5	GWATER	27-OCT-83	2J	1,2-Dichloroethenes (cis and trans)	2000	UGL
WELL	03U029	106.5	GWATER	27-OCT-83	3W	Di-n-butyl phthalate	5	UGL
WELL	03U029	106.5	GWATER	27-OCT-83	3W	Diisooctyl phthalate	60	UGL
WELL	03U029	106.5	GWATER	27-OCT-83	2J	Trichloroethene	3000	UGL
WELL	03U029	106.5	GWATER	27-OCT-83	3W	Triethyl phosphate / Ethyl phosphate	7	UGL
WELL	03U029	0	GWATER	02-MAY-84	99	1,1,1-Trichloroethane	270	UGL
WELL	03U029	0	GWATER	02-MAY-84	99	1,1-Dichloroethane	21	UGL
WELL	03U029	0	GWATER	02-MAY-84	99	1,1-Dichloroethene	37	UGL
WELL	03U029	0	GWATER	02-MAY-84	99	1,2-Dichloroethenes (cis and trans)	870	UGL
WELL	03U029	0	GWATER	02-MAY-84	99	Trichloroethene	3400	UGL
WELL	03U029	0	GWATER	05-JUL-84	99	Trichloroethene	15600	UGL
WELL	03U029	0	GWATER	05-JUL-84	99	Trichloroethene	15900	UGL
WELL	03U029	0	GWATER	28-SEP-84	99	1,2-Dichloroethenes (cis and trans)	1400	UGL
WELL	03U029	0	GWATER	28-SEP-84	99	Trichloroethene	18400	UGL
WELL	03U029	102	GWATER	09-JUL-85	3W	4-Nitrophenol	20	UGL
WELL	03U029	102	GWATER	09-JUL-85	3W	Diseleno diindole	10	UGL
WELL	03U029	102	GWATER	09-JUL-85	3W	Pyrene	30	UGL
WELL	03U029	1	GWATER	03-DEC-87	99	Bis (2-ethylhexyl) phthalate	11	UGL
WELL	03U029	124.4	GWATER	17-AUG-88	UM05	1,1,1-Trichloroethane	170	UGL
WELL	03U029	124.4	GWATER	17-AUG-88	UM05	1,1-Dichloroethane	5	UGL
WELL	03U029	124.4	GWATER	17-AUG-88	UM05	1,2-Dichloroethenes (cis and trans)	240	UGL
WELL	03U029	124.4	GWATER	17-AUG-88	UM05	Trichloroethene	2000	UGL
WELL	03U029	0	GWATER	19-AUG-88	UM06	Di-n-octyl phthalate	12	UGL
WELL	03U030	108.3	GWATER	27-OCT-83	3W	Diisobutyl phthalate	3	UGL
WELL	03U030	108.3	GWATER	27-OCT-83	3W	Diisooctyl phthalate	400	UGL
WELL	03U030	108.3	GWATER	27-OCT-83	2J	Methylene chloride	200	UGL
WELL	03U030	108.3	GWATER	27-OCT-83	2J	Trichloroethene	70	UGL
WELL	03U030	134	GWATER	22-AUG-88	UM05	Acetone	15	UGL
WELL	03U030	134	GWATER	22-AUG-88	UM05	Methylene chloride	5.8	UGL
WELL	03U030	134	GWATER	22-AUG-88	UM05	Trichloroethene	9.2	UGL
WELL	03U031	49.5	GWATER	06-OCT-83	3W	1,4-Diacetylbenzene / 1,1'-(1,4-Phenylene)bis(ethanone)	20	UGL
WELL	03U031	49.5	GWATER	06-OCT-83	3W	1-Acetyl-4-(1-hyroxy-1-methylethyl)benzene	100	UGL
WELL	03U031	49.5	GWATER	06-OCT-83	3W	Acrolein	50	UGL
WELL	03U031	49.5	GWATER	06-OCT-83	3W	Diisooctyl phthalate	80	UGL
WELL	03U032	152.5	GWATER	27-OCT-83	2J	1,1,1-Trichloroethane	80	UGL
WELL	03U032	152.5	GWATER	27-OCT-83	3W	1,2-Dichloroethane	50	UGL
WELL	03U032	152.5	GWATER	27-OCT-83	3W	Di-n-butyl phthalate	6	UGL
WELL	03U032	152.5	GWATER	27-OCT-83	3W	Diisooctyl phthalate	50	UGL
WELL	03U032	152.5	GWATER	27-OCT-83	2J	Methylene chloride	60	UGL
WELL	03U032	152.5	GWATER	27-OCT-83	2J	Trichloroethene	50	UGL
WELL	03U032	152.5	GWATER	27-OCT-83	3W	Triethyl phosphate / Ethyl phosphate	3	UGL
WELL	03U075	2.9	GWATER	10-NOV-87	99	Bis (2-ethylhexyl) phthalate	14.3	UGL
WELL	03U078	75.6	GWATER	06-DEC-85	2J	1,2-Dichloroethenes (cis and trans)	10	UGL
WELL	03U078	75.6	GWATER	06-DEC-85	2J	2-Methyl-1-pentene	10	UGL

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	03U078	75.6	GWATER	06-DEC-85	2J	Tetrachloroethene	100	UGL
WELL	03U078	75.6	GWATER	06-DEC-85	2J	Trichloroethene	300	UGL
WELL	03U079	0	GWATER	12-NOV-84	99	1,2-Dichloroethenes (cis and trans)	675	UGL
WELL	03U079	0	GWATER	12-NOV-84	99	Trichloroethene	7360	UGL
WELL	03U079	74.1	GWATER	04-DEC-87	UM07	Trichloroethene	6000	UGL
WELL	03U084	4.7	GWATER	23-NOV-87	99	Bis (2-ethylhexyl) phthalate	12	UGL
WELL	03U087	155	GWATER	17-NOV-88	UM05	Toluene	7	UGL
WELL	03U087	155	GWATER	17-NOV-88	UM05	Xylenes, total combined	16	UGL
WELL	03U089	1.1	GWATER	20-NOV-87	99	Bis (2-ethylhexyl) phthalate	11	UGL
WELL	03U089	122	GWATER	17-NOV-88	UM06	Bis (2-ethylhexyl) phthalate	460	UGL
WELL	03U089	122	GWATER	17-NOV-88	UM06	Di-n-octyl phthalate	18	UGL
WELL	03U093	136.9	GWATER	04-DEC-87	UM07	1,1,1-Trichloroethane	6000	UGL
WELL	03U093	136.9	GWATER	04-DEC-87	UM07	Trichloroethene	400000	UGL
WELL	03U094	140.2	GWATER	04-DEC-87	UM07	1,1,1-Trichloroethane	6000	UGL
WELL	03U094	140.2	GWATER	04-DEC-87	UM07	Trichloroethene	10000	UGL
WELL	03U097	84	GWATER	17-NOV-88	UM06	Bis (2-ethylhexyl) phthalate	14	UGL
WELL	03U097	84	GWATER	17-NOV-88	UM06	Di-n-octyl phthalate	63	UGL
WELL	03U099	96	GWATER	21-NOV-85	2J	Methylcyclopentane (TIC)	20	UGL
WELL	03U099	96	GWATER	21-NOV-85	2J	Trichloroethene	30	UGL
WELL	03U099	96	GWATER	19-DEC-85	3W	Hexacosane	10	UGL
WELL	03U099	96	GWATER	19-DEC-85	3W	Hexadecanoic acid / Palmitic acid (TIC)	10	UGL
WELL	03U099	96	GWATER	19-DEC-85	2J	Methylcyclohexane	20	UGL
WELL	03U099	96	GWATER	19-DEC-85	3W	Pentacosane	10	UGL
WELL	03U099	105	GWATER	17-NOV-88	UM05	Acetone	17	UGL
WELL	03U099	105	GWATER	17-NOV-88	UM06	Bis (2-ethylhexyl) phthalate	370	UGL
WELL	03U099	105	GWATER	17-NOV-88	UM06	Di-n-octyl phthalate	15	UGL
WELL	03U099	105	GWATER	17-NOV-88	UM05	Toluene	9	UGL
WELL	03U099	105	GWATER	17-NOV-88	UM05	Xylenes, total combined	10	UGL
WELL	03U111	6.3	GWATER	20-NOV-87	99	Bis (2-ethylhexyl) phthalate	11	UGL
WELL	03U113	1.1	GWATER	18-NOV-87	99	Bis (2-ethylhexyl) phthalate	41	UGL
WELL	03U114	116.6	GWATER	12-DEC-85	2J	1,2-Dichloroethenes (cis and trans)	60	UGL
WELL	03U114	116.6	GWATER	12-DEC-85	2J	Trichloroethene	200	UGL
WELL	03U114	1.1	GWATER	23-NOV-87	99	Bis (2-ethylhexyl) phthalate	33	UGL
WELL	03U114	114	GWATER	23-NOV-87	UM07	1,1,1-Trichloroethane	1000	UGL
WELL	03U114	114	GWATER	23-NOV-87	UM07	Trichloroethene	2000	UGL
WELL	03U528	0	GWATER	01-OCT-84	99	Trichloroethene	50	UGL
WELL	03U528	0	GWATER	16-SEP-85	99	Trichloroethene	23000	UGL
WELL	03U528	0	GWATER	16-SEP-85	99	Trichloroethene	24000	UGL
WELL	03U528	0	GWATER	16-SEP-85	99	cis-1,2-Dichloroethene	890	UGL
WELL	03U528	0	GWATER	16-SEP-85	99	cis-1,2-Dichloroethene	960	UGL
WELL	03U528	0	GWATER	17-SEP-85	99	1,1,1-Trichloroethane	200	UGL
WELL	03U528	0	GWATER	17-SEP-85	99	Trichloroethene	22000	UGL
WELL	03U528	0	GWATER	17-SEP-85	99	Trichloroethene	25000	UGL
WELL	03U528	0	GWATER	17-SEP-85	99	cis-1,2-Dichloroethene	870	UGL
WELL	03U528	0	GWATER	17-SEP-85	99	cis-1,2-Dichloroethene	890	UGL
WELL	03U528	0	GWATER	18-SEP-85	99	1,1,1-Trichloroethane	200	UGL
WELL	03U528	0	GWATER	18-SEP-85	99	Trichloroethene	21000	UGL
WELL	03U528	0	GWATER	18-SEP-85	99	Trichloroethene	25000	UGL
WELL	03U528	0	GWATER	18-SEP-85	99	cis-1,2-Dichloroethene	820	UGL
WELL	03U528	0	GWATER	18-SEP-85	99	cis-1,2-Dichloroethene	830	UGL
WELL	03U528	0	GWATER	19-SEP-85	99	1,2-Dichloroethenes (cis and trans)	740	UGL
WELL	03U528	0	GWATER	19-SEP-85	99	Trichloroethene	18000	UGL
WELL	03U658	0	GWATER	01-OCT-84	99	Trichloroethene	50	UGL
WELL	03U659	0	GWATER	03-OCT-84	99	1,2-Dichloroethenes (cis and trans)	600	UGL
WELL	03U659	0	GWATER	03-OCT-84	99	Trichloroethene	9200	UGL
WELL	03U821	0	GWATER	11-AUG-86	99	1,1,1-Trichloroethane	150	UGL
WELL	03U821	0	GWATER	11-AUG-86	99	1,1-Dichloroethane	26	UGL
WELL	03U821	0	GWATER	11-AUG-86	99	1,1-Dichloroethene	30	UGL
WELL	03U821	0	GWATER	11-AUG-86	99	1,2-Dichloroethenes (cis and trans)	4	UGL

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	03U821	0	GWATER	11-AUG-86	99	Trichloroethene	720	UGL
WELL	03U821	0	GWATER	29-JAN-87	99	1,1,1-Trichloroethane	270	UGL
WELL	03U821	0	GWATER	29-JAN-87	99	1,1-Dichloroethane	36	UGL
WELL	03U821	0	GWATER	29-JAN-87	99	1,1-Dichloroethene	41	UGL
WELL	03U821	0	GWATER	29-JAN-87	99	Tetrachloroethene	1	UGL
WELL	03U821	0	GWATER	29-JAN-87	99	Trichloroethene	960	UGL
WELL	03U821	0	GWATER	29-JAN-87	99	trans-1,2-Dichloroethene	7	UGL
WELL	03U822	0	GWATER	06-MAY-86	99	1,1,1-Trichloroethane	21	UGL
WELL	03U822	0	GWATER	06-MAY-86	99	Trichloroethene	22	UGL
WELL	03U822	0	GWATER	11-AUG-86	99	1,1,1-Trichloroethane	16	UGL
WELL	04U001	47.7	GWATER	29-SEP-83	3W	Di-n-octyl phthalate	100	UGL
WELL	04U001	47.7	GWATER	29-SEP-83	3W	Tetrahydrofuran / Diethylene oxide	7	UGL
WELL	04U001	41	GWATER	28-JUN-85	3W	Di-n-octyl phthalate	9	UGL
WELL	04U002	261.8	GWATER	25-OCT-82	2J	1,1,1-Trichloroethane	30	UGL
WELL	04U002	261.8	GWATER	25-OCT-82	2J	1,1-Dichloroethene	3	UGL
WELL	04U002	261.8	GWATER	25-OCT-82	2J	1,2-Dichloroethenes (cis and trans)	2	UGL
WELL	04U002	261.8	GWATER	25-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	30	UGL
WELL	04U002	261.8	GWATER	25-OCT-82	2J	Trichloroethene	70	UGL
WELL	04U002	72.2	GWATER	30-SEP-83	2J	1,2-Dichloroethane	10	UGL
WELL	04U002	72.2	GWATER	30-SEP-83	3W	1,2-Dichloroethane	2	UGL
WELL	04U002	72.2	GWATER	30-SEP-83	3W	Bis(pentafluorophenyl) phenyl phosphine	60	UGL
WELL	04U002	72.2	GWATER	30-SEP-83	3W	Di-n-octyl phthalate	90	UGL
WELL	04U002	72.2	GWATER	30-SEP-83	3W	Tetrahydrofuran / Diethylene oxide	20	UGL
WELL	04U002	72.2	GWATER	30-SEP-83	2J	Trichloroethene	20	UGL
WELL	04U002	72.2	GWATER	30-SEP-83	3W	a,a-Dimethylbenzenemethanol	20	UGL
WELL	04U002	69.8	GWATER	17-NOV-87	UM07	Trichloroethene	80	UGL
WELL	04U003	217.2	GWATER	20-OCT-82	2J	1,1,1-Trichloroethane	100	UGL
WELL	04U003	217.2	GWATER	20-OCT-82	2J	1,1-Dichloroethane	3	UGL
WELL	04U003	217.2	GWATER	20-OCT-82	2J	1,1-Dichloroethene	6	UGL
WELL	04U003	217.2	GWATER	20-OCT-82	2J	1,2-Dichloroethenes (cis and trans)	2	UGL
WELL	04U003	217.2	GWATER	20-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	60	UGL
WELL	04U003	217.2	GWATER	20-OCT-82	2J	Trichloroethene	200	UGL
WELL	04U003	96.1	GWATER	04-OCT-83	3W	Bis (2-ethylhexyl) phthalate	300	UGL
WELL	04U003	96.1	GWATER	04-OCT-83	3W	a,a-Dimethylbenzenemethanol	5	UGL
WELL	04U007	216.1	GWATER	18-OCT-82	2J	1,1,1-Trichloroethane	70	UGL
WELL	04U007	216.1	GWATER	18-OCT-82	2J	1,1-Dichloroethene	7	UGL
WELL	04U007	216.1	GWATER	18-OCT-82	2J	1,2-Dichloroethenes (cis and trans)	5	UGL
WELL	04U007	216.1	GWATER	18-OCT-82	2J	1-Octanol	200	UGL
WELL	04U007	216.1	GWATER	18-OCT-82	2J	2-Ethyl-4-methyl-1-pentanol	10	UGL
WELL	04U007	216.1	GWATER	18-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	200	UGL
WELL	04U007	216.1	GWATER	18-OCT-82	2J	Trichloroethene	200	UGL
WELL	04U007	49.5	GWATER	04-OCT-83	3W	Di-n-octyl phthalate	30	UGL
WELL	04U007	49.5	GWATER	04-OCT-83	3W	Tetrahydrofuran / Diethylene oxide	60	UGL
WELL	04U007	48	GWATER	24-JUN-85	3W	Diisooctyl phthalate	20	UGL
WELL	04U007	45.9	GWATER	22-NOV-85	2J	Hexane (TIC)	3000	UGL
WELL	04U007	45.9	GWATER	22-NOV-85	2J	Methylcyclopentane (TIC)	600	UGL
WELL	04U012	164.9	GWATER	20-OCT-82	2J	Methylcyclopentane (TIC)	7	UGL
WELL	04U012	164.9	GWATER	20-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	20	UGL
WELL	04U012	24.5	GWATER	28-SEP-83	3W	8-Methyldecanoic acid methyl ester	2	UGL
WELL	04U012	24.5	GWATER	28-SEP-83	3W	Heptadecanoic acid, methyl ester	6	UGL
WELL	04U012	23	GWATER	26-JUN-85	3W	Di-n-octyl phthalate	10	UGL
WELL	04U020	105.9	GWATER	05-OCT-83	2J	1,1,1-Trichloroethane	40	UGL
WELL	04U020	105.9	GWATER	05-OCT-83	2J	1,1-Dichloroethane	50	UGL
WELL	04U020	105.9	GWATER	05-OCT-83	3W	Diisooctyl phthalate	100	UGL
WELL	04U020	105.9	GWATER	05-OCT-83	3W	Propanoic acid 2-methylbutyl ester	2	UGL
WELL	04U020	105.9	GWATER	05-OCT-83	2J	Trichloroethene	200	UGL
WELL	04U802	0	GWATER	13-FEB-85	99	Trichloroethene	18	UGL
WELL	04U832	0	GWATER	12-DEC-86	99	1,1,1-Trichloroethane	9	UGL
WELL	04U832	0	GWATER	12-DEC-86	99	1,1-Dichloroethane	3	UGL

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	04U832	0	GWATER	12-DEC-86	99	1,1-Dichloroethene	2	UGL
WELL	04U832	0	GWATER	12-DEC-86	99	Chloroform	1	UGL
WELL	04U832	0	GWATER	12-DEC-86	99	Trichloroethene	37	UGL
WELL	04U841	0	GWATER	06-JAN-87	99	1,1,1-Trichloroethane	2	UGL
WELL	04U841	0	GWATER	06-JAN-87	99	Chloroform	1	UGL
WELL	04U841	0	GWATER	06-JAN-87	99	Trichloroethene	2	UGL
WELL	1291501MW	170	GWATER	17-NOV-92	UM05	1,1,1-Trichloroethane	87	UGL
WELL	1291501MW	170	GWATER	17-NOV-92	UM05	1,1-Dichloroethene	5.2	UGL
WELL	1291501MW	170	GWATER	17-NOV-92	UM06	Bis (2-ethylhexyl) phthalate	36	UGL
WELL	1291501MW	170	GWATER	17-NOV-92	UM06	Di-n-octyl phthalate	15	UGL
WELL	1291501MW	170	GWATER	17-NOV-92	UM05	Trichloroethene	110	UGL
WELL	1291501MW	170	GWATER	17-NOV-92	UM05	1,1,1-Trichloroethane	97	UGL
WELL	1291501MW	170	GWATER	17-NOV-92	UM05	1,1-Dichloroethene	5.9	UGL
WELL	1291501MW	170	GWATER	17-NOV-92	UM06	Bis (2-ethylhexyl) phthalate	88	UGL
WELL	1291501MW	170	GWATER	17-NOV-92	UM06	Di-n-octyl phthalate	100	UGL
WELL	1291501MW	170	GWATER	17-NOV-92	UM05	Trichloroethene	120	UGL
WELL	1291501MW	170	GWATER	19-FEB-93	UM05	1,1,1-Trichloroethane	83	UGL
WELL	1291501MW	170	GWATER	19-FEB-93	UM05	1,1-Dichloroethene	5.7	UGL
WELL	1291501MW	170	GWATER	19-FEB-93	UM06	Bis (2-ethylhexyl) phthalate	40	UGL
WELL	1291501MW	170	GWATER	19-FEB-93	UM05	Trichloroethene	94	UGL
WELL	1291501MW	170	GWATER	19-FEB-93	UM05	1,1,1-Trichloroethane	77	UGL
WELL	1291501MW	170	GWATER	19-FEB-93	UM05	1,1-Dichloroethene	6	UGL
WELL	1291501MW	170	GWATER	19-FEB-93	UM06	Bis (2-ethylhexyl) phthalate	46	UGL
WELL	1291501MW	170	GWATER	19-FEB-93	UM06	Di-n-octyl phthalate	14	UGL
WELL	1291501MW	170	GWATER	19-FEB-93	UM05	Trichloroethene	93	UGL
WELL	200075	130.9	GWATER	24-MAR-89	UM06	Di-n-butyl phthalate	290	UGL
WELL	200076	80	GWATER	27-MAR-89	UM06	Di-n-butyl phthalate	230	UGL
WELL	200076	80	GWATER	27-MAR-89	UM05	Xylenes, total combined	6	UGL
WELL	206796	40.9	GWATER	14-JUN-88	UM05	1,1,1-Trichloroethane	18	UGL
WELL	206796	40.9	GWATER	14-JUN-88	UM05	Trichloroethene	100	UGL
WELL	206796	4	GWATER	05-JUL-88	UM05	1,1,1-Trichloroethane	22	UGL
WELL	206796	4	GWATER	05-JUL-88	UM05	1,1-Dichloroethene	6.7	UGL
WELL	206796	4	GWATER	05-JUL-88	UM05	Trichloroethene	85	UGL
WELL	206796	.1	GWATER	19-JUL-88	UM05	1,1,1-Trichloroethane	22	UGL
WELL	206796	.1	GWATER	19-JUL-88	UM05	Trichloroethene	75	UGL
WELL	206796	4	GWATER	02-AUG-88	UM05	1,1,1-Trichloroethane	25	UGL
WELL	206796	4	GWATER	02-AUG-88	UM05	1,1-Dichloroethene	5.2	UGL
WELL	206796	4	GWATER	02-AUG-88	UM05	Trichloroethene	100	UGL
WELL	206796	4	GWATER	16-AUG-88	UM05	1,1,1-Trichloroethane	24	UGL
WELL	206796	4	GWATER	16-AUG-88	UM05	1,1-Dichloroethene	5.1	UGL
WELL	206796	4	GWATER	16-AUG-88	UM05	Trichloroethene	93	UGL
WELL	206796	40.9	GWATER	30-AUG-88	UM05	1,1,1-Trichloroethane	30	UGL
WELL	206796	40.9	GWATER	30-AUG-88	UM05	Methylene chloride	6	UGL
WELL	206796	40.9	GWATER	30-AUG-88	UM05	Trichloroethene	110	UGL
WELL	206796	40.9	GWATER	13-SEP-88	UM05	1,1,1-Trichloroethane	23	UGL
WELL	206796	40.9	GWATER	13-SEP-88	UM05	1,1-Dichloroethene	5.7	UGL
WELL	206796	40.9	GWATER	13-SEP-88	UM05	Trichloroethene	100	UGL
WELL	206796	40.9	GWATER	27-SEP-88	UM05	1,1,1-Trichloroethane	25	UGL
WELL	206796	40.9	GWATER	27-SEP-88	UM05	1,1-Dichloroethane	6.6	UGL
WELL	206796	40.9	GWATER	27-SEP-88	UM05	Trichloroethene	140	UGL
WELL	206797	43.1	GWATER	14-JUN-88	UM05	1,1,1-Trichloroethane	11	UGL
WELL	206797	43.1	GWATER	14-JUN-88	UM05	Trichloroethene	51	UGL
WELL	206797	4.3	GWATER	05-JUL-88	UM05	1,1,1-Trichloroethane	12	UGL
WELL	206797	4.3	GWATER	05-JUL-88	UM05	Trichloroethene	42	UGL
WELL	206797	.1	GWATER	19-JUL-88	UM05	1,1,1-Trichloroethane	11	UGL
WELL	206797	.1	GWATER	19-JUL-88	UM05	Trichloroethene	38	UGL
WELL	206797	4.3	GWATER	02-AUG-88	UM05	1,1,1-Trichloroethane	13	UGL
WELL	206797	4.3	GWATER	02-AUG-88	UM05	Trichloroethene	44	UGL
WELL	206797	4.3	GWATER	16-AUG-88	UM05	1,1,1-Trichloroethane	12	UGL

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	206797	4.3	GWATER	16-AUG-88	UM05	Trichloroethene	42	UGL
WELL	206797	43.1	GWATER	30-AUG-88	UM05	1,1,1-Trichloroethane	15	UGL
WELL	206797	43.1	GWATER	30-AUG-88	UM05	Trichloroethene	53	UGL
WELL	206797	43.1	GWATER	13-SEP-88	UM05	1,1,1-Trichloroethane	11	UGL
WELL	206797	43.1	GWATER	13-SEP-88	UM05	Trichloroethene	47	UGL
WELL	206797	43.1	GWATER	27-SEP-88	UM05	1,1,1-Trichloroethane	16	UGL
WELL	206797	43.1	GWATER	27-SEP-88	UM05	Trichloroethene	68	UGL
WELL	234301	0	GWATER	22-MAR-94	UG03	trans-1,2-Dichloroethene	.311	UGL
WELL	234307	0	GWATER	22-MAR-94	UG03	trans-1,2-Dichloroethene	.159	UGL
WELL	234313	0	GWATER	22-MAR-94	UG03	trans-1,2-Dichloroethene	.244	UGL
WELL	249137	0	GWATER	24-MAR-94	UG03	trans-1,2-Dichloroethene	.192	UGL
WELL	249137	0	GWATER	24-MAR-94	UG03	trans-1,2-Dichloroethene	.375	UGL
WELL	405651	0	GWATER	01-APR-91	UG03	trans-1,2-Dichloroethene	.4	UGL
WELL	452938	20.8	GWATER	20-MAR-89	UM06	Di-n-butyl phthalate	15	UGL
WELL	452939	72.1	GWATER	20-MAR-89	UM06	Di-n-butyl phthalate	39	UGL
WELL	A1.5	0	GWATER	18-AUG-93	UM05	Acetone	22	UGL
WELL	A1.5	0	GWATER	18-AUG-93	UM05	Trichloroethene	18	UGL
WELL	A2EAST	0	GWATER	18-AUG-93	UM05	1,1,1-Trichloroethane	31	UGL
WELL	A2EAST	0	GWATER	18-AUG-93	UM05	1,1,1-Trichloroethane	32	UGL
WELL	A2NORTH	0	GWATER	18-AUG-93	UM05	Acetone	37	UGL
WELL	A2NORTH	0	GWATER	18-AUG-93	UM05	Methylethyl ketone / 2-Butanone	12	UGL
WELL	E10EAST	0	GWATER	28-JUL-93	UM05	Trichloroethene	8.8	UGL
WELL	E11	0	GWATER	28-JUL-93	UM05	Trichloroethene	12	UGL
WELL	E2SOUTH	0	GWATER	20-JUL-93	UM05	Trichloroethene	6	UGL
WELL	E3	0	GWATER	20-JUL-93	UM05	Trichloroethene	6.9	UGL
WELL	E5SOUTH	0	GWATER	20-JUL-93	UM05	Trichloroethene	12	UGL
WELL	E5SOUTH	0	GWATER	20-JUL-93	UM05	cis-1,2-Dichloroethene	5.9	UGL
WELL	E9	0	GWATER	20-JUL-93	UM05	Trichloroethene	7.3	UGL
WELL	I01MW	0	GWATER	16-JUL-92	UM05	Acetone	14	UGL
WELL	I01MW	0	GWATER	07-APR-93	UM05	Carbon disulfide	8.8	UGL
WELL	I01SW	0	GWATER	08-APR-93	UM05	Methylethyl ketone / 2-Butanone	26	UGL
WELL	I01SW	0	GWATER	08-APR-93	UM05	Trichloroethene	5.5	UGL
WELL	I01SW	0	GWATER	10-MAY-93	UM05	Acetone	13	UGL
WELL	I02MW	0	GWATER	11-MAY-93	UM05	1,1,1-Trichloroethane	17	UGL
WELL	I02MW	0	GWATER	11-MAY-93	UM05	Acetone	28	UGL
WELL	I02MW	0	GWATER	11-MAY-93	UM05	Trichloroethene	6.2	UGL
WELL	I02SW	0	GWATER	08-APR-93	UM05	1,1,1-Trichloroethane	19	UGL
WELL	I02SW	0	GWATER	08-APR-93	UM05	Acetone	46	UGL
WELL	I02SW	0	GWATER	08-APR-93	UM05	Trichloroethene	26	UGL
WELL	I02SW	0	GWATER	08-APR-93	UM05	1,1,1-Trichloroethane	19	UGL
WELL	I02SW	0	GWATER	08-APR-93	UM05	Acetone	71	UGL
WELL	I02SW	0	GWATER	08-APR-93	UM05	Trichloroethene	28	UGL
WELL	I02SW	0	GWATER	10-MAY-93	UM05	Acetone	23	UGL
WELL	I02SW	0	GWATER	10-MAY-93	UM05	Methylethyl ketone / 2-Butanone	23	UGL
WELL	I02SW	0	GWATER	10-MAY-93	UM05	Trichloroethene	7.2	UGL
WELL	I02SW	0	GWATER	18-AUG-93	UM05	1,1,1-Trichloroethane	7.7	UGL
WELL	I02SW	0	GWATER	18-AUG-93	UM05	Acetone	23	UGL
WELL	I02SW	0	GWATER	18-AUG-93	UM05	Trichloroethene	10	UGL
WELL	I03MW	0	GWATER	13-APR-93	UM05	Acetone	11	UGL
WELL	I03MW	0	GWATER	12-MAY-93	UM05	Acetone	220	UGL
WELL	I05MW	0	GWATER	03-NOV-92	UM05	Trichloroethene	11	UGL
WELL	K01SW	0	GWATER	08-APR-93	UM05	Acetone	24	UGL
WELL	K01SW	0	GWATER	08-APR-93	UM05	Trichloroethene	9.3	UGL
WELL	K02SW	0	GWATER	08-APR-93	UM05	Trichloroethene	29	UGL
WELL	K02SW	0	GWATER	10-MAY-93	UM05	Trichloroethene	10	UGL
WELL	K02SW	0	GWATER	20-JUL-93	UM05	Trichloroethene	5.5	UGL
WELL	K03SW	0	GWATER	10-MAY-93	UM05	Acetone	12	UGL
WELL	K04MW	0	GWATER	03-NOV-92	UM05	1,1-Dichloroethane	9.4	UGL
WELL	K04MW	0	GWATER	03-NOV-92	UM05	Trichloroethene	12	UGL

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	K04MW	0	GWATER	06-APR-93	UM05	1,1-Dichloroethane	5.5	UGL
WELL	K04MW	0	GWATER	06-APR-93	UM05	Trichloroethene	16	UGL
WELL	MW-18D	73.3	GWATER	21-MAR-89	UM06	Di-n-butyl phthalate	64	UGL
WELL	MW-18D	73.3	GWATER	21-MAR-89	UM06	Napthalene	29	UGL
WELL	MW-18D	76.8	GWATER	21-MAR-89	UM05	Xylenes, total combined	100	UGL
WELL	MW-22D	94.2	GWATER	21-MAR-89	UM05	1,1,2,2-Tetrachloroethane	6	UGL
WELL	MW-22D	94.2	GWATER	21-MAR-89	UM06	Di-n-butyl phthalate	33	UGL
WELL	MW-9D	73.3	GWATER	21-MAR-89	UM06	2-Methylnaphthalene	35	UGL
WELL	MW-9D	73.3	GWATER	21-MAR-89	UM05	Benzene	160	UGL
WELL	MW-9D	73.3	GWATER	21-MAR-89	UM06	Di-n-butyl phthalate	47	UGL
WELL	MW-9D	73.3	GWATER	21-MAR-89	UM05	Ethylbenzene	300	UGL
WELL	MW-9D	73.3	GWATER	21-MAR-89	UM06	Napthalene	110	UGL
WELL	MW-9D	73.3	GWATER	21-MAR-89	UM05	Toluene	70	UGL
WELL	MW-9D	73.3	GWATER	21-MAR-89	UM05	Xylenes, total combined	600	UGL
WELL	OW-15	75.7	GWATER	21-MAR-89	UM05	Benzene	64	UGL
WELL	OW-15	75.7	GWATER	21-MAR-89	UM06	Di-n-butyl phthalate	30	UGL
WELL	OW-15	75.7	GWATER	21-MAR-89	UM05	Toluene	6	UGL
WELL	PJ#506	284	GWATER	03-OCT-83	2J	1,1,1-Trichloroethane	800	UGL
WELL	PJ#506	284	GWATER	03-OCT-83	2J	1,1-Dichloroethene	50	UGL
WELL	PJ#506	284	GWATER	03-OCT-83	3W	1,2-Dichloroethenes (cis and trans)	50	UGL
WELL	PJ#506	284	GWATER	03-OCT-83	3W	Di-n-octyl phthalate	4	UGL
WELL	PJ#506	284	GWATER	03-OCT-83	3W	Hexane (TIC)	9	UGL
WELL	PJ#506	284	GWATER	03-OCT-83	2J	Trichloroethene	1000	UGL
WELL	PJ#507	297.4	GWATER	03-OCT-83	2J	1,1,1-Trichloroethane	500	UGL
WELL	PJ#507	297.4	GWATER	03-OCT-83	2J	1,1-Dichloroethene	30	UGL
WELL	PJ#507	297.4	GWATER	03-OCT-83	3W	1,2-Dichloroethane	40	UGL
WELL	PJ#507	297.4	GWATER	03-OCT-83	2J	Carbon tetrachloride	50	UGL
WELL	PJ#507	297.4	GWATER	03-OCT-83	3W	Di-n-octyl phthalate	4	UGL
WELL	PJ#507	297.4	GWATER	03-OCT-83	2J	Trichloroethene	700	UGL
WELL	PJ#507	130	GWATER	10-JUL-85	3W	Octadecyl stearate / Octadecanoic acid octadecyl ester	20	UGL
WELL	PJ#508	308.7	GWATER	03-OCT-83	2J	1,1,1-Trichloroethane	700	UGL
WELL	PJ#508	308.7	GWATER	03-OCT-83	2J	1,1-Dichloroethane	100	UGL
WELL	PJ#508	308.7	GWATER	03-OCT-83	2J	1,1-Dichloroethene	70	UGL
WELL	PJ#508	308.7	GWATER	03-OCT-83	2J	1,2-Dichloroethenes (cis and trans)	20	UGL
WELL	PJ#508	308.7	GWATER	03-OCT-83	2J	Carbon tetrachloride	90	UGL
WELL	PJ#508	308.7	GWATER	03-OCT-83	2J	Trichloroethene	700	UGL
WELL	PJA074	222	GWATER	08-NOV-83	2J	1,1,1-Trichloroethane	50	UGL
WELL	PJA074	222	GWATER	08-NOV-83	2J	1,1-Dichloroethane	20	UGL
WELL	PJA074	222	GWATER	08-NOV-83	2J	Trichloroethene	100	UGL
WELL	PJA074	223	GWATER	22-FEB-84	3W	Di-n-butyl phthalate	5	UGL
WELL	PJB074	246	GWATER	17-NOV-83	2J	1,1,1-Trichloroethane	50	UGL
WELL	PJB074	246	GWATER	17-NOV-83	2J	1,1-Dichloroethane	20	UGL
WELL	PJB074	246	GWATER	17-NOV-83	2J	Trichloroethene	100	UGL
WELL	PJB074	234	GWATER	18-JUL-85	3W	Trichloropropenes	6	UGL
WELL	PJB074	234	GWATER	18-JUL-85	3W	Trimethylhexanes	8	UGL
WELL	PJC074	260	GWATER	23-FEB-84	2J	Methylene chloride	40	UGL
WELL	PJC074	260	GWATER	23-FEB-84	2J	Trichloroethene	10	UGL
WELL	PJE074	297	GWATER	25-FEB-84	2J	1,1,1-Trichloroethane	40	UGL
WELL	PJE074	297	GWATER	25-FEB-84	2J	1,1-Dichloroethane	20	UGL
WELL	PJE074	297	GWATER	25-FEB-84	2J	1,1-Dichloroethene	20	UGL
WELL	PJE074	297	GWATER	25-FEB-84	2J	Trichloroethene	200	UGL
WELL	PJG074	335	GWATER	26-FEB-84	2J	Chloroform	600	UGL
WELL	PJG074	335	GWATER	26-FEB-84	2J	Methylene chloride	7000	UGL
WELL	PJJ074	375	GWATER	27-FEB-84	2J	Methylene chloride	200	UGL
WELL	PJJ074	375	GWATER	27-FEB-84	2J	Trichloroethene	50	UGL
WELL	PRD6	284	GWATER	03-OCT-83	2J	1,1,1-Trichloroethane	800	UGL
WELL	PRD6	284	GWATER	03-OCT-83	2J	1,1-Dichloroethene	50	UGL
WELL	PRD6	284	GWATER	03-OCT-83	3W	1,2-Dichloroethenes (cis and trans)	50	UGL
WELL	PRD6	284	GWATER	03-OCT-83	3W	Hexane (TIC)	9	UGL

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LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	PRD6	284	GWATER	03-OCT-83	2J	Trichloroethene	1000	UGL
WELL	PRD7	297.4	GWATER	03-OCT-83	2J	1,1,1-Trichloroethane	500	UGL
WELL	PRD7	297.4	GWATER	03-OCT-83	2J	1,1-Dichloroethene	30	UGL
WELL	PRD7	297.4	GWATER	03-OCT-83	3W	1,2-Dichloroethane	40	UGL
WELL	PRD7	297.4	GWATER	03-OCT-83	2J	Carbon tetrachloride	50	UGL
WELL	PRD7	297.4	GWATER	03-OCT-83	3W	Di-n-octyl phthalate	4	UGL
WELL	PRD7	297.4	GWATER	03-OCT-83	2J	Trichloroethene	700	UGL
WELL	PRD8	308.7	GWATER	03-OCT-83	2J	1,1,1-Trichloroethane	700	UGL
WELL	PRD8	308.7	GWATER	03-OCT-83	2J	1,1-Dichloroethane	100	UGL
WELL	PRD8	308.7	GWATER	03-OCT-83	2J	1,1-Dichloroethene	70	UGL
WELL	PRD8	308.7	GWATER	03-OCT-83	2J	Carbon tetrachloride	90	UGL
WELL	PRD8	308.7	GWATER	03-OCT-83	2J	Trichloroethene	700	UGL
WELL	PRD8	308.7	GWATER	03-OCT-83	2J	trans-1,2-Dichloroethene	20	UGL
WELL	S12U1	7.1	GWATER	06-OCT-83	3W	Diisooctyl phthalate	30	UGL
WELL	S12U1	7.1	GWATER	06-OCT-83	3W	Dioctyl adipate (TIC)	6	UGL
WELL	S12U1	7.1	GWATER	06-OCT-83	3W	Unidentified TIC	1	UGL
WELL	S12U3	79.7	GWATER	20-OCT-82	2J	1-Octanol	80	UGL
WELL	S12U3	79.7	GWATER	20-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	2	UGL
WELL	S12U4	164.9	GWATER	20-OCT-82	2J	Methylcyclopentane (TIC)	7	UGL
WELL	S12U4	164.9	GWATER	20-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	20	UGL
WELL	S12U4	24.5	GWATER	28-SEP-83	3W	8-Methyldecanoic acid methyl ester	2	UGL
WELL	S12U4	24.5	GWATER	28-SEP-83	3W	Heptadecanoic acid, methyl ester	6	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	1,1,1-Trichloroethane	9000	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	1,1-Dichloroethane	2000	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	1,1-Dichloroethene	1000	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	1,2-Dichloroethane	40	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	2-Ethyl-4-methyl-1-pentanol	6	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	Butyl ethyl ether	4	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	Chloroform	20	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	Tetrachloroethene	3	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	300	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	Trichloroethene	8000	UGL
WELL	S14U3	155.4	GWATER	21-OCT-82	2J	trans-1,2-Dichloroethene	2000	UGL
WELL	S14U3	137	GWATER	05-OCT-83	2J	1,1,1-Trichloroethane	5000	UGL
WELL	S14U3	137	GWATER	05-OCT-83	2J	1,1-Dichloroethane	1000	UGL
WELL	S14U3	137	GWATER	05-OCT-83	2J	1,1-Dichloroethene	300	UGL
WELL	S14U3	137	GWATER	05-OCT-83	2J	Chloroform	10	UGL
WELL	S14U3	137	GWATER	05-OCT-83	3W	Diisooctyl phthalate	30	UGL
WELL	S14U3	137	GWATER	05-OCT-83	3W	Diphenylamine	5	UGL
WELL	S14U3	137	GWATER	05-OCT-83	2J	Methylene chloride	20	UGL
WELL	S14U3	137	GWATER	05-OCT-83	3W	Tetrahydrofuran / Diethylene oxide	2000	UGL
WELL	S14U3	137	GWATER	05-OCT-83	2J	Trichloroethene	3000	UGL
WELL	S14U3	137	GWATER	05-OCT-83	2J	trans-1,2-Dichloroethene	300	UGL
WELL	S15U3	87	GWATER	27-SEP-83	3W	4-Methylbenzene sulfonamide	3	UGL
WELL	S15U3	87	GWATER	27-SEP-83	3W	N-Butyl-4-methylbenzenesulfonamide	10	UGL
WELL	S15U3	87	GWATER	27-SEP-83	3W	Triethyl phosphate / Ethyl phosphate	3	UGL
WELL	S16U3	108.6	GWATER	21-OCT-82	2J	2-Ethyl-4-methyl-1-pentanol	3	UGL
WELL	S16U3	108.6	GWATER	21-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	20	UGL
WELL	S17L3	91.1	GWATER	13-OCT-83	2J	1,1,1-Trichloroethane	300	UGL
WELL	S17L3	91.1	GWATER	13-OCT-83	3W	1,2-Dichloroethane	10	UGL
WELL	S17L3	91.1	GWATER	13-OCT-83	2J	Trichloroethene	400	UGL
WELL	S17U3	109.9	GWATER	25-OCT-82	2J	1,1,1-Trichloroethane	500	UGL
WELL	S17U3	109.9	GWATER	25-OCT-82	2J	1,1-Dichloroethene	40	UGL
WELL	S17U3	109.9	GWATER	25-OCT-82	2J	Freon / Dichlorofluoromethane	7	UGL
WELL	S17U3	109.9	GWATER	25-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	100	UGL
WELL	S17U3	109.9	GWATER	25-OCT-82	2J	Trichloroethene	300	UGL
WELL	S17U3	92.7	GWATER	04-OCT-83	2J	1,1,1-Trichloroethane	200	UGL
WELL	S17U3	92.7	GWATER	04-OCT-83	2J	1,1-Dichloroethene	10	UGL
WELL	S17U3	92.7	GWATER	04-OCT-83	3W	Hexane (TIC)	200	UGL

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	S17U3	92.7	GWATER	04-OCT-83	3W	Methylethyl ketone / 2-Butanone	30	UGL
WELL	S17U3	92.7	GWATER	04-OCT-83	3W	Tetrahydrofuran / Diethylene oxide	200	UGL
WELL	S17U3	92.7	GWATER	04-OCT-83	2J	Trichloroethene	100	UGL
WELL	S17U3	92.7	GWATER	04-OCT-83	3W	Unidentified TIC	20	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	2J	1,1,1-Trichloroethane	5000	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	2J	1,1-Dichloroethane	200	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	2J	1,1-Dichloroethene	400	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	3W	C18H30O Unknown	10	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	3W	C22h40O Unknown	8	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	2J	Chloroform	8	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	2J	Freon / Dichlorofluoromethane	20	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	2J	Methylcyclopentane (TIC)	2	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	3W	Sulfur	8	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	2J	Tetrachloroethene	2	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	2J	Trichloroethene	8000	UGL
WELL	S18U3	155.1	GWATER	27-OCT-82	2J	trans-1,2-Dichloroethene	70	UGL
WELL	S1U4	47.7	GWATER	29-SEP-83	3W	Di-n-octyl phthalate	100	UGL
WELL	S1U4	47.7	GWATER	29-SEP-83	3W	Tetrahydrofuran / Diethylene oxide	7	UGL
WELL	S20L3	103.6	GWATER	05-OCT-83	2J	1,1,1-Trichloroethane	400	UGL
WELL	S20L3	103.6	GWATER	05-OCT-83	2J	1,1-Dichloroethane	200	UGL
WELL	S20L3	103.6	GWATER	05-OCT-83	2J	1,1-Dichloroethene	60	UGL
WELL	S20L3	103.6	GWATER	05-OCT-83	3W	2,Butyltetrahydrofuran	2	UGL
WELL	S20L3	103.6	GWATER	05-OCT-83	3W	Diisooctyl phthalate	100	UGL
WELL	S20L3	103.6	GWATER	05-OCT-83	3W	Tetrahydrofuran / Diethylene oxide	900	UGL
WELL	S20L3	103.6	GWATER	05-OCT-83	2J	Trichloroethene	800	UGL
WELL	S20L3	103.6	GWATER	05-OCT-83	3W	Unidentified TIC	2	UGL
WELL	S20L3	103.6	GWATER	05-OCT-83	2J	trans-1,2-Dichloroethene	20	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	2J	1,1,1-Trichloroethane	2000	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	2J	1,1-Dichloroethane	300	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	2J	1,1-Dichloroethene	200	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	3W	1,2-Dichloroethane	9	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	3W	2-Ethyl-1-hexanol	20	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	3W	4-Nitrophenol	1	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	3W	Acetophenone	1	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	3W	Cyclohexanone (TIC)	20	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	3W	Diisooctyl phthalate	10	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	2J	Methylene chloride	20	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	3W	Tetrahydrofuran / Diethylene oxide	600	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	2J	Trichloroethene	2000	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	3W	Trimethylbenzenes	2	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	3W	Unidentified TIC	10	UGL
WELL	S20M3	104.7	GWATER	05-OCT-83	2J	trans-1,2-Dichloroethene	70	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	1,1,1-Trichloroethane	8000	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	1,1-Dichloroethane	300	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	1,1-Dichloroethene	1000	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	1,2-Dichloroethane	10	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	Chloroethane	2	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	Chloroform	10	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	Hexane (TIC)	70	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	Methylcyclopentane (TIC)	6	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	Tetrachloroethene	3	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	3	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	Trichloroethene	8000	UGL
WELL	S20U3	126.9	GWATER	27-OCT-82	2J	trans-1,2-Dichloroethene	200	UGL
WELL	S20U3	103.8	GWATER	05-OCT-83	2J	1,1,1-Trichloroethane	3000	UGL
WELL	S20U3	103.8	GWATER	05-OCT-83	2J	1,1-Dichloroethane	200	UGL
WELL	S20U3	103.8	GWATER	05-OCT-83	2J	1,1-Dichloroethene	400	UGL
WELL	S20U3	103.8	GWATER	05-OCT-83	3W	1,2-Dichloroethane	70	UGL
WELL	S20U3	103.8	GWATER	05-OCT-83	3W	Bis (2-ethylhexyl) phthalate	30	UGL

TABLE 3

LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	S20U3	103.8	GWATER	05-OCT-83	2J	Trichloroethene	2000	UGL
WELL	S20U3	103.8	GWATER	05-OCT-83	2J	trans-1,2-Dichloroethene	90	UGL
WELL	S20U4	105.9	GWATER	05-OCT-83	2J	1,1,1-Trichloroethane	40	UGL
WELL	S20U4	105.9	GWATER	05-OCT-83	2J	1,1-Dichloroethane	50	UGL
WELL	S20U4	105.9	GWATER	05-OCT-83	3W	Diisooctyl phthalate	100	UGL
WELL	S20U4	105.9	GWATER	05-OCT-83	2J	Trichloroethene	200	UGL
WELL	S20U4	105.9	GWATER	05-OCT-83	3W	Unidentified TIC	2	UGL
WELL	S21U3	162.4	GWATER	27-OCT-82	2J	1,1,1-Trichloroethane	5	UGL
WELL	S21U3	162.4	GWATER	27-OCT-82	2J	Chloroform	6	UGL
WELL	S21U3	162.4	GWATER	27-OCT-82	2J	Tetrachloroethene	3	UGL
WELL	S21U3	162.4	GWATER	27-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	200	UGL
WELL	S21U3	162.4	GWATER	27-OCT-82	2J	Trichloroethene	80	UGL
WELL	S21U3	97.3	GWATER	29-SEP-83	2J	1,1,1-Trichloroethane	30	UGL
WELL	S21U3	97.3	GWATER	29-SEP-83	2J	1,1,2-Trichloroethane	20	UGL
WELL	S21U3	97.3	GWATER	29-SEP-83	3W	Tetrahydrofuran / Diethylene oxide	50	UGL
WELL	S21U3	97.3	GWATER	29-SEP-83	2J	Trichloroethene	60	UGL
WELL	S27U3	115.8	GWATER	27-OCT-83	3W	1,1,2-Trichloroethane	20	UGL
WELL	S27U3	115.8	GWATER	27-OCT-83	3W	Di-n-butyl phthalate	1	UGL
WELL	S27U3	115.8	GWATER	27-OCT-83	3W	Diisooctyl phthalate	20	UGL
WELL	S27U3	115.8	GWATER	27-OCT-83	2J	Methylene chloride	90	UGL
WELL	S27U3	115.8	GWATER	27-OCT-83	2J	Trichloroethene	40	UGL
WELL	S28U3	109.2	GWATER	27-OCT-83	2J	1,1,1-Trichloroethane	40	UGL
WELL	S28U3	109.2	GWATER	27-OCT-83	3W	Di-n-butyl phthalate	3	UGL
WELL	S28U3	109.2	GWATER	27-OCT-83	3W	Diisooctyl phthalate	60	UGL
WELL	S28U3	109.2	GWATER	27-OCT-83	2J	Trichloroethene	500	UGL
WELL	S28U3	109.2	GWATER	27-OCT-83	3W	Triethyl phosphate / Ethyl phosphate	1	UGL
WELL	S28U3	109.2	GWATER	27-OCT-83	2J	trans-1,2-Dichloroethene	40	UGL
WELL	S29U3	106.5	GWATER	27-OCT-83	2J	1,1,1-Trichloroethane	300	UGL
WELL	S29U3	106.5	GWATER	27-OCT-83	2J	1,1-Dichloroethane	20	UGL
WELL	S29U3	106.5	GWATER	27-OCT-83	2J	1,1-Dichloroethene	60	UGL
WELL	S29U3	106.5	GWATER	27-OCT-83	3W	1,1-Diphenylhydrazine	20	UGL
WELL	S29U3	106.5	GWATER	27-OCT-83	3W	Di-n-butyl phthalate	5	UGL
WELL	S29U3	106.5	GWATER	27-OCT-83	3W	Diisooctyl phthalate	60	UGL
WELL	S29U3	106.5	GWATER	27-OCT-83	2J	Trichloroethene	3000	UGL
WELL	S29U3	106.5	GWATER	27-OCT-83	3W	Triethyl phosphate / Ethyl phosphate	7	UGL
WELL	S29U3	106.5	GWATER	27-OCT-83	2J	trans-1,2-Dichloroethene	2000	UGL
WELL	S2U3	79.1	GWATER	25-OCT-82	2J	1,1,1-Trichloroethane	4	UGL
WELL	S2U3	79.1	GWATER	25-OCT-82	2J	1,1,2-Trichloroethane	30	UGL
WELL	S2U3	79.1	GWATER	25-OCT-82	2J	1,1-Dichloroethene	2	UGL
WELL	S2U3	79.1	GWATER	25-OCT-82	2J	Chloroform	2	UGL
WELL	S2U3	79.1	GWATER	25-OCT-82	2J	Methylcyclopentane (TIC)	5	UGL
WELL	S2U3	79.1	GWATER	25-OCT-82	2J	Trichloroethene	60	UGL
WELL	S2U3	73.9	GWATER	30-SEP-83	3W	Di-n-octyl phthalate	10	UGL
WELL	S2U3	73.9	GWATER	30-SEP-83	2J	Trichloroethene	20	UGL
WELL	S2U4	261.8	GWATER	25-OCT-82	2J	1,1,1-Trichloroethane	30	UGL
WELL	S2U4	261.8	GWATER	25-OCT-82	2J	1,1-Dichloroethene	3	UGL
WELL	S2U4	261.8	GWATER	25-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	30	UGL
WELL	S2U4	261.8	GWATER	25-OCT-82	2J	Trichloroethene	70	UGL
WELL	S2U4	261.8	GWATER	25-OCT-82	2J	trans-1,2-Dichloroethene	2	UGL
WELL	S2U4	72.2	GWATER	30-SEP-83	2J	1,2-Dichloroethane	10	UGL
WELL	S2U4	72.2	GWATER	30-SEP-83	3W	1,2-Dichloroethane	2	UGL
WELL	S2U4	72.2	GWATER	30-SEP-83	3W	Bis(pentafluorophenyl) phenyl phosphine	60	UGL
WELL	S2U4	72.2	GWATER	30-SEP-83	3W	Di-n-octyl phthalate	90	UGL
WELL	S2U4	72.2	GWATER	30-SEP-83	3W	Tetrahydrofuran / Diethylene oxide	20	UGL
WELL	S2U4	72.2	GWATER	30-SEP-83	2J	Trichloroethene	20	UGL
WELL	S2U4	72.2	GWATER	30-SEP-83	3W	a,a-Dimethylbenzenemethanol	20	UGL
WELL	S30U3	108.3	GWATER	27-OCT-83	3W	Diisobutyl phthalate	3	UGL
WELL	S30U3	108.3	GWATER	27-OCT-83	3W	Diisooctyl phthalate	400	UGL
WELL	S30U3	108.3	GWATER	27-OCT-83	2J	Methylene chloride	20	UGL

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LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	S30U3	108.3	GWATER	27-OCT-83	2J	Trichloroethene	70	UGL
WELL	S31U3	49.5	GWATER	06-OCT-83	3W	Acrolein	50	UGL
WELL	S31U3	49.5	GWATER	06-OCT-83	3W	Diisooctyl phthalate	80	UGL
WELL	S31U3	49.5	GWATER	06-OCT-83	3W	Unidentified TIC	20	UGL
WELL	S31U3	49.5	GWATER	06-OCT-83	3W	Unidentified TIC	100	UGL
WELL	S32U3	152.5	GWATER	27-OCT-83	2J	1,1,1-Trichloroethane	80	UGL
WELL	S32U3	152.5	GWATER	27-OCT-83	3W	1,2-Dichloroethane	50	UGL
WELL	S32U3	152.5	GWATER	27-OCT-83	3W	Di-n-butyl phthalate	6	UGL
WELL	S32U3	152.5	GWATER	27-OCT-83	3W	Diisooctyl phthalate	50	UGL
WELL	S32U3	152.5	GWATER	27-OCT-83	2J	Methylene chloride	60	UGL
WELL	S32U3	152.5	GWATER	27-OCT-83	2J	Trichloroethene	50	UGL
WELL	S32U3	152.5	GWATER	27-OCT-83	3W	Triethyl phosphate / Ethyl phosphate	3	UGL
WELL	S3U3	108.1	GWATER	20-OCT-82	2J	1,1,1-Trichloroethane	200	UGL
WELL	S3U3	108.1	GWATER	20-OCT-82	2J	1,1-Dichloroethane	50	UGL
WELL	S3U3	108.1	GWATER	20-OCT-82	2J	1,1-Dichloroethene	60	UGL
WELL	S3U3	108.1	GWATER	20-OCT-82	2J	1,2-Dichloroethane	3	UGL
WELL	S3U3	108.1	GWATER	20-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	3	UGL
WELL	S3U3	108.1	GWATER	20-OCT-82	2J	Trichloroethene	600	UGL
WELL	S3U3	108.1	GWATER	20-OCT-82	2J	trans-1,2-Dichloroethene	40	UGL
WELL	S3U3	94.5	GWATER	04-OCT-83	2J	1,1,1-Trichloroethane	40	UGL
WELL	S3U3	94.5	GWATER	04-OCT-83	3W	Bis (2-ethylhexyl) phthalate	30	UGL
WELL	S3U3	94.5	GWATER	04-OCT-83	2J	Trichloroethene	300	UGL
WELL	S3U3	94.5	GWATER	04-OCT-83	3W	Triethyl phosphate / Ethyl phosphate	2	UGL
WELL	S3U3	94.5	GWATER	04-OCT-83	3W	Unidentified TIC	10	UGL
WELL	S3U3	94.5	GWATER	04-OCT-83	2J	trans-1,2-Dichloroethene	20	UGL
WELL	S3U4	217.2	GWATER	20-OCT-82	2J	1,1,1-Trichloroethane	100	UGL
WELL	S3U4	217.2	GWATER	20-OCT-82	2J	1,1-Dichloroethane	3	UGL
WELL	S3U4	217.2	GWATER	20-OCT-82	2J	1,1-Dichloroethene	6	UGL
WELL	S3U4	217.2	GWATER	20-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	60	UGL
WELL	S3U4	217.2	GWATER	20-OCT-82	2J	Trichloroethene	200	UGL
WELL	S3U4	217.2	GWATER	20-OCT-82	2J	trans-1,2-Dichloroethene	2	UGL
WELL	S3U4	96.1	GWATER	04-OCT-83	3W	Bis (2-ethylhexyl) phthalate	300	UGL
WELL	S3U4	96.1	GWATER	04-OCT-83	3W	a,a-Dimethylbenzenemethanol	5	UGL
WELL	S45U1	10.5	GWATER	25-OCT-83	2J	Methylene chloride	70	UGL
WELL	S4L3	104	GWATER	28-SEP-83	2J	Tetrahydrofuran / Diethylene oxide	20	UGL
WELL	S4U1	14.8	GWATER	06-OCT-83	3W	1-Methyl-1,3-cyclopentadiene	60	UGL
WELL	S4U1	14.8	GWATER	06-OCT-83	3W	Di-n-butyl phthalate	2	UGL
WELL	S4U1	14.8	GWATER	06-OCT-83	3W	Diisooctyl phthalate	30	UGL
WELL	S4U1	14.8	GWATER	06-OCT-83	3W	Hexadecanoic acid / Palmitic acid (TIC)	3	UGL
WELL	S4U1	14.8	GWATER	06-OCT-83	3W	Hexane (TIC)	300	UGL
WELL	S4U1	14.8	GWATER	06-OCT-83	3W	Indole / 2,3-Benzopyrrole	3	UGL
WELL	S4U1	14.8	GWATER	26-OCT-83	2J	Methylene chloride	40	UGL
WELL	S64U1	17.5	GWATER	27-OCT-83	2J	1,1,1-Trichloroethane	40	UGL
WELL	S64U1	17.5	GWATER	27-OCT-83	2J	1,1-Dichloroethane	40	UGL
WELL	S64U1	17.5	GWATER	27-OCT-83	3W	1-Chloro-2,4-hexadiene	3	UGL
WELL	S64U1	17.5	GWATER	27-OCT-83	3W	Chloroethane	4	UGL
WELL	S64U1	17.5	GWATER	27-OCT-83	3W	Diisooctyl phthalate	10	UGL
WELL	S64U1	17.5	GWATER	27-OCT-83	2J	Trichloroethene	30	UGL
WELL	S64U1	17.5	GWATER	27-OCT-83	2J	trans-1,2-Dichloroethene	600	UGL
WELL	S74PJA	222	GWATER	08-NOV-83	2J	1,1,1-Trichloroethane	50	UGL
WELL	S74PJA	222	GWATER	08-NOV-83	2J	1,1-Dichloroethane	20	UGL
WELL	S74PJA	222	GWATER	08-NOV-83	3W	Di-n-butyl phthalate	5	UGL
WELL	S74PJA	222	GWATER	08-NOV-83	2J	Trichloroethene	100	UGL
WELL	S74PJB	246	GWATER	17-NOV-83	2J	1,1,1-Trichloroethane	50	UGL
WELL	S74PJB	246	GWATER	17-NOV-83	2J	1,1-Dichloroethane	20	UGL
WELL	S74PJB	246	GWATER	17-NOV-83	2J	Trichloroethene	100	UGL
WELL	S74PJC	260	GWATER	23-FEB-84	2J	Methylene chloride	40	UGL
WELL	S74PJC	260	GWATER	23-FEB-84	2J	Trichloroethene	10	UGL
WELL	S74PJE	297	GWATER	25-FEB-84	2J	1,1,1-Trichloroethane	40	UGL

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LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN SOIL AND GROUNDWATER

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

TYPE	SITE	DEPTH	MATRIX	DATE	TEST METHOD	CHEMNAME	CONC	UNITS
WELL	S74PJE	297	GWATER	25-FEB-84	2J	1,1-Dichloroethane	20	UGL
WELL	S74PJE	297	GWATER	25-FEB-84	2J	1,1-Dichloroethene	20	UGL
WELL	S74PJE	297	GWATER	25-FEB-84	2J	Trichloroethene	200	UGL
WELL	S74PJG	335	GWATER	26-FEB-84	2J	Chloroform	600	UGL
WELL	S74PJG	335	GWATER	26-FEB-84	2J	Methylene chloride	7000	UGL
WELL	S74PJJ	375	GWATER	27-FEB-84	2J	Methylene chloride	200	UGL
WELL	S74PJJ	375	GWATER	27-FEB-84	2J	Trichloroethene	50	UGL
WELL	S7U3	75.9	GWATER	18-OCT-82	2J	1-Octanol	200	UGL
WELL	S7U3	75.9	GWATER	18-OCT-82	2J	3-Methylpentane (TIC)	3	UGL
WELL	S7U3	75.9	GWATER	18-OCT-82	2J	Methylcyclopentane (TIC)	7	UGL
WELL	S7U3	75.9	GWATER	18-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	8	UGL
WELL	S7U4	216.1	GWATER	18-OCT-82	2J	1,1,1-Trichloroethane	70	UGL
WELL	S7U4	216.1	GWATER	18-OCT-82	2J	1,1-Dichloroethene	7	UGL
WELL	S7U4	216.1	GWATER	18-OCT-82	2J	1-Octanol	200	UGL
WELL	S7U4	216.1	GWATER	18-OCT-82	2J	2-Ethyl-4-methyl-1-pentanol	10	UGL
WELL	S7U4	216.1	GWATER	18-OCT-82	2J	Tetrahydrofuran / Diethylene oxide	200	UGL
WELL	S7U4	216.1	GWATER	18-OCT-82	2J	Trichloroethene	200	UGL
WELL	S7U4	216.1	GWATER	18-OCT-82	2J	trans-1,2-Dichloroethene	5	UGL
WELL	S7U4	49.5	GWATER	04-OCT-83	3W	Di-n-octyl phthalate	30	UGL
WELL	S7U4	49.5	GWATER	04-OCT-83	3W	Tetrahydrofuran / Diethylene oxide	60	UGL
WELL	TGRSE	0	GWATER	04-JUN-91	UG03	trans-1,2-Dichloroethene	7.8	UGL
WELL	TGRSI	0	GWATER	07-APR-93	UG03	trans-1,2-Dichloroethene	1.03	UGL

Notes: All data from IRDMIS November 1994.

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data[b] Sfo (mg/kg/day)[1]	RfDo (mg/kg/day)[1]	Statistical Data[c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater[d] Contaminant	Other	Preliminary Chemical of Concern
Site A												
Alpha gross[a]	X	X	8	3	37.50	2.2000	3.4667	4.7000	13.9±6.1[f]	--		
Beta gross[a]	X	X	8	8	100.00	4.7000	9.0375	14.2000	25.7±3.8[f]	--		
Cyanide	X	2.00E-02	30	3	10.00	4.7900	8.4633	15.8000	--	--		Cyanide
Antimony	X	4.00E-04	194	18	9.28	52.5000	363.4889	1650.0000	2.0	Unit 1		Antimony
Arsenic	1.75E+00	3.00E-04	214	4	1.87	8.3700	16.0900	31.6000	4.0	--		--
Barium	X	7.00E-02	186	186	100.00	6.3500	659.2964	64000.0000	345.0	--		Barium
Beryllium	4.30E+00	5.00E-03	207	4	1.93	0.3840	0.4353	0.5480	0.7	--		--
Cadmium	X	1.00E-03	210	6	2.86	0.3630	4.6475	20.1000	0.7	--		--
Chromium	X	1.00E+00	208	207	99.52	2.0600	22.0763	1400.0000	8.6	--		Chromium
Cobalt	X	X	187	126	67.38	2.9000	5.2838	26.6000	7.5	--		
Copper	X	3.70E-02	208	118	56.73	3.3300	1540.7875	78000.0000	19.0	--		Copper
Lead	X	X	208	70	33.65	3.1700	2795.2626	57000.0000	45.0	--		Lead
Manganese	X	1.40E-01	187	187	100.00	1.2100	190.7706	1900.0000	282.0	--		Manganese
Mercury	X	3.00E-04	199	1	0.50	0.1450	0.1450	0.1450	0.16	--		--
Molybdenum	X	5.00E-03	187	4	2.14	6.3400	11.7700	19.4000	4.0	--		--
Nickel	X	2.00E-02	208	59	28.37	4.5600	23.7749	420.0000	34.0	--		Nickel
Selenium	X	5.00E-03	207	0	0.00	8.7400	--[e]	12.4000	--	--		--
Silver	X	5.00E-03	213	21	9.86	0.5430	4.9027	42.6000	4.0	--		Silver
Thallium	X	7.00E-05	207	0	0.00	9.7500	--[e]	12.5000	10.0	--		--
Vanadium	X	7.00E-03	187	187	100.00	4.7700	12.0344	39.8000	16.0	--		Vanadium
Zinc	X	3.00E-01	188	188	100.00	6.2900	174.3464	10000.0000	24.0	--		Zinc
1,1,1-Trichloroethane	X	9.00E-02	98	0	0.00	0.0025	--[e]	8.1000	None	--		
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	20	0	0.00	7.2000	--[e]	7.2000	None	--		
2,4-Dinitrotoluene	6.80E-01	2.00E-03	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Acetone	X	1.00E-01	78	5	6.41	0.0440	0.1252	0.4000	None	--	LFC	
Anthracene	X	3.00E-01	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Benzene	2.90E-02	X	99	2	2.02	0.0033	0.0082	0.0130	None	Unit 1		Benzene
Benzo[a]anthracene	7.30E-01	X	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Benzo[a]pyrene	7.30E+00	X	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Benzo[g,h,i]perylene	X	X	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Bis (2-ethylhexyl) phthalate	1.40E-02	2.00E-02	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Chrysene	7.30E-03	X	4	0	0.00	0.3000	--[e]	0.3000	None	--		
cis-1,2-Dichloroethene	X	1.00E-02	78	2	2.56	0.0180	0.0790	0.1400	None	Unit 1		cis-1,2-Dichloroethene
Di-n-butyl phthalate	X	1.00E-01	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Ethylbenzene	X	1.00E-01	78	3	3.85	0.0620	0.0810	0.1000	None	--		Ethylbenzene
Fluoranthene	X	4.00E-02	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Indeno[1,2,3-C,D]pyrene	7.30E-01	X	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Methylene chloride	7.50E-03	6.00E-02	98	1	1.02	0.0160	0.0160	0.0160	None	--		
Methylethyl ketone / 2-Butanone	X	6.00E-01	78	7	8.97	0.0020	0.0181	0.0700	None	--	LFC	
PCB 1248	7.70E+00	2.00E-05	8	0	0.00	0.0900	--[e]	0.0900	None	--		
PCB 1260	7.70E+00	2.00E-05	8	0	0.00	0.0620	--[e]	0.0620	None	--		
Phenanthrene	X	X	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Pyrene	X	3.00E-02	4	0	0.00	0.3000	--[e]	0.3000	None	--		
Tetrachloroethene	5.20E-02	1.00E-02	98	2	2.04	0.0047	0.0124	0.0200	None	Unit 1		Tetrachloroethene
Toluene	X	2.00E-01	99	1	1.01	0.0088	0.0088	0.0088	None	--		
Total Heptachlorodibenzo-p-dioxins	1.00E-03	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Heptachlorodibenzofurans	1.00E-03	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		

TABLE 4

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data[b] Sfo (mg/kg/day)$^{-1}$	RfDo (mg/kg/day)$^{-1}$	Statistical Data[c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater[d] Contaminant	Other	Preliminary Chemical of Concern
Total Hexachlorodibenzo-p-dioxins	4.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Hexachlorodibenzofurans	1.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Octochlorodibenzo-p-dioxins	0	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Octochlorodibenzofurans	0	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total pentachlorodibenzo-p-dioxins	5.00E-01	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Pentachlorodibenzofurans	1.00E-01	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Tetrachlorodibenzo-p-dioxins	1.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Trichloroethene	1.10E-02	6.00E-03	98	0	0.00	0.0025	--[e]	2.6000	None	Unit 1		Trichloroethene
Xylenes, total combined	X	2.00E+00	99	5	5.05	0.2000	1.9880	8.5800	None	--		Xylenes, total combined
										--		
Site B										--		
Cyanide	X	2.00E-02	2	0	0.00	1.2200	--[e]	1.2200	None	--		
Antimony	X	4.00E-04	9	0	0.00	82.9000	--[e]	82.9000	2.0	--		--
Arsenic	1.75E+00	3.00E-04	11	0	0.00	2.4000	--[e]	12.7000	4.0	--		--
Barium	X	7.00E-02	9	9	100.00	19.3000	84.6667	181.0000	345.0	--		--
Beryllium	4.30E+00	5.00E-03	11	1	9.09	0.5620	0.5620	0.5620	0.7	--		--
Cadmium	X	1.00E-03	11	0	0.00	0.2500	--[e]	0.4270	0.7	--		--
Chromium	X	1.00E+00	11	11	100.00	2.3900	8.0518	14.1000	8.6	--		Chromium
Cobalt	X	X	9	5	55.56	4.2300	6.1440	7.9300	7.5	--		
Copper	X	3.70E-02	11	9	81.82	2.9900	11.1389	16.3000	19.0	--		--
Lead	X	X	11	6	54.55	5.9200	25.3867	41.4000	45.0	--		--
Manganese	X	1.40E-01	9	9	100.00	71.6000	221.0667	440.0000	282.0	--		Manganese
Mercury	X	3.00E-04	11	0	0.00	0.0870	--[e]	0.0870	0.16	--		--
Molybdenum	X	5.00E-03	9	0	0.00	4.0000	--[e]	4.0000	4.0	--		--
Nickel	X	2.00E-02	11	5	45.45	5.4800	16.0160	33.9000	34.0	--		--
Selenium	X	5.00E-03	11	0	0.00	8.7400	--[e]	12.4000	–	--		--
Silver	X	5.00E-03	11	0	0.00	0.5000	--[e]	1.0100	4.0	--		--
Thallium	X	7.00E-05	11	0	0.00	9.7500	--[e]	12.5000	10.0	--		--
Vanadium	X	7.00E-03	9	9	100.00	4.7100	12.8289	24.9000	16.0	--		Vanadium
Zinc	X	3.00E-01	9	9	100.00	9.8100	31.3233	56.7000	24.0	--		Zinc
1,1,1-Trichloroethane	X	9.00E-02	21	0	0.00	0.0025	--[e]	8.1000	None	--		
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	2	0	0.00	7.2000	--[e]	7.2000	None	--		
Acetone	X	1.00E-01	16	0	0.00	0.0450	--[e]	0.0450	None	--		
Benzene	2.90E-02	X	19	0	0.00	0.0025	--[e]	1.2000	None	--		
cis 1,2-Dichloroethene	X	1.00E-02	16	0	0.00	0.0025	--[e]	0.0025	None	--		
Ethylbenzene	X	1.00E-01	16	0	0.00	0.0025	--[e]	0.0025	None	--		
Methylene chloride	7.50E-03	6.00E-02	18	3	16.67	0.0160	0.0183	0.0200	None	--	LFC	
Methylethyl ketone / 2-Butanone	X	6.00E-01	16	1	6.25	0.0030	0.0030	0.0030	None	--	LFC	
Tetrachloroethene	5.20E-02	1.00E-02	21	0	0.00	0.0025	--[e]	4.1000	None	--		
Toluene	X	2.00E-01	19	0	0.00	0.0025	--[e]	0.6500	None	--		
Trichloroethene	1.10E-02	6.00E-03	21	0	0.00	0.0025	--[e]	2.6000	None	--		
Xylenes, total combined	X	2.00E+00	19	0	0.00	0.0075	--[e]	4.9400	None	--		
Site C												
Antimony	X	4.00E-04	26	11	42.31	4.4800	899.8382	9200.0000	2.0	--		Antimony
Arsenic	1.75E+00	3.00E-04	30	15	50.00	0.7900	4.7960	19.5000	4.0	--		Arsenic
Barium	X	7.00E-02	26	26	100.00	12.7000	231.2654	2070.0000	345.0	--		Barium

TABLE 4

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data [b] Sfo (mg/kg/day) [1]	Toxicity Data [b] RfDo (mg/kg/day) [1]	Statistical Data [c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater [d] Contaminant	Other	Preliminary Chemical of Concern
Beryllium	4.30E+00	5.00E-03	30	3	10.00	0.7020	1.0587	1.7200	0.7	--		Beryllium
Cadmium	X	1.00E-03	30	2	6.67	0.8720	3.0060	5.1400	0.7	--		Cadmium
Chromium	X	1.00E+00	30	27	90.00	5.9500	12.8556	65.8000	8.6	--		Chromium
Cobalt	X	X	26	23	88.46	2.2900	5.2426	11.3000	7.5	--		
Copper	X	3.70E-02	30	30	100.00	2.7200	621.0040	5300.0000	19.0	--		Copper
Lead	X	X	30	29	96.67	3.1000	4973.6779	49000.0000	45.0	--		Lead
Manganese	X	1.40E-01	26	26	100.00	99.3000	504.6269	6320.0000	282.0	--		Manganese
Mercury	X	3.00E-04	29	0	0.00	0.0500	--[e]	0.0870	0.16	--		--
Molybdenum	X	5.00E-03	11	1	9.09	42.2000	42.2000	42.2000	4.0	--		Molybdenum
Nickel	X	2.00E-02	30	26	86.67	5.0400	13.0969	34.0000	34.0	--		--
Selenium	X	5.00E-03	30	3	10.00	1.4300	1.9833	2.5400	--	--		--
Silver	X	5.00E-03	30	2	6.67	0.5740	0.7775	0.9810	4.0	--		--
Thallium	X	7.00E-05	30	5	16.67	9.2800	23.5900	44.8000	10.0	--		Thallium
Vanadium	X	7.00E-03	26	25	96.15	5.2100	13.4132	41.7000	16.0	--		Vanadium
Zinc	X	3.00E-01	26	24	92.31	15.0000	178.4667	628.0000	24.0	--		Zinc
1,1,1-Trichloroethane	X	9.00E-02	24	0	0.00	0.0025	--[e]	8.1000	None	--		
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	4	0	0.00	7.2000	--[e]	7.2000	None	--		
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.50E+05	X	22	17	77.27	3.41E-07	2.45E-05	1.00E-04	None	--		2,3,7,8-Tetrachlorodibenzo-p-dioxin
2,3,7,8-Tetrachlorodibenzofuran	1.50E+04	X	23	16	69.57	4.19E-07	9.32E-06	4.00E-05	None	--		2,3,7,8-Tetrachlorodibenzofuran
Acetone	X	1.00E-01	18	5	27.78	0.0440	0.1742	0.5000	None	--		Acetone
Benzene	2.90E-02	X	23	0	0.00	0.0025	--[e]	1.2000	None	--		
cis-1,2-Dichloroethene	X	1.00E-02	18	0	0.00	0.0025	--[e]	0.0100	None	--		
Ethylbenzene	X	1.00E-01	18	1	5.56	0.0043	0.0043	0.0043	None	--	LFC	
Methylene chloride	7.50E-03	6.00E-02	22	0	0.00	0.0062	--[e]	3.6000	None	--		
Methylethyl ketone / 2-Butanone	X	6.00E-01	18	8	44.44	0.0028	0.0152	0.0600	None	--	LFC	
Tetrachloroethene	5.20E-02	1.00E-02	24	0	0.00	0.0025	--[e]	4.1000	None	--		
Toluene	X	2.00E-01	23	0	0.00	0.0025	--[e]	0.6500	None	--		
Total Heptachlorodibenzo-p-dioxins	1.00E-03	X	26	21	80.77	2.08E-06	3.00E-04	3.10E-03	None	--		Total Heptachlorodibenzo-p-dioxins
Total Heptachlorodibenzofurans	1.00E-03	X	25	15	60.00	4.26E-07	1.17E-05	1.00E-04	None	--		Total Heptachlorodibenzofurans
Total Hexachlorodibenzo-p-dioxins	4.00E-02	X	23	21	91.30	8.66E-07	1.00E-04	9.00E-04	None	--		Total Hexachlorodibenzo-p-dioxins
Total Hexachlorodibenzofurans	1.00E-02	X	26	20	76.92	3.46E-07	1.36E-05	1.00E-04	None	--		Total Hexachlorodibenzofurans
Total Octochlorodibenzo-p-dioxins	0	X	26	24	92.31	2.40E-05	9.00E-04	8.50E-03	None	--		Total Octochlorodibenzo-p-dioxins
Total Octochlorodibenzofurans	0	X	25	17	68.00	6.78E-07	4.78E-05	6.00E-04	None	--		Total Octochlorodibenzofurans
Total pentachlorodibenzo-p-dioxins	5.00E-01	X	23	16	69.57	1.82E-06	3.87E-05	2.00E-04	None	--		Total pentachlorodibenzo-p-dioxins
Total Pentachlorodibenzofurans	1.00E-01	X	24	18	75.00	3.29E-07	2.27E-05	2.00E-04	None	--		Total Pentachlorodibenzofurans
Total Tetrachlorodibenzo-p-dioxins	1.00E-02	X	1	0	0.00	1.00E-03	--[e]	1.00E-03	None	--		
Trichloroethene	1.10E-02	6.00E-03	24	0	0.00	0.0025	--[e]	2.6000	None	--		
Xylenes, total combined	X	2.00E+00	23	0	0.00	0.0075	--[e]	4.9400	None	--		
Site D												
Cyanide	X	2.00E-02	5	0	0.00	1.2200	--[e]	1.2200	--	--		
Arsenic	1.75E+00	3.00E-04	13	0	0.00	2.4000	--[e]	2.4000	4.0	--		--
Beryllium	4.30E+00	5.00E-03	13	0	0.00	0.6800	--[e]	0.6800	0.7	--		--
Cadmium	X	1.00E-03	13	5	38.46	0.2570	0.2780	0.2920	0.7	--		--
Chromium	X	1.00E+00	13	13	100.00	5.4800	8.6854	18.5000	8.6	--		Chromium
Copper	X	3.70E-02	13	13	100.00	4.8200	8.9369	13.7000	19.0	--		--
Lead	X	X	13	6	46.15	2.2100	3.8217	8.5800	45.0	--		--
Mercury	X	3.00E-04	13	0	0.00	0.0870	--[e]	0.0870	0.16	--		--
Nickel	X	2.00E-02	13	13	100.00	8.4900	11.9808	18.4000	34.0	--		--

TABLE 4

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data [b] Sfo (mg/kg/day)[f]	Toxicity Data [b] RfDo (mg/kg/day)[f]	Statistical Data [c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater [d] Contaminant	Other	Preliminary Chemical of Concern
Selenium	X	5.00E-03	13	0	0.00	8.7400	--[e]	8.7400	--	--		--
Silver	X	5.00E-03	13	3	23.08	1.3200	1.9600	3.1500	4.0	--		--
Thallium	X	7.00E-05	13	0	0.00	9.7500	--[e]	9.7500	10.0	--		--
1,1,1-Trichloroethane	X	9.00E-02	67	2	2.99	9.8100	16.6050	23.4000	None	Unit 3		1,1,1-Trichloroethane
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	16	0	0.00	7.2000	--[e]	7.2000	None	--		
Acetone	X	1.00E-01	20	0	0.00	0.0450	--[e]	20.0000	None	--		
Benzene	2.90E-02	X	29	0	0.00	0.0025	--[e]	10.0000	None	--		
cis-1,2-Dichloroethene	X	1.00E-02	20	0	0.00	0.0025	--[e]	10.0000	None	Unit 3		cis-1,2-Dichloroethene
Ethylbenzene	X	1.00E-01	20	0	0.00	0.0025	--[e]	10.0000	None	--		
Methylene chloride	7.50E-03	6.00E-02	36	0	0.00	0.0062	--[e]	10.0000	None	--		
Methylethyl ketone / 2-Butanone	X	6.00E-01	20	0	0.00	0.0051	--[e]	20.0000	None	--		
PCB 1248	7.70E+00	2.00E-05	1	0	0.00	0.0900	--[e]	0.0900	None	--		
PCB 1260	7.70E+00	2.00E-05	1	1	100.00	0.9960	0.9960	0.9960	None	--		PCB 1260
Tetrachloroethene	5.20E-02	1.00E-02	67	0	0.00	0.0025	--[e]	1000.0000	None	Unit 3		Tetrachloroethene
Toluene	X	2.00E-01	29	0	0.00	0.0025	--[e]	10.0000	None	--		
Total Heptachlorodibenzo-p-dioxins	1.00E-03	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Heptachlorodibenzofurans	1.00E-03	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Hexachlorodibenzo-p-dioxins	4.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Hexachlorodibenzofurans	1.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Octochlorodibenzo-p-dioxins	0	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Octochlorodibenzofurans	0	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total pentachlorodibenzo-p-dioxins	5.00E-01	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Pentachlorodibenzofurans	1.00E-01	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Tetrachlorodibenzo-p-dioxins	1.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Trichloroethene	1.10E-02	6.00E-03	66	17	25.76	0.0034	423.0089	2600.0000	None	Unit 3		Trichloroethene
Xylenes, total combined	X	2.00E+00	25	0	0.00	0.0075	--[e]	4.9400	None	--		
Site E												
Cyanide	X	2.00E-02	10	0	0.00	1.2200	--[e]	1.2200	--	--		
Antimony	X	4.00E-04	97	1	1.03	851.0000	851.0000	851.0000	2.0	--		Antimony
Arsenic	1.75E+00	3.00E-04	112	4	3.57	3.3100	10.9975	28.6000	4.0	--		--
Barium	X	7.00E-02	97	97	100.00	12.2000	419.4887	34000.0000	345.0	--		Barium
Beryllium	4.30E+00	5.00E-03	106	20	18.87	0.3530	0.3798	0.4020	0.7	--		--
Cadmium	X	1.00E-03	108	6	5.56	0.3280	3.5027	6.8700	0.7	--		Cadmium
Chromium	X	1.00E+00	107	106	99.07	3.9100	14.8378	111.0000	8.6	--		Chromium
Cobalt	X	X	96	95	98.96	3.4000	7.8315	53.5000	7.5	--		
Copper	X	3.70E-02	107	105	98.13	4.0800	956.7299	72000.0000	19.0	--		Copper
Lead	X	X	107	33	30.84	3.4200	4893.6803	140000.0000	45.0	--		Lead
Manganese	X	1.40E-01	96	96	100.00	93.4000	320.1604	2500.0000	282.0	--		Manganese
Mercury	X	3.00E-04	106	10	9.43	0.0986	0.2749	1.0700	0.16	--		Mercury
Molybdenum	X	5.00E-03	96	2	2.08	14.9000	187.4500	360.0000	4.0	--		--
Nickel	X	2.00E-02	107	85	79.44	8.4700	16.2709	100.0000	34.0	--		Nickel
Selenium	X	5.00E-03	106	0	0.00	8.7400	--[e]	12.4000	--	--		--
Silver	X	5.00E-03	111	8	7.21	0.7560	5.4033	13.4000	4.0	--		Silver
Thallium	X	7.00E-05	107	0	0.00	9.7500	--[e]	12.5000	10.0	--		--
Vanadium	X	7.00E-03	97	96	98.97	6.4000	20.7406	121.0000	16.0	--		Vanadium
Zinc	X	3.00E-01	96	96	100.00	11.5000	245.4385	10000.0000	24.0	--		Zinc

TABLE 4

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data [b] Sfo (mg/kg/day)$^{-1}$	Toxicity Data [b] RfDo (mg/kg/day)$^{-1}$	Statistical Data [c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater [d] Contaminant	Other	Preliminary Chemical of Concern
1,1,1-Trichloroethane	X	9.00E-02	74	0	0.00	0.0025	--[e]	8.1000	None	Unit 3		1,1,1-Trichloroethane
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	17	0	0.00	7.2000	--[e]	7.2000	None	--		
2,4-Dinitrotoluene	6.80E-01	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Acetone	X	1.00E-01	55	1	1.82	0.0380	0.0380	0.0380	None	--	LFC	
Anthracene	X	3.00E-01	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Benzene	2.90E-02	X	64	0	0.00	0.0025	--[e]	1.2000	None	--		
Benzo[a]anthracene	7.30E-01	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Benzo[a]pyrene	7.30E+00	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Benzo[g,h,i]perylene	X	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Bis (2-ethylhexyl) phthalate	1.40E-02	2.00E-02	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Chrysene	7.30E-03	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
cis-1,2-Dichloroethene	X	1.00E-02	55	0	0.00	0.0025	--[e]	0.2000	None	Unit 3		cis-1,2-Dichloroethene
Di-n-butyl phthalate	X	1.00E-01	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Ethylbenzene	X	1.00E-01	55	0	0.00	0.0025	--[e]	0.3000	None	--		
Fluoranthene	X	4.00E-02	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Indeno[1,2,3-C,D]pyrene	7.30E-01	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Methylene chloride	7.50E-03	6.00E-02	72	0	0.00	0.0062	--[e]	3.6000	None	--		
Methylethyl ketone / 2-Butanone	X	6.00E-01	57	4	7.02	0.0019	0.0032	0.0053	None	--	LFC	
PCB 1248	7.70E+00	2.00E-05	9	0	0.00	0.0900	--[e]	1.0000	None	--		
PCB 1260	7.70E+00	2.00E-05	9	1	11.11	0.3530	0.3530	0.3530	None	--		PCB 1260
Phenanthrene	X	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Pyrene	X	3.00E-02	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Tetrachloroethene	5.20E-02	1.00E-02	74	1	1.35	0.0099	0.0099	0.0099	None	Unit 3		Tetrachloroethene
Toluene	X	2.00E-01	64	0	0.00	0.0025	--[e]	0.6500	None	--		
Total Heptachlorodibenzo-p-dioxins	1.00E-03	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Heptachlorodibenzofurans	1.00E-03	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Hexachlorodibenzo-p-dioxins	4.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Hexachlorodibenzofurans	1.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Octochlorodibenzo-p-dioxins	0	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Octochlorodibenzofurans	0	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total pentachlorodibenzo-p-dioxins	5.00E-01	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Pentachlorodibenzofurans	1.00E-01	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Tetrachlorodibenzo-p-dioxins	1.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Trichloroethene	1.10E-02	6.00E-03	74	1	1.35	0.0180	0.0180	0.0180	None	Unit 3		Trichloroethene
Xylenes, total combined	X	2.00E+00	63	0	0.00	0.0075	--[e]	4.9400	None	--		
Site G												
Alpha gross [a]	X	X	5	3	60.00	3.1000	6.3667	10.0000	13.9±6.1 [f]	--		
Beta gross [a]	X	X	5	5	100.00	11.0000	14.5600	21.6000	25.7±3.8 [f]	--		
Arsenic	1.75E+00	3.00E-04	7	1	14.29	3.0600	3.0600	3.0600	4	--		--
Beryllium	4.30E+00	5.00E-03	7	0	0.00	0.6800	--[e]	0.6800	0.7	--		--
Cadmium	X	1.00E-03	7	7	100.00	0.2570	0.3679	0.6100	0.7	--		--
Chromium	X	1.00E+00	7	7	100.00	5.4800	12.8400	16.3000	8.6	--		Chromium
Copper	X	3.70E-02	7	7	100.00	5.8000	25.8857	77.0000	19	--		Copper
Lead	X	X	7	7	100.00	3.5400	32.5814	98.0000	45	--		Lead

TABLE 4

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data [b] Sfo (mg/kg/day)[1]	RfDo (mg/kg/day)[1]	Statistical Data [c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater [d] Contaminant	Other	Preliminary Chemical of Concern
Mercury	X	3.00E-04	6	0	0.00	0.0870	-- [e]	0.0870	0.16	--		--
Nickel	X	2.00E-02	7	7	100.00	10.2000	23.7429	34.4000	34	--		Nickel
Selenium	X	5.00E-03	7	0	0.00	8.7400	-- [e]	8.7400	--	--		--
Silver	X	5.00E-03	7	0	0.00	1.0100	-- [e]	1.0100	4	--		--
Thallium	X	7.00E-05	7	0	0.00	9.7500	-- [e]	9.7500	10	--		--
1,1,1-Trichloroethane	X	9.00E-02	70	0	0.00	0.0025	-- [e]	8.1000	None	Unit 3		1,1,1-Trichloroethane
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	10	0	0.00	7.2000	-- [e]	7.2000	None	--		
Acetone	X	1.00E-01	22	0	0.00	0.0450	-- [e]	5.0000	None	--		
Benzene	2.90E-02	X	27	0	0.00	0.0025	-- [e]	1.2000	None	--		
cis-1,2-Dichloroethene	X	1.00E-02	22	0	0.00	0.0025	-- [e]	0.2000	None	Unit 3		cis-1,2-Dichloroethene
Ethylbenzene	X	1.00E-01	22	0	0.00	0.0025	-- [e]	0.3000	None	--		
Methylene chloride	7.50E-03	6.00E-02	32	2	6.25	0.0088	0.0090	0.0091	None	--	LFC	
Methylethyl ketone / 2-Butanone	X	*6.00E-01*	22	0	0.00	0.0051	-- [e]	5.0000	None	--		
Tetrachloroethene	5.20E-02	1.00E-02	70	0	0.00	0.0025	-- [e]	4.1000	None	Unit 3		Tetrachloroethene
Toluene	X	2.00E-01	27	0	0.00	0.0025	-- [e]	0.6500	None	--		
Trichloroethene	1.10E-02	6.00E-03	70	4	5.71	0.0027	1.8700	7.4700	None	Unit 3		Trichloroethene
Xylenes, total combined	X	2.00E+00	25	1	4.00	5.5200	5.5200	5.5200	None	--		
Site H												
Cyanide	X	2.00E-02	20	1	5.00	80.0000	80.0000	80.0000	--	--		Cyanide
Antimony	X	4.00E-04	45	2	4.44	66.0000	2183.0000	4300.0000	2.0	--		*Antimony*
Arsenic	1.75E+00	3.00E-04	54	9	16.67	3.6100	7.1400	17.1000	4.0	--		Arsenic
Barium	X	7.00E-02	44	44	100.00	8.1500	411.8261	13000.0000	345.0	--		Barium
Beryllium	4.30E+00	5.00E-03	54	22	40.74	0.3550	0.4449	0.6370	0.7	--		--
Cadmium	X	1.00E-03	54	16	29.63	0.2570	3.2564	19.4000	0.7	--		Cadmium
Chromium	X	1.00E+00	54	54	100.00	1.7200	23.3559	340.0000	8.6	--		Chromium
Cobalt	X	X	44	43	97.73	3.1400	13.1858	60.4000	7.5	--		
Copper	X	3.70E-02	54	52	96.30	4.0600	3017.7987	140000.0000	19.0	--		Copper
Lead	X	X	54	21	38.89	2.2600	16259.9219	330000.0000	45.0	--		Lead
Manganese	X	1.40E-01	44	44	100.00	16.8000	495.4364	3600.0000	282.0	--		Manganese
Mercury	X	3.00E-04	49	4	8.16	0.1720	0.3045	0.4950	0.16	--		Mercury
Molybdenum	X	5.00E-03	44	5	11.36	5.2700	14.0440	40.0000	4.0	--		Molybdenum
Nickel	X	2.00E-02	54	46	85.19	6.8600	28.4893	246.0000	34.0	--		Nickel
Selenium	X	5.00E-03	54	0	0.00	8.7400	-- [e]	12.4000	--	--		--
Silver	X	5.00E-03	54	13	24.07	0.5820	6.0198	23.7000	4.0	--		Silver
Thallium	X	7.00E-05	54	0	0.00	9.7500	-- [e]	12.5000	10.0	--		--
Vanadium	X	7.00E-03	44	43	97.73	2.5600	19.6372	39.1000	16.0	--		Vanadium
Zinc	X	3.00E-01	44	44	100.00	21.2000	1631.2023	59000.0000	24.0	--		Zinc
1,1,1-Trichloroethane	X	9.00E-02	50	0	0.00	0.0025	-- [e]	8.1000	None	--		
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	18	0	0.00	7.2000	-- [e]	7.2000	None	--		
2,4-Dinitrotoluene	6.80E-01	2.00E-03	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
Acetone	X	1.00E-01	29	1	3.45	0.1400	0.1400	0.1400	None	--		
Anthracene	X	3.00E-01	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
Benzene	2.90E-02	X	36	0	0.00	0.0025	-- [e]	1.2000	None	--		
Benzo[a]anthracene	7.30E-01	X	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
Benzo[a]pyrene	7.30E+00	X	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
Benzo[g,h,i]perylene	X	X	1	0	0.00	0.3000	-- [e]	0.3000	None	--		

9/23/97

TABLE 4

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data [b] Sfo $(mg/kg/day)^{-1}$	RfDo $(mg/kg/day)^{1}$	Statistical Data [c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater [d] Contaminant	Other	Preliminary Chemical of Concern
Bis (2-ethylhexyl) phthalate	1.40E-02	2.00E-02	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
Chrysene	7.30E-03	X	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
cis-1,2-Dichloroethene	X	1.00E-02	29	0	0.00	0.0025	-- [e]	0.0025	None	--		
Di-n-butyl phthalate	X	1.00E-01	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
Dieldrin	1.60E+01	5.00E-05	6	0	0.00	0.0078	-- [e]	0.0078	None	--		
Ethylbenzene	X	1.00E-01	29	0	0.00	0.0025	-- [e]	0.0025	None	--		
Fluoranthene	X	4.00E-02	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
Indeno[1,2,3-C,D]pyrene	7.30E-01	X	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
Methylene chloride	7.50E-03	6.00E-02	47	7	14.89	0.0088	0.0138	0.0170	None	--	LFC	
Methylethyl ketone / 2-Butanone	X	6.00E-01	29	3	10.34	0.0044	0.0144	0.0330	None	--	LFC	
p,p-DDD	2.40E-01	X	6	0	0.00	0.0112	-- [e]	0.0112	None	--		
p,p-DDE	3.40E-01	X	6	2	33.33	0.0168	0.1044	0.1920	None	--		p,p-DDE
p,p-DDT	3.40E-01	5.00E-04	6	4	66.67	0.0157	0.0946	0.2070	None	--		p,p-DDT
PCB 1248	7.70E+00	2.00E-05	10	0	0.00	0.0400	-- [e]	0.0900	None	--		
PCB 1260	7.70E+00	2.00E-05	10	0	0.00	0.0400	-- [e]	0.0620	None	--		
Phenanthrene	X	X	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
Pyrene	X	3.00E-02	1	0	0.00	0.3000	-- [e]	0.3000	None	--		
Tetrachloroethene	5.20E-02	1.00E-02	50	2	4.00	0.0050	0.0110	0.0170	None	--		
Toluene	X	2.00E-01	36	0	0.00	0.0025	-- [e]	0.6500	None	--		
Total Heptachlorodibenzo-p-dioxins	1.00E-03	X	1	0	0.00	0.0010	-- [e]	0.0010	None	--		
Total Heptachlorodibenzofurans	1.00E-03	X	1	0	0.00	0.0010	-- [e]	0.0010	None	--		
Total Hexachlorodibenzo-p-dioxins	4.00E-02	X	1	0	0.00	0.0010	-- [e]	0.0010	None	--		
Total Hexachlorodibenzofurans	1.00E-02	X	1	0	0.00	0.0010	-- [e]	0.0010	None	--		
Total Octochlorodibenzo-p-dioxins	0	X	1	0	0.00	0.0010	-- [e]	0.0010	None	--		
Total Octochlorodibenzofurans	0	X	1	0	0.00	0.0010	-- [e]	0.0010	None	--		
Total pentachlorodibenzo-p-dioxins	5.00E-01	X	1	0	0.00	0.0010	-- [e]	0.0010	None	--		
Total Pentachlorodibenzofurans	1.00E-01	X	1	0	0.00	0.0010	-- [e]	0.0010	None	--		
Total Tetrachlorodibenzo-p-dioxins	1.00E-02	X	1	0	0.00	0.0010	-- [e]	0.0010	None	--		
Trichloroethene	1.10E-02	6.00E-03	50	0	0.00	0.0025	-- [e]	2.6000	None	--		
Xylenes, total combined	X	2.00E+00	36	0	0.00	0.0075	-- [e]	4.9400	None	--		
Site 129-3												
Cyanide	X	2.00E-02	55	1	1.82	10.2000	10.2000	10.2000	--	--		Cyanide
Antimony	X	4.00E-04	53	2	3.77	40.4000	201.2000	362.0000	2	--		Antimony
Arsenic	1.75E+00	3.00E-04	61	0	0.00	2.0000	-- [e]	12.7000	4	--		--
Barium	X	7.00E-02	50	50	100.00	10.4000	34.0360	267.0000	345	--		--
Beryllium	4.30E+00	5.00E-03	60	0	0.00	0.2500	-- [e]	0.6800	0.7	--		--
Cadmium	X	1.00E-03	61	1	1.64	6.2300	6.2300	6.2300	0.7	--		--
Chromium	X	1.00E+00	61	61	100.00	3.0000	9.4174	130.0000	8.6	--		Chromium
Cobalt	X	X	50	48	96.00	2.9000	5.0502	10.5000	7.5	--		
Copper	X	3.70E-02	61	61	100.00	3.7700	86.5169	4700.0000	19	--		Copper
Lead	X	X	61	17	27.87	2.2100	299.7006	3700.0000	45	--		Lead
Manganese	X	1.40E-01	50	50	100.00	1.6400	201.6888	1100.0000	282	--		Manganese
Mercury	X	3.00E-04	52	5	9.62	0.0100	1.4748	6.7000	0.16	--		Mercury
Molybdenum	X	5.00E-03	50	0	0.00	4.0000	-- [e]	4.0000	4	--		--
Nickel	X	2.00E-02	61	25	40.98	5.9400	12.5540	31.4000	34	--		--

TABLE 4

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data [b] Sfo (mg/kg/day)$^{-1}$	RfDo (mg/kg/day)$^{-1}$	Statistical Data [c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater [d] Contaminant	Other	Preliminary Chemical of Concern
Selenium	X	5.00E-03	60	0	0.00	8.7400	-- [e]	12.4000	–	--		--
Silver	X	5.00E-03	60	2	3.33	0.5280	1.1640	1.8000	4	--		--
Thallium	X	7.00E-05	61	0	0.00	9.7500	-- [e]	12.5000	10	--		--
Vanadium	X	7.00E-03	51	51	100.00	5.5800	11.4508	22.8000	16	--		Vanadium
Zinc	X	3.00E-01	50	50	100.00	8.9400	18.0134	72.7000	24	--		Zinc
1,1,1-Trichloroethane	X	9.00E-02	60	0	0.00	0.0025	-- [e]	8.1000	None	Unit 3		**1,1,1-Trichloroethane**
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	18	0	0.00	7.2000	-- [e]	7.2000	None	--		
2,4-Dinitrotoluene	6.80E-01	2.00E-03	50	2	4.00	0.9920	1.5410	2.0900	None	--		
Acetone	X	1.00E-01	41	0	0.00	0.0450	-- [e]	5.0000	None	--		
Benzene	2.90E-02	X	46	0	0.00	0.0025	-- [e]	1.2000	None	--		
cis-1,2-Dichloroethene	X	1.00E-02	41	0	0.00	0.0025	-- [e]	0.2000	None	Unit 3		**cis-1,2-Dichloroethene**
Ethylbenzene	X	1.00E-01	41	0	0.00	0.0025	-- [e]	0.3000	None	--		
Methylene chloride	7.50E-03	6.00E-02	59	4	6.78	0.0110	0.0145	0.0200	None	--	LFC	
Methylethyl ketone / 2-Butanone	X	6.00E-01	41	0	0.00	0.0051	-- [e]	5.0000	None	--		
Nitroglycerine	X	X	50	4	8.00	4.4600	27.9900	72.5000	None	--		Nitroglycerine
PCB 1248	7.70E+00	2.00E-05	2	0	0.00	0.0900	-- [e]	0.0900	None	--		
PCB 1260	7.70E+00	2.00E-05	2	0	0.00	0.0620	-- [e]	0.0620	None	--		
Tetrachloroethene	5.20E-02	1.00E-02	60	0	0.00	0.0025	-- [e]	4.1000	None	Unit 3		**Tetrachloroethene**
Toluene	X	2.00E-01	46	1	2.17	1.3900	1.3900	1.3900	None	--		
Trichloroethene	1.10E-02	6.00E-03	60	1	1.67	120.0000	120.0000	120.0000	None	Unit 3		Trichloroethene
Xylenes, total combined	X	2.00E+00	45	0	0.00	0.0075	-- [e]	4.9400	None	--		
Site 129-5												
Cyanide	X	2.00E-02	5	2	40.00	6.7800	7.3200	7.8600	–	--		Cyanide
Antimony	X	4.00E-04	2	1	50.00	1510.0000	1510.0000	1510.0000	2	--		Antimony
Arsenic	1.75E+00	3.00E-04	5	0	0.00	2.4000	-- [e]	12.7000	4	--		--
Barium	X	7.00E-02	2	2	100.00	23.7000	13511.8500	27000.0000	345	--		Barium
Beryllium	4.30E+00	5.00E-03	4	0	0.00	0.2500	-- [e]	0.6800	0.7	--		--
Cadmium	X	1.00E-03	4	0	0.00	0.2500	-- [e]	0.4270	0.7	--		--
Chromium	X	1.00E+00	4	4	100.00	5.1800	6.4275	7.2100	8.6	--		--
Cobalt	X	X	2	2	100.00	4.4400	4.6300	4.8200	7.5	--		
Copper	X	3.70E-02	4	4	100.00	4.6100	4254.3200	17000.0000	19	--		Copper
Lead	X	X	4	3	75.00	4.0900	53340.3300	160000.0000	45	--		Lead
Manganese	X	1.40E-01	2	2	100.00	146.0000	162.0000	178.0000	282	--		--
Mercury	X	3.00E-04	5	0	0.00	0.0870	-- [e]	0.0870	0.16	--		--
Molybdenum	X	5.00E-03	2	0	0.00	4.0000	-- [e]	4.0000	4	--		--
Nickel	X	2.00E-02	4	2	50.00	8.0200	9.1600	10.3000	34	--		--
Selenium	X	5.00E-03	4	0	0.00	8.7400	-- [e]	12.4000	–	--		--
Silver	X	5.00E-03	5	2	40.00	4.0200	4.2250	4.4300	4	--		--
Thallium	X	7.00E-05	4	0	0.00	9.7500	-- [e]	12.5000	10	--		--
Vanadium	X	7.00E-03	2	2	100.00	7.5300	8.3900	9.2500	16	--		--
Zinc	X	3.00E-01	2	2	100.00	26.8000	1168.4000	2310.0000	24	--		Zinc
1,1,1-Trichloroethane	X	9.00E-02	14	0	0.00	0.0025	-- [e]	8.1000	None	--		
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	2	0	0.00	7.2000	-- [e]	7.2000	None	--		
2,4-Dinitrotoluene	6.80E-01	2.00E-03	26	0	0.00	0.2510	-- [e]	0.3000	None	--		
Acetone	X	1.00E-01	11	0	0.00	0.0450	-- [e]	5.0000	None	--		
Anthracene	X	3.00E-01	2	0	0.00	0.3000	-- [e]	0.3000	None	--		

TABLE 4

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data [b] Sfo $(mg/kg/day)^{-1}$	RfDo $(mg/kg/day)^{-1}$	Statistical Data [c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater [d] Contaminant	Other	Preliminary Chemical of Concern
Benzene	2.90E-02	X	13	0	0.00	0.0025	--[e]	1.2000	None	--		
Benzo[a]anthracene	7.30E-01	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Benzo[a]pyrene	7.30E+00	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Benzo[g,h,i]perylene	X	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Bis (2-ethylhexyl) phthalate	1.40E-02	2.00E-02	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Chrysene	7.30E-03	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
cis-1,2-Dichloroethene	X	1.00E-02	11	0	0.00	0.0025	--[e]	0.2000	None	--		
Di-n-butyl phthalate	X	1.00E-01	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Ethylbenzene	X	1.00E-01	11	0	0.00	0.0025	--[e]	0.3000	None	--		
Fluoranthene	X	4.00E-02	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Indeno[1,2,3-C,D]pyrene	7.30E-01	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Methylene chloride	7.50E-03	6.00E-02	13	0	0.00	0.0062	--[e]	3.6000	None	--		
Methylethyl ketone / 2-Butanone	X	6.00E-01	11	0	0.00	0.0051	--[e]	5.0000	None	--		
Nitroglycerine	X	X	24	0	0.00	2.5000	--[e]	2.5000	None	--		
PCB 1248	7.70E+00	2.00E-05	2	0	0.00	0.0900	--[e]	0.0900	None	--		
PCB 1260	7.70E+00	2.00E-05	2	0	0.00	0.0620	--[e]	0.0620	None	--		
Phenanthrene	X	X	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Pyrene	X	3.00E-02	2	0	0.00	0.3000	--[e]	0.3000	None	--		
Tetrachloroethene	5.20E-02	1.00E-02	14	0	0.00	0.0025	--[e]	4.1000	None	--		
Toluene	X	2.00E-01	13	0	0.00	0.0025	--[e]	0.6500	None	--		
Trichloroethene	1.10E-02	6.00E-03	14	0	0.00	0.0025	--[e]	2.6000	None	--		
Xylenes, total combined	X	2.00E+00	12	0	0.00	0.0075	--[e]	4.9400	None	--		
Site 129-15												
Alpha gross [a]	X	X	6	4	66.67	1.7000	2.3000	2.8000	13.9±6.1 [f]	--		
Beta gross [a]	X	X	6	6	100.00	11.2000	13.0333	16.7000	25.7±3.8 [f]	--		
Cyanide	X	2.00E-02	4	0	0.00	1.2200	--[e]	1.2200	--	--		
Antimony	X	4.00E-04	6	0	0.00	50.0000	--[e]	82.9000	2	--		--
Arsenic	1.75E+00	3.00E-04	15	2	13.33	4.0000	4.5000	5.0000	4	--		Arsenic
Barium	X	7.00E-02	4	4	100.00	50.2000	58.5000	75.0000	345	--		--
Beryllium	4.30E+00	5.00E-03	13	1	7.69	0.3800	0.3800	0.3800	0.7	--		--
Cadmium	X	1.00E-03	15	4	26.67	0.2570	0.4955	0.8930	0.7	--		Cadmium
Chromium	X	1.00E+00	15	15	100.00	5.0400	10.0613	23.8000	8.6	--		Chromium
Cobalt	X	X	4	4	100.00	5.3800	5.8525	6.8400	7.5	--		
Copper	X	3.70E-02	15	15	100.00	3.8100	12.8747	28.8000	19	--		Copper
Lead	X	X	15	13	86.67	2.6900	13.5562	27.0000	45	--		--
Manganese	X	1.40E-01	4	4	100.00	330.0000	462.5000	620.0000	282	--		Manganese
Mercury	X	3.00E-04	10	1	10.00	0.0200	0.0200	0.0200	0.16	--		--
Molybdenum	X	5.00E-03	4	0	0.00	4.0000	--[e]	4.0000	4	--		--
Nickel	X	2.00E-02	15	15	100.00	7.6000	13.0280	19.4000	34	--		--
Selenium	X	5.00E-03	13	0	0.00	8.7400	--[e]	12.4000	--	--		--
Silver	X	5.00E-03	13	1	7.69	4.0000	4.0000	4.0000	4	--		--
Thallium	X	7.00E-05	15	0	0.00	9.7500	--[e]	12.5000	10	--		--
Vanadium	X	7.00E-03	6	6	100.00	11.4000	17.9333	29.0000	16	--		Vanadium
Zinc	X	3.00E-01	4	4	100.00	31.4000	39.5500	52.3000	24	--		Zinc
1,1,1-Trichloroethane	X	9.00E-02	49	0	0.00	0.0025	--[e]	8.1000	None	Unit 3		1,1,1-Trichloroethane

9/23/97

TABLE 4

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data[b] Sfo (mg/kg/day)$^{-1}$	RfDo (mg/kg/day)$^{-1}$	Statistical Data[c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater[d] Contaminant	Other	Preliminary Chemical of Concern
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	17	0	0.00	7.2000	--[e]	7.2000	None	--		
2,4-Dinitrotoluene	6.80E-01	2.00E-03	5	0	0.00	0.3100	--[e]	3.3000	None	--		
Acetone	X	1.00E-01	30	0	0.00	0.0450	--[e]	5.0000	None	--		
Anthracene	X	3.00E-01	5	1	20.00	0.2200	0.2200	0.2200	None	--		Anthracene
Benzene	2.90E-02	X	37	0	0.00	0.0025	--[e]	1.2000	None	--		
Benzo[a]anthracene	7.30E-01	X	5	2	40.00	0.3000	0.3650	0.4300	None	--		Benzo[a]anthracene
Benzo[a]pyrene	7.30E+00	X	5	2	40.00	0.3100	0.3400	0.3700	None	--		Benzo[a]pyrene
Benzo[g,h,i]perylene	X	X	5	1	20.00	0.3600	0.3600	0.3600	None	--		
Bis (2-ethylhexyl) phthalate	1.40E-02	2.00E-02	5	1	20.00	0.4800	0.4800	0.4800	None	--		Bis (2-ethylhexyl) phthalate
Chrysene	7.30E-03	X	5	2	40.00	0.3500	0.4250	0.5000	None	--		Chrysene
cis-1,2-Dichloroethene	X	1.00E-02	30	0	0.00	0.0025	--[e]	0.2000	None	Unit 3		**cis-1,2-Dichloroethene**
Di-n-butyl phthalate	X	1.00E-01	5	1	20.00	4.2000	4.2000	4.2000	None	--		Di-n-butyl phthalate
Dieldrin	1.60E+01	5.00E-05	2	0	0.00	0.0078	--[e]	0.0078	None	--		
Ethylbenzene	X	1.00E-01	30	0	0.00	0.0025	--[e]	0.3000	None	--		
Fluoranthene	X	4.00E-02	5	2	40.00	0.4100	0.5000	0.5900	None	--		Fluoranthene
Indeno[1,2,3-C,D]pyrene	7.30E-01	X	5	1	20.00	0.2500	0.2500	0.2500	None	--		Indeno[1,2,3-C,D]pyrene
Methylene chloride	7.50E-03	6.00E-02	47	0	0.00	0.0062	--[e]	3.6000	None	--		
Methylethyl ketone / 2-Butanone	X	6.00E-01	30	0	0.00	0.0051	--[e]	5.0000	None	--		
p,p-DDD	2.40E-01	X	2	2	100.00	0.0428	0.0527	0.0625	None	--		p,p-DDD
p,p-DDE	3.40E-01	X	2	2	100.00	0.0308	0.0694	0.1080	None	--		p,p-DDE
p,p-DDT	3.40E-01	5.00E-04	2	2	100.00	0.0239	0.0387	0.0535	None	--		p,p-DDT
PCB 1248	7.70E+00	2.00E-05	10	0	0.00	0.0400	--[e]	1.0000	None	--		
PCB 1260	7.70E+00	2.00E-05	10	0	0.00	0.0400	--[e]	1.0000	None	--		
Phenanthrene	X	X	5	2	40.00	0.3300	0.5250	0.7200	None	--		
Pyrene	X	3.00E-02	5	1	20.00	0.5500	0.5500	0.5500	None	--		Pyrene
Tetrachloroethene	5.20E-02	1.00E-02	49	0	0.00	0.0025	--[e]	4.1000	None	Unit 3		**Tetrachloroethene**
Toluene	X	2.00E-01	37	0	0.00	0.0025	--[e]	0.6500	None	--		
Total Heptachlorodibenzo-p-dioxins	1.00E-03	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Heptachlorodibenzofurans	1.00E-03	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Hexachlorodibenzo-p-dioxins	4.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Hexachlorodibenzofurans	1.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Octochlorodibenzo-p-dioxins	0	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Octochlorodibenzofurans	0	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total pentachlorodibenzo-p-dioxins	5.00E-01	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Pentachlorodibenzofurans	1.00E-01	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Total Tetrachlorodibenzo-p-dioxins	1.00E-02	X	1	0	0.00	0.0010	--[e]	0.0010	None	--		
Trichloroethene	1.10E-02	6.00E-03	49	2	4.08	0.0027	0.0028	0.0029	None	Unit 3		**Trichloroethene**
Xylenes, total combined	X	2.00E+00	35	0	0.00	0.0075	--[e]	4.9400	None	--		

Notes:

Bolded entries indicate compound failed to satisfy the screening criteria. Compound is included as a TBE compound based on its presence in groundwater or compound is included as PCOC if the level of exceedance is significantly above the screening criteria.

Background concentrations for inorganic constituents were developed using chemical data from soil samples collected outside the boundaries of known source areas.

Background concentrations were not developed for organic constituents. It is assumed that detections of organic compounds are anthropogenic in origin and any detection is a detection above background (non-detect).

X = Oral slope factor or reference dose not available.

<NB = Sample population is less than range of national background values.

LFC = Lab or field contaminant from historic data where sample blanks cannot be verified.

Footnotes:

TABLE 4

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data [b]		Statistical Data [c]									Preliminary Chemical of Concern
	Sfo (mg/kg/day)[-1]	RfDo (mg/kg/day)[-1]	# Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater [d] Contaminant	Other	

a Radionuclides are reported in units of pCi/g
b Toxicity data obtained from IRIS, HEAST, or ECAO Technical Support Center.
c Chemical data obtained from IRDMIS, November 1994.
d Compounds listed in this column are identified as Chemicals of Concern for Operable Unit 2 Groundwater. See associated groundwater tables for screening.
e Constituent minimum and maximum concentrations for those compounds with zero detections are the minimum and maximum method detection limits (MDL) respectively.
f Background for Gross Alpha and Beta derived from background determinations in Site J Closure Report, July 1993.

Table 5
COCs and Recommended Remediation Goals
Twin Cities Army Ammunition Plant
Operable Unit 2 Feasibility Study

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Preliminary Remediation Goals Carcinogen (mg/kg)	ARAR/TBC[1] (mg/kg)	Background (mg/kg)	COC	Recommended Remediation Goal (mg/kg)
Site A							
Antimony	1650	33.6	NA	400	2.0	Antimony	33.6
Barium	64000	21745	NA	-	345	Barium	21745
Chromium	1400	35985.9	NA	-	8.6	--	
Copper	78000	19593	NA	-	19	Copper	19593
Cyanide	15.8	9546	NA	-	--	--	
Lead	57000	NA	NA	1200	45	Lead	1200
Manganese	1900	2503	NA	-	282	--	
Nickel	420	6213	NA	-	34	--	
Silver	42.6	1553	NA	-	4.0	--	
Vanadium	39.8	252	NA	-	16	--	
Zinc	10000	289792	NA	-	24	--	
Xylene	8.58	578609	NA	-		--	
TBE[1] Compounds							
Benzene							
Chloroform							
cis-1,2-Dichloroethene							
1,2-Dichloroethane							
1,1-Dichloroethene							
Tetrachloroethene							
Trichloroethene							
1,3,5-Trinitrobenzene							
bis(2-ethylhexyl)phthalate							
ethylbenzene							
Site B							
Chromium	14	35986	NA	-	8.6	--	
Manganese	440	1251	NA	-	282	--	
Vanadium	25	126	NA	-	16	--	
Zinc	57	289792	NA	-	24	--	
Site C							
Antimony	9200	67.2	NA	-	2.0	Antimony	67.2
Arsenic	19.5	222	1.38	-	4.0	Arsenic	4.0
Barium	2070	21745	NA	-	345	--	
Beryllium	1.72	180	2.34E-02	-	0.7	Beryllium	0.7
Cadmium	5.14	99.2	NA	-	0.7	--	
Chromium	65.8	35986	NA	-	8.6	--	
Copper	5300	39185	NA	-	19	--	
Lead	49000	NA	NA	1200	45	Lead	1200
Manganese	6320	2503	NA	-	282	Manganese	2503
Molybdenum	42.2	840	NA	-	4.0	--	
Thallium	44.8	11.8	NA	-	10	Thallium	11.8
Vanadium	41.7	252	NA	-	16	--	
Zinc	628	289792	NA	-	24	--	

COCs and Recommended Remediation Goals
Twin Cities Army Ammunition Plant
Operable Unit 2 Feasibility Study

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Carcinogen (mg/kg)	ARAR/TBC [1] (mg/kg)	Background (mg/kg)	COC	Recommended Remediation Goal (mg/kg)
Acetone	5.00E-01	31064	NA	-		--	
Site D							
Chromium	18.5	35986	NA	-	8.6	--	
PCB 1260	0.996	5.68	5.16E-02	10		--	
Trichloroethene	2600	743	15.8	4.16E-01		Trichloroethene	4.16E-01
Additional TBE Compounds							
1,1,1-Trichloroethane							
1,1-Dichloroethane							
1,2-Dichloroethane							
1,1-Dichloroethene							
cis-1,2-Dichloroethene							
Tetrachloroethene							
1,1,2-Trichloroethane							
Xylenes							
Site E							
Antimony	851	22.4	NA	-	2.0	Antimony	22.4
Barium	34000	21745	NA	-	345	Barium	21745
Cadmium	6.87	99.2	NA	-	0.7	--	
Chromium	111	35985.9	NA	-	8.6	--	
Copper	72000	13062	NA	-	19	Copper	13062
Lead	140000	NA	NA	1200	45	Lead	1200
Manganese	2500	834	NA	-	282	Manganese	834
Mercury	1.07	93.2	NA	-	0.16	--	
Nickel	100	6213	NA	-	34	--	
Silver	13.4	1553	NA	-	4.0	--	
Vanadium	121	252	NA	-	16	--	
Zinc	10000	289792	NA	-	24	--	
PCB 1260	3.53E-01	5.68	1.03E-01	10		--	
Additional TBE Compounds							
1,1,1-Trichloroethane							
1,1-Dichlorethane							
1,2-Dichlorethane							
1,1-Dichlorethene							
cis-1,2-Dichlorethene							
Tetrachloroethene							
Trichloroethene							
Dichloromethane (Methylene Chloride)							
Site G							
Chromium	16.3	35985.9	NA	-	8.6	--	
Copper	77.0	13062	NA	-	19	--	
Lead	98.0	NA	NA	1200	45	--	

COCs and Recommended Remediation Goals
Twin Cities Army Ammunition Plant
Operable Unit 2 Feasibility Study

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Preliminary Remediation Goals Carcinogen (mg/kg)	ARAR/TBC ' (mg/kg)	Background (mg/kg)	COC	Recommended Remediation Goal (mg/kg)
Nickel	34.4	2071	NA	-	34	--	
Trichloroethene	7.47	248	31.5	3.95		Trichloroethene	3.95
Additional TBE Compounds							
1,1,1-Trichloroethane							
1,1-Dichloroethane							
1,2-Dichloroethane							
1,1-Dichloroethene							
cis-1,2-Dichloroethene							
Tetrachloroethene							
1,1,2-Trichloroethane							
trans-Dichloroethene							
Dichloromethane (Methylene Chloride)							
Site H							
Antimony	4300	33.6	NA	-	2.0	Antimony	33.6
Arsenic	17.1	222	1.4	-	4.0	Arsenic	4.0
Barium	13000	21745	NA	-	345	--	
Cadmium	19	99.2	NA	-	0.7	--	
Chromium	340	35986	NA	-	8.6	--	
Copper	140000	19593	NA	-	19	Copper	19593
Cyanide	80	9546	NA	-		--	
Lead	330000	NA	NA	1200	45	Lead	1200
Manganese	3600	2503	NA	-	282	Manganese	2503
Mercury	0.495	93.2	NA	-	0.16	--	
Molybdenum	40	840	NA	-	4.0	--	
Nickel	246	6213	NA	-	34	--	
Silver	24	1553	NA	-	4.0	--	
Vanadium	39	252	NA	-	16	--	
Zinc	59000	289792	NA	-	24	--	
p,p-DDE	1.92E-01	NA	5.53	-		--	
p,p-DDT	2.07E-01	177	2.92	-		--	
Site 129-3							
Antimony	362	22.4	NA	-	2.0	Antimony	22.4
Chromium	130	35985.9	NA	-	8.6	--	
Copper	4700	39185	NA	-	19	--	
Lead	3700	NA	NA	1200	45	Lead	1200
Manganese	1100	834	NA	-	282	Manganese	834
Mercury	6.70	93.2	NA	-	0.16	--	
Vanadium	22.8	252	NA	-	16	--	
Zinc	72.7	289792	NA	-	24	--	
Nitroglycerine	72.5	NA	NA	-		Nitroglycerine	Not yet established
Trichloroethene	120	248	31.5	4.43		Trichloroethene	4.43

COCs and Recommended Remediation Goals
Twin Cities Army Ammunition Plant
Operable Unit 2 Feasibility Study

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Preliminary Remediation Goals Carcinogen (mg/kg)	ARAR/TBC [1] (mg/kg)	Background (mg/kg)	COC	Recommended Remediation Goal (mg/kg)
Additional TBE Compounds							
1,1,1-Trichloroethane							
1,1-Dichloroethane							
1,2-Dichloroethane							
1,1-Dichloroethene							
cis-1,2-Dichloroethene							
Tetrachloroethene							
Cyanide							
Site 129-5							
Antimony	1510	67.2	NA	-	2.0	Antimony	67.2
Barium	27000	21745	NA	-	345	Barium	21745
Copper	17000	39185	NA	-	19	--	
Cyanide	7.86	9546	NA	-	--	--	
Lead	160000	NA	NA	1200	45	Lead	1200
Zinc	2310	289792	NA	-	24	--	
Additional TBE Compounds							
Benzene							
Dichloromethane (Methylene Chloride)							
Trichloroethene							
Site 129-15							
Arsenic	5.0	111	0.460	-	4.0	Arsenic	4.0
Cadmium	0.89	99.2	NA	-	0.7	--	
Chromium	23.8	35985.9	NA	-	8.6	--	
Copper	28.8	39185	NA	-	19	--	
Manganese	620	1251	NA	-	282	--	
Vanadium	29.0	126.0	NA	-	16.0	--	
Zinc	52.3	289792	NA	-	24	--	
Anthracene	0.220	50428	NA	-		--	
Benzo[a]anthracene	0.430	NA	0.215	-		Benzo[a]anthracene	0.215
Benzo[a]pyrene	0.370	NA	0.021	-		Benzo[a]pyrene	0.021
Bis (2-ethylhexyl) phthalate	0.480	1070	10.7	3.98		--	
Chrysene	0.50	NA	64.5	-		--	
Di-n-butyl phthalate	4.20	2839	NA	>1000		--	
Fluoranthene	0.59	6724	NA	-		--	
Indeno[1,2,3-C,D]pyrene	0.250	NA	0.645	-		--	
p,p-DDD	0.063	NA	7.83	-		--	
p,p-DDE	0.108	NA	5.53	-		--	
p,p-DDT	0.054	177	2.92	-		--	
Pyrene	0.550	5043	NA	-		--	
Additional TBE Compounds							
1,1,1-Trichloroethane							
1,1-Dichloroethane							
1,2-Dichloroethane							
1,1-Dichloroethene							

COCs and Recommended Remediation Goals
Twin Cities Army Ammunition Plant
Operable Unit 2 Feasibility Study

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Preliminary Remediation Goals Carcinogen (mg/kg)	ARAR/TBC ¹ (mg/kg)	Background (mg/kg)	COC	Recommended Remediation Goal (mg/kg)
cis-1,2-Dichloroethene							
Tetrachloroethene							
Trichloroethene							
Carbon Tetrachloride (Tetrachloromethane)							
Di-n-Octyl Phthalate							

Notes:
ARAR/TBC ¹ Clean-up goals for Lead and PCBs are based on Health Standards; All other goals based on groundwater protection from leaching
PRG ¹- Preliminary Remediation Goals
TBE ¹- To Be Evaluated: TBE Compounds were not included in PRG calculations; these compounds will be considered during remedial actions
NA ¹ - Not Applicable

TABLE 6

SCREENING OF CHEMICALS OF CONCERN - UNIT 1 GROUNDWATER
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Constituent Statistics [a]: Number of Samples	Number of Detections	% Detections	Min (ug/l)	Mean (ug/l)	Max (ug/l)	Comparison to TCAAP Background: Background (ug/l)	Number Above Background	% Above Background	Applicable Requirements	Relevant and Appropriate Requirements: Federal MCL [b] (ug/l)	Federal MCLG [c] (ug/l)	Minnesota MCL [d] (ug/l)	Minnesota SMCL [e] (ug/l)	Minnesota HRL [f] (ug/l)	Action Levels [g] (ug/l)	TBC: Health Advisories [h] (ug/l)	Engineering Evaluation	Chemical of Concern
Site A																			
Cyanide	34	0	0.00	8.17	--[i]	8.35	None	--	--	--	200.0	200.0	200.0	--	100.0	--	200.0		
Antimony	62	10	16.13	1.10	11.67	54.80	<10	5	8.06	--	6.0	6.0	6.0	--	6.0	--	3.0		Antimony
Arsenic	198	13	6.57	0.25	4.18	7.78	6.80	6	3.03	--	50*	--	50.0	--	--	--	--		
Barium	189	177	93.65	18.30	99.52	320.00	240.00	16	8.47	--	2,000.0	2,000.0	2,000.0	--	2,000.0	--	2,000.0		
Beryllium	50	0	0.00	0.10	--[i]	2.50	<1.5	0	0.00	--	4.0	4.0	4.0	--	0.08	--	--		
Cadmium	193	15	7.77	0.10	0.42	1.16	0.90	2	1.04	--	5.0	5.0	5.0	--	4.0	--	5.0		
Chromium	189	5	2.65	2.53	3.50	3.89	3.80	4	2.12	--	100.0	100.0	100.0	--	100**	--	100.0		
Cobalt	62	3	4.84	1.40	3.57	7.10	0.50	3	4.84	--	--	--	--	--	--	--	30.0		
Copper	59	28	47.46	0.97	74.69	707.00	4.00	15	25.42	--	--	1,300.0	--	1,000.0	--	1,300.0	--		
Lead	202	38	18.81	0.80	11.43	86.00	4.20	35	17.33	--	--	0.0	15.0	--	--	15.0	--	DC	
Manganese	45	45	100.00	9.00	519.27	2050.00	7,500.00	0	0.00	--	--	--	--	50.0	100.0	--	--		
Mercury	98	1	1.02	0.71	0.71	0.71	0.36	1	1.02	--	2.0	2.0	2.0	--	--	--	2.0		
Molybdenum	4	0	0.00	30.90	--[i]	30.90	--	--	--	--	--	--	--	--	--	40.0	40.0		
Nickel	199	38	19.10	4.98	8.54	20.60	15.00	38	19.10	--	100.0	100.0	100.0	--	100.0	--	100.0		
Selenium	50	6	12.00	1.00	3.28	8.10	1.00	2	4.00	--	50.0	50.0	50.0	--	30.0	--	--		
Silver	43	4	9.30	3.51	6.83	16.30	4.10	4	9.30	--	--	--	--	100.0	30.0	--	100.0		
Thallium	52	0	0.00	1.00	--[i]	100.00	4.00	0	0.00	--	2.0	0.5	2.0	--	0.6	--	0.4		
Vanadium	51	1	1.96	4.40	4.40	4.40	<20	0	0.00	--	--	--	--	--	50.0	--	--		
Zinc	168	128	76.19	13.20	148.95	3520.00	36.00	108	64.29	--	--	--	--	5,000.0	2,000.0	--	2,000.0	DC	
1,1,1-Trichloroethane	421	4	0.95	0.58	5.86	15.30	None	--	--	--	200.0	200.0	200.0	--	600.0	--	200.0		
1,1,2,2-Tetrachloroethane	1	0	0.00	5.00	--[i]	5.00	None	--	--	--	--	--	--	--	2.0	--	70.0		
1,1,2-Trichloro-1,2,2-trifluoroethane	292	4	1.37	0.62	0.83	1.30	None	--	--	--	--	--	--	--	200,000.0	--	--		
1,1,2-Trichloroethane	421	1	0.24	91.00	91.00	91.00	None	--	--	--	5.0	3.0	5.0	--	3.0	--	3.0		
1,1-Dichloroethane	293	1	0.34	78.00	78.00	78.00	None	--	--	--	--	--	--	--	70.0	--	--		
1,1-Dichloroethene	412	7	1.70	1.11	12.55	56.00	None	--	--	--	7.0	7.0	7.0	--	6.0	--	7.0		1,1-Dichloroethene
1,2-Dichloroethane	421	29	6.89	0.25	0.97	14.00	None	--	--	--	5.0	0.0	5.0	--	4.0	--			1,2-Dichloroethane
1,2-Dichloropropane	421	1	0.24	1.07	1.07	1.07	None	--	--	--	5.0	0.0	5.0	--	5.0	--	--		
Benzene	289	76	26.30	0.22	12.59	270.00	None	--	--	--	5.0	0.0	5.0	--	10.0	--	--		Benzene
Bis (2-ethylhexyl) phthalate	1	0	0.00	10.00	--[i]	10.00	None	--	--	--	6.0	0.0	6.0	--	20.0	--	--		
Bromomethane	1	0	0.00	10.00	--[i]	10.00	None	--	--	--	--	--	--	--	10.0	--	10.0		
Carbon tetrachloride	293	0	0.00	1.10	--[i]	28.00	None	--	--	--	5.0	0.0	5.0	--	3.0	--	--		
Chloroform	421	48	11.40	0.31	7.77	120.00	None	--	--	--	100/80[k]	--	100/80[k]	--	60.0	--	--		Chloroform
cis-1,2-Dichloroethene	24	10	41.67	1.20	72.45	190.00	None	--	--	--	70.0	70.0	70.0	--	70.0	--	70.0		cis-1,2-Dichloroethene
Diethyl phthalate	1	0	0.00	10.00	--[i]	10.00	None	--	--	--	--	--	--	--	6,000.0	--	5,000.0		
Methylene chloride	292	6	2.05	4.30	20.90	64.00	None	--	--	--	5.0	0.0	5.0	--	50.0	--	--		
PCB 1242	1	0	0.00	200.00	--[i]	200.00	None	--	--	--	0.5	0.0 (PCBs)	--	--	0.04 (PCBs)	--	--		
PCB 1248	1	0	0.00	200.00	--[i]	200.00	None	--	--	--	0.5	0.0 (PCBs)	--	--	0.04 (PCBs)	--	--		
Tetrachloroethene	421	185	43.94	0.59	92.13	1000.00	None	--	--	--	5.0	0.0	5.0	--	7.0	--	--		Tetrachloroethene
Toluene	288	13	4.51	0.49	8.14	34.00	None	--	--	--	1,000.0	1,000.0	1,000.0	--	1,000.0	--	1,000.0		
trans-1,2-Dichloroethene	28	2	7.14	6.70	7.60	8.50	None	--	--	--	100.0	100.0	100.0	--	100.0	--	100.0		
Trichloroethene	421	278	66.03	0.31	41.00	750.00	None	--	--	--	5.0	0.0	5.0	--	30.0	--	--		Trichloroethene
Vinyl chloride (chloroethane)	421	0	0.00	1.50	--[i]	95.00	None	--	--	--	2.0	0.0	2.0	--	0.2	--	--		
Xylenes, total combined	288	11	3.82	1.48	17.99	56.10	None	--	--	--	10,000.0	10,000.0	10,000.0	--	10,000.0	--	10,000.0		
Site B																			
Cyanide	5	0	0.00	8.00	--[i]	8.17	None	--	--	--	200.0	200.0	200.0	--	100.0	--	200.0		
Antimony	12	0	0.00	3.03	--[i]	37.10	<10	0	0.00	--	6.0	6.0	6.0	--	6.0	--	3.0		
Arsenic	16	2	12.50	6.40	18.25	30.10	6.80	2	12.50	--	50*	--	50.0	--	--	--	--		
Barium	13	12	92.31	24.50	256.77	1,530.00	240.00	6	46.15	--	2,000.0	2,000.0	2,000.0	--	2,000.0	--	2,000.0		
Beryllium	12	3	25.00	5.15	6.40	7.62	<1.5	3	25.00	--	4.0	4.0	4.0	--	0.08	--	--	DC*	
Cadmium	13	5	38.46	0.19	0.40	0.67	0.90	0	0.00	--	5.0	5.0	5.0	--	4.0	--	5.0		
Chromium	13	2	15.38	13.50	124.75	236.00	3.80	2	15.38	--	100.0	100.0	100.0	--	100**	--	100.0	DC*	
Cobalt	9	5	55.56	4.48	201.76	749.00	0.50	5	55.56	--	--	--	--	--	--	--	30.0	DC*	
Copper	7	5	71.43	1.48	57.17	259.00	4.00	2	28.57	--	--	1,300.0	--	1,000.0	--	1,300.0	--		

TABLE 6

SCREENING OF CHEMICALS OF CONCERN - UNIT 1 GROUNDWATER
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Constituent Statistics[a] Number of Samples	Number of Detections	% Detections	Min (ug/l)	Mean (ug/l)	Max (ug/l)	Comparison to TCAAP Background: Background (ug/l)	Number Above Background	% Above Background	Applicable Requirements	Relevant and Appropriate Requirements: Federal MCL[b] (ug/l)	Federal MCLG[c] (ug/l)	Minnesota MCL[d] (ug/l)	Minnesota SMCL[e] (ug/l)	Minnesota HRL[f] (ug/l)	Action Levels[g] (ug/l)	TBC: Health Advisories[h] (ug/l)	Engineering Evaluation	Chemical of Concern
Lead	15	4	26.67	1.41	39.91	155.00	4.20	4	26.67	--	--	0.0	15.0	--	--	15.0	--	DC*	
Manganese	7	7	100.00	47.00	1,496.14	5,500.00	7,500.00	0	0.00	--	--	--	--	50.0	100.0	--	--		
Mercury	9	0	0.00	0.24	--[i]	0.74	0.36	0	0.00	--	2.0	2.0	2.0	--	--	--	2.0		
Molybdenum	2	0	0.00	30.90	--[i]	30.90	--	--	--	--	--	--	--	--	--	--	40.0		
Nickel	13	3	23.08	8.66	71.24	196.00	15.00	3	23.08	--	100.0	100.0	100.0	--	100.0	--	100.0	DC*	
Selenium	14	0	0.00	3.02	--[i]	75.00	1.00	0	0.00	--	50.0	50.0	50.0	--	30.0	--	--		
Silver	9	0	0.00	1.93	--[i]	12.50	4.10	0	0.00	--	--	--	--	100.0	30.0	--	100.0		
Thallium	15	0	0.00	2.00	--[i]	100.00	4.00	0	0.00	--	2.0	0.5	2.0	--	0.6	--	0.4		
Vanadium	4	1	25.00	414.00	414.00	414.00	<20	1	25.00	--	--	--	--	--	50.0	--	--	DC*	
Zinc	7	2	28.57	1,490.00	1,635.00	1,780.00	36.00	2	28.57	--	--	--	--	5,000.0	2,000.0	--	2,000.0		
1,1,1-Trichloroethane	21	0	0.00	0.81	--[i]	1.16	None	--	--	--	200.0	200.0	200.0	--	600.0	--	200.0		
1,1,2-Trichloro-1,2,2-trifluoroethane	7	0	0.00	1.00	--[i]	4.50	None	--	--	--	--	--	--	--	200,000.0	--	--		
1,1,2-Trichloroethane	21	0	0.00	0.99	--[i]	1.52	None	--	--	--	5.0	3.0	5.0	--	3.0	--	3.0		
1,1-Dichloroethane	7	0	0.00	0.72	--[i]	0.97	None	--	--	--	--	--	--	--	70.0	--	--		
1,1-Dichloroethene	21	0	0.00	0.49	--[i]	1.01	None	--	--	--	7.0	7.0	7.0	--	6.0	--	7.0		
1,2-Dichloroethane	21	0	0.00	0.50	--[i]	4.63	None	--	--	--	5.0	0.0	5.0	--	4.0	--	--		
1,2-Dichloropropane	21	0	0.00	0.62	--[i]	3.94	None	--	--	--	5.0	0.0	5.0	--	5.0	--	--		
Benzene	15	0	0.00	0.41	--[i]	3.09	None	--	--	--	5.0	0.0	5.0	--	10.0	--	--		
Carbon tetrachloride	7	0	0.00	1.10	--[i]	1.30	None	--	--	--	5.0	0.0	5.0	--	3.0	--	--		
Chloroform	21	2	9.52	0.38	0.39	0.39	None	--	--	--	100/80[k]	--	100/80[k]	--	60.0	--	--		
cis-1,2 Dichloroethene	1	0	0.00	0.89	--[i]	0.89	None	--	--	--	70.0	70.0	70.0	--	70.0	--	70.0		
Methylene chloride	7	0	0.00	1.41	--[i]	3.20	None	--	--	--	5.0	0.0	5.0	--	50.0	--	--		
Tetrachloroethene	21	1	4.76	1.41	1.41	1.41	None	--	--	--	5.0	0.0	5.0	--	7.0	--	--		
Toluene	15	1	6.67	31.00	31.00	31.00	None	--	--	--	1,000.0	1,000.0	1,000.0	--	1,000.0	--	1,000.0		
trans-1,2-Dichloroethene	1	0	0.00	1.06	--[i]	1.06	None	--	--	--	100.0	100.0	100.0	--	100.0	--	100.0		
Trichloroethene	21	2	9.52	0.75	0.93	1.11	None	--	--	--	5.0	0.0	5.0	--	30.0	--	--		
Vinyl chloride (chloroethane)	21	0	0.00	1.50	--[i]	4.10	None	--	--	--	2.0	0.0	2.0	--	0.2	--	--		
Xylenes, total combined	15	1	6.67	1.20	1.20	1.20	None	--	--	--	10,000.0	10,000.0	10,000.0	--	10,000.0	--	10,000.0		
Site C																			
Cyanide	3	0	0.00	8.17	--[i]	8.35	None	--	--	--	200.0	200.0	200.0	--	100.0	--	200.0		
Antimony	1	0	0.00	10.00	--[i]	10.00	<10	0	0.00	--	6.0	6.0	6.0	--	6.0	--	3.0		
Arsenic	3	2	66.67	16.50	30.25	44.00	6.80	2	66.67	--	50*	--	50.0	--	--	--	--		
Barium	3	3	*100.00*	*160.00*	396.67	530.00	240.00	3	*100.00*	--	2,000.0	2,000.0	2,000.0	--	2,000.0	--	2,000.0		
Beryllium	1	0	0.00	1.47	--[i]	1.47	<1.5	0	0.00	--	4.0	4.0	4.0	--	0.08	--	--		
Cadmium	3	2	66.67	0.19	0.28	0.36	0.90	0	0.00	--	5.0	5.0	5.0	--	4.0	--	5.0		
Chromium	3	1	33.33	2.73	2.73	2.73	3.80	0	0.00	--	100.0	100.0	100.0	--	100**	--	100.0		
Copper	1	1	100.00	2.08	2.08	2.08	4.00	0	0.00	--	--	1,300.0	--	1,000.0	--	1,300.0	--		
Lead	3	0	0.00	1.26	--[i]	2.65	4.20	0	0.00	--	--	0.0	15.0	--	--	15.0	--		
Manganese	1	1	100.00	2,000.00	2,000.00	2,000.00	7,500.00	0	0.00	--	--	--	--	50.0	100.0	--	--		
Mercury	1	0	0.00	0.70	--[i]	0.70	0.36	0	0.00	--	2.0	2.0	2.0	--	--	--	2.0		
Nickel	3	0	0.00	5.32	--[i]	5.94	15.00	0	0.00	--	100.0	100.0	100.0	--	100.0	--	100.0		
Selenium	1	0	0.00	3.06	--[i]	3.06	1.00	0	0.00	--	50.0	50.0	50.0	--	30.0	--	--		
Silver	1	1	100.00	3.12	3.12	3.12	4.10	0	0.00	--	--	--	--	100.0	30.0	--	100.0		
Thallium	1	0	0.00	2.70	--[i]	2.70	4.00	0	0.00	--	2.0	0.5	2.0	--	0.6	--	0.4		
Zinc	3	1	33.33	25.00	25.00	25.00	36.00	1	33.33	--	--	--	--	5,000.0	2,000.0	--	2,000.0		
1,1,1-Trichloroethane	10	0	0.00	0.81	--[i]	5.00	None	--	--	--	200.0	200.0	200.0	--	600.0	--	200.0		
1,1,2,2-Tetrachloroethane	1	0	0.00	5.00	--[i]	5.00	None	--	--	--	--	--	--	--	2.0	--	--		
1,1,2-Trichloro-1,2,2-trifluoroethane	6	0	0.00	1.00	--[i]	4.50	None	--	--	--	--	--	--	--	200,000.0	--	--		
1,1,2-Trichloroethane	10	0	0.00	0.99	--[i]	5.00	None	--	--	--	5.0	3.0	5.0	--	3.0	--	3.0		

TABLE 6

SCREENING OF CHEMICALS OF CONCERN - UNIT 1 GROUNDWATER
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Constituent Statistics [a]: Number of Samples	Number of Detections	% Detections	Min (ug/l)	Mean (ug/l)	Max (ug/l)	Comparison to TCAAP Background: Background (ug/l)	Number Above Background	% Above Background	Applicable Requirements	Relevant and Appropriate Requirements: Federal MCL [b] (ug/l)	Federal MCLG [c] (ug/l)	Minnesota MCL [d] (ug/l)	Minnesota SMCL [e] (ug/l)	Minnesota HRL [f] (ug/l)	Action Levels [g] (ug/l)	TBC: Health Advisories [h] (ug/l)	Engineering Evaluation	Chemical of Concern
1,1-Dichloroethane	7	0	0.00	0.72	--[i]	5.00	None	--	--	--	--	--	--	--	70.0	--	--		
1,1-Dichloroethene	10	0	0.00	0.49	--[i]	5.00	None	--	--	--	7.0	7.0	7.0	--	6.0	--	7.0		
1,2-Dichloroethane	10	0	0.00	0.50	--[i]	5.00	None	--	--	--	5.0	0.0	5.0	--	4.0	--	--		
1,2-Dichloropropane	10	0	0.00	0.62	--[i]	5.00	None	--	--	--	5.0	0.0	5.0	--	5.0	--	--		
Benzene	6	0	0.00	0.41	--[i]	5.00	None	--	--	--	5.0	0.0	5.0	--	10.0	--	--		
Bromomethane	1	0	0.00	10.00	--[i]	10.00	None	--	--	--	--	--	--	--	10.0	--	10.0		
Carbon tetrachloride	7	0	0.00	1.10	--[i]	5.00	None	--	--	--	5.0	0.0	5.0	--	3.0	--	--		
Chloroform	10	0	0.00	0.41	--[i]	5.00	None	--	--	--	100/80[k]	--	100/80[k]	--	60.0	--	--		
cis-1,2-Dichloroethene	1	0	0.00	0.89	--[i]	0.89	None	--	--	--	70.0	70.0	70.0	--	70.0	--	70.0		
Diethyl phthalate	1	0	0.00	10.00	--[i]	10.00	None	--	--	--	--	--	--	--	6,000.0	--	5,000.0		
Methylene chloride	7	1	14.29	1.83	1.83	1.83	None	--	--	--	5.0	0.0	5.0	--	50.0	--	--		
PCB 1242	1	0	0.00	200.00	--[i]	200.00	None	--	--	--	0.5	0.0 (PCBs)	--	--	0.04 (PCBs)	--	--		
PCB 1248	1	0	0.00	200.00	--[i]	200.00	None	--	--	--	0.5	0.0 (PCBs)	--	--	0.04 (PCBs)	--	--		
Tetrachloroethene	10	0	0.00	0.88	--[i]	5.00	None	--	--	--	5.0	0.0	5.0	--	7.0	--	--		
Toluene	5	0	0.00	0.87	--[i]	3.39	None	--	--	--	1,000.0	1,000.0	1,000.0	--	1,000.0	--	1,000.0		
trans-1,2-Dichloroethene	1	0	0.00	1.06	--[i]	1.06	None	--	--	--	100.0	100.0	100.0	--	100.0	--	100.0		
Trichloroethene	10	0	0.00	0.50	--[i]	5.00	None	--	--	--	5.0	0.0	5.0	--	30.0	--	--		
Vinyl chloride (chloroethane)	10	0	0.00	1.50	--[i]	10.00	None	--	--	--	2.0	0.0	2.0	--	0.2	--	--		
Xylenes, total combined	5	0	0.00	1.17	--[i]	8.28	None	--	--	--	10,000.0	10,000.0	10,000.0	--	10,000.0	--	10,000.0		
Site H																			
Antimony	2	0	0.00	10.00	--[i]	10.00	<10	0	0.00	--	6.0	6.0	6.0	--	6.0	--	3.0		
Arsenic	3	1	33.33	10.30	10.30	10.30	6.80	1	33.33	--	50*	--	50.0	--	--	--	--		
Barium	4	3	75.00	190.00	253.33	300.00	240.00	3	75.00	--	2,000.0	2,000.0	2,000.0	--	2,000.0	--	2,000.0		
Beryllium	2	0	0.00	1.47	--[i]	1.47	<1.5	0	0.00	--	4.0	4.0	4.0	--	0.08	--	--		
Cadmium	4	4	100.00	0.34	0.70	1.12	0.90	2	50.00	--	5.0	5.0	5.0	--	4.0	--	5.0		
Chromium	4	1	25.00	6.67	6.67	6.67	3.80	1	25.00	--	100.0	100.0	100.0	--	100**	--	100.0		
Copper	2	2	100.00	1.44	2.38	3.32	4.00	0	0.00	--	--	1,300.0	--	1,000.0	--	1,300.0	--		
Lead	4	1	25.00	3.47	3.47	3.47	4.20	1	25.00	--	--	0.0	15.0	--	--	15.0	--		
Manganese	2	2	100.00	140.00	3,070.00	6,000.00	7,500.00	0	0.00	--	--	--	--	50.0	100.0	--	--		
Mercury	2	0	0.00	0.70	--[i]	0.70	0.36	0	0.00	--	2.0	2.0	2.0	--	--	--	2.0		
Nickel	4	3	75.00	9.44	12.11	14.00	15.00	3	75.00	--	100.0	100.0	100.0	--	100.0	--	100.0		
Selenium	2	0	0.00	3.06	--[i]	3.06	1.00	0	0.00	--	50.0	50.0	50.0	--	30.0	--	--		
Silver	2	1	50.00	4.01	4.01	4.01	4.10	1	50.00	--	--	--	--	100.0	30.0	--	100.0		
Thallium	2	0	0.00	2.70	--[i]	2.70	4.00	0	0.00	--	2.0	0.5	2.0	--	0.6	--	0.4		
Zinc	2	1	50.00	67.70	67.70	67.70	36.00	1	50.00	--	--	--	--	5,000.0	2,000.0	--	2,000.0		
1,1,1-Trichloroethane	14	1	7.14	2.62	2.62	2.62	None	--	--	--	200.0	200.0	200.0	--	600.0	--	200.0		
1,1,2-Trichloro-1,2,2-trifluoroethane	10	0	0.00	1.00	--[i]	4.50	None	--	--	--	--	--	--	--	200,000.0	--	--		
1,1,2-Trichloroethane	14	0	0.00	0.99	--[i]	1.52	None	--	--	--	5.0	3.0	5.0	--	3.0	--	3.0		
1,1-Dichloroethane	10	0	0.00	0.72	--[i]	0.97	None	--	--	--	--	--	--	--	70.0	--	--		
1,1-Dichloroethene	14	0	0.00	0.49	--[i]	1.01	None	--	--	--	7.0	7.0	7.0	--	6.0	--	7.0		
1,2-Dichloroethane	14	1	7.14	0.34	0.34	0.34	None	--	--	--	5.0	0.0	5.0	--	4.0	--	--		
1,2-Dichloropropane	14	0	0.00	0.62	--[i]	3.94	None	--	--	--	5.0	0.0	5.0	--	5.0	--	--		
Benzene	10	0	0.00	0.41	--[i]	3.09	None	--	--	--	5.0	0.0	5.0	--	10.0	--	--		
Carbon tetrachloride	10	0	0.00	1.10	--[i]	1.30	None	--	--	--	5.0	0.0	5.0	--	3.0	--	--		
Chloroform	14	0	0.00	0.41	--[i]	1.08	None	--	--	--	100/80[k]	--	100/80[k]	--	60.0	--	--		
cis-1,2-Dichloroethene	2	0	0.00	0.89	--[i]	0.89	None	--	--	--	70.0	70.0	70.0	--	70.0	--	70.0		
Methylene chloride	10	0	0.00	1.41	--[i]	3.20	None	--	--	--	5.0	0.0	5.0	--	50.0	--	--		
Tetrachloroethene	14	0	0.00	0.88	--[i]	2.41	None	--	--	--	5.0	0.0	5.0	--	7.0	--	--		
Toluene	10	1	10.00	22.70	22.70	22.70	None	--	--	--	1,000.0	1,000.0	1,000.0	--	1,000.0	--	1,000.0		

TABLE 6

SCREENING OF CHEMICALS OF CONCERN - UNIT 1 GROUNDWATER
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Constituent Statistics [a]						Comparison to TCAAP Background			Applicable Requirements	Relevant and Appropriate Requirements						TBC	Engineering Evaluation	Chemical of Concern
	Number of Samples	Number of Detections	% Detections	Min (ug/l)	Mean (ug/l)	Max (ug/l)	Background (ug/l)	Number Above Background	% Above Background		Federal MCL [b] (ug/l)	Federal MCLG [c] (ug/l)	Minnesota MCL [d] (ug/l)	Minnesota SMCL [e] (ug/l)	Minnesota HRL [f] (ug/l)	Action Levels [g] (ug/l)	Health Advisories [h] (ug/l)		
trans-1,2-Dichloroethene	2	0	0.00	1.06	-- [i]	1.06	None	--	--	--	100.0	100.0	100.0	--	100.0	--	100.0		
Trichloroethene	14	2	14.29	0.38	0.47	0.57	None	--	--	--	5.0	0.0	5.0	--	30.0	--	--		
Vinyl chloride (chloroethane)	14	0	0.00	1.50	-- [i]	4.10	None	--	--	--	2.0	0.0	2.0	--	0.2	--	--		
Xylenes, total combined	10	0	0.00	1.17	-- [i]	8.28	None	--	--	--	10,000.0	10,000.0	10,000.0	--	10,000.0	--	10,000.0		

Notes:

Background concentrations for inorganic constituents were developed using chemical data from wells outside the boundaries and upgradient of known source areas.

Background concentrations were not developed for organic constituents. It is assumed that detections of organic compounds are arthropogenic in origin and any detection is a detection above background (non-detect).

None = Background concentrations are not available for these constituents since they are either organic compounds or cyanide which is treated similar to organic compounds.

<RB = Sample population is less than range of regional background values. Value in parentheses is the maximum concentration from the range of regional background numbers.

DC = Compound has not historically been detected consistently from one sampling round to another.

DC* = Samples with highest detections for this compound were unfiltered and therefore the IRDMIS results may not be representative of true contaminant concentrations. All other sample detections are below ARARs.

Footnotes:

a Data used for statistical analysis obtained from IRDMIS, November 1994.

b Federal MCLs are the current federal maximum contaminant levels for drinking water as established under the Safe Drinking Water Act (40 CFR Part 141)

c Federal MCLGs are the current federal maximum contaminant level goals for drinking water as established under the Safe Drinking Water Act (40 CFR Part 141)

d Minnesota MCLs are the current state maximum contaminant levels for drinking water as established in the Minnesota Rules Chapter 4720

e Minnesota SMCLs are the current state secondary maximum contaminant levels for drinking water as established in the Minnesota Rules Chapter 4720

f Minnesota HRLs are the state health risk limits for substances found to degrade Minnesota groundwater as established in Minnesota Rules Chapter 4717

g The action levels for lead and copper were promulgated under the Safe Drinking Water Act; the state of Minnesota has also adopted these as MCLs

h Health Advisories are the federal lifetime advisories from the USEPA Office of Water (November 1994). The Health Advisory for Cobalt is a state advisory level established by the Minnesota Department of Health.

i Constituent minimum and maximum concentrations for those compounds with zero detections are the minimum and maximum method detection limits (MDL) respectively.

j. -t < tcrit < t: Two sample t-Test indicated no significant difference in sample populations
t > tcrit: Two sample t-Test indicated a difference in sample populations

k 100 µg/l is current MCL. Total for all trihalomethanes combined cannot exceed 80 µg/l level.

* The value for arsenic is a National Interim Primary Drinking Water Regulation MCL. According to EPA's regulatory agenda, EPA plans to propose a revised MCL in November 1995 with a final rule expected November 1997.

** The HRL shown is for chromium VI, not for total chromium

TABLE 7

SCREENING OF CHEMICALS OF CONCERN - UNIT 3/4 GROUNDWATER
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Constituent Statistics[a] Number of Samples	Number of Detections	% Detections	Min (ug/l)	Mean (ug/l)	Max (ug/l)	Comparison to TCAAP Background: Background (ug/l)	Number Above Background	% Above Background	Applicable Requirements	Relevant and Appropriate Requirements: Federal MCL[b] (ug/l)	Federal MCLG[c] (ug/l)	Minnesota MCL[d] (ug/l)	Minnesota SMCL[e] (ug/l)	Minnesota HRL[f] (ug/l)	Action Levels[g] (ug/l)	TBC: Health Advisories[h] (ug/l)	Engineering Evaluation	Chemical of Concern
Alpha gross	2	1	50.00	2.80	2.80	2.80	None	–	–	–	15.0[n]	–	15.0[n]	–	–	–	–		
Beta gross	2	1	50.00	3.50	3.50	3.50	None	–	–	–	–	–	–	–	–	–	–		
Antimony	28	0	0.00	6.00	--[i]	37.10	<10	0	0.00	–	6.0	6.0	6.0	–	6.0	–	3.0		
Arsenic	52	3	5.77	7.73	9.46	10.80	14.0	2	3.85	–	50*	–	50.0	–	–	–	–		
Barium	51	50	98.04	16.80	99.31	470.00	206.0	7	13.73	–	2,000.0	2,000.0	2,000.0	–	2,000.0	–	2,000.0		
Beryllium	27	0	0.00	1.47	--[i]	4.00	<1.5	0	0.00	–	4.0	4.0	4.0	–	0.08	–	–		
Cadmium	51	13	25.49	0.11	0.31	1.46	0.17	4	7.84	–	5.0	5.0	5.0	–	4.0	–	5.0		
Chromium	54	19	35.19	2.53	7.53	44.40	3.1	19	35.19	–	100.0	100.0	100.0	–	100**	–	100.0		
Cobalt	6	0	0.00	2.00	--[i]	25.00	0.5	0	0.00	–	–	–	–	–	–	–	30.0		
Copper	26	25	96.15	0.79	118.12	2,120.00	27.0	4	15.38	–	–	1,300.0	–	1,000.0	–	1,300.0	–	DC	
Cyanide	28	0	0.00	8.17	--[i]	8.35	–	–	–	–	200.0	200.0	200.0	–	100.0	–	200.0		
Lead	54	4	7.41	2.87	39.23	146.00	3.8	1	1.85	–	–	0.0	15.0	–	–	15.0	–	DC	
Manganese	26	25	96.15	2.20	246.98	1,800.00	760.0	3	11.54	–	–	–	–	50.0	100.0	–	–	DC	
Mercury	32	0	0.00	0.70	--[i]	0.74	0.57	0	0.00	–	2.0	2.0	2.0	–	–	–	2.0		
Molybdenum	4	0	0.00	30.90	--[i]	30.90	4.4	0	0.00	–	–	–	–	–	–	–	40.0		
Nickel	50	4	8.00	6.21	7.15	8.85	6.8	4	8.00	–	100.0	100.0	100.0	–	100.0	–	100.0		
Selenium	27	1	3.70	4.27	4.27	4.27	5.2	0	0.00	–	50.0	50.0	50.0	–	30.0	–	–		
Silver	26	4	15.38	1.98	2.92	3.66	3.3	3	11.54	–	–	–	–	100.0	30.0	–	100.0		
Thallium	31	0	0.00	2.00	--[i]	100.00	5.4	0	0.00	–	2.0	0.5	2.0	–	0.6	–	0.4		
Vanadium	4	0	0.00	20.00	--[i]	20.00	<20	0	0.00	–	–	–	–	–	50.0	–	–		
Zinc	36	4	11.11	177.00	1,939.00	4,870.00	72.0	4	11.11	–	–	–	–	5,000.0	2,000.0	–	2,000.0	DC	
1,1,1-Trichloroethane	222	88	39.64	0.26	1,521.96	16,200.00	None	–	–	–	200.0	200.0	200.0	–	600.0	–	200.0		1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane	24	1	4.17	5.20	5.20	5.20	None	–	–	–	–	–	–	–	2.0	–	–		
1,1,2-Trichloro-1,2,2-trifluoroethane	130	0	0.00	1.00	--[i]	45,000.00	None	–	–	–	–	–	–	–	200,000.0	–	–		
1,1,2-Trichloroethane	226	5	2.21	14.00	20.80	25.00	None	–	–	–	5.0	3.0	5.0	–	3.0	–	3.0		
1,1-Dichloroethane	187	15	8.02	0.62	94.95	740.00	None	–	–	–	–	–	–	–	70.0	–	–		1,1-Dichloroethane
1,1-Dichloroethene	223	31	13.90	0.30	286.09	1,800.00	None	–	–	–	7.0	7.0	7.0	–	6.0	–	7.0		1,1-Dichloroethene
1,2-Dichloroethane	223	12	5.38	0.33	9.99	50.00	None	–	–	–	5.0	0.0	5.0	–	4.0	–	–		1,2-Dichloroethane
1,2-Dichloropropane	193	0	0.00	0.20	--[i]	6,200.00	None	–	–	–	5.0	0.0	5.0	–	5.0	–	–		
1,3-Dimethylbenzene / m-Xylene	2	1	50.00	0.20	0.20	0.20	None	–	–	–	–	–	–	–	–	–	1.0		
1,3-Dinitrobenzene	2	1	50.00	0.34	0.34	0.34	None	–	–	–	–	–	–	–	–	–	–		
Benzene	96	7	7.29	0.55	1.06	2.47	None	–	–	–	5.0	0.0	5.0	–	10.0	–	–		
Bis (2-ethylhexyl) phthalate	3	0	0.00	10.00	--[i]	10.00	None	–	–	–	6.0	0.0	6.0	–	20.0	–	–		
Bromomethane	24	0	0.00	0.50	--[i]	10.00	None	–	–	–	–	–	–	–	10.0	–	10.0		
Carbon tetrachloride	154	1	0.65	3.25	3.25	3.25	None	–	–	–	5.0	0.0	5.0	–	3.0	–	–		
Chloroform	225	6	2.67	0.69	14.42	29.00	None	–	–	–	100/80[m]	–	100/80[m]	–	60.0	–	–		
cis-1,2-Dichloroethene	67	16	23.88	0.40	171.48	440.00	None	–	–	–	70.0	70.0	70.0	–	70.0	–	70.0		cis-1,2-Dichloroethene
Dichlorodifluoromethane	7	0	0.00	0.50	--[i]	1.00	None	–	–		–	–	–	–	–	–	1,000.0		
Diethyl phthalate	9	0	0.00	10.00	--[i]	10.00	None	–	–	–	–	–	–	–	6,000.0	–	5,000.0		
Methylene chloride	153	5	3.27	2.34	64.04	260.00	None	–	–	–	5.0	0.0	5.0	–	50.0	–	–		
o-Xylene / 1,2-Dimethylbenzene	2	1	50.00	0.20	0.20	0.20	None	–	–	–	–	–	–	–	–	–	600.0		
p-Xylene / 1,4-Dimethylbenzene	2	1	50.00	0.20	0.20	0.20	None	–	–	–	–	–	–	–	–	–	75.0		
PCB 1242	11	0	0.00	0.62	--[i]	200.00	None	–	–	–	0.5	0.0 (PCBs)	–	–	0.04 (PCBs)	–	–		
PCB 1248	11	0	0.00	0.34	--[i]	200.00	None	–	–	–	0.5	0.0 (PCBs)	–	–	0.04 (PCBs)	–	–		
Tetrachloroethene	226	17	7.52	0.91	7.11	58.00	None	–	–	–	5.0	0.0	5.0	–	7.0	–	–		Tetrachloroethene
Toluene	94	9	9.57	0.30	4.04	17.30	None	–	–	–	1,000.0	1,000.0	1,000.0	–	1,000.0	–	1,000.0		
trans-1,2-Dichloroethene	99	3	3.03	0.70	15.33	44.00	None	–	–	–	100.0	100.0	100.0	–	100.0	–	100.0		
Trichloroethene	221	135	61.09	0.20	3,837.07	65,400.00	None	–	–	–	5.0	0.0	5.0	–	30.0	–	–		Trichloroethene
Trichlorofluoromethane	18	1	5.56	1.90	1.90	1.90	None	–	–	–	–	–	–	–	2,000.0	–	–		
Vinyl chloride (chloroethane)	225	0	0.00	0.20	--[i]	15,000.00	None	–	–	–	2.0	0.0	2.0	–	0.2	–	–		
Xylenes, total combined	92	0	0.00	1.17	--[i]	5,800.00	None	–	–	–	10,000.0	10,000.0	10,000.0	–	10,000.0	–	10,000.0		

Notes:
Background concentrations for inorganic constituents were developed using chemical data from wells outside the boundaries and upgradient of known source areas.
Background concentrations were not developed for organic constituents. It is assumed that detections of organic compounds are arthropogenic in origin and any detection is a detection above background (non-detect).
None = Background concentrations are not available for these constituents since they are either organic compounds or cyanide which is treated similar to organic compounds.
<RB = Sample population is less than range of regional background values. Value in parentheses is the maximum concentration from the range of regional background numbers.
DC = Compound has not historically been detected consistently from one sampling round to another.

TABLE 7

SCREENING OF CHEMICALS OF CONCERN - UNIT 3/4 GROUNDWATER
TCAAP OU-2 FEASIBILITY STUDY

	Constituent Statistics [a]						Comparison to TCAAP Background			Applicable Requirements	Relevant and Appropriate Requirements						TBC	Engineering Evaluation	
Constituent	Number of Samples	Number of Detections	% Detections	Min (ug/l)	Mean (ug/l)	Max (ug/l)	Background (ug/l)	Number Above Background	% Above Background		Federal MCL [b] (ug/l)	Federal MCLG [c] (ug/l)	Minnesota MCL [d] (ug/l)	Minnesota SMCL [e] (ug/l)	Minnesota HRL [f] (ug/l)	Action Levels [g] (ug/l)	Health Advisories [h] (ug/l)		Chemical of Concern

Footnotes:

a Data used for statistical analysis obtained from IRDMIS, November 1994. Units as specified with the exception of Gross Alpha and Gross Beta which have units of pCi/l.
b Federal MCLs are the current federal maximum contaminant levels for drinking water as established under the Safe Drinking Water Act (40 CFR Part 141)
c Federal MCLGs are the current federal maximum contaminant level goals for drinking water as established under the Safe Drinking Water Act (40 CFR Part 141)
d Minnesota MCLs are the current state maximum contaminant levels for drinking water as established in the Minnesota Rules Chapter 4720
e Minnesota SMCLs are the current state secondary maximum contaminant levels for drinking water as established in the Minnesota Rules Chapter 4720
f Minnesota HRLs are the state health risk limits for substances found to degrade Minnesota groundwater as established in Minnesota Rules Chapter 4717
g The action levels for lead and copper were promulgated under the Safe Drinking Water Act; the state of Minnesota has also adopted these as MCLs
h Health Advisories are the federal lifetime advisories from the USEPA Office of Water (November 1994). The Health Advisory for Cobalt is a state advisory level established by the Minnesota Department of Health.
i Constituent minimum and maximum concentrations for those compounds with zero detections are the minimum and maximum method detection limits (MDL) respectively.
j Concentrations for radionuclides in units of pCi/l.
k: $-t < t_{crit} < t$: Two sample t-Test indicated no significant difference in sample populations indicating concentrations are representative of background.
$t > t_{crit}$. Two sample t-Test indicated a difference in sample populations.
m: 100 µg/l is current MCL. Total for all trihalomethanes combined cannot exceed 80 µg/l level.
n: MCL for gross alpha particles is expressed in units of picocuries per liter (pCi/l). MCL for gross alpha particle activity in community water systems includes radium-226 but excludes radon and uranium.
* The value for arsenic is a National Interim Primary Drinking Water Regulation MCL. According to EPA's regulatory agenda, EPA plans to propose a revised MCL in November 1995 with a final rule expected November 1997.
** The HRL shown is for chromium VI, not for total chromium

TABLE 8

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data[b] Sfo (mg/kg/day)$^{-1}$	RfDo (mg/kg/day)	Statistical Data[c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater[d] Contaminant	Other	Preliminary Chemical of Concern
Site I												
Alpha gross[a]	X	X	5	5	100.00	9.1000	11.5800	14.9000	13.9+6.1[f]	--		
Beta gross[a]	X	X	5	5	100.00	15.5000	28.0200	64.5000	25.7+3.8[f]	--		
Cesium 137[a]	3.16E-11	X	4	3	75.00	0.0400	0.2033	0.5100	0.5 - 1.0	--		
Radium 226[a]	2.95E-10	X	4	4	100.00	0.4800	0.7375	1.1400	0.5 - 2.0	--		
Strontium 90[a]	4.09E-11	X	4	1	25.00	0.0800	0.0800	0.0800	.01 - 1.0	--		
Cyanide	X	2.00E-02	17	0	0.00	1.2200	--[e]	1.2200	--	--		
Antimony	X	4.00E-04	14	0	0.00	82.9000	--[e]	82.9000	2	--		
Arsenic	1.75E+00	3.00E-04	17	0	0.00	2.4000	--[e]	12.7000	4	--		
Barium	X	7.00E-02	16	16	100.00	27.0000	75.1000	282.0000	345	--		
Beryllium	4.30E+00	5.00E-03	17	6	35.29	0.3980	0.4278	0.4620	0.7	--		
Cadmium	X	5.00E-04	19	7	36.84	0.2920	31.5804	109.0000	0.7	--		Cadmium
Chromium	X	1.00E+00	19	19	100.00	8.5100	34.4616	262.0000	8.6	--		Chromium
Cobalt	X	X	14	14	100.00	6.4200	11.6221	21.9000	7.5	--		
Copper	X	3.70E-02	17	17	100.00	12.4000	26.7588	78.1000	19	--		Copper
Lead	X	X	19	16	84.21	3.1700	44.9856	75.2000	45	--		Lead
Manganese	X	2.40E-02	16	14	87.50	193.0000	440.8571	870.0000	282	--		Manganese
Mercury	X	3.00E-04	19	0	0.00	0.0870	--[e]	1.3000	0.16	--		
Molybdenum	X	5.00E-03	14	2	14.29	11.6000	11.6500	11.7000	4	--		Molybdenum
Nickel	X	2.00E-02	17	16	94.12	9.2800	18.2237	43.3000	34	--		Nickel
Selenium	X	5.00E-03	17	0	0.00	8.7400	--[e]	12.4000	--	--		
Silver	X	5.00E-03	17	3	17.65	1.6500	4.7467	9.1700	4	--		Silver
Thallium	X	7.00E-05	28	2	7.14	0.0120	0.0140	0.0160	10	--		
Vanadium	X	7.00E-03	14	14	100.00	9.2500	25.4107	46.1000	16	--		Vanadium
Zinc	X	3.00E-01	16	16	100.00	20.0000	97.2875	196.0000	24	--		Zinc
1,1,1-Trichloroethane	X	9.00E-02	17	1	5.88	0.0042	0.0042	0.0042	None	--		1,1,1-Trichloroethane
1,1,2-Trichloro-1,2,2-trifluoroethane	X	3.00E+01	3	0	0.00	7.2000	--[e]	7.2000	None	--		
1,1-Dichloroethane	X	1.00E-01	17	0	0.00	0.0025	--[e]	2.9000	None	--		
1,1-Dichloroethene	6.00E-01	9.00E-03	17	0	0.00	0.0320	--[e]	8.5000	None	--		*1,1-Dichloroethene*
1,2-Dichloroethane	9.10E-02	X	17	0	0.00	0.0027	--[e]	3.0000	None	--		
Acetone	X	1.00E-01	14	1	7.14	0.1000	0.1000	0.1000	None	--		Acetone
Benzene	2.90E-02	X	16	0	0.00	0.0025	--[e]	1.2000	None	--		
Carbon tetrachloride	1.30E-01	7.00E-04	17	0	0.00	0.0031	--[e]	1.7000	None	--		

TABLE 8

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data [b] Sfo $(mg/kg/day)^{-1}$	Toxicity Data [b] RfDo (mg/kg/day)	Statistical Data [c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater [d] Contaminant	Other	Preliminary Chemical of Concern
Chloroform	6.10E-03	1.00E-02	17	0	0.00	0.0026	--[e]	2.9000	None	--		
cis-1,2-Dichloroethene	X	1.00E-02	14	1	7.14	0.0420	0.0420	0.0420	None	Unit 1		cis-1,2-Dichloroethene
Ethylbenzene	X	1.00E-01	14	0	0.00	0.0025	--[e]	0.6200	None	--		
Methylene chloride	7.50E-03	6.00E-02	17	3	17.65	0.0130	0.0213	0.0260	None	--		Methylene chloride
Methylethyl ketone / 2-Butanone	X	6.00E-01	14	1	7.14	0.0150	0.0150	0.0150	None	--		Methylethyl ketone / 2-Butanone
PCB 1248	7.70E+00	2.00E-05	3	0	0.00	0.0900	--[e]	0.0900	None	--		
PCB 1260	7.70E+00	2.00E-05	3	0	0.00	0.0620	--[e]	0.0620	None	--		
Tetrachloroethene	5.20E-02	1.00E-02	17	0	0.00	0.0025	--[e]	4.1000	None	--		*Tetrachloroethene*
Toluene	X	2.00E-01	16	0	0.00	0.0025	--[e]	0.6500	None	--		
trans-1,2-Dichloroethene	X	2.00E-02	14	0	0.00	0.0025	--[e]	0.6200	None	--		
Trichloroethene	1.10E-02	6.00E-03	16	7	43.75	0.0046	0.2009	1.0000	None	Unit 1		Trichloroethene
Vinyl chloride (chloroethane)	1.90E+00	X	17	0	0.00	0.0038	--[e]	1.8000	None	--		*Vinyl chloride (chloroethane)*
Xylenes, total combined	X	2.00E+00	16	0	0.00	0.0075	--[e]	4.9400	None	--		
Site K												
Cyanide	X	2.00E-02	29	4	13.79	0.1600	1.5475	4.4700	--	--		Cyanide
Antimony	X	4.00E-04	11	0	0.00	82.9000	--[e]	82.9000	2	--		
Arsenic	1.75E+00	3.00E-04	11	0	0.00	12.7000	--[e]	12.7000	4	--		
Barium	X	7.00E-02	19	11	57.89	16.8000	73.4273	200.0000	345	--		
Beryllium	4.30E+00	5.00E-03	11	2	18.18	0.3980	0.4120	0.4260	0.7	--		
Cadmium	X	5.00E-04	37	4	10.81	3.3800	13.4550	34.8000	0.7	--		Cadmium
Chromium	X	1.00E+00	37	37	100.00	1.4800	23.0281	77.2000	8.6	--		Chromium
Cobalt	X	X	11	11	100.00	6.8400	10.9800	18.4000	7.5	--		
Copper	X	3.70E-02	29	24	82.76	3.0400	63.7016	837.0000	19	--		Copper
Lead	X	X	35	25	71.43	3.5100	64.4980	543.0000	45	--		Lead
Manganese	X	2.40E-02	19	15	78.95	152.0000	464.8000	1300.0000	282	--		Manganese
Mercury	X	3.00E-04	35	4	11.43	0.0250	0.0580	0.1380	0.16	--		
Molybdenum	X	5.00E-03	11	2	18.18	7.3400	141.1700	275.0000	4	--		Molybdenum
Nickel	X	2.00E-02	29	16	55.17	9.3700	16.4262	25.8000	34	--		*Nickel*
Selenium	X	5.00E-03	11	0	0.00	12.4000	--[e]	12.4000	--	--		
Silver	X	5.00E-03	11	5	45.45	1.9000	2.9980	4.3900	4	--		Silver
Thallium	X	7.00E-05	11	0	0.00	12.5000	--[e]	12.5000	10	--		
Vanadium	X	7.00E-03	11	11	100.00	4.7800	18.2182	25.8000	16	--		Vanadium
Zinc	X	3.00E-01	37	36	97.30	1.[illegible]000	80.3750	825.0000	24	--		Z[illegible]

TABLE 8

SCREENING OF PRELIMINARY CHEMICALS OF CONCERN - SOILS
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Toxicity Data[b] Sfo (mg/kg/day)$^{-1}$	RfDo (mg/kg/day)	Statistical Data[c] # Samples	# Detections	% Detections	Min (mg/kg)	Mean (mg/kg)	Max (mg/kg)	Background (mg/kg)	Groundwater Contaminant[d]	Other	Preliminary Chemical of Concern
1,1,1-Trichloroethane	X	9.00E-02	10	1	10.00	0.0093	0.0093	0.0093	None	--		1,1,1-Trichloroethane
1,1-Dichloroethane	X	1.00E-01	10	0	0.00	0.0025	--[e]	0.6200	None	--		
1,1-Dichloroethene	6.00E-01	9.00E-03	10	0	0.00	0.0320	--[e]	0.6200	None	--		
Acetone	X	1.00E-01	10	0	0.00	0.0450	--[e]	1.2000	None	--		
Benzene	2.90E-02	X	10	0	0.00	0.0025	--[e]	0.6200	None	--		
Carbon tetrachloride	1.30E-01	7.00E-04	10	0	0.00	0.0031	--[e]	0.6200	None	--		
Chloroform	6.10E-03	1.00E-02	10	0	0.00	0.0026	--[e]	0.6200	None	--		
cis-1,2-Dichloroethene	X	1.00E-02	10	0	0.00	0.0025	--[e]	0.6200	None	--		***cis-1,2-Dichloroethene***
Ethylbenzene	X	1.00E-01	10	0	0.00	0.0025	--[e]	0.6200	None	--		
Methylene chloride	7.50E-03	6.00E-02	10	2	20.00	0.0079	0.0135	0.0190	None	--		Methylene chloride
Methylethyl ketone / 2-Butanone	X	6.00E-01	10	0	0.00	0.0051	--[e]	1.2000	None	--		
Tetrachloroethene	5.20E-02	1.00E-02	10	0	0.00	0.0025	--[e]	0.6200	None	--		
Toluene	X	2.00E-01	10	0	0.00	0.0025	--[e]	0.6200	None	--		
trans-1,2-Dichloroethene	X	2.00E-02	10	0	0.00	0.0025	--[e]	0.6200	None	--		***trans-1,2-Dichloroethene***
Trichloroethene	1.10E-02	6.00E-03	9	1	11.11	0.0032	0.0032	0.0032	None	Unit 1		Trichloroethene
Vinyl chloride (chloroethane)	1.90E+00	X	10	0	0.00	0.0038	--[e]	1.2000	None	--		
Xylenes, total combined	X	2.00E+00	10	0	0.00	0.0075	--[e]	0.6200	None	--		

Notes:

Italicized and bolded entries in the preliminary contaminant of concern column indicate compound failed to satisfy the screening criteria. Compound is included as a TBE compound based on its presence in groundwater or compound is included as PCOC if the level of exceedance is significantly above the screening criteria.

Background concentrations for inorganic constituents were developed using chemical data from soil samples collected outside the boundaries of known source areas.

Background concentrations were not developed for organic constituents. It is assumed that detections of organic compounds are anthropogenic in origin and any detection is a detection above background (non-detect).

Background concentrations for radionuclides obtained from Minnesota Department of Health, Section of Radiation Control and USEPA's Office of Radiation and Indoor Air.

X = Oral slope factor or reference dose not available.

LFC = Lab or field contaminant from historic data where sample blanks cannot be verified.

Footnotes:

a Radionuclides are reported in units of pCi/g. Slope factors reported in units of risk/pCi.

b Toxicity data obtained from IRIS, HEAST, or ECAO Technical Support Center.

c Chemical data obtained from IRDMIS, November 1994.

d Compounds listed in this column are identified as Chemicals of Concern for Operable Unit 2 Groundwater. See associated groundwater tables for screening.

e Constituent minimum and maximum concentrations for those compounds with zero detections are the minimum and maximum method detection limits (MDL) respectively.

f Background for Gross Alpha and Beta derived from background determinations in Site J Closure Report, July 1993.

TABLE 9
COCs and Recommended Remediation Goals
Twin Cities Army Ammunition Plant
Operable Unit 2 Feasibility Study

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Carcinogen (mg/kg)	ARAR/TBC [1] (mg/kg)	Background (mg/kg)	COC	Site Specific Remediation Goal (mg/kg)
Site I							
Cadmium	109	33.1	NA[4]	-	0.7	--	NA[5]
Chromium	262	36000	NA	-	8.6	--	NA
Copper	78.1	39200	NA	-	19	--	NA
Lead	75.2	NA	NA	1200	45	--	NA
Manganese	870	834	NA	-	282	--	NA[5]
Molybdenum	11.7	840	NA	-	4	--	NA
Nickel	43.3	6210	NA	-	34	--	NA
Silver	9.17	1550	NA	-	4	--	NA
Vanadium	46.1	84	NA	-	16	--	NA
Zinc	196	290000	NA	-	24	--	NA
1,1,1-Trichloroethane	0.0042	11100	NA	383	--	--	NA
Acetone	0.1	31100	NA	45	--	--	NA
cis-1,2-Dichloroethene	0.042	1240	NA	22	--	--	NA
Methylene chloride	0.026	8200	51	8	--	--	NA
Methyl ethyl ketone / 2-Butanone	0.015	101000	NA	255	--	--	NA
Trichloroethene	1	743	31.5	19	--	--	NA

TBE [3] Compounds

Cadmium
Manganese
1,1-Dichloroethene
Tetrachloroethene
Vinyl chloride (chloroethane)
1,1,2-Trichloroethane
Trichloroethene

TABLE 9
COCs and Recommended Remediation Goals
Twin Cities Army Ammunition Plant
Operable Unit 2 Feasibility Study

Constituent	Maximum Soil Concentration (mg/kg)	Preliminary Remediation Goals Noncarcinogen (mg/kg)	Carcinogen (mg/kg)	ARAR/TBC [1] (mg/kg)	Background (mg/kg)	COC	Site Specific Remediation Goal (mg/kg)
Site K							
Cadmium	34.8	33.1	NA	-	0.7	--	NA[5]
Chromium	77.2	36000	NA	-	8.6	--	NA
Copper	837	42400	NA	-	19	--	NA
Cyanide	4.47	9550	NA	-	--	--	NA
Lead	543	NA	NA	1200	45	--	NA
Manganese	1300	834	NA	-	282	--	NA[5]
Molybdenum	275	840	NA	-	4	--	NA
Silver	4.39	1550	NA	-	4	--	NA
Vanadium	25.8	84	NA	-	16	--	NA
Zinc	825	290000	NA	-	24	--	NA
1,1,1-Trichloroethane	0.0093	11100	NA	-	--	--	NA
Methylene chloride	0.019	8200	25.5	0.4	--	--	NA
Trichloroethene	0.0032	743	15.8	1	--	--	NA

TBE [3] Compounds

Cadmium
Manganese
Lead
Nickel
Zinc
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
Trichloroethene

Notes:
ARAR/TBC [1] Clean-up goals for Lead and PCBs are based on Health Standards; All other goals based on groundwater protection from leaching
PRG [2]- Preliminary Remediation Goals
TBE [3] - To Be Evaluated: TBE Compounds were not included in PRG calculations; these compounds will be considered during remedial actions.
NA [4] - Not Applicable
[5] - Cadmium and manganese are TBEs because they each have a single anomalous detection above the PRG.

TABLE 10

SCREENING OF CHEMICALS OF CONCERN - UNIT 1 GROUNDWATER
TCAAP OU-2 FEASIBILITY STUDY

Constituent	Constituent Statistics a: Number of Samples	Number of Detections	% Detections	Min (ug/l)	Mean (ug/l)	Max (ug/l)	Comparison to TCAAP Background: Background (ug/l)	Number Above Background	% Above Background	Applicable Requirements	Relevant and Appropriate Requirements: Federal MCL[b] (ug/l)	Federal MCLG[c] (ug/l)	Minnesota MCL[d] (ug/l)	Minnesota SMCL[e] (ug/l)	Minnesota HRL[f] (ug/l)	Action Levels[g] (ug/l)	TBC: Health Advisories[h] (ug/l)	Engineering Evaluation	Chemical of Concern
Site I																			
Antimony	5	0	0.00	2.00	--[i]	37.10	<10	0	0.00	--	6.0	6.0	6.0	--	6.0	--	3.0		
Arsenic	8	1	12.50	8.00	8.00	8.00	6.80	1	12.50	--	50*	--	50.0	--	--	--	--		
Barium	7	7	100.00	22.20	99.84	220.00	240.00	0	0.00	--	2,000.0	2,000.0	2000.0	--	2,000.0	--	2,000.0		
Beryllium	5	1	20.00	1.20	1.20	1.20	<1.5	0	0.00	--	4.0	4.0	4.0	--	0.08	--	--		
Cadmium	7	0	0.00	0.20	--[i]	5.00	0.90	0	0.00	--	5.0	5.0	5.0	--	4.0	--	5.0		
Chromium	7	2	28.57	3.06	14.03	25.00	3.80	1	14.29	--	100.0	100.0	100.0	--	100**	--	100.0		
Cobalt	6	0	0.00	2.00	--[i]	25.00	0.50	0	0.00	--	--	--	--	--	--	--	30.0		
Copper	7	3	42.86	5.00	23.45	60.00	4.50	3	42.86	--	--	1,300.0	--	1000.0	--	1,300.0	--		
Lead	7	1	10.00	5.00	5.00	5.00	4.20	1	14.29	--	--	0.0	15.0	--	--	15.0	--		
Manganese	7	4	57.14	6.02	399.86	1,500.00	7,500.00	0	0.00	--	--	--	--	50.0	100.0	--	--		
Mercury	8	0	0.00	0.20	--[i]	0.74	0.36	0	0.00	--	2.0	2.0	2.0	--	--	--	2.0		
Molybdenum	3	0	0.00	30.90	--[i]	30.90	--	--	--	--	--	--	--	--	--	40.0	40.0		
Nickel	6	1	16.67	164.00	164.00	164.00	15.00	1	16.67	--	100.0	100.0	100.0	--	100.0	--	100.0	DC	*Nickel*
Selenium	5	0	0.00	5.00	--[i]	75.00	1.00	0	0.00	--	50.0	50.0	50.0	--	30.0	--	--		
Silver	6	1	16.67	1.16	1.16	1.16	4.10	0	0.00	--	--	--	--	100.0	30.0	--	100.0		
Thallium	4	0	0.00	0.28	--[i]	100.00	4.00	0	0.00	--	2.0	0.5	2.0	--	0.6	--	0.4		
Vanadium	6	0	0.00	20.00	--[i]	20.00	<20	0	0.00	--	--	--	--	--	50.0	--	--		
Zinc	7	2	28.57	22.40	46.20	70.00	36.00	1	14.29	--	--	--	--	5000.0	2,000.0	--	2,000.0		
1,1,1-Trichloroethane	36	14	38.89	1.04	5.68	22.00	None	--	--	--	200.0	200.0	200.0	--	600.0	--	200.0		
1,1,2,2-Tetrachloroethane	10	0	0.00	1.20	--[i]	5.00	None	--	--	--	--	--	--	--	2.0	--	70.0		
1,1,2-Trichloro-1,2,2-trifluoroethane	13	0	0.00	1.00	--[i]	5.00	None	--	--	--	--	--	--	--	200,000.0	--	--		
1,1,2-Trichloroethane	37	0	0.00	0.99	--[i]	25.00	None	--	--	--	5.0	3.0	5.0	--	3.0	--	3.0		
1,1-Dichloroethane	23	3	13.04	4.99	8.26	14.00	None	--	--	--	--	--	--	--	70.0	--	--		
1,1-Dichloroethene	37	1	2.70	2.96	2.96	2.96	None	--	--	--	7.0	7.0	7.0	--	6.0	--	7.0		
1,2-Dichloroethane	34	1	2.94	1.42	1.42	1.42	None	--	--	--	5.0	0.0	5.0	--	4.0	--	--		
1,2-Dichloroethenes (cis and trans)	27	12	44.44	1.25	187.86	430.00	None	--	--	--	--	--	--	--	70.0	--	--		1,2-Dichloroethenes (cis and trans)
1,2-Dichloropropane	37	0	0.00	0.62	--[i]	16.00	None	--	--	--	5.0	0.0	5.0	--	5.0	--	--		
Acetone	5	0	0.00	1.00	--[i]	50.00	None	--	--	--	--	--	--	--	700.0	--	--		
Benzene	24	0	0.00	0.41	--[i]	77.00	None	--	--	--	5.0	0.0	5.0	--	10.0	--	--		
Bromomethane	10	0	0.00	5.00	--[i]	10.00	None	--	--	--	--	--	--	--	10.0	--	10.0		
Carbon tetrachloride	23	0	0.00	1.30	--[i]	6.50	None	--	--	--	5.0	0.0	5.0	--	3.0	--	--		
Chloroform	37	0	0.00	0.41	--[i]	10.00	None	--	--	--	100/80[k]	--	100/80[k]	--	60.0	--	--		
cis-1,2-Dichloroethene	10	2	20.00	2.50	2.75	3.00	None	--	--	--	70.0	70.0	70.0	--	70.0	--	70.0		
Ethylbenzene	10	0	0.00	1.00	--[i]	5.00	None	--	--	--	700.0	700.0	700.0	--	700.0	--	700.0		
Methylene chloride	23	0	0.00	3.20	--[i]	16.00	None	--	--	--	5.0	0.0	5.0	--	50.0	--	--		
Methylethyl ketone / 2-Butanone	10	0	0.00	5.00	--[i]	10.00	None	--	--	--	--	--	--	--	4,000.0	--	--		
PCB 1242	5	0	0.00	0.10	--[i]	1.30	None	--	--	--	0.5	0.0	--	--	0.04	--	--		
PCB 1248	5	0	0.00	0.10	--[i]	1.30	None	--	--	--	0.5	0.0	--	--	0.04	--	--		
Tetrachloroethene	37	0	0.00	0.88	--[i]	22.00	None	--	--	--	5.0	0.0	5.0	--	7.0	--	--		
Toluene	24	2	8.33	1.24	14.37	27.50	None	--	--	--	1,000.0	1,000.0	1000.0	--	1,000.0	--	1,000.0		
trans-1,2-Dichloroethene	20	1	5.00	13.00	13.00	13.00	None	--	--	--	100.0	100.0	100.0	--	100.0	--	100.0		
Trichloroethene	35	20	57.14	0.76	14.51	77.00	None	--	--	--	5.0	0.0	5.0	--	30.0	--	–		Trichloroethene
Vinyl chloride (chloroethane)	37	5	13.51	3.58	9.00	18.00	None	--	--	--	2.0	0.0	2.0	--	0.2	--	--		Vinyl chloride (chloroethane)
Xylenes, total combined	22	0	0.00	1.17	--[i]	29.00	None	--	--	--	10,000.0	10,000.0	10000.0	--	10,000.0	--	10,000.0		
Site K																			
Cyanide	5	0	0.00	8.17	--[i]	8.35	--	--	--	--	200.0	200.0	200.0	--	100.0	--	200.0		
Antimony	16	0	0.00	2.00	--[i]	37.10	<10	0	0.00	--	6.0	6.0	6.0	--	6.0	--	3.0		
Arsenic	21	5	23.81	7.73	14.52	20.60	6.80	5	23.81	--	50*	--	50.0	--	--	--	--		
Barium	21	20	95.24	37.30	201.32	361.00	240.00	9	42.86	--	2,000.0	2,000.0	2,000.0	--	2,000.0	--	2000.0		
Beryllium	16	0	0.00	0.08	--[i]	4.00	<1.5	0	0.00	--	4.0	4.0	4.0	--	0.08	--	--		
Cadmium	21	4	15.38	0.20	0.33	0.46	0.90	0	0.00	--	5.0	5.0	5.0	--	4.0	--	5.0		
Chromium	21	5	23.81	2.53	9.64	32.00	3.80	3	14.29	--	100.0	100.0	100.0	--	100*	--	100.0		
Cobalt	14	1	7.14	2.80	2.80	2.80	0.50	1	7.14	--	--	--	--	--	--	--	30.0		
Copper	16	6	37.50	1.53	5.87	14.80	4.50	2	12.50	--	--	1,300.0	--	1,000.0	--	1,300.0	--		
Lead	21	2	6.90	3.57	4.34	5.10	4.20	1	4.76	--	--	0.0	15.0	--	--	15.0	--		*Lead*
Manganese	16	15	93.75	42.20	1,162.32	4,500.00	7,500.00	0	0.00	--	--	--	--	50.0	100.0	--	--		

TABLE 10

SCREENING OF CHEMICALS OF CONCERN - UNIT 1 GROUNDWATER
TCAAP OU-2 FEASIBILITY STUDY

	Constituent Statistics a						Comparison to TCAAP Background			Applicable Requirements	Relevant and Appropriate Requirements						TBC	Engineering Evaluation	
Constituent	Number of Samples	Number of Detections	% Detections	Min (ug/l)	Mean (ug/l)	Max (ug/l)	Background (ug/l)	Number Above Background	% Above Background		Federal MCL[b] (ug/l)	Federal MCLG[c] (ug/l)	Minnesota MCL[d] (ug/l)	Minnesota SMCL[e] (ug/l)	Minnesota HRL[f] (ug/l)	Action Levels[g] (ug/l)	Health Advisories[h] (ug/l)		Chemical of Concern
Mercury	20	0	0.00	0.20	--[i]	0.74	0.36	0	0.00	--	2.0	2.0	2.0	--	--	--	2.0		
Molybdenum	8	0	0.00	30.90	--[i]	30.90	--	--	--	--	--	--	--	--	--	40.0	40.0		
Nickel	21	5	23.81	6.73	*59.86*	*178.00*	15.00	2	9.52	--	100.0	100.0	100.0	--	100.0	--	100.0	DC	***Nickel***
Selenium	19	0	0.00	3.06	--[i]	75.00	1.00	0	0.00	--	50.0	50.0	50.0	--	30.0	--	--		
Silver	15	1	6.67	0.62	0.62	0.62	4.10	0	0.00	--	--	--	--	100.0	30.0	--	100.0		
Thallium	16	0	0.00	0.28	--[i]	100.00	4.00	0	0.00	--	2.0	0.5	2.0	--	0.6	--	0.4		
Vanadium	11	1	9.09	10.00	10.00	10.00	<20	0	0.00	--	--	--	--	--	50.0	--	--		
Zinc	23	17	73.91	13.20	166.54	1,440.00	36.00	6	26.09	--	--	--	--	5,000.0	2,000.0	--	2000.0		*Zinc*
1,1,1-Trichloroethane	70	0	0.00	0.81	--[i]	5,000.00	None	--	--	--	200.0	200.0	200.0	--	600.0	--	200.0		
1,1,2,2-Tetrachloroethane	14	0	0.00	1.20	--[i]	5.00	None	--	--	--	--	--	--	--	2.0	--	70.0		
1,1,2-Trichloro-1,2,2-trifluoroethane	41	6	14.63	4.91	16.33	42.50	None	--	--	--	--	--	--	--	200,000.0	--	--		
1,1,2-Trichloroethane	70	0	0.00	0.99	--[i]	5,000.00	None	--	--	--	5.0	3.0	5.0	--	3.0	--	3.0		
1,1-Dichloroethane	53	8	15.09	0.85	3.62	7.70	None	--	--	--	--	--	--	--	70.0	--	--		
1,1-Dichloroethene	70	0	0.00	0.49	--[i]	5,000.00	None	--	--	--	7.0	7.0	7.0	--	6.0	--	7.0		
1,2-Dichloroethane	70	2	2.86	0.27	0.38	0.48	None	--	--	--	5.0	0.0	5.0	--	4.0	--	--		
1,2-Dichloroethenes (cis and trans)	56	35	62.50	0.59	260.25	3,900.00	None	--	--	--	--	--	--	--	70.0	--	--		1,2-Dichloroethenes (cis and trans)
1,2-Dichloropropane	70	0	0.00	0.62	--[i]	5,000.00	None	--	--	--	5.0	0.0	5.0	--	5.0	--	--		
Acetone	13	0	0.00	10.00	--[i]	50.00	None	--	--	--	--	--	--	--	700.0	--	--		
Benzene	34	0	0.00	0.41	--[i]	15,000.00	None	--	--	--	5.0	0.0	5.0	--	10.0	--	--		
Bromomethane	14	0	0.00	5.00	--[i]	10.00	None	--	--	--	--	--	--	--	10.0	--	10.0		
Carbon tetrachloride	55	0	0.00	1.10	--[i]	6,500.00	None	--	--	--	5.0	0.0	5.0	--	3.0	--	--		
Chloroform	70	0	0.00	0.41	--[i]	3,600.00	None	--	--	--	100/80[k]	--	100/80[k]	--	60.0	--	--		
cis-1,2-Dichloroethene	14	2	14.29	0.60	0.65	0.70	None	--	--	--	70.0	70.0	70.0	--	70.0	--	70.0		
Ethylbenzene	14	0	0.00	1.00	--[i]	5.00	None	--	--	--	700.0	700.0	700.0	--	700.0	--	700.0		
Methylene chloride	55	0	0.00	1.80	--[i]	16,000.00	None	--	--	--	5.0	0.0	5.0	--	50.0	--	--		
Methylethyl ketone / 2-Butanone	14	0	0.00	5.00	--[i]	10.00	None	--	--	--	--	--	--	--	4,000.0	--	--		
Styrene	14	0	0.00	1.00	--[i]	5.00	None	--	--	--	100.0	100.0	100.0	--	10.0	--	100.0		
Tetrachloroethene	70	0	0.00	0.88	--[i]	5,000.00	None	--	--	--	5.0	0.0	5.0	--	7.0	--	--		
Toluene	34	1	2.94	17.10	17.10	17.10	None	--	--	--	1,000.0	1,000.0	1,000.0	--	1,000.0	--	1000.0		
trans-1,2-Dichloroethene	50	4	8.00	0.45	20.90	80.00	None	--	--	--	100.0	100.0	100.0	--	100.0	--	100.0		
Trichloroethene	68	29	42.65	0.93	20,871.52	200,000.00	None	--	--	--	5.0	0.0	5.0	--	30.0	--	--		Trichloroethene
Vinyl chloride (chloroethane)	70	0	0.00	1.00	--[i]	9,500.00	None	--	--	--	2.0	0.0	2.0	--	0.2	--	--		
Xylenes, total combined	32	1	3.13	22.80	22.80	22.80	None	--	--	--	10,000.0	10,000.0	10,000.0	--	10,000.0	--	10000.0		

Notes:

Italicized and bolded entries in chemical of concern column indicate compound included as a TBB. Nickel included as TBB based on inconsistant data.

Lead and zinc are included as TBB for Site K based on additivity in monitoring well 01U604 on December 7, 1987.

Background concentrations for inorganic constituents were developed using chemical data from wells outside the boundaries and upgradient of known source areas.

Background concentrations were not developed for organic constituents. It is assumed that detections of organic compounds are arthropogenic in origin and any detection is a detection above background (non-detect).

None = Background concentrations are not available for these constituents since they are either organic compounds or cyanide which is treated similar to organic compounds.

DC = Compound has not historically been detected consistently from one sampling round to another.

DC* = Samples with highest detections for this compound were unfiltered and therefore the IRDMIS results may not be representative of true contaminant concentrations. All other sample detections are below ARARs.

Footnotes:

a Data used for statistical analysis obtained from IRDMIS, November 1994.

b Federal MCLs are the current federal maximum contaminant levels for drinking water as established under the Safe Drinking Water Act (40 CFR Part 141)

c Federal MCLGs are the current federal maximum contaminant level goals for drinking water as established under the Safe Drinking Water Act (40 CFR Part 141)

d Minnesota MCLs are the current state maximum contaminant levels for drinking water as established in the Minnesota Rules Chapter 4720

e Minnesota SMCLs are the current state secondary maximum contaminant levels for drinking water as established in the Minnesota Rules Chapter 4720

f Minnesota HRLs are the state health risk limits for substances found to degrade Minnesota groundwater as established in Minnesota Rules Chapter 4717

g The action levels for lead and copper were promulgated under the Safe Drinking Water Act; the state of Minnesota has also adopted these as MCLs

h Health Advisories are the federal lifetime advisories from the USEPA Office of Water (November 1994). The Health Advisory for Cobalt is a state advisory level established by the Minnesota Department of Health.

i Constituent minimum and maximum concentrations for those compounds with zero detections are the minimum and maximum method detection limits (MDL) respectively.

k: 100 ug/l is current MCL. Total for all trihalomethanes combined cannot exceed 80 ug/l level.

* The value for arsenic is a National Interim Primary Drinking Water Regulation MCL. According to EPA's regulatory agenda, EPA plans to propose a revised MCL in November 1995 with a final rule expected November 1997.

** The HRL shown is for chromium VI, not for total chromium

APPENDIX C-4

USEPA EXPOSURE MODEL
FOR
ASSESSING RISKS ASSOCIATED WITH
ADULT EXPOSURES TO LEAD
IN SOIL

TWIN CITIES ARMY AMMUNITION PLANT

Attachment 1

to

U.S. EPA Comments on the Operable Unit 2 Feasibility Study Twin Cities Army Ammunition Plant, July 1996

A Slope Factor Approach and Exposure Model for Assessing Risks Associated with Adult Exposures to Lead in Soil

U.S. EPA's Technical Review Workgroup (TRW) for Lead has been evaluating methodologies for assessing risks associated with non-residential adult exposure to lead at NPL sites since 1994. Although U.S. EPA has not yet sanctioned a particular methodology, the TRW has recently developed an approach which is conceptually similar to a slope factor approach for deriving risk-based remediation goals. This approach has subsequently been used at several other sites within and outside EPA Region 5 as a basis for determining industrial lead cleanup levels. The approach assumes a pregnant female worker as a receptor and impacts on the developing fetus.

The approach utilizes a biokinetic slope factor to relate soil lead intake to blood lead concentrations in adults. The basis for the risk-based remediation goal (RBRG) calculation is the following algorithm which relates soil concentration to blood lead concentration (PbB) in the developing fetus:

$$PbB_{95th}fetal = R*GSD_i^{1.645}*\left[\frac{(PbS*BKSF*IR_s*AF_s*EF_s)}{AT}+PbB_0\right]$$

where:

$PbB_{95th}fetal$ = 95th percentile PbB of the fetus in a population of pregnant women exposed to lead-contaminated soil (μg/dl),

R = Mean ration of fetal to maternal PbB (unitless);

GSD_i = Individual geometric standard deviation of PbB among a population of pregnant women or women of child-bearing age exposed to lead-contaminated soil (unitless),

PbS = Estimated soil lead concentration (μg/g);

BKSF = Biokinetic slope factor (μg/dl increase in PbB per μg/day lead absorbed);

IR_s = Mean daily intake rate of soil (g/day);

AF_s = Absolute absorption factor (bioavailability of lead in soil (unitless);

EF_a = Exposure frequency for adult workers (days),

PbB_0 = Geometric mean PbB in women of child-bearing age not exposed to lead-contaminated sil and dust from occupational or recreational activities at the site (µg/dl),

AT = Averaging time (days)

Rearranging the above equation, a protective soil lead concentration, given a specific exposure scenario, may be calculated, as follows:

$$PbS = \frac{[(PbB_{95th}fetal)-PbB_0/R*GSD_i^{1.645}]*AT}{(BKSF*IR_s*AF_s*EF_s)}$$

Recommended default values for each of the parameters in the above equations are as follows (Default values are intended to be generic and are applied to specific sites only when high quality site-specific data are not available):

Parameter	Unit	Value	Comment
$PbB_{95th}fetal$	µg/dl	10	For estimating RBRGs based upon risk to developing fetus.
GSD_i	µg/dl	1.8 2.1	Valued of 1.8 is recommended for more homogeneous population while 2.1 is recommended for diverse, urban populations, as can be supported by site-specific characteristics of the exposed population.
R	--	0.9	Based upon published literature.
PbB_0	µg/dl	1.7 - 2.2	Plausible range based upon Phase 1 of the Third National Health and Nutrition Examination Survey for Mexican-American and non-Hispanic black, and white women of child-bearing age. Point estimate should be selected based upon site-specific demographics.
BKSF	µg/dl// µg/dy	0.4	Based upon published literature.
IR_s	mg/dy	50	Non-contact intensive (e.g., predominantly indoors) occupational exposures
EF_s	dy/yr	250	Minimum is 1/wk over a minimum duration of 90 days.
AF_s	--	0.12	Based upon an absorption factor for soluble lead of 0.20 and a relative bioavailability of 0.6 (soluble/soil).

Based upon U.S. EPA Region 5 Geographic Information System (GIS) demographic information, the communities around TCAAP, up to a five mile radius, can be classified as having a homogenous population. Thus a **GSD$_i$** value of **1.8** is appropriate. Site-specific values for PbB_0 are not available. However, the range of acceptable PbS values may be bracketed by calculating PbS using both the low and the high end values for PbB_0.

Setting **PbB_0 at 1.8** (low end), the calculated cleanup level for lead, under the industrial use scenario is **1536 parts per million (ppm)**.

Setting **PbB_0 at 2.2** (high end), the calculated cleanup level for lead, under the industrial use scenario, is **1232 ppm**.

Given the lack of site-specific PbB_0 values, the more protective value for soil lead, 1232 ppm, is the preferred lead cleanup criterion for TCAAP soils under the industrial use scenario.

Appendix D

MONTGOMERY WATSON

APPENDIX D

OPERABLE UNIT 2
DETAILED COST ESTIMATES

TWIN CITIES ARMY AMMUNITION PLANT

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE A - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
	TOTAL CAPITAL COSTS			$0
O&M COSTS (30 YR)				
Long Term Monitoring	1	ls	$1,536	$1,500
Analysis				
Metals (reg TAT)	24	ea	$350	$8,400
VOCs (reg TAT)	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
	TOTAL O & M COSTS			$13,800
	PRESENT WORTH OF O&M COSTS			$171,100
FUTURE COSTS (30 YR)				
Five Year Site Review	1	ls	$10,000.00	$10,000
	TOTAL FUTURE COSTS			$10,000
	PRESENT WORTH OF FUTURE COSTS			$21,600
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$192,700

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE A - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Comments
CAPITAL COSTS	No capital costs associated with this alternative
O&M COSTS (30 YR)	
Long Term Monitoring	Assume Assoc. Engineer labor, 10 samples per day, quarterly monitoring (Source: Montgomery Watson Estimate)
Analysis	
Metals (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
VOCs (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
Reporting	Assume 16 hrs Assoc Level, 2 hrs Prof Level, 2 Hrs WP, 10% ODCs (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
Five Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate) 5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE A - ALTERNATIVE 2
SHALLOW SOIL
IN-SITU FIXATION AND CAPPING

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	3	mo	$400	$1,200
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	1.05	acre	$2,200	$2,300
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	1.05	acre	$6,500	$6,800
Field Characterization and Screening	1	ls	$164,800	$164,800
CONTAINMENT				
In-Situ Stabilization Bench-Scale Test	1	ls	$50,000	$50,000
Mobilization of In-Situ Stabilization Equ.	1	ls	$27,000	$27,000
In-Situ Stabilization	1400	bcy	$100	$140,000
Confirmation Sampling	28	ea	$355	$9,900
Construct Cap over AOC	1.05	acre	$124,580	$131,200
POST CONSTRUCTION				
Construct Fence	3,720	lf	$13	$48,400
	Total Construction Costs			**$639,700**
Engineering & Design (8% of CC)				$51,200
Permitting & Legal (12% of CC)				$76,800
Services During Construction (8% of CC)				$51,200
	Total Engineering and Construction Costs			$818,900
Contingency (10% of ECC)				$81,900
	Subtotal Capital Costs			$900,800
Contingency for Unknowns (30% of SCC)				$270,200
	TOTAL CAPITAL COSTS			$1,171,000
O&M COSTS (30 YR)				
AOC Cap Maintenance	1.05	acre	$500	$500
Long Term Monitoring	1	ls	$13,800	$13,800
	TOTAL O&M COSTS			$14,300
	PRESENT WORTH OF O&M COSTS			$177,300
FUTURE COSTS (30 YR)				
5-Year Review	1	ls	$10,000	$10,000
5-Year Re-Landscape Area	1.05	ls	$14,735	$15,500
	TOTAL FUTURE COSTS			$25,500
	PRESENT WORTH OF FUTURE COSTS			$55,000
30-YEAR TOTAL PRESENT WORTH				$1,403,300

NOTES: VOLUME OF CONTAMINATED AREA (bcy) 1400
AREA OF SITE (acres) 0.88
DISCOUNT RATE 7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE A - ALTERNATIVE 2
SHALLOW SOIL
***IN-SITU* FIXATION AND CAPPING**

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Asphalt PML Pad (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
CONTAINMENT	
In-Situ Stabilization Bench-Scale Test	Source: Vendor Estimate
Mobilization of In-Situ Stabilization Equ.	Source: RACER Estimate
In-Situ Stabilization	Assume stabilization of entire AOC. (Source: RACER)
Confirmation Sampling	Collect one samples/50 cy stabilized: Analysis for compressive strength/compaction ($155) and TCLP ($200) (Source: RACER)
Construct Cap over AOC	Construction of a MSW Cap over entire AOC + 20% overlap. (Source: RACER)
POST CONSTRUCTION	
Construct Fence	Assume a 6' chain link, galv steel, perimeter fence (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
O&M COSTS (30 YR)	
AOC Cap Maintenance	Mowing 12 times/year and Fertilizing 1/year. (Source: RACER)
Long Term Monitoring	Quarterly monitoring of 5-wells plus one QA/QC sample collected each quarter (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate)
5-Year Re-Landscape Area	Re-landscaping to divert stormwater around site. Price includes installation of erosion control measures, re-grading and resodding site
	5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES: VOLUME OF CONTAMINATED AREA (bcy)	1400
AREA OF SITE (acres)	0.88
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE A - ALTERNATIVE 3
SHALLOW SOIL
SOIL WASHING/SOIL LEACHING

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	6	mo	$400	$2,400
Decontamination Facility	1	ls	$44,000	$44,000
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	1.05	acre	$2,200	$2,300
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	1.05	acre	$6,500	$6,800
Soil Excavation and Backfill	1,400	bcy	$9.00	$12,600
UXO Oversight During Excavation	14	wk	$2,000	$28,800
Field Characterization and Screening	1	ls	$192,500	$192,500
Sampling and Analysis of Buried Debris	2,100	ton	$1.10	$2,300
Disposal Misc Buried Debris	21	ton	$3,350	$70,400
INORGANIC TREATMENT				
Bench Scale Study	1	ls	$139,000	$139,000
Ordnance Screening	5	mo	$52,800	$285,100
Mobilization of Soil Washing/Leaching Equ.	1	ls	$116,000	$116,000
Treatment by Soil Washing/Leaching	2,079	ton	$85	$176,700
Recovered Metals Recycling	62	drum	$292	$18,200
TCLP Sampling of Treated Soil	63	ea	$200	$12,600
On-Site Stabilization of Soil Failing TCLP	294	ton	$40	$11,800
Off-Site Disposal of Soil Failing TCLP	323	ton	$80	$25,900
Additional Fill Material	263	cy	$4.00	$1,100
	Total Construction Costs			**$1,170,100**
Engineering & Design (8% of CC)				$93,600
Permitting & Legal (12% of CC)				$140,400
Services During Construction (8% of CC)				$93,600
	Total Engineering and Construction Costs			$1,497,700
Contingency (10% of ECC)				$149,800
	Subtotal Capital Costs			$1,647,500
Contingency for Unknowns (30% of SCC)				$494,300
	TOTAL CAPITAL COSTS			$2,141,800
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$13,831	$13,800
	TOTAL FUTURE COSTS			$23,800
	PRESENT WORTH OF FUTURE COSTS			$17,000
30-YEAR TOTAL PRESENT WORTH				$2,158,800

NOTES: VOLUME OF CONTAMINATED AREA (bcy) 1400
AREA OF SITE (acres) 0.88
DISCOUNT RATE 7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE A - ALTERNATIVE 3
SHALLOW SOIL
SOIL WASHING/SOIL LEACHING

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Asphalt PML Pad capable of withstanding increased load from soil washing system for extended period of time (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft² grid with minimum of 75 samples collected (Source: Vendor Quote)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Estimate based on weight of soil excavated (Source: Site F Experience)
Disposal Misc Buried Debris	Disposal costs for material other than soil (misc. material). Assume 1% of excavated weight is misc. material (Source: Site F Experience)
INORGANIC TREATMENT	
Bench Scale Study	Source: Vendor Estimate
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of the entire project duration. (Source: 1995 Means)
Mobilization of Soil Washing/Leaching Equ.	Assumes 50,000 tons can be treated in one year (6mo * 30 ton/hr * 10 hr/day) (Source: Vendor Estimate)
Treatment by Soil Washing/Leaching	Assumes 99% of AOC is treated [Treated Vol[illegible] *99% * 1.5] (Source: Vendor Estimate)
Recovered Metals Recycling	Assumes weight of recovered metals is 3% of treated soil, by weight. [Treated Vol[illegible] * 0.03 = Treated Vol[illegible]] (Source: Site F Experience)
TCLP Sampling of Treated Soil	One sample per 33 tons of processed material [Treated Vol/33]. Price covers analysis for RCRA metals. (Source: Vendor Estimate)
On-Site Stabilization of Soil Failing TCLP	Assumes 14% of soil volume is untreatable by soil washing/leaching. [Vol_AOC[illegible] * 0.14 * 1.5ton/cy] {Sources: Volume Estimate from Site F Experience - - Stabilization Price from Vendor}
Off-Site Disposal of Soil Failing TCLP	Assumes 10% Bulking From Stabilization. Cost includes Disposal and Trans to USPCI MICF Landfill (Source: Vendor Estimate)
Additional Fill Material	15% of AOCvol (14% Soil + 1% Misc Mat.) will be unclassified fill from off-site source. [VOL_AOC[illegible] * 0.15] (Source: RACER) Assumes treated soil from soil washing/leaching (85%) will be backfilled on site
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES: VOLUME OF CONTAMINATED AREA (bcy)	1400
AREA OF SITE (acres)	0.88
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE A - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/ON-SITE STABILIZATION/
OFF-SITE DISPOSAL

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	3	mo	$400	$1,200
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	1.05	acre	$2,200	$2,300
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	1.05	acre	$6,500	$6,800
AOC Soil Excavation and Backfill	1,400	bcy	$9.00	$12,600
UXO Oversight During Excavation	9	wk	$2,000	$18,000
Field Characterization and Screening	1	ls	$158,700	$158,700
Off-Site Fill	1,750	cy	$4.00	$7,000
DISPOSAL (NON-DIOXIN CONTAMINATED MATERIAL)				
Ordnance Screening	3	mo	$52,800	$142,600
TCLP Testing	14	ea	$200	$2,800
On-Site Stabilization	2,079	ton	$40	$83,200
Disposal of Stabilized Material	2,287	ton	$80	$183,000
Sampling and Analysis of Buried Debris	2,100	ton	$1.10	$2,300
Disposal Buried Debris	21	ton	$3,350	$70,400
	Total Construction Costs			**$749,000**
Engineering & Design (8% of CC)				$59,900
Permitting & Legal (12% of CC)				$89,900
Services During Construction (8% of CC)				$59,900
	Total Engineering and Construction Costs			$958,700
Contingency (10% of ECC)				$95,900
	Subtotal Capital Costs			$1,054,600
Contingency for Unknowns (30% of SCC)				$316,400
	TOTAL CAPITAL COSTS			$1,371,000
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$13,836	$13,800
	TOTAL FUTURE COSTS			$23,800
	PRESENT WORTH OF FUTURE COSTS			$17,000
30-YEAR TOTAL PRESENT WORTH				$1,388,000

NOTES

VOLUME OF CONTAMINATED AREA (bcy)	1400
AREA OF SITE (acres)	0.88
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE A - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/ON-SITE STABILIZATION/
OFF-SITE DISPOSAL

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Construction of Asphalt PML Pad (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
AOC Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
Off-Site Fill	Unclassified fill from off-site source. Assumes 25% Bulking Factor. [AOC_{bcy} * 1.25 = AOC_{cy}] (Source: RACER)
DISPOSAL (NON-DIOXIN CONTAMINATED MATERIAL)	
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of project duration. (Source: 1995 Means)
TCLP Testing	One sample per 100 tons of excavated soil. Price covers analysis for RCRA metals (Source: Vendor Estimate)
On-Site Stabilization	Assumes 99% of excavated volume requires stabilization. [AOC_{bcy} * 0.99 * 1.5ton/bcy = AOC_{tons}] (Source: Vendor Est.)
Disposal of Stabilized Material	Assumes 10% Bulking From Stabilization. Cost includes Disposal and Trans to USPCI MICF Landfill (Source Vendor Est.)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Based on weight of soil excavated (Source: Site F Exp.)
Disposal Buried Debris	Disposal costs for material other than soil (misc. material). 1% of excavated weight is misc. material (Source: Site F Exp.)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Costs
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	

NOTES

VOLUME OF CONTAMINATED AREA (bcy)	1400
AREA OF SITE (acres)	0.88
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE A
DUMP
REMOVAL ASSUMING 100%
CONSTRUCTION DEBRIS

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	6	mo	$400	$2,400
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Decontamination	1	ls	$500	$500
SITE WORK				
Site Clearing	0.54	acre	$2,200	$1,200
Soil Excavation and Backfill	4,400	bcy	$9.00	$39,600
UXO Oversight During Excavation	17	wk	$2,000	$33,600
TCLP Sampling	44	ea	$550	$24,200
Disposal of Construction Debris	6,600	ton	$20	$131,100
Additional Fill Material	5,500	cy	$4.00	$22,000
	Total Construction Costs			$264,600
Engineering & Design (8% of CC)				$21,200
Permitting & Legal (12% of CC)				$31,800
Services During Construction (8% of CC)				$21,200
	Total Engineering and Construction Costs			$338,800
Contingency (10% of ECC)				$33,900
	Subtotal Capital Costs			$372,700
Contingency for Unknowns (30% of SCC)				$111,800
	TOTAL CAPITAL COSTS			$484,500
30-YEAR TOTAL PRESENT WORTH	Discount Rate = 7%			$484,500

NOTES

VOLUME OF DUMP (bcy)	4,400
AREA OF DUMP (acres)	0.45

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE A
DUMP
REMOVAL ASSUMING 100%
CONSTRUCTION DEBRIS

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source: 1995 Means)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Decontamination	Use of pressure washer; Assumes decon facility constructed for soil site can be used (Source: 1995 Means)
SITE WORK	
Site Clearing	Assume 120% of site cleared (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 70% of project duration to oversee excavation (Source: RACER)
TCLP Sampling	Sample collected every 100 tons. Price covers analysis for RCRA Metals and VOCs (Source: Vendor Estimate)
Disposal of Construction Debris	Assumes material is transported/disposed in a Sub D landfill in Elk River, MN without additional treatment. (Source: Vendor Est.)
Additional Fill Material	Backfill dump with unclassified fill from off-site source. 25% Bulking Factor [LFVol bcy * 1.25 = LFVol cy] (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal Capital Cost
30-YEAR TOTAL PRESENT WORTH	
NOTES	
VOLUME OF DUMP (bcy)	4,400
AREA OF DUMP (acres)	0.45

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE A
DUMP
REMOVAL ASSUMING 100%
HAZARDOUS WASTE

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	6	mo	$400	$2,400
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Decontamination	1	ls	$500	$500
SITE WORK				
Site Clearing	0.54	acre	$2,200	$1,200
Soil Excavation and Backfill	4,400	bcy	$9.00	$39,600
UXO Oversight During Excavation	17	wk	$2,000	$33,600
Material Segregation	24	wk	$4,100	$98,400
TCLP Sampling	44	ea	$550	$24,200
On-Site Stabilization of Hazardous Materials	6,600	ton	$40	$264,000
Dispose of Stabilized Material	7,260	ton	$80	$580,800
Additional Fill Material	5,500	cy	$4.00	$22,000
	Total Construction Costs			$1,076,700
Engineering & Design (8% of CC)				$86,100
Permitting & Legal (12% of CC)				$129,200
Services During Construction (8% of CC)				$86,100
	Total Engineering and Construction Costs			$1,378,100
Contingency (10% of ECC)				$137,800
	Subtotal Capital Costs			$1,515,900
Contingency for Unknowns (30% of SCC)				$454,800
	TOTAL CAPITAL COSTS			$1,970,700

30-YEAR TOTAL PRESENT WORTH	Discount Rate = 7%	$1,970,700
NOTES		
VOLUME OF DUMP (bcy)	4,400	
AREA OF DUMP (acres)	0.45	

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE A
DUMP
REMOVAL ASSUMING 100%
HAZARDOUS WASTE

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source: 1995 Means)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Decontamination	Use of pressure washer: Assumes decon facility constructed for soil site can be used (Source: 1995 Means)
SITE WORK	
Site Clearing	Assume 120% of site cleared (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 70% of project duration to oversee excavation (Source: RACER)
Material Segregation	Two additional laborers on site for project duration to sort through excavated material (Source: 1995 Means)
TCLP Sampling	Sample collected every 100 tons. Price covers analysis for RCRA Metals and VOCs (Source: Vendor Estimate)
On-Site Stabilization of Hazardous Materials	Stabilization of hazardous debris; Assumed to be 100% of material excavated [LF bcy * 1.5 ton/bcy] (Source: Vendor Est.)
Dispose of Stabilized Material	Assumes 10% bulking factor. Material is transported/disposed in a Sub D landfill (MICF). [LFtons * 1.1] (Source: Vendor Est.)
Additional Fill Material	Backfill dump with unclassified fill from off-site source. 25% Bulking Factor [LFVol bcy * 1.25 = LFVol cy] (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal Capital Cost

30-YEAR TOTAL PRESENT WORTH

NOTES

VOLUME OF DUMP (bcy)	4,400
AREA OF DUMP (acres)	0.45

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE B
DUMP
CHARACTERIZATION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
Decontamination Facility	1	ls	$2,000	$2,000
Trench Excavation and Backfill	200	bcy	$60	$12,000
Soil Boring for Characterization	100	lf	$15	$1,500
UXO Oversight During Field Work	1	wk	$2,000	$2,000
Sampling Labor	1	wk	$16,000	$16,000
OVA Survey	1	wk	$284	$300
Characterization Samples				
Metals	50	ea	$350	$17,500
VOCs	50	ea	$105	$5,300
TCLP	50	ea	$550	$27,500
SVOC	20	ea	$576	$11,500
Gross alpha and beta	20	ea	$90	$1,800
Dioxins/Furans (low resolution)	10	ea	$800	$8,000
Reporting	1	ls	$10,000	$10,000
Subtotal Capital Costs				$115,400
Contingency (10% of SCC)				$11,500
TOTAL CAPITAL COSTS				$126,900
30-YEAR TOTAL PRESENT WORTH				$126,900

NOTES

VOLUME OF DUMP (bcy)	12,400
AREA OF DUMP (acres)	1.28

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE B
DUMP
CHARACTERIZATION

Item/Description	Comments
CAPITAL COSTS	
Decontamination Facility	Temporary decon facility for field vehicles and equip (Source: RACER)
Trench Excavation and Backfill	Cost for digging four test pits, to depth, using loader-backhoe (Source: 1995 Means)
Soil Boring for Characterization	Characterization of landfill; One soil boring to depth on 50-foot grid (Source: Vendor Estimate)
UXO Oversight During Field Work	UXO Master Technician on site for project duration to oversee excavation (Source: RACER)
Sampling Labor	Assume Assoc. Engineer labor rate, for 70% of project duration (Source: Montgomery Watson Estimate)
OVA Survey	Assume equipment rental for project duration @$1134/mo (Source: Vendor Estimate)
Characterization Samples	Assumes soil boring samples collected at 3' increments; Assumes four samples collected from base of each trench.
Metals	85% of sample volume @ regular TAT (Source: Vendor Estimate)
VOCs	85% of sample volume @ regular TAT (Source: Vendor Estimate)
TCLP	85% of sample volume. Price covers analysis for RCRA Metals and VOCs (Source: Vendor Estimate)
SVOC	30% of sample volume @ regular TAT (Source: Vendor Estimate)
Gross alpha and beta	30% of sample volume @ regular TAT (Source: Vendor Estimate)
Dioxins/Furans (low resolution)	10% of sample volume @ Regular TAT (Source: Vendor Estimate)
Reporting	Cost for generating a Sampling and Analysis Report. Assumes 100 hrs. at Prof. level and 20 hrs. at Admin level. (Source: Montgomery Watson)
Subtotal Capital Costs	
Contingency (10% of SCC)	10% of Subtotal Capital Costs
TOTAL CAPITAL COSTS	

30-YEAR TOTAL PRESENT WORTH

NOTES

VOLUME OF DUMP (bcy)	12,400
AREA OF DUMP (acres)	1.28

COST ESTIMATE
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SITE C - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
Install Monitoring Wells				
Mobilization	1	ls	$1,300	$1,300
Well Installation	1	ea	$3,600	$3,600
	TOTAL CAPITAL COSTS			$4,900
O&M COSTS (30 YR)				
Long Term Monitoring	1	ls	$1,536	$1,500
Analysis				
Metals (reg TAT)	24	ea	$350	$8,400
VOCs (reg TAT)	24	ea	$105	$2,500
Dioxins/Furans (reg TAT)	24	ea	$800	$19,200
Reporting	1	ls	$1,395	$1,400
	TOTAL O & M COSTS			$33,000
	PRESENT WORTH OF O&M COSTS			$409,200
FUTURE COSTS (30 YR)				
Five Year Site Review	1	ls	$10,000.00	$10,000
	TOTAL FUTURE COSTS			$10,000
	PRESENT WORTH OF FUTURE COSTS			$21,600
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$435,700

COST ESTIMATE
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SITE C - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Comments
CAPITAL COSTS	
Install Monitoring Wells	
Mobilization	Assumes a total of 5 wells will be monitored at each site. (Source: RACER)
Well Installation	Well installated to a depth of 20-feet (Source: RACER)
O&M COSTS (30 YR)	
Long Term Monitoring	Assume Assoc. Engineer labor, 10 samples per day, quarterly monitoring (Source: Montgomery Watson Estimate
Analysis	
Metals (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
VOCs (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
Dioxins/Furans (reg TAT)	Quarterly monitoring for dioxin/furans (Source: Vendor Estimate)
Reporting	Assume 16 hrs Assoc Level, 2 hrs Prof Level, 2 Hrs WP, 10% ODCs (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
Five Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate) 5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE C - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/OFF-SITE DISPOSAL

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	5	mo	$400	$2,000
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.30	acre	$2,200	$700
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.30	acre	$6,500	$1,900
AOC Soil Excavation and Backfill	2,600	bcy	$9.00	$23,400
UXO Oversight During Excavation	15	wk	$2,000	$30,000
Field Characterization and Screening	1	ls	$285,700	$285,700
Off-Site Fill	3,250	cy	$4.00	$13,000
DISPOSAL (DIOXIN/FURAN CONTAMINATED SOIL)				
Construction of Temporary Staging Facility	1	ls	$20,700	$20,700
Transportation of Waste off-site	3900	ton	$380	$1,482,000
Disposal of Waste	3900	ton	$188	$733,200
DISPOSAL (NON-DIOXIN CONTAMINATED MATERIAL)				
Ordnance Screening	5	mo	$52,800	$237,600
Sampling and Analysis of Buried Debris	3,900	ton	$1.10	$4,300
Disposal Buried Debris	39	ton	$3,350	$130,700
	Total Construction Costs			**$3,023,300**
Engineering & Design (8% of CC)				$241,900
Permitting & Legal (12% of CC)				$362,800
Services During Construction (8% of CC)				$241,900
	Total Engineering and Construction Costs			$3,869,900
Contingency (10% of ECC)				$387,000
	Subtotal Capital Costs			$4,256,900
Contingency for Unknowns (30% of SCC)				$1,277,100
	TOTAL CAPITAL COSTS			$5,534,000
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$46,836	$46,800
	TOTAL FUTURE COSTS			$56,800
	PRESENT WORTH OF FUTURE COSTS			$40,500
30-YEAR TOTAL PRESENT WORTH				$5,574,500

NOTES

VOLUME OF CONTAMINATED AREA (bcy)	2600
AREA OF SITE (acres)	0.25
DISCOUNT RATE	7%

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Construction of Asphalt PML Pad (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
AOC Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
Off-Site Fill	Unclassified fill from off-site source. Assumes 25% Bulking Factor. [AOC_{bcy} * 1.25 = AOC_{cy}] (Source: RACER)
DISPOSAL (DIOXIN/FURAN CONTAMINATED SOIL)	SITE C ONLY
Construction of Temporary Staging Facility	Construction of a 1600 sf pad suitable for heavy equipment (Source: RACER)
Transportation of Waste off-site	Loading and transportation to APTUS/Rollands Incinerator in Aragonite, UT. {VOLbcy * 1.5 = VOLton]
Disposal of Waste	Incineration and disposal of incinerator ash at APTUS/Rollands Incinerator and Landfill (Source: Vendor Est.)
DISPOSAL (NON-DIOXIN CONTAMINATED MATERIAL)	
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of project duration. (Source: 1995 Means)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Based on weight of soil excavated (Source: Site F Exp.)
Disposal Buried Debris	Disposal costs for material other than soil (misc. material). 1% of excavated weight is misc. material (Source: Site F Exp.)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Costs
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES	
VOLUME OF CONTAMINATED AREA (bcy)	2600
AREA OF SITE (acres)	0.25
DISCOUNT RATE	7%

COST ESTIMATE
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SITE E - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
	TOTAL CAPITAL COSTS			$0
O&M COSTS (30 YR)				
Long Term Monitoring	1	ls	$1,536	$1,500
Analysis				
Metals (reg TAT)	24	ea	$350	$8,400
VOCs (reg TAT)	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
	TOTAL O & M COSTS			$13,800
	PRESENT WORTH OF O&M COSTS			$171,100
FUTURE COSTS (30 YR)				
Five Year Site Review	1	ls	$10,000.00	$10,000
	TOTAL FUTURE COSTS			$10,000
	PRESENT WORTH OF FUTURE COSTS			$21,600
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$192,700

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE E - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Comments
CAPITAL COSTS	No capital costs associated with this alternative
O&M COSTS (30 YR)	
Long Term Monitoring	Assume Assoc. Engineer labor, 10 samples per day, quarterly monitoring (Source: Montgomery Watson Estimate)
Analysis	
Metals (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
VOCs (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
Reporting	Assume 16 hrs Assoc Level, 2 hrs Prof Level, 2 Hrs WP, 10% ODCs (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
Five Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate) 5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE E - ALTERNATIVE 2
SHALLOW SOIL
***IN-SITU* FIXATION AND CAPPING**

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	2	mo	$400	$800
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.27	acre	$2,200	$600
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.27	acre	$6,500	$1,800
Field Characterization and Screening	1	ls	$20,000	$20,000
CONTAINMENT				
In-Situ Stabilization Bench-Scale Test	1	ls	$50,000	$50,000
Mobilization of In-Situ Stabilization Equ.	1	ls	$27,000	$27,000
In-Situ Stabilization	300	bcy	$150	$45,000
Confirmation Sampling	6	ea	$355	$2,100
Construct Cap over AOC	0.27	acre	$135,380	$36,600
POST CONSTRUCTION				
Construct Fence	640	lf	$13	$8,300
	Total Construction Costs			**$250,300**
Engineering & Design (8% of CC)				$20,000
Permitting & Legal (12% of CC)				$30,000
Services During Construction (8% of CC)				$20,000
	Total Engineering and Construction Costs			$320,300
Contingency (10% of ECC)				$32,000
	Subtotal Capital Costs			$352,300
Contingency for Unknowns (30% of SCC)				$105,700
	TOTAL CAPITAL COSTS			$458,000
O&M COSTS (30 YR)				
AOC Cap Maintenance	0.08	acre	$600	$0
Long Term Monitoring	1	ls	$13,800	$13,800
	TOTAL O&M COSTS			$13,800
	PRESENT WORTH OF O&M COSTS			$171,100
FUTURE COSTS (30 YR)				
5-Year Review	1	ls	$10,000	$10,000
5-Year Re-Landscape Area	0.08	ls	$14,735	$1,200
	TOTAL FUTURE COSTS			$11,200
	PRESENT WORTH OF FUTURE COSTS			$24,200
30-YEAR TOTAL PRESENT WORTH				$653,300

NOTES: VOLUME OF CONTAMINATED AREA (bcy) 300
AREA OF SITE (acres) 0.23
DISCOUNT RATE 7%

COST ESTIMATE
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SITE E - ALTERNATIVE 2
SHALLOW SOIL
IN-SITU FIXATION AND CAPPING

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Rental Allowance per 1995 Means. Assume two trailers at monthly rental cost of $200/each
Decontamination Facility	Asphalt PML Pad constructed on site
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment
Site Clearing	Assume 120% of AOC site cleared. Weighted cost
Mobilization and Prep of UXO/Metal Survey Equ	Mapping/Site Prep/Set-up and Tear Down.
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance. Weighted cost
Field Characterization and Screening	Samples collected on a prorated basis by AOC
CONTAINMENT	
In-Situ Stabilization Bench-Scale Test	Vendor Estimate
Mobilization of In-Situ Stabilization Equ.	Racer Estimate
In-Situ Stabilization	Assume stabilization of entire AOC Weighted cost
Confirmation Sampling	Collect one samples/50 cy stabilized: Analysis includes compressive strenght ($25), compaction ($130) and TCLP ($200)
Construct Cap over AOC	Construction of a MSW Cap over entire AOC + 20% overlap. Weighted cost
POST CONSTRUCTION	
Construct Fence	Assume a 6' chain link, galv steel, perimeter fence
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of sub-total of Capital Cost
O&M COSTS (30 YR)	
AOC Cap Maintenance	Mowing 12 times/year and Fertilizing 1/year. Weighted cost
Long Term Monitoring	Quarterly monitoring of 5-wells plus one QA/QC sample collected each quarter
	O&M * 12.4 (P/A for 30 YRS @ 7%)
FUTURE COSTS (30 YR)	
5-Year Review	
5-Year Re-Landscape Area	Re-landscaping to divert stormwater around site. Price includes installation of erosion control measures, regrading and resodding site
	FUTURE COST * 2.1577 (P/F every 5 yrs for 30 YRS @ 7%)
30-YEAR TOTAL PRESENT WORTH	30-yr Present Worth based on an annual interest rate of 7%.
NOTES: VOLUME OF CONTAMINATED AREA (bcy)	300
AREA OF SITE (acres)	0.23
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE E - ALTERNATIVE 3
SHALLOW SOIL
SOIL WASHING/SOIL LEACHING

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	3	mo	$400	$1,200
Decontamination Facility	1	ls	$44,000	$44,000
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.27	acre	$2,200	$600
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.27	acre	$6,500	$1,800
Soil Excavation and Backfill	300	bcy	$9.00	$2,700
UXO Oversight During Excavation	7	wk	$2,000	$14,400
Field Characterization and Screening	1	ls	$20,000	$20,000
Sampling and Analysis of Buried Debris	450	ton	$1.10	$500
Disposal Misc Buried Debris	5	ton	$3,350	$15,100
INORGANIC TREATMENT				
Bench Scale Study	1	ls	$139,000	$139,000
Ordnance Screening	3	mo	$52,800	$142,600
Mobilization of Soil Washing/Leaching Equ.	1	ls	$116,000	$116,000
Treatment by Soil Washing/Leaching	446	ton	$85	$37,900
Recovered Metals Recycling	13	drum	$292	$3,900
TCLP Sampling of Treated Soil	14	ea	$200	$2,700
On-Site Stabilization of Soil Failing TCLP	63	ton	$40	$2,500
Off-Site Disposal of Soil Failing TCLP	69	ton	$80	$5,500
Additional Fill Material	56	cy	$4.00	$200
	Total Construction Costs			**$572,200**
Engineering & Design (8% of CC)				$45,800
Permitting & Legal (12% of CC)				$68,700
Services During Construction (8% of CC)				$45,800
	Total Engineering and Construction Costs			$732,500
Contingency (10% of ECC)				$73,300
	Subtotal Capital Costs			$805,800
Contingency for Unknowns (30% of SCC)				$241,700
	TOTAL CAPITAL COSTS			$1,047,500
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$13,831	$13,800
	TOTAL FUTURE COSTS			$23,800
	PRESENT WORTH OF FUTURE COSTS			$17,000
30-YEAR TOTAL PRESENT WORTH				$1,064,500

NOTES: VOLUME OF CONTAMINATED AREA (bcy) 300
AREA OF SITE (acres) 0.23
DISCOUNT RATE 7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE E - ALTERNATIVE 3
SHALLOW SOIL
SOIL WASHING/SOIL LEACHING

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source: 1995 Means)
Decontamination Facility	Asphalt PML Pad capable of withstanding increased load from soil washing system for extended period of time (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Estimate based on weight of soil excavated (Source: Site F Experience)
Disposal Misc Buried Debris	Disposal costs for material other than soil (misc. material). Assume 1% of excavated weight is misc. material (Source: Site F Experience)
INORGANIC TREATMENT	
Bench Scale Study	Source: Vendor Estimate
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of the entire project duration. (Source: 1995 Means)
Mobilization of Soil Washing/Leaching Equ.	Assumes 50,000 tons can be treated in one year (6mo * 30 ton/hr * 10 hr/day) (Source: Vendor Estimate)
Treatment by Soil Washing/Leaching	Assumes 99% of AOC is treated [Treated Vol$_{ss}$ *99%* 1.5] (Source: Vendor Estimate)
Recovered Metals Recycling	Assumes weight of recovered metals is 3% of treated soil, by weight. [Treated Vol$_{ss}$ * 0.03 = Treated Vol$_{ss}$] (Source: Site F Experience)
TCLP Sampling of Treated Soil	One sample per 33 tons of processed material [Treated Vol/33]. Price covers analysis for RCRA metals. (Source: Vendor Estimate)
On-Site Stabilization of Soil Failing TCLP	Assumes 14% of soil volume is untreatable by soil washing/leaching. [Vol_AOC$_{ss}$ * 0.14 * 1.5ton/cy] {Sources: Volume Estimate from Site F Experience - - Stabilization Price from Vendor}
Off-Site Disposal of Soil Failing TCLP	Assumes 10% Bulking From Stabilization. Cost includes Disposal and Trans to USPCI MICF Landfill (Source: Vendor Estimate)
Additional Fill Material	15% of AOCvol (14% Soil + 1% Misc Mat.) will be unclassified fill from off-site source. [VOL_AOC$_{ss}$ * 0.15] (Source: RACER) Assumes treated soil from soil washing/leaching (85%) will be backfilled on site
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)

30-YEAR TOTAL PRESENT WORTH

NOTES:	VOLUME OF CONTAMINATED AREA (bcy)	300
	AREA OF SITE (acres)	0.23
	DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE E - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/ON-SITE STABILIZATION/
OFF-SITE DISPOSAL

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	2	mo	$400	$800
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.27	acre	$2,200	$600
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.27	acre	$6,500	$1,800
AOC Soil Excavation and Backfill	300	bcy	$9.00	$2,700
UXO Oversight During Excavation	6	wk	$2,000	$12,000
Field Characterization and Screening	1	ls	$20,000	$20,000
Off-Site Fill	375	cy	$4.00	$1,500
DISPOSAL (NON-DIOXIN CONTAMINATED MATERIAL)				
Ordnance Screening	2	mo	$52,800	$95,000
TCLP Testing	3	ea	$200	$600
On-Site Stabilization	446	ton	$40	$17,800
Disposal of Stabilized Material	490	ton	$80	$39,200
Sampling and Analysis of Buried Debris	450	ton	$1.10	$500
Disposal Buried Debris	5	ton	$3,350	$15,100
	Total Construction Costs			**$265,700**
Engineering & Design (8% of CC)				$21,300
Permitting & Legal (12% of CC)				$31,900
Services During Construction (8% of CC)				$21,300
	Total Engineering and Construction Costs			$340,200
Contingency (10% of ECC)				$34,000
	Subtotal Capital Costs			$374,200
Contingency for Unknowns (30% of SCC)				$112,300
	TOTAL CAPITAL COSTS			$486,500
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$13,836	$13,800
	TOTAL FUTURE COSTS			$23,800
	PRESENT WORTH OF FUTURE COSTS			$17,000
30-YEAR TOTAL PRESENT WORTH				$503,500

NOTES

VOLUME OF CONTAMINATED AREA (bcy)	300
AREA OF SITE (acres)	0.23
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE E - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/ON-SITE STABILIZATION/
OFF-SITE DISPOSAL

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Construction of Asphalt PML Pad (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
AOC Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
Off-Site Fill	Unclassified fill from off-site source. Assumes 25% Bulking Factor. [AOC_{bcy} * 1.25 = AOC_{cy}] (Source: RACER)
DISPOSAL (NON-DIOXIN CONTAMINATED MATERIAL)	
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of project duration. (Source: 1995 Means)
TCLP Testing	One sample per 100 tons of excavated soil. Price covers analysis for RCRA metals (Source: Vendor Estimate)
On-Site Stabilization	Assumes 99% of excavated volume requires stabilization. [AOC_{bcy} * 0.99 * 1.5ton/bcy = AOC_{ton}] (Source: Vendor Est.)
Disposal of Stabilized Material	Assumes 10% Bulking From Stabilization. Cost includes Disposal and Trans to USPCI MICF Landfill (Source Vendor Est.)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Based on weight of soil excavated (Source: Site F Exp.)
Disposal Buried Debris	Disposal costs for material other than soil (misc. material). 1% of excavated weight is misc. material (Source: Site F Exp.)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Costs
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES	
VOLUME OF CONTAMINATED AREA (bcy)	300
AREA OF SITE (acres)	0.23
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE E
DUMP
REMOVAL ASSUMING 100%
CONSTRUCTION DEBRIS

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	10	mo	$400	$4,000
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Decontamination	1	ls	$500	$500
SITE WORK				
Site Clearing	0.75	acre	$2,200	$1,700
Soil Excavation and Backfill	12,200	bcy	$9.00	$109,800
UXO Oversight During Excavation	28	wk	$2,000	$56,000
TCLP Sampling	122	ea	$550	$67,100
Disposal of Construction Debris	18,300	ton	$20	$363,400
Additional Fill Material	15,250	cy	$4.00	$61,000
	Total Construction Costs			$673,500
Engineering & Design (8% of CC)				$53,900
Permitting & Legal (12% of CC)				$80,800
Services During Construction (8% of CC)				$53,900
	Total Engineering and Construction Costs			$862,100
Contingency (10% of ECC)				$86,200
	Subtotal Capital Costs			$948,300
Contingency for Unknowns (30% of SCC)				$284,500
	TOTAL CAPITAL COSTS			$1,232,800
30-YEAR TOTAL PRESENT WORTH	Discount Rate = 7%			$1,232,800

NOTES

VOLUME OF DUMP (bcy)	12,200
AREA OF DUMP (acres)	0.63

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE E
DUMP
REMOVAL ASSUMING 100%
CONSTRUCTION DEBRIS

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source: 1995 Means)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Decontamination	Use of pressure washer; Assumes decon facility constructed for soil site can be used (Source: 1995 Means)
SITE WORK	
Site Clearing	Assume 120% of site cleared (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 70% of project duration to oversee excavation (Source: RACER)
TCLP Sampling	Sample collected every 100 tons. Price covers analysis for RCRA Metals and VOCs (Source: Vendor Estimate)
Disposal of Construction Debris	Assumes material is transported/disposed in a Sub D landfill in Elk River, MN without additional treatment. (Source: Vendor Est.)
Additional Fill Material	Backfill dump with unclassified fill from off-site source. 25% Bulking Factor [LFVol bcy * 1.25 = LFVol cy] (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal Capital Cost

30-YEAR TOTAL PRESENT WORTH

NOTES

VOLUME OF DUMP (bcy)	12,200
AREA OF DUMP (acres)	0.63

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE E
DUMP
REMOVAL ASSUMING 100%
HAZARDOUS WASTE

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	10	mo	$400	$4,000
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Decontamination	1	ls	$500	$500
SITE WORK				
Site Clearing	0.75	acre	$2,200	$1,700
Soil Excavation and Backfill	12,200	bcy	$9.00	$109,800
UXO Oversight During Excavation	28	wk	$2,000	$56,000
Material Segregation	40	wk	$4,100	$164,000
TCLP Sampling	122	ea	$550	$67,100
On-Site Stabilization of Hazardous Materials	18,300	ton	$40	$732,000
Dispose of Stabilized Material	20,130	ton	$80	$1,610,400
Additional Fill Material	15,250	cy	$4.00	$61,000
	Total Construction Costs			$2,816,500
Engineering & Design (8% of CC)				$225,300
Permitting & Legal (12% of CC)				$338,000
Services During Construction (8% of CC)				$225,300
	Total Engineering and Construction Costs			$3,605,100
Contingency (10% of ECC)				$360,500
	Subtotal Capital Costs			$3,965,600
Contingency for Unknowns (30% of SCC)				$1,189,700
	TOTAL CAPITAL COSTS			$5,155,300
30-YEAR TOTAL PRESENT WORTH	Discount Rate = 7%			$5,155,300
NOTES				
VOLUME OF DUMP (bcy)	12,200			
AREA OF DUMP (acres)	0.63			

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE E
DUMP
REMOVAL ASSUMING 100%
HAZARDOUS WASTE

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source: 1995 Means)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Decontamination	Use of pressure washer; Assumes decon facility constructed for soil site can be used (Source: 1995 Means)
SITE WORK	
Site Clearing	Assume 120% of site cleared (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 70% of project duration to oversee excavation (Source: RACER)
Material Segregation	Two additional laborers on site for project duration to sort through excavated material (Source: 1995 Means)
TCLP Sampling	Sample collected every 100 tons. Price covers analysis for RCRA Metals and VOCs (Source: Vendor Estimate)
On-Site Stabilization of Hazardous Materials	Stabilization of hazardous debris; Assumed to be 100% of material excavated [LF bcy * 1.5 ton/bcy] (Source: Vendor Est.)
Dispose of Stabilized Material	Assumes 10% bulking factor. Material is transported/disposed in a Sub D landfill (MICF). [LFtons * 1.1] (Source: Vendor Est.)
Additional Fill Material	Backfill dump with unclassified fill from off-site source. 25% Bulking Factor [LFVol bcy * 1.25 = LFVol cy] (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal Capital Cost

30-YEAR TOTAL PRESENT WORTH

NOTES

VOLUME OF DUMP (bcy)	12,200
AREA OF DUMP (acres)	0.63

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
Install Monitoring Wells				
Mobilization	1	ls	$1,300	$1,300
Well Installation	3	ea	$3,600	$10,800
TOTAL CAPITAL COSTS				$12,100
O&M COSTS (30 YR)				
Long Term Monitoring	1	ls	$1,536	$1,500
Analysis				
Metals (reg TAT)	24	ea	$350	$8,400
VOCs (reg TAT)	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
TOTAL O & M COSTS				$13,800
PRESENT WORTH OF O&M COSTS				$171,100
FUTURE COSTS (30 YR)				
Five Year Site Review	1	ls	$10,000.00	$10,000
TOTAL FUTURE COSTS				$10,000
PRESENT WORTH OF FUTURE COSTS				$21,600
PRESENT WORTH	Discount Rate	7.00%		
TOTAL PRESENT WORTH				$204,800

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Comments
CAPITAL COSTS	
Install Monitoring Wells	
Mobilization	Assumes a total of 5 wells will be monitored at each site. (Source: RACER)
Well Installation	Well installated to a depth of 20-feet (Source: RACER)
O&M COSTS (30 YR)	
Long Term Monitoring	Assume Assoc. Engineer labor, 10 samples per day, quarterly monitoring (Source: Montgomery Watson Estimate)
Analysis	
Metals (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
VOCs (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
Reporting	Assume 16 hrs Assoc Level, 2 hrs Prof Level, 2 Hrs WP, 10% ODCs (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
Five Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate) 5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H - ALTERNATIVE 2
SHALLOW SOIL
***IN-SITU* FIXATION AND CAPPING**

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	2	mo	$400	$800
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.34	acre	$2,200	$700
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.34	acre	$6,500	$2,200
Field Characterization and Screening	1	ls	$40,000	$40,000
CONTAINMENT				
In-Situ Stabilization Bench-Scale Test	1	ls	$50,000	$50,000
Mobilization of In-Situ Stabilization Equ.	1	ls	$27,000	$27,000
In-Situ Stabilization	500	bcy	$150	$75,000
Confirmation Sampling	10	ea	$355	$3,600
Construct Cap over AOC	0.34	acre	$135,380	$46,000
POST CONSTRUCTION				
Install Monitoring Wells				
Mobilization	1	ls	$1,300	$1,300
Well Installation	3	ea	$3,600	$10,800
Construct Fence	780	lf	$13	$10,100
	Total Construction Costs			**$325,600**
Engineering & Design (8% of CC)				$26,000
Permitting & Legal (12% of CC)				$39,100
Services During Construction (8% of CC)				$26,000
	Total Engineering and Construction Costs			$416,700
Contingency (10% of ECC)				$41,700
	Subtotal Capital Costs			$458,400
Contingency for Unknowns (30% of SCC)				$137,500
	TOTAL CAPITAL COSTS			$595,900
O&M COSTS (30 YR)				
AOC Cap Maintenance	0.10	acre	$600	$100
Long Term Monitoring	1	ls	$13,800	$13,800
	TOTAL O&M COSTS			$13,900
	PRESENT WORTH OF O&M COSTS			$172,400
FUTURE COSTS (30 YR)				
5-Year Review	1	ls	$10,000	$10,000
5-Year Re-Landscape Area	0.10	ls	$14,735	$1,500
	TOTAL FUTURE COSTS			$11,500
	PRESENT WORTH OF FUTURE COSTS			$24,800
30-YEAR TOTAL PRESENT WORTH				$793,100

NOTES: VOLUME OF CONTAMINATED AREA (bcy) 500
AREA OF SITE (acres) 0.28
DISCOUNT RATE 7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H - ALTERNATIVE 2
SHALLOW SOIL
***IN-SITU* FIXATION AND CAPPING**

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Asphalt PML Pad (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
CONTAINMENT	
In-Situ Stabilization Bench-Scale Test	Source: Vendor Estimate
Mobilization of In-Situ Stabilization Equ.	Source: RACER Estimate
In-Situ Stabilization	Assume stabilization of entire AOC. (Source: RACER)
Confirmation Sampling	Collect one samples/50 cy stabilized; Analysis for compressive strength/compaction ($155) and TCLP ($200) (Source: RACER)
Construct Cap over AOC	Construction of a MSW Cap over entire AOC + 20% overlap. (Source: RACER)
POST CONSTRUCTION	
Install Monitoring Wells	
Mobilization	Assumes a total of 5 wells will be monitored at each site. (Source: RACER)
Well Installation	Well installated to a depth of 20-feet (Source: RACER)
Construct Fence	Assume a 6' chain link, galv steel, perimeter fence (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
O&M COSTS (30 YR)	
AOC Cap Maintenance	Mowing 12 times/year and Fertilizing 1/year. (Source: RACER)
Long Term Monitoring	Quarterly monitoring of 5-wells plus one QA/QC sample collected each quarter (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate)
5-Year Re-Landscape Area	Re-landscaping to divert stormwater around site. Price includes installation of erosion control measures, re-grading and resodding site
	5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES: VOLUME OF CONTAMINATED AREA (bcy)	500
AREA OF SITE (acres)	0.28
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H - ALTERNATIVE 3
SHALLOW SOIL
SOIL WASHING/SOIL LEACHING

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	3	mo	$400	$1,200
Decontamination Facility	1	ls	$44,000	$44,000
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.34	acre	$2,200	$700
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.34	acre	$6,500	$2,200
Soil Excavation and Backfill	500	bcy	$9.00	$4,500
UXO Oversight During Excavation	7	wk	$2,000	$14,400
Field Characterization and Screening	1	ls	$40,000	$40,000
Sampling and Analysis of Buried Debris	750	ton	$1.10	$800
Disposal Misc Buried Debris	8	ton	$3,350	$25,100
INORGANIC TREATMENT				
Bench Scale Study	1	ls	$139,000	$139,000
Ordnance Screening	3	mo	$52,800	$142,600
Mobilization of Soil Washing/Leaching Equ.	1	ls	$116,000	$116,000
Treatment by Soil Washing/Leaching	743	ton	$85	$63,100
Recovered Metals Recycling	22	drum	$292	$6,500
TCLP Sampling of Treated Soil	23	ea	$200	$4,500
On-Site Stabilization of Soil Failing TCLP	105	ton	$40	$4,200
Off-Site Disposal of Soil Failing TCLP	116	ton	$80	$9,200
Additional Fill Material	94	cy	$4.00	$400
	Total Construction Costs			**$640,000**
Engineering & Design (8% of CC)				$51,200
Permitting & Legal (12% of CC)				$76,800
Services During Construction (8% of CC)				$51,200
	Total Engineering and Construction Costs			$819,200
Contingency (10% of ECC)				$81,900
	Subtotal Capital Costs			$901,100
Contingency for Unknowns (30% of SCC)				$270,300
	TOTAL CAPITAL COSTS			$1,171,400
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$13,831	$13,800
	TOTAL FUTURE COSTS			$23,800
	PRESENT WORTH OF FUTURE COSTS			$17,000
30-YEAR TOTAL PRESENT WORTH				$1,188,400

NOTES: VOLUME OF CONTAMINATED AREA (bcy) 500
AREA OF SITE (acres) 0.28
DISCOUNT RATE 7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H - ALTERNATIVE 3
SHALLOW SOIL
SOIL WASHING/SOIL LEACHING

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Asphalt PML Pad capable of withstanding increased load from soil washing system for extended period of time (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Estimate based on weight of soil excavated (Source: Site F Experience)
Disposal Misc Buried Debris	Disposal costs for material other than soil (misc. material). Assume 1% of excavated weight is misc. material (Source: Site F Experience)
INORGANIC TREATMENT	
Bench Scale Study	Source: Vendor Estimate
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of the entire project duration. (Source: 1995 Means)
Mobilization of Soil Washing/Leaching Equ.	Assumes 50,000 tons can be treated in one year (6mo * 30 ton/hr * 10 hr/day) (Source: Vendor Estimate)
Treatment by Soil Washing/Leaching	Assumes 99% of AOC is treated [Treated Vol_{bcy} *99%* 1.5] (Source: Vendor Estimate)
Recovered Metals Recycling	Assumes weight of recovered metals is 3% of treated soil, by weight. [Treated Vol[illegible] * 0.03 = Treated Vol[illegible]] (Source: Site F Experience)
TCLP Sampling of Treated Soil	One sample per 33 tons of processed material [Treated Vol/33]. Price covers analysis for RCRA metals. (Source: Vendor Estimate)
On-Site Stabilization of Soil Failing TCLP	Assumes 14% of soil volume is untreatable by soil washing/leaching. [Vol_AOC_{cy} * 0.14 * 1.5ton/cy] {Sources: Volume Estimate from Site F Experience - - Stabilization Price from Vendor}
Off-Site Disposal of Soil Failing TCLP	Assumes 10% Bulking From Stabilization. Cost includes Disposal and Trans to USPCI MICF Landfill (Source: Vendor Estimate)
Additional Fill Material	15% of AOCvol (14% Soil + 1% Misc Mat.) will be unclassified fill from off-site source. [VOL_AOC_{cy} * 0.15] (Source: RACER) Assumes treated soil from soil washing/leaching (85%) will be backfilled on site
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES: VOLUME OF CONTAMINATED AREA (bcy)	500
AREA OF SITE (acres)	0.28
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/ON-SITE STABILIZATION/ OFF-SITE DISPOSAL

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	2	mo	$400	$800
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.34	acre	$2,200	$700
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.34	acre	$6,500	$2,200
AOC Soil Excavation and Backfill	500	bcy	$9.00	$4,500
UXO Oversight During Excavation	6	wk	$2,000	$12,000
Field Characterization and Screening	1	ls	$60,000	$60,000
Off-Site Fill	625	cy	$4.00	$2,500
DISPOSAL (NON-DIOXIN CONTAMINATED MATERIAL)				
Ordnance Screening	2	mo	$52,800	$95,000
TCLP Testing	5	ea	$200	$1,000
On-Site Stabilization	743	ton	$40	$29,700
Disposal of Stabilized Material	817	ton	$80	$65,300
Sampling and Analysis of Buried Debris	750	ton	$1.10	$800
Disposal Buried Debris	8	ton	$3,350	$25,100
	Total Construction Costs			**$357,700**
Engineering & Design (8% of CC)				$28,600
Permitting & Legal (12% of CC)				$42,900
Services During Construction (8% of CC)				$28,600
	Total Engineering and Construction Costs			$457,800
Contingency (10% of ECC)				$45,800
	Subtotal Capital Costs			$503,600
Contingency for Unknowns (30% of SCC)				$151,100
	TOTAL CAPITAL COSTS			$654,700
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$13,836	$13,800
	TOTAL FUTURE COSTS			$23,800
	PRESENT WORTH OF FUTURE COSTS			$17,000
30-YEAR TOTAL PRESENT WORTH				$671,700

NOTES

VOLUME OF CONTAMINATED AREA (bcy)	500
AREA OF SITE (acres)	0.28
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/ON-SITE STABILIZATION/
OFF-SITE DISPOSAL

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source: 1995 Means)
Decontamination Facility	Construction of Asphalt PML Pad (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
AOC Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
Off-Site Fill	Unclassified fill from off-site source. Assumes 25% Bulking Factor. [$AOC_{bcy} * 1.25 = AOC_{cy}$] (Source: RACER)
DISPOSAL (NON-DIOXIN CONTAMINATED MATERIAL)	
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of project duration. (Source: 1995 Means)
TCLP Testing	One sample per 100 tons of excavated soil. Price covers analysis for RCRA metals (Source: Vendor Estimate)
On-Site Stabilization	Assumes 99% of excavated volume requires stabilization. [$AOC_{bcy} * 0.99 * 1.5ton/bcy = AOC_{ton}$] (Source: Vendor Est.)
Disposal of Stabilized Material	Assumes 10% Bulking From Stabilization. Cost includes Disposal and Trans to USPCI MICF Landfill (Source Vendor Est.)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Based on weight of soil excavated (Source: Site F Exp.)
Disposal Buried Debris	Disposal costs for material other than soil (misc. material). 1% of excavated weight is misc. material (Source: Site F Exp.)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Costs
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES	
VOLUME OF CONTAMINATED AREA (bcy)	500
AREA OF SITE (acres)	0.28
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H
DUMP
REMOVAL ASSUMING 100%
CONSTRUCTION DEBRIS

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	8	mo	$400	$3,200
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Decontamination	1	ls	$500	$500
SITE WORK				
Site Clearing	0.44	acre	$2,200	$1,000
Soil Excavation and Backfill	9,500	bcy	$9.00	$85,500
UXO Oversight During Excavation	22	wk	$2,000	$44,800
TCLP Sampling	95	ea	$550	$52,300
Disposal of Construction Debris	14,250	ton	$20	$283,000
Additional Fill Material	11,875	cy	$4.00	$47,500
	Total Construction Costs			$527,800
Engineering & Design (8% of CC)				$42,200
Permitting & Legal (12% of CC)				$63,300
Services During Construction (8% of CC)				$42,200
	Total Engineering and Construction Costs			$675,500
Contingency (10% of ECC)				$67,600
	Subtotal Capital Costs			$743,100
Contingency for Unknowns (30% of SCC)				$222,900
	TOTAL CAPITAL COSTS			$966,000
30-YEAR TOTAL PRESENT WORTH	Discount Rate = 7%			$966,000

NOTES

VOLUME OF DUMP (bcy)	9,500
AREA OF DUMP (acres)	0.37

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H
DUMP
REMOVAL ASSUMING 100%
CONSTRUCTION DEBRIS

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source: 1995 Means)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Decontamination	Use of pressure washer; Assumes decon facility constructed for soil site can be used (Source: 1995 Means)
SITE WORK	
Site Clearing	Assume 120% of site cleared (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 70% of project duration to oversee excavation (Source: RACER)
TCLP Sampling	Sample collected every 100 tons. Price covers analysis for RCRA Metals and VOCs (Source: Vendor Estimate)
Disposal of Construction Debris	Assumes material is transported/disposed in a Sub D landfill in Elk River, MN without additional treatment. (Source: Vendor Est.)
Additional Fill Material	Backfill dump with unclassified fill from off-site source. 25% Bulking Factor [LFVol bcy * 1.25 = LFVol cy] (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subotal Capital Cost

30-YEAR TOTAL PRESENT WORTH

NOTES

VOLUME OF DUMP (bcy)	9,500
AREA OF DUMP (acres)	0.37

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE H
DUMP
REMOVAL ASSUMING 100%
HAZARDOUS WASTE

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	8	mo	$400	$3,200
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Decontamination	1	ls	$500	$500
SITE WORK				
Site Clearing	0.44	acre	$2,200	$1,000
Soil Excavation and Backfill	9,500	bcy	$9.00	$85,500
UXO Oversight During Excavation	22	wk	$2,000	$44,800
Material Segregation	32	wk	$4,100	$131,200
TCLP Sampling	95	ea	$550	$52,300
On-Site Stabilization of Hazardous Materials	14,250	ton	$40	$570,000
Dispose of Stabilized Material	15,675	ton	$80	$1,254,000
Additional Fill Material	11,875	cy	$4.00	$47,500
	Total Construction Costs			$2,200,000
Engineering & Design (8% of CC)				$176,000
Permitting & Legal (12% of CC)				$264,000
Services During Construction (8% of CC)				$176,000
	Total Engineering and Construction Costs			$2,816,000
Contingency (10% of ECC)				$281,600
	Subtotal Capital Costs			$3,097,600
Contingency for Unknowns (30% of SCC)				$929,300
	TOTAL CAPITAL COSTS			$4,026,900

30-YEAR TOTAL PRESENT WORTH	Discount Rate = 7%	$4,026,900
NOTES		
VOLUME OF DUMP (bcy)	9,500	
AREA OF DUMP (acres)	0.37	

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE H
DUMP
REMOVAL ASSUMING 100%
HAZARDOUS WASTE

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source: 1995 Means)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Decontamination	Use of pressure washer; Assumes decon facility constructed for soil site can be used (Source: 1995 Means)
SITE WORK	
Site Clearing	Assume 120% of site cleared (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 70% of project duration to oversee excavation (Source: RACER)
Material Segregation	Two additional laborers on site for project duration to sort through excavated material (Source: 1995 Means)
TCLP Sampling	Sample collected every 100 tons. Price covers analysis for RCRA Metals and VOCs (Source: Vendor Estimate)
On-Site Stabilization of Hazardous Materials	Stabilization of hazardous debris; Assumed to be 100% of material excavated [LF bcy * 1.5 ton/bcy] (Source: Vendor Est.)
Dispose of Stabilized Material	Assumes 10% bulking factor. Material is transported/disposed in a Sub D landfill (MICF). [LFtons * 1.1] (Source: Vendor Est.)
Additional Fill Material	Backfill dump with unclassified fill from off-site source. 25% Bulking Factor [LFVol bcy * 1.25 = LFVol cy] (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal Capital Cost

30-YEAR TOTAL PRESENT WORTH

NOTES

VOLUME OF DUMP (bcy)	9,500
AREA OF DUMP (acres)	0.37

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE 129-3 - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
Install Monitoring Wells				
Mobilization	1	ls	$1,300	$1,300
Well Installation	3	ea	$11,500	$34,500
	TOTAL CAPITAL COSTS			$35,800
O&M COSTS (30 YR)				
Long Term Monitoring	1	ls	$1,536	$1,500
Analysis				
Metals (reg TAT)	24	ea	$350	$8,400
VOCs (reg TAT)	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
	TOTAL O & M COSTS			$13,800
	PRESENT WORTH OF O&M COSTS			$171,100
FUTURE COSTS (30 YR)				
Five Year Site Review	1	ls	$10,000.00	$10,000
	TOTAL FUTURE COSTS			$10,000
	PRESENT WORTH OF FUTURE COSTS			$21,600
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$228,500

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE 129-3 - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Comments
CAPITAL COSTS	
Install Monitoring Wells	
Mobilization	Assumes a total of 5 wells will be monitored at each site. (Source: RACER)
Well Installation	Well installated to a depth of 130-feet (Source: RACER)
O&M COSTS (30 YR)	
Long Term Monitoring	Assume Assoc. Engineer labor, 10 samples per day, quarterly monitoring (Source: Montgomery Watson Estimate)
Analysis	
Metals (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
VOCs (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
Reporting	Assume 16 hrs Assoc Level, 2 hrs Prof Level, 2 Hrs WP, 10% ODCs (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
Five Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate) 5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE 129-3 - ALTERNATIVE 2
SHALLOW SOIL
***IN-SITU* FIXATION AND CAPPING**

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	1	mo	$400	$400
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.03	acre	$2,200	$100
Mobilization and Prep of UXO/Metal Survey Equ	1.00	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.03	acre	$6,500	$200
Field Characterization and Screening	1	ls	$20,000	$20,000
CONTAINMENT				
In-Situ Stabilization Bench-Scale Test	1	ls	$50,000	$50,000
Mobilization of In-Situ Stabilization Equ.	1	ls	$27,000	$27,000
In-Situ Stabilization	100	bcy	$150	$15,000
Confirmation Sampling	2	ea	$355	$700
Construct Cap over AOC	0.03	acre	$135,380	$4,100
POST CONSTRUCTION				
Install Monitoring Wells				
Mobilization	1	ls	$1,300	$1,300
Well Installation	3	ea	$11,500	$34,500
Construct Fence	300	lf	$13	$3,900
	Total Construction Costs			**$215,300**
Engineering & Design (8% of CC)				$17,200
Permitting & Legal (12% of CC)				$25,800
Services During Construction (8% of CC)				$17,200
	Total Engineering and Construction Costs			$275,500
Contingency (10% of ECC)				$27,600
	Subtotal Capital Costs			$303,100
Contingency for Unknowns (30% of SCC)				$90,900
	TOTAL CAPITAL COSTS			$394,000
O&M COSTS (30 YR)				
AOC Cap Maintenance	0.01	acre	$600	$0
Long Term Monitoring	1	ls	$27,600	$27,600
	TOTAL O&M COSTS			$27,600
	PRESENT WORTH OF O&M COSTS			$342,200
FUTURE COSTS (30 YR)				
5-Year Review	1	ls	$10,000	$10,000
5-Year Re-Landscape Area	0.01	ls	$14,735	$100
	TOTAL FUTURE COSTS			$10,100
	PRESENT WORTH OF FUTURE COSTS			$21,800
30-YEAR TOTAL PRESENT WORTH				$758,000

NOTES: VOLUME OF CONTAMINATED AREA (bcy) 100
AREA OF SITE (acres) 0.03
DISCOUNT RATE 7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE 129-3 - ALTERNATIVE 2
SHALLOW SOIL
IN-SITU FIXATION AND CAPPING

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Asphalt PML Pad (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
CONTAINMENT	
In-Situ Stabilization Bench-Scale Test	Source: Vendor Estimate
Mobilization of In-Situ Stabilization Equ.	Source: RACER Estimate
In-Situ Stabilization	Assume stabilization of entire AOC. (Source: RACER)
Confirmation Sampling	Collect one samples/50 cy stabilized: Analysis for compressive strength/compaction ($155) and TCLP ($200) (Source: RACER)
Construct Cap over AOC	Construction of a MSW Cap over entire AOC + 20% overlap. (Source: RACER)
POST CONSTRUCTION	
Install Monitoring Wells	
Mobilization	Assumes a total of 5 wells will be monitored at each site. (Source: RACER)
Well Installation	Well installated to a depth of 130-feet (Source: RACER)
Construct Fence	Assume a 6' chain link, galv steel, perimeter fence (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
O&M COSTS (30 YR)	
AOC Cap Maintenance	Mowing 12 times/year and Fertilizing 1/year. (Source: RACER)
Long Term Monitoring	Quarterly monitoring of 5-wells plus one QA/QC sample collected each quarter (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate)
5-Year Re-Landscape Area	Re-landscaping to divert stormwater around site. Price includes installation of erosion control measures, re-grading and resodding site
	5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES: VOLUME OF CONTAMINATED AREA (bcy)	100
AREA OF SITE (acres)	0.03
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE 129-3 - ALTERNATIVE 3
SHALLOW SOIL
SOIL WASHING/SOIL LEACHING

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	1	mo	$400	$400
Decontamination Facility	1	ls	$44,000	$44,000
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.03	acre	$2,200	$100
Mobilization and Prep of UXO/Metal Survey Equ	1	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.03	acre	$6,500	$200
Soil Excavation and Backfill	100	bcy	$9.00	$900
UXO Oversight During Excavation	2	wk	$2,000	$4,800
Field Characterization and Screening	1	ls	$25,000	$25,000
Sampling and Analysis of Buried Debris	150	ton	$1.10	$200
Disposal Misc Buried Debris	1.50	ton	$3,350	$5,000
ORGANIC PRETREATMENT EX-SITU SVE				
Construction of Temporary Treatment Facility	1	ls	$36,700	$36,700
System O&M and Monitoring	4	wk	$3,126	$12,500
INORGANIC TREATMENT				
Bench Scale Study	1	ls	$139,000	$139,000
Ordnance Screening	1	mo	$52,800	$47,500
Mobilization of Soil Washing/Leaching Equ.	1	ls	$116,000	$116,000
Treatment by Soil Washing/Leaching	149	ton	$85	$12,600
Recovered Metals Recycling	4	drum	$292	$1,300
TCLP Sampling of Treated Soil	5	ea	$550	$2,500
On-Site Stabilization of Soil Failing TCLP	21	ton	$40	$800
Off-Site Disposal of Soil Failing TCLP	23	ton	$80	$1,800
Additional Fill Material	19	cy	$4.00	$100
	Total Construction Costs			**$473,000**
Engineering & Design (8% of CC)				$37,800
Permitting & Legal (12% of CC)				$56,800
Services During Construction (8% of CC)				$37,800
	Total Engineering and Construction Costs			$605,400
Contingency (10% of ECC)				$60,500
	Subtotal Capital Costs			$665,900
Contingency for Unknowns (30% of SCC)				$199,800
	TOTAL CAPITAL COSTS			$865,700
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$27,631	$27,600
	TOTAL FUTURE COSTS			$37,600
	PRESENT WORTH OF FUTURE COSTS			$26,800
30-YEAR TOTAL PRESENT WORTH				$892,500

NOTES: VOLUME OF CONTAMINATED AREA (bcy) 100
AREA OF SITE (acres) 0.03
DISCOUNT RATE 7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE 129-3 - ALTERNATIVE 3
SHALLOW SOIL
SOIL WASHING/SOIL LEACHING

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Asphalt PML Pad capable of withstanding increased load from soil washing system for extended period of time (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Estimate based on weight of soil excavated (Source: Site F Experience)
Disposal Misc Buried Debris	Disposal costs for material other than soil (misc. material). Assume 1% of excavated weight is misc. material (Source: Site F Experience)
ORGANIC PRETREATMENT EX-SITU SVE	SITE 129-3 ONLY
Construction of Temporary Treatment Facility	Temporary Holding Facility with vent system, PVC Liner and subbase suitable for heavy traffic/side berms/PVC Cover. (Source: RACER)
System O&M and Monitoring	Assumes biotreatment will take a total of 4 wks. System monitored and sampled weekly (Source: RACER)
INORGANIC TREATMENT	
Bench Scale Study	Source: Vendor Estimate
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of the entire project duration. (Source: 1995 Means)
Mobilization of Soil Washing/Leaching Equ.	Assumes 50,000 tons can be treated in one year (6mo * 30 ton/hr * 10 hr/day) (Source: Vendor Estimate)
Treatment by Soil Washing/Leaching	Assumes 99% of AOC is treated [Treated Vol_{sw} *99%* 1.5] (Source: Vendor Estimate)
Recovered Metals Recycling	Assumes weight of recovered metals is 3% of treated soil, by weight. [Treated Vol_{sw} * 0.03 = Treated Vol[illegible]] (Source: Site F Experience)
TCLP Sampling of Treated Soil	One sample per 33 tons of processed material. Price covers analysis for RCRA metals and VOCs (Source: Vendor Estimate)
On-Site Stabilization of Soil Failing TCLP	Assumes 14% of soil volume is untreatable by soil washing/leaching. [Vol_AOC_{sw} * 0.14 * 1.5ton/cy] {Sources: Volume Estimate from Site F Experience - - Stabilization Price from Vendor}
Off-Site Disposal of Soil Failing TCLP	Assumes 10% Bulking From Stabilization. Cost includes Disposal and Trans to USPCI MICF Landfill (Source: Vendor Estimate)
Additional Fill Material	15% of AOCvol (14% Soil + 1% Misc Mat.) will be unclassified fill from off-site source. [VOL_AOC_{sw} * 0.15] (Source: RACER) Assumes treated soil from soil washing/leaching (85%) will be backfilled on site
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES: VOLUME OF CONTAMINATED AREA (bcy)	100
AREA OF SITE (acres)	0.03
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE 129-3 - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/ON-SITE STABILIZATION/
OFF-SITE DISPOSAL

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	1	mo	$400	$400
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equ	1	ls	$10,000	$10,000
Site Clearing	0.03	acre	$2,200	$100
Mobilization and Prep of UXO/Metal Survey	1	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.03	acre	$6,500	$200
AOC Soil Excavation and Backfill	100	bcy	$9.00	$900
UXO Oversight During Excavation	3	wk	$2,000	$6,000
Field Characterization and Screening	1	ls	$25,000	$25,000
Off-Site Fill	125	cy	$4.00	$500
ORGANIC PRETREATMENT EX-SITU SVE				
Construction of Temporary Treatment Facility	1	ls	$36,700	$36,700
System O&M and Monitoring	4	wk	$3,126	$12,500
Ordnance Screening	0.9	mo	$52,800	$47,500
TCLP Testing	1	ea	$550	$550
On-Site Stabilization	149	ton	$40	$5,900
Disposal of Stabilized Material	163	ton	$80	$13,100
Sampling and Analysis of Buried Debris	150	ton	$1.10	$200
Disposal Buried Debris	2	ton	$3,350	$5,000
	Total Construction Costs			**$212,650**
Engineering & Design (8% of CC)				$17,000
Permitting & Legal (12% of CC)				$25,500
Services During Construction (8% of CC)				$17,000
	Total Engineering and Construction Costs			$272,150
Contingency (10% of ECC)				$27,200
	Subtotal Capital Costs			$299,350
Contingency for Unknowns (30% of SCC)				$89,800
	TOTAL CAPITAL COSTS			$389,150
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$27,636	$27,600
	TOTAL FUTURE COSTS			$37,600
	PRESENT WORTH OF FUTURE COSTS			$26,800
30-YEAR TOTAL PRESENT WORTH				$416,000

NOTES

VOLUME OF CONTAMINATED AREA (bcy)	100
AREA OF SITE (acres)	0.03
DISCOUNT RATE	7%

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SITE 129-3 - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/ON-SITE STABILIZATION/
OFF-SITE DISPOSAL

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Construction of Asphalt PML Pad (Source: RACER)
Mobilization/Demobilization of General Equ	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
AOC Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
Off-Site Fill	Unclassified fill from off-site source. Assumes 25% Bulking Factor. [$AOC_{bcy} * 1.25 = AOC_{cy}$] (Source: RACER)
ORGANIC PRETREATMENT EX-SITU SVE	
Construction of Temporary Treatment Facility	Temporary holding facility with vent system, 30 HP blower, PVC Liner and cover suitable for veh. traffic (Source: RACER)
System O&M and Monitoring	Assumes active SVE will take a total of 4 wks. System monitored and sampled weekly (Source: RACER)
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of project duration. (Source: 1995 Means)
TCLP Testing	One sample per 100 tons of excavated soil. Price covers analysis for RCRA metals and VOCs (Source: Vendor Estimate)
On-Site Stabilization	Assumes 99% of excavated volume requires stabilization. [$AOC_{bcy} * 0.99 * 1.5ton/bcy = AOC_{ton}$] (Source: Vendor Est.)
Disposal of Stabilized Material	Assumes 10% Bulking From Stabilization. Cost includes Disposal and Trans to USPCI MICF Landfill (Source Vendor Est.)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Based on weight of soil excavated (Source: Site F Exp.)
Disposal Buried Debris	Disposal costs for material other than soil (misc. material). 1% of excavated weight is misc. material (Source: Site F Exp.)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Costs
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES	
VOLUME OF CONTAMINATED AREA (bcy)	100
AREA OF SITE (acres)	0.03
DISCOUNT RATE	7%

COST ESTIMATE
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SITE 129-5 - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
Install Monitoring Wells				
Mobilization	1	ls	$1,300	$1,300
Well Installation	2	ea	$11,500	$23,000
	TOTAL CAPITAL COSTS			$24,300
O&M COSTS (30 YR)				
Long Term Monitoring	1	ls	$1,536	$1,500
Analysis				
Metals (reg TAT)	24	ea	$350	$8,400
VOCs (reg TAT)	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
	TOTAL O & M COSTS			$13,800
	PRESENT WORTH OF O&M COSTS			$171,100
FUTURE COSTS (30 YR)				
Five Year Site Review	1	ls	$10,000.00	$10,000
	TOTAL FUTURE COSTS			$10,000
	PRESENT WORTH OF FUTURE COSTS			$21,600
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$217,000

COST ESTIMATE
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SITE 129-5 - ALTERNATIVE 1
SHALLOW SOIL
NO ACTION

Item/Description	Comments
CAPITAL COSTS	
Install Monitoring Wells	
Mobilization	Assumes a total of 5 wells will be monitored at each site. (Source: RACER)
Well Installation	Well installated to a depth of 130-feet (Source: RACER)
O&M COSTS (30 YR)	
Long Term Monitoring	Assume Assoc. Engineer labor, 10 samples per day, quarterly monitoring (Source: Montgomery Watson Estimate)
Analysis	
Metals (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
VOCs (reg TAT)	Quarterly monitoring of 5-wells plus one QA/QC sample (Source: Vendor Estimate)
Reporting	Assume 16 hrs Assoc Level, 2 hrs Prof Level, 2 Hrs WP, 10% ODCs (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
Five Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate) 5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
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SITE 129-5 - ALTERNATIVE 2
SHALLOW SOIL
***IN-SITU* FIXATION AND CAPPING**

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	1	mo	$400	$400
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.01	acre	$2,200	$30
Mobilization and Prep of UXO/Metal Survey Equ	1	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.01	acre	$6,500	$100
Field Characterization and Screening	1	ls	$10,000	$10,000
CONTAINMENT				
In-Situ Stabilization Bench-Scale Test	1	ls	$50,000	$50,000
Mobilization of In-Situ Stabilization Equ.	1	ls	$27,000	$27,000
In-Situ Stabilization	15	bcy	$150	$2,300
Confirmation Sampling	1	ea	$355	$400
Construct Cap over AOC	0.01	acre	$135,380	$2,000
POST CONSTRUCTION				
Install Monitoring Wells				
Mobilization	1	ls	$1,300	$1,300
Well Installation	2	ea	$11,500	$23,000
Construct Fence	200	lf	$13	$2,600
	Total Construction Costs			**$177,200**
Engineering & Design (8% of CC)				$14,200
Permitting & Legal (12% of CC)				$21,300
Services During Construction (8% of CC)				$14,200
	Total Engineering and Construction Costs			$226,900
Contingency (10% of ECC)				$22,700
	Subtotal Capital Costs			$249,600
Contingency for Unknowns (30% of SCC)				$74,900
	TOTAL CAPITAL COSTS			$324,500
O&M COSTS (30 YR)				
AOC Cap Maintenance	0.00	acre	$600	$0
Long Term Monitoring	1	ls	$13,800	$13,800
	TOTAL O&M COSTS			$13,800
	PRESENT WORTH OF O&M COSTS			$171,100
FUTURE COSTS (30 YR)				
5-Year Review	1	ls	$10,000	$10,000
5-Year Re-Landscape Area	0.00	ls	$14,735	$100
	TOTAL FUTURE COSTS			$10,100
	PRESENT WORTH OF FUTURE COSTS			$21,800
30-YEAR TOTAL PRESENT WORTH				$517,400

NOTES: VOLUME OF CONTAMINATED AREA (bcy)	15
AREA OF SITE (acres)	0.01
DISCOUNT RATE	7%

COST ESTIMATE
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SITE 129-5 - ALTERNATIVE 2
SHALLOW SOIL
***IN-SITU* FIXATION AND CAPPING**

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Asphalt PML Pad (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
CONTAINMENT	
In-Situ Stabilization Bench-Scale Test	Source: Vendor Estimate
Mobilization of In-Situ Stabilization Equ.	Source: RACER Estimate
In-Situ Stabilization	Assume stabilization of entire AOC. (Source: RACER)
Confirmation Sampling	Collect one samples/50 cy stabilized; Analysis for compressive strength/compaction ($155) and TCLP ($200) (Source: RACER)
Construct Cap over AOC	Construction of a MSW Cap over entire AOC + 20% overlap. (Source: RACER)
POST CONSTRUCTION	
Install Monitoring Wells	
Mobilization	Assumes a total of 5 wells will be monitored at each site. (Source: RACER)
Well Installation	Well installated to a depth of 130-feet (Source: RACER)
Construct Fence	Assume a 6' chain link, galv steel, perimeter fence (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
O&M COSTS (30 YR)	
AOC Cap Maintenance	Mowing 12 times/year and Fertilizing 1/year. (Source: RACER)
Long Term Monitoring	Quarterly monitoring of 5-wells plus one QA/QC sample collected each quarter (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate)
5-Year Re-Landscape Area	Re-landscaping to divert stormwater around site. Price includes installation of erosion control measures, re-grading and resodding site
	5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES: VOLUME OF CONTAMINATED AREA (bcy)	15
AREA OF SITE (acres)	0.01
DISCOUNT RATE	7%

COST ESTIMATE
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SITE 129-5 - ALTERNATIVE 3
SHALLOW SOIL
SOIL WASHING/SOIL LEACHING

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	1	mo	$400	$400
Decontamination Facility	1	ls	$44,000	$44,000
Mobilization/Demobilization of General Equipment	1	ls	$10,000	$10,000
Site Clearing	0.01	acre	$2,200	$30
Mobilization and Prep of UXO/Metal Survey Equ	1	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.01	acre	$6,500	$100
Soil Excavation and Backfill	15	bcy	$9.00	$100
UXO Oversight During Excavation	2	wk	$2,000	$4,800
Field Characterization and Screening	1	ls	$10,000	$10,000
Sampling and Analysis of Buried Debris	23	ton	$1.10	$20
Disposal Misc Buried Debris	0.23	ton	$3,350	$800
INORGANIC TREATMENT				
Bench Scale Study	1	ls	$139,000	$139,000
Ordnance Screening	1	mo	$52,800	$47,500
Mobilization of Soil Washing/Leaching Equ.	1	ls	$116,000	$116,000
Treatment by Soil Washing/Leaching	22	ton	$85	$1,900
Recovered Metals Recycling	1	drum	$292	$200
TCLP Sampling of Treated Soil	1	ea	$200	$200
On-Site Stabilization of Soil Failing TCLP	3	ton	$40	$100
Off-Site Disposal of Soil Failing TCLP	3	ton	$80	$300
Additional Fill Material	3	cy	$4.00	$10
	Total Construction Costs			**$387,100**
Engineering & Design (8% of CC)				$31,000
Permitting & Legal (12% of CC)				$46,500
Services During Construction (8% of CC)				$31,000
	Total Engineering and Construction Costs			$495,600
Contingency (10% of ECC)				$49,600
	Subtotal Capital Costs			$545,200
Contingency for Unknowns (30% of SCC)				$163,600
	TOTAL CAPITAL COSTS			$708,800
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$13,831	$13,800
	TOTAL FUTURE COSTS			$23,800
	PRESENT WORTH OF FUTURE COSTS			$17,000
30-YEAR TOTAL PRESENT WORTH				$725,800

NOTES: VOLUME OF CONTAMINATED AREA (bcy) 15
AREA OF SITE (acres) 0.01
DISCOUNT RATE 7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE 129-5 - ALTERNATIVE 3
SHALLOW SOIL
SOIL WASHING/SOIL LEACHING

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Asphalt PML Pad capable of withstanding increased load from soil washing system for extended period of time (Source: RACER)
Mobilization/Demobilization of General Equipment	Allowance for associated project costs and contractor equipment.(Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey Equ	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft^2 grid with minimum of 75 samples collected (Source: Vendor Quote)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Estimate based on weight of soil excavated (Source: Site F Experience)
Disposal Misc Buried Debris	Disposal costs for material other than soil (misc. material). Assume 1% of excavated weight is misc. material (Source: Site F Experience)
INORGANIC TREATMENT	
Bench Scale Study	Source: Vendor Estimate
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of the entire project duration. (Source: 1995 Means)
Mobilization of Soil Washing/Leaching Equ.	Assumes 50,000 tons can be treated in one year (6mo * 30 ton/hr * 10 hr/day) (Source: Vendor Estimate)
Treatment by Soil Washing/Leaching	Assumes 99% of AOC is treated [Treated Vol[illegible] *99%* 1.5] (Source: Vendor Estimate)
Recovered Metals Recycling	Assumes weight of recovered metals is 3% of treated soil, by weight. [Treated Vol[illegible] * 0.03 = Treated Vol[illegible]] (Source: Site F Experience)
TCLP Sampling of Treated Soil	One sample per 33 tons of processed material [Treated Vol/33]. Price covers analysis for RCRA metals. (Source: Vendor Estimate)
On-Site Stabilization of Soil Failing TCLP	Assumes 14% of soil volume is untreatable by soil washing/leaching. [Vol_AOC$_{cy}$ * 0.14 * 1.5ton/cy] {Sources: Volume Estimate from Site F Experience - - Stabilization Price from Vendor}
Off-Site Disposal of Soil Failing TCLP	Assumes 10% Bulking From Stabilization. Cost includes Disposal and Trans to USPCI MICF Landfill (Source: Vendor Estimate)
Additional Fill Material	15% of AOCvol (14% Soil + 1% Misc Mat.) will be unclassified fill from off-site source. [VOL_AOC$_{cy}$ * 0.15] (Source: RACER) Assumes treated soil from soil washing/leaching (85%) will be backfilled on site
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Cost
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES: VOLUME OF CONTAMINATED AREA (bcy)	15
AREA OF SITE (acres)	0.01
DISCOUNT RATE	7%

COST ESTIMATE
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SITE 129-5 - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/ON-SITE STABILIZATION/
OFF-SITE DISPOSAL

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	0.50	mo	$400	$200
Decontamination Facility	1	ls	$36,500	$36,500
Mobilization/Demobilization of General Equip	1	ls	$10,000	$10,000
Site Clearing	0.01	acre	$2,200	$30
Mobilization and Prep of UXO/Metal Survey	1	ls	$11,600	$11,600
UXO/Metal Debris Survey and Clearing	0.01	acre	$6,500	$100
AOC Soil Excavation and Backfill	15	bcy	$9.00	$100
UXO Oversight During Excavation	2	wk	$2,000	$3,000
Field Characterization and Screening	1	ls	$10,000	$10,000
Off-Site Fill	19	cy	$4.00	$75
DISPOSAL (NON-DIOXIN CONTAMINATED MATERIAL)				
Ordnance Screening	0.45	mo	$52,800	$23,800
TCLP Testing	1	ea	$200	$200
On-Site Stabilization	22	ton	$40	$900
Disposal of Stabilized Material	25	ton	$80	$2,000
Sampling and Analysis of Buried Debris	23	ton	$1.10	$20
Disposal Buried Debris	0.23	ton	$3,350	$800
	Total Construction Costs			**$99,300**
Engineering & Design (8% of CC)				$7,900
Permitting & Legal (12% of CC)				$11,900
Services During Construction (8% of CC)				$7,900
	Total Engineering and Construction Costs			$127,000
Contingency (10% of ECC)				$12,700
	Subtotal Capital Costs			$139,700
Contingency for Unknowns (30% of SCC)				$41,900
	TOTAL CAPITAL COSTS			$181,600
FUTURE COSTS (5 YR)				
5-Year Review	1	ls	$10,000	$10,000
Long Term Monitoring	1	ls	$13,836	$13,800
	TOTAL FUTURE COSTS			$23,800
	PRESENT WORTH OF FUTURE COSTS			$17,000
30-YEAR TOTAL PRESENT WORTH				$198,600

NOTES

VOLUME OF CONTAMINATED AREA (bcy)	15
AREA OF SITE (acres)	0.01
DISCOUNT RATE	7%

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE 129-5 - ALTERNATIVE 4
SHALLOW SOIL
EXCAVATION/ON-SITE STABILIZATION/
OFF-SITE DISPOSAL

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assume two trailers at monthly rental cost of $200/each (Source:1995 Means)
Decontamination Facility	Construction of Asphalt PML Pad (Source: RACER)
Mobilization/Demobilization of General Equip	Allowance for associated project costs and contractor equipment (Source: Montgomery Watson Estimate)
Site Clearing	Assume 120% of site cleared (Source: RACER)
Mobilization and Prep of UXO/Metal Survey	Price includes Mapping/Site Prep/Set-up and Tear Down (Source: RACER)
UXO/Metal Debris Survey and Clearing	Survey and Clearance of Shallow Ordnance (3' Depth) (Source: RACER)
AOC Soil Excavation and Backfill	Excavation/backfill/grading and reveg. of site - Assumes 12" lifts with excavator and wheel loader (Source: RACER)
UXO Oversight During Excavation	UXO Master Technician on site for 60% of project duration to oversee excavation (Source: RACER)
Field Characterization and Screening	Assumes samples collected on a 2500 ft² grid with minimum of 75 samples collected (Source: Vendor Quote)
Off-Site Fill	Unclassified fill from off-site source. Assumes 25% Bulking Factor. [$AOC_{bcy} * 1.25 = AOC_{cy}$] (Source: RACER)
DISPOSAL (NON-DIOXIN CONTAMINATED MATERIAL)	
Ordnance Screening	Cost includes rental of conveyors, hoppers and scaffolding and 4 laborers for 90% of project duration. (Source: 1995 Means)
TCLP Testing	One sample per 100 tons of excavated soil. Price covers analysis for RCRA metals (Source: Vendor Estimate)
On-Site Stabilization	Assumes 99% of excavated volume requires stabilization. [$AOC_{bcy} * 0.99 * 1.5ton/bcy = AOC_{tons}$] (Source: Vendor Est.)
Disposal of Stabilized Material	Assumes 10% Bulking From Stabilization. Cost includes Disposal and Trans to USPCI MICF Landfill (Source Vendor Est.)
Sampling and Analysis of Buried Debris	Sampling and Analysis of material other than soil (misc. material). Based on weight of soil excavated (Source: Site F Exp.)
Disposal Buried Debris	Disposal costs for material other than soil (misc. material). 1% of excavated weight is misc. material (Source: Site F Exp.)
Engineering & Design (8% of CC)	8% of Construction Costs
Permitting & Legal (12% of CC)	12% of Construction Costs
Services During Construction (8% of CC)	8% of Construction Costs
Contingency (10% of ECC)	10% of Total Engineering and Construction Costs
Contingency for Unknowns (30% of SCC)	30% of Subtotal of Capital Cost
FUTURE COSTS (5 YR)	
5-Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Long Term Monitoring	Cost of monitoring five wells, quarterly, in fifth year following remediation. (Source: Montgomery Watson Estimate)
	5 Yr FC * .7131 (P/F factor for costs incurred after n = 5 YRS @ 7%) (Source: Civil Engineering Reference Manual 1986)
30-YEAR TOTAL PRESENT WORTH	
NOTES	
VOLUME OF CONTAMINATED AREA (bcy)	15
AREA OF SITE (acres)	0.01
DISCOUNT RATE	7%

COST ESTIMATE
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SITE 129-15
DUMP
CHARACTERIZATION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
Decontamination Facility	1	ls	$2,000	$2,000
Geophysical Investigation	1	ls	$70,000	$70,000
Trench Excavation and Backfill	1,300	bcy	$60	$78,000
Soil Boring for Characterization	400	lf	$15	$6,000
UXO Oversight During Field Work	2	wk	$2,000	$4,000
Sampling Labor	2	wk	$16,000	$32,000
OVA Survey	2	wk	$284	$600
Characterization Samples				
Metals	100	ea	$350	$35,000
VOCs	100	ea	$105	$10,500
TCLP	100	ea	$550	$55,000
SVOC	40	ea	$576	$23,000
Gross alpha and beta	40	ea	$90	$3,600
Dioxins/Furans (low resolution)	10	ea	$800	$8,000
Reporting	1	ls	$10,000	$10,000
Subtotal Capital Costs				$337,700
Contingency (10% of SCC)				$33,800
TOTAL CAPITAL COSTS				$371,500
30-YEAR TOTAL PRESENT WORTH				$371,500

NOTES

VOLUME OF DUMP (bcy)	53,000
AREA OF DUMP (acres)	1.17

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE 129-15
DUMP
CHARACTERIZATION

Item/Description	Comments
CAPITAL COSTS	
Decontamination Facility	Temporary decon facility for field vehicles and equip (Source: RACER)
Geophysical Investigation	Estimate (Source: Montgomery Watson Estimate)
Trench Excavation and Backfill	Cost for digging four, 30' trenches to depth using loader-backhoe (Source: 1995 Means)
Soil Boring for Characterization	Characterization of landfill: One soil boring to depth on 60-foot grid (Source: Vendor Estimate)
UXO Oversight During Field Work	UXO Master Technician on site for project duration to oversee excavation (Source: RACER)
Sampling Labor	Assume Assoc. Engineer labor rate, for 70% of Project duration (Source: Montgomery Watson Estimate)
OVA Survey	Assume equipment rental for project duration @$1134/mo (Source: Vendor Estimate)
Characterization Samples	Assumes soil boring samples collected at 5' increments; Assumes four samples collected from base of each trench
Metals	85% of sample volume @ regular TAT (Source: Vendor Estimate)
VOCs	85% of sample volume @ regular TAT (Source: Vendor Estimate)
TCLP	85% of sample volume @ regular TAT. Price covers analysis for RCRA Metals and VOCs (Source: Vendor Estimate)
SVOC	30% of sample volume @ regular TAT (Source: Vendor Estimate)
Gross alpha and beta	30% of sample volume @ regular TAT (Source: Vendor Estimate)
Dioxins/Furans (low resolution)	10% of sample volume @ Regular TAT (Source: Vendor Estimate)
Reporting	Cost for generating a Sampling and Analysis Report. Assumes 100 hrs. at Prof. level and 20 hrs. at Admin level. (Source: Montgomery Watson)
Subtotal Capital Costs	
Contingency (10% of SCC)	10% of Subtotal Capital Costs
TOTAL CAPITAL COSTS	
30-YEAR TOTAL PRESENT WORTH	

NOTES

VOLUME OF DUMP (bcy)	53,000
AREA OF DUMP (acres)	1.17

ALTERNATIVE COST ESTIMATES
FOR
DEEP SOIL SITES
D AND G

OPERABLE UNIT 2 FEASIBILITY STUDY
TWIN CITIES ARMY AMMUNITION PLANT

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COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE D - ALTERNATIVE 1
DEEP SOIL
NO ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
Dismantle System				
Bldg. Demolition	1	ls	$5,000	$5,000
Piping Demolition	1	ls	$3,000	$3,000
Abandon Wells	40	ea	$500	$20,000
Field Oversight	24	hr	$65	$1,600
Project Management	8	hr	$100	$800
	Total Construction Costs			$30,400
Engineering & Design (8% of CC)				$2,400
Permitting & Legal (12% of CC)				$3,600
Services During Construction (8% of CC)				$2,400
	Total Engineering and Construction Costs			$38,800
Contingency (10% of ECC)				$3,900
	TOTAL CAPITAL COSTS			$42,700
O&M COSTS (30 YRS)				
Maintain Existing Cap	0.86	acres	$600	$500
Long Term Monitoring				
Sampling	24	hr	$65	$1,600
Analysis	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
	TOTAL O & M COSTS			$6,000
	PRESENT WORTH OF O&M COSTS			$74,500
FUTURE COSTS (30 YR)				
5-Year Re-Landscape Area	0.86	ls	$14,735	$12,700
5-Year Site Review	1	ls	$10,000	$10,000
	TOTAL FUTURE COSTS			$22,700
	PRESENT WORTH OF FUTURE COSTS			$49,000
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$166,200

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE D - ALTERNATIVE 1
DEEP SOIL
NO ACTION

Item/Description	Comments
CAPITAL COSTS	
Dismantle System	
Bldg. Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Piping Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Abandon Wells	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Field Oversight	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Project Management	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	12% of Construction Cost
Services During Construction (8% of CC)	8% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
O&M COSTS (30 YRS)	
Maintain Existing Cap	Mowing 12 times/year and Fertilizing 1/year (Source: RACER)
Long Term Monitoring	
Sampling	Assume Quarterly Sampling of 5 Wells by Assoc Level (Source Montgomery Watson Estimate)
Analysis	Assume Quarterly VOC Analysis of 5 Wells + 1 QA/QC Sample (Source: Vendor Estimate)
Reporting	Yearly Report of quarterly sampling and analysis, Assoc. Eng. (Source Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr period @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
5-Year Re-Landscape Area	Re-landscaping to divert stormwater around site. Price includes installation of erosion control measures, re-grading and resodding site
5-Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate)
	5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr period @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE D - ALTERNATIVE 2
DEEP SOIL
NO FURTHER ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
O&M COSTS (30 YRS)				
Maintain Existing Cap	0.86	acres	$600	$500
Long Term Monitoring				
Sampling	24	hr	$65	$1,600
Analysis	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
Existing System Operating Costs				
Electric Power	100,000	kWH	$0.06	$6,000
System Maintenance	1	ls	$3,500	$3,500
System Sampling Analysis	12	mo	$200	$2,400
Reporting	96	hr	$65	$6,200
	TOTAL O & M COSTS			$24,100
	PRESENT WORTH OF O&M COSTS			$299,100
FUTURE COSTS (30 YRS)				
5-Year Re-Landscape Area	0.86	ls	$14,735	$12,700
5-Year Site Review	1	ls	$10,000	$10,000
	TOTAL 5-YR COSTS			$22,700
30 Yr - Dismantle System				
Bldg. Demolition	1	ls	$5,000	$5,000
Piping Demolition	1	ls	$3,000	$3,000
Abandon Wells	40	ea	$500	$20,000
Field Oversight	24	hr	$65	$1,600
Project Management	8	hr	$100	$800
	30-Yr Construction Costs			$30,400
Engineering & Design (8% of CC)				$2,400
Permitting & Legal (12% of CC)				$3,600
Services During Construction (8% of CC)				$2,400
	30-Yr Engineering and Construction Costs			$38,800
Contingency (10% of ECC)				$3,900
	TOTAL 30-YR COSTS			$42,700
	PRESENT WORTH OF FUTURE COSTS			$54,600
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$353,700

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE D - ALTERNATIVE 2
DEEP SOIL
NO FURTHER ACTION

Item/Description	Comments
O&M COSTS (30 YRS)	
Maintain Existing Cap	Mowing 12 times/year and Fertilizing 1/year (Source: RACER)
Long Term Monitoring	
Sampling	Assume Quarterly Sampling of 5 Wells by Assoc Level (Source Montgomery Watson Estimate)
Analysis	Assume Quarterly VOC Analysis of 5 Wells + 1 QA/QC Sample (Source: Vendor Estimate)
Reporting	Yearly Report of quarterly sampling and analysis, Assoc. Eng. (Source Montgomery Watson Estimate)
Existing System Operating Costs	
Electric Power	Based on 1995 cost of $500/month. (Source: 1995 Costs)
System Maintenance	Based on 1995 costs
System Sampling Analysis	Based on monthly cost for air samples. (Source: 1995 Costs)
Reporting	12 days at an 8 hour day, Assoc. Eng. labor rate (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr period @ 7%) (Source: Civil Eng. Refer. Manual 1986)
FUTURE COSTS (30 YRS)	
5-Year Re-Landscape Area	Re-landscaping to divert stormwater around site. Price includes installation of erosion control measures.
5-Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate)
30 Yr - Dismantle System	
Bldg. Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Piping Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Abandon Wells	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Field Oversight	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Project Management	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	12% of Construction Cost
Services During Construction (8% of CC)	8% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
	5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr period @ 7%) + 30 Yr FC * .1314 (P/F factor for cost incurred at n = 30 Yrs period @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE D - ALTERNATIVE 3
DEEP SOIL
EXPAND SVE SYSTEM

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	1	mo	$400	$400
Decontamination Facility	1	ea	$8,000	$8.000
Mobilization/Demobilization of General Equipment	1	ls	$5,000	$5,000
EXPAND SVE SYSTEM				
Characterization				
Geophysical Surveys	1	ls	$50,000	$50,000
Drilling and Characterization - 4 SVE vents	1	ls	$179,200	$179,200
Pilot Study	1	ls	$24,410	$24,400
Soil Vapor Extraction System - 16 additional vents	16	ea	$6,100	$97,600
	Total Construction Costs			$364,600
Engineering & Design (8% of CC)				$29,200
Permitting & Legal (12% of CC)				$43,800
Services During Construction (8% of CC)				$29,200
	Engineering and Construction Costs			$466,800
Contingency (10% of ECC)				$46,700
	TOTAL CAPITAL COSTS			$513,500
O&M COSTS (5 YR)				
Long Term Monitoring				
Sampling	24	hr	$65	$1,600
Analysis	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
Existing System Operating Costs				
Electric Power	100,000	kWH	$0.06	$6,000
System Maintenance	1	ls	$3,500	$3,500
System Sampling Analysis	12	mo	$200	$2,400
Reporting	96	hr	$65	$6,200
	TOTAL O & M COSTS			$23,600
	PRESENT WORTH OF O&M COSTS			$96,800
FUTURE COSTS (5 YR)				
Confirmation Sampling and Analysis				
Drilling	500	ft	$15	$7,500
Professional Oversight	1	ls	2,000	$2,000
Analysis	5	ea	$105	$500
Five Year Site Review	1	ls	$10,000	$10,000
Dismantle System				
Bldg. Demolition	1	ls	$5,000	$5,000
Piping Demolition	1	ls	$3,000	$3,000
Abandon Wells	60	ea	$500	$30,000
Field Oversight	24	hr	$65	$1,600
Project Management	8	hr	$100	$800
	5-Yr Construction Costs			$60,400
Engineering & Design (8% of CC)				$4,800
Permitting & Legal (12% of CC)				$7,200
Services During Construction (8% of CC)				$4,800
	5-Yr Engineering and Construction Costs			$77,200
Contingency (10% of ECC)				$7,700
	TOTAL 5-YR COSTS			$84,900
	PRESENT WORTH OF FUTURE COSTS			$60,500
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$670,800

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE D - ALTERNATIVE 3
DEEP SOIL
EXPAND SVE SYSTEM

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assumes 2 trailers at monthly rental cost of $200 each. (Source: 1995 Means)
Decontamination Facility	Construction of decon facility suitable for light equipment (Source: RACER)
Mobilization/Demobilization of General Equipment	Estimated allowance for all activities assoc. with mob/demob. (Source: Montgomery Watson Estimate)
EXPAND SVE SYSTEM	
Characterization	
Geophysical Surveys	Geophysical Survey; Costs to be verified during pre-design activities (Source: Montgomery Watson Estimate)
Drilling and Characterization - 4 SVE vents	Assumes 4 vents w/ 4 monitor pts. w/ dual tube air rot. drilling & sampling @ 3 ft. int. (Source: RACER)
Pilot Study	4-Day Pilot Test (Source: Montgomery Watson Estimate)
Soil Vapor Extraction System - 16 additional vents	Assumes16 vents to variable depths (no monitor points) w/ HSA drilling; no sampling. Assumes 2 vents from Pilot Test are suitable (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	12% of Construction Cost
Services During Construction (8% of CC)	8% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
O&M COSTS (5 YR)	
Long Term Monitoring	
Sampling	Assume Quarterly Sampling of 5 Wells by Assoc Level (Source: Montgomery Watson Estimate)
Analysis	Assume Quarterly VOC Analysis of 5 Wells + 1 QA/QC Sample (Source: Vendor Estimate)
Reporting	Yearly Report of quarterly sampling and analysis, Assumes 15 hrs Assoc. Eng. (Source: Montgomery Watson Estimate)
Existing System Operating Costs	
Electric Power	Based on 1995 cost of $500/month. (Source: 1995 Costs)
System Maintenance	(Source: 1995 Costs)
System Sampling Analysis	Based on monthly cost for air samples. (Source: 1995 Costs)
Reporting	12 days at an 8 hour day, Assoc. Eng. labor rate (Source: Montgomery Watson Estimate)
	O&M * 4.1002 (P/A factor for cost incurred annually for n = 5 Yr period @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (5 YR)	
Confirmation Sampling and Analysis	
Drilling	Collection of four soil samples (2 ea @ 90' and 150') to verify that remediation is complete (Source: Vendor Estimate)
Professional Oversight	Assume Assoc Level on site during drilling (30hrs) (Source: Montgomery Watson Estimate)
Analysis	Analysis of verification samples, + QA/QC sample, for VOCs. (Source: Vendor Estimate)
Five Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate)
Dismantle System	
Bldg. Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Piping Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Abandon Wells	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Field Oversight	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Project Management	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	12% of Construction Cost
Services During Construction (8% of CC)	8% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
	FC * .7130 (P/F factor for cost incurred after n = 5 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE G - ALTERNATIVE 1
DEEP SOIL
NO ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
Dismantle System				
Bldg. Demolition	1	ls	$5,000	$5,000
Piping Demolition	1	ls	$3,000	$3,000
Abandon Wells	90	ea	$500	$45,000
Field Oversight	36	hr	$65	$2,300
Project Management	12	hr	$100	$1,200
	Total Construction Costs			$56,500
Engineering & Design (8% of CC)				$4,500
Permitting & Legal (12% of CC)				$6,800
Services During Construction (8% of CC)				$4,500
	Total Engineering and Construction Costs			$72,300
Contingency (10% of ECC)				$7,200
	TOTAL CAPITAL COSTS			$79,500
O&M COSTS (30 YRS)				
Maintain Existing Cap	1.58	acres	$500	$800
Long Term Monitoring				
Sampling	24	hr	$65	$1,600
Analysis	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
	TOTAL O & M COSTS			$6,300
	PRESENT WORTH OF O&M COSTS			$78,200
FUTURE COSTS (30 YR)				
5-Year Re-Landscape Area	1.58	ls	$14,735	$23,200
5-Year Site Review	1	ls	$10,000	$10,000
	TOTAL FUTURE COSTS			$33,200
	PRESENT WORTH OF FUTURE COSTS			$71,600
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$229,300

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE G - ALTERNATIVE 1
DEEP SOIL
NO ACTION

Item/Description	Comments
CAPITAL COSTS	
Dismantle System	
Bldg. Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Piping Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Abandon Wells	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Field Oversight	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Project Management	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	12% of Construction Cost
Services During Construction (8% of CC)	8% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
O&M COSTS (30 YRS)	
Maintain Existing Cap	Mowing 12 times/year and Fertilizing 1/year (Source: RACER)
Long Term Monitoring	
Sampling	Assume Quarterly Sampling of 5 Wells by Assoc Level (Source Montgomery Watson Estimate)
Analysis	Assume Quarterly VOC Analysis of 5 Wells + 1 QA/QC Sample (Source: Vendor Estimate)
Reporting	Yearly Report of quarterly sampling and analysis, Assoc. Eng. (Source Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr period @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
5-Year Re-Landscape Area	Re-landscaping to divert stormwater around site. Price includes installation of erosion control measures, re-grading and resodding site
5-Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate)
	5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr period @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE G - ALTERNATIVE 2
DEEP SOIL
NO FURTHER ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
O&M COSTS (30 YRS)				
Maintain Existing Cap	1.58	acres	$500	$800
Long Term Monitoring				
Sampling	24	hr	$65	$1,600
Analysis	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
Existing System Operating Costs				
Electric Power	110,000	kWH	$0.06	$6,600
System Maintenance	1	ls	$3,500	$3,500
System Sampling for Air Emissions	12	mo	$200	$2,400
Reporting	96	hr	$65.00	$6,200
	TOTAL O & M COSTS			$25,000
	PRESENT WORTH OF O&M COSTS			$310,200
FUTURE COSTS (30 YR)				
5-Year Re-Landscape Area	1.58	ls	$14,735	$23,200
5-Year Site Review	1	ls	$10,000	$10,000
	TOTAL 5-YR COSTS			$33,200
30 Yr - Dismantle System				
Bldg. Demolition	1	ls	$5,000	$5,000
Piping Demolition	1	ls	$3,000	$3,000
Abandon Wells	90	ea	$500	$45,000
Field Oversight	36	hr	$65	$2,300
Project Management	12	hr	$100	$1,200
	30-Yr Construction Costs			$56,500
Engineering & Design (8% of CC)				$4,500
Permitting & Legal (12% of CC)				$6,800
Services During Construction (8% of CC)				$4,500
	30-Yr Engineering and Construction Costs			$72,300
Contingency (10% of ECC)				$7,200
	TOTAL 30-YR COSTS			$79,500
	PRESENT WORTH OF FUTURE COSTS			$82,100
PRESENT WORTH	Discount Rate 7.00%			
	TOTAL PRESENT WORTH			$392,300

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE G - ALTERNATIVE 2
DEEP SOIL
NO FURTHER ACTION

Item/Description	Comments
O&M COSTS (30 YRS)	
Maintain Existing Cap	Mowing 12 times/year and Fertilizing 1/year (Source: RACER)
Long Term Monitoring	
Sampling	Assume Quarterly Sampling of 5 Wells by Assoc Level (Source Montgomery Watson Estimate)
Analysis	Assume Quarterly VOC Analysis of 5 Wells + 1 QA/QC Sample (Source: Vendor Estimate)
Reporting	Yearly Report of quarterly sampling and analysis, Assoc. Eng. (Source Montgomery Watson Estimate)
Existing System Operating Costs	
Electric Power	Based on 1995 cost of $500/month. (Source: 1995 Costs)
System Maintenance	Based on 1995 costs
System Sampling for Air Emissions	Based on monthly cost for air samples. (Source: 1995 Costs)
Reporting	12 days at an 8 hour day, Assoc. Eng. labor rate (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr period @ 7%) (Source: Civil Eng. Refer. Manual 1986)
FUTURE COSTS (30 YR)	
5-Year Re-Landscape Area	Re-landscaping to divert stormwater around site. Price includes installation of erosion control measures.
5-Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate)
30 Yr - Dismantle System	
Bldg. Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Piping Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Abandon Wells	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Field Oversight	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Project Management	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	12% of Construction Cost
Services During Construction (8% of CC)	8% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
	5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr period @ 7%) + 30 Yr FC * .1314 (P/F factor for cost incurred at n = 30 Yrs period @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE G - ALTERNATIVE 3
DEEP SOIL
EXPAND SVE SYSTEM

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	1	mo	$400	$400
Decontamination Facility	1	ea	$8,000	$8,000
Mobilization/Demobilization of General Equipment	1	ls	$5,000	$5,000
EXPAND SVE SYSTEM				
Characterization				
Geophysical Surveys	1	ls	$50,000	$50,000
Drilling and Characterization - 4 SVE vents	1	ls	$182,140	$182,100
Pilot Study	1	ls	$24,410	$24,400
Soil Vapor Extraction System - 20 additional vents	20	ls	$6,000	$120,000
	Total Construction Costs			$389,900
Engineering & Design (8% of CC)				$31,200
Permitting & Legal (12% of CC)				$46,800
Services During Construction (8% of CC)				$31,200
	Engineering and Construction Costs			$499,100
Contingency (10% of ECC)				$49,900
	TOTAL CAPITAL COSTS			$549,000
O&M COSTS (5YR)				
Long Term Monitoring				
Sampling	24	hr	$65	$1,600
Analysis	24	ea	$105	$2,500
Reporting	1	ls	$1,395	$1,400
Existing System Operating Costs				
Electric Power	110,000	kWH	$0.06	$6,600
System Maintenance	1	ls	$3,500	$3,500
System Sampling Air Emissions	12	mo	$200	$2,400
Reporting	96	hr	$65.00	$6,200
	TOTAL O & M COSTS			$24,200
	PRESENT WORTH OF O&M COSTS			$99,300
FUTURE COSTS (5 YR)				
Confirmation Sampling and Analysis				
Drilling	400	ft	$15	$6,000
Professional Oversight	1	ls	1,600	$1,600
Analysis	5	ea	$105	$500
5-Yr Site Review	1	ls	$10,000	$10,000
Dismantle System				
Bldg. Demolition	1	ls	$5,000	$5,000
Piping Demolition	1	ls	$3,000	$3,000
Abandon Wells	114	ea	$500	$57,000
Field Oversight	36	hr	$65	$2,300
Project Management	12	hr	$100	$1,200
	5-Yr Construction Costs			$78,500
Engineering & Design (8% of CC)				$6,300
Permitting & Legal (12% of CC)				$9,400
Services During Construction (8% of CC)				$6,300
	5-Yr Engineering and Construction Costs			$100,500
Contingency (10% of ECC)				$10,100
	TOTAL 5-YR COSTS			$110,600
	PRESENT WORTH OF FUTURE COSTS			$78,900
PRESENT WORTH	Discount Rate 7.00%			
	TOTAL PRESENT WORTH			$727,200

COST ESTIMATE
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SITE G - ALTERNATIVE 3
DEEP SOIL
EXPAND SVE SYSTEM

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assumes 2 trailers at monthly rental cost of $200 each. (Source: 1995 Means)
Decontamination Facility	Construction of decon facility suitable for light equipment (Source: RACER)
Mobilization/Demobilization of General Equipment	Estimated allowance for all activities assoc. with mob/demob. (Source: Montgomery Watson Estimate)
EXPAND SVE SYSTEM	
Characterization	
Geophysical Surveys	Geophysical Survey; Costs to be verified during pre-design activities (Source: Montgomery Watson Estimate)
Drilling and Characterization - 4 SVE vents	Assumes 4 vents w/ 4 monitor pts. w/ dual tube air rot. drilling & sampling @ 3 ft. int. (Source: RACER)
Pilot Study	4-Day Pilot Test (Source: Montgomery Watson Estimate)
Soil Vapor Extraction System - 20 additional vents	Racer: 20 vents to variable depths (no monitor points) w/ HSA drilling; no sampling. Assumes 2 vents from Pilot Test are suitable (Source: RACER)
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	12% of Construction Cost
Services During Construction (8% of CC)	8% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
O&M COSTS (5YR)	
Long Term Monitoring	
Sampling	Assume Quarterly Sampling of 5 Wells by Assoc Level (Source: Montgomery Watson Estimate)
Analysis	Assume Quarterly VOC Analysis of 5 Wells + 1 QA/QC Sample (Source: Vendor Estimate)
Reporting	Yearly Report of quarterly sampling and analysis. Assumes 15 hrs Assoc. Eng.
Existing System Operating Costs	(Source: Montgomery Watson Estimate)
Electric Power	Based on 1995 cost of $500/month. (Source: 1995 Costs)
System Maintenance	Based on 1995 costs.
System Sampling Air Emissions	Based on monthly cost for air samples. (Source: 1995 Costs)
Reporting	12 days at an 8 hour day, Assoc. Eng. labor rate (Source: Montgomery Watson Estimate)
	O&M * 4.1002 (P/A factor for cost incurred annually for n = 5 Yr period @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (5 YR)	
Confirmation Sampling and Analysis	
Drilling	Collection of four soil samples (2 ea @ 80' and 120') to verify that remediation is complete (Source: Vendor Estimate)
Professional Oversight	Assume Assoc Level on site during drilling (25hrs) (Source: Montgomery Watson Estimate)
Analysis	Analysis of verification samples, + QA/QC sample, for VOCs. (Source: Vendor Estimate)
5-Yr Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
Dismantle System	(Source: Montgomery Watson Estimate)
Bldg. Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Piping Demolition	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Abandon Wells	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Field Oversight	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Project Management	Estimate (Source: Wenck Interim Remedial Action Performance Evaluation)
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	12% of Construction Cost
Services During Construction (8% of CC)	8% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
	FC * .7130 (P/F factor for cost incurred after n = 5 Yr period @ 7%) (Source: Civil Eng. Refer. Manual 1986)
PRESENT WORTH	Present worth of alternative

ALTERNATIVE COST ESTIMATES FOR SHALLOW GROUNDWATER SITES A, I AND K

OPERABLE UNIT 2 FEASIBILITY STUDY
TWIN CITIES ARMY AMMUNITION PLANT

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SITE A - ALTERNATIVE 1
SHALLOW GROUNDWATER
NO ACTION

	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
	TOTAL CAPITAL COSTS			$0
O & M COSTS (30 YR)				
Long term Monitoring of 18 Boundary Wells				
Sampling Labor	80	hr	$65	$5,200
Analysis	72	ea	$455	$32,800
Reporting	40	hr	$65	$2,600
	TOTAL O & M COSTS			$40,600
	PRESENT WORTH OF O&M COSTS			$503,440
FUTURE COSTS (30 YR)				
Five Year Site Review	1	ls	$10,000	$10,000
	TOTAL FUTURE COSTS			$10,000
	PRESENT WORTH OF FUTURE COSTS			$21,600
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$525,000

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE A - ALTERNATIVE 1
SHALLOW GROUNDWATER
NO ACTION

	Comments
CAPITAL COSTS	No capital costs associated with this alternative
O & M COSTS (30 YR)	
Long term Monitoring of 18 Boundary Wells	
Sampling Labor	Assume Assoc. Engineer labor rate, 20 hrs. per sampling event, 4 times/year (Source: Montgomery Watson Estimate)
Analysis	18 boundary wells, 4 time/year, $105 VOCs, $350 metals (Source: Vendor Estimate)
Reporting	40 hrs. at Assoc. eng. labor rate (Source: Montgomery Watson Estimate)
	O&M * 12.4 (P/A factor for cost incurred annually for n = 30 Yr @ 7%) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
Five Year Site Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level (Source: Montgomery Watson Estimate) 5 Yr FC *2.1577 (P/F factor for cost incurred at n = 5 Yr for 30 Yr period @ 7%) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE A - ALTERNATIVE 2
SHALLOW GROUNDWATER
BOUNDARY CONTAINMENT

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Decontamination Facility	1	ea	$8,000	$8,000
Source Characterization/Remediation	1	ls	$500,000	$500,000
	Total Construction Costs			$508,000
Engineering & Design (8% of CC)				$40,600
Permitting & Legal (12% of CC)				$61,000
Services During Construction (8% of CC)				$40,600
	Total Engineering and Construction Costs			$650,200
Contingency (10% of ECC)				$65,000
	Subtotal Capital Costs			$715,200
Contingency (30% of SCC)				$214,600
	TOTAL CAPITAL COSTS			$929,800
O & M COSTS (10 YR)				
Long term Monitoring of 18 Boundary Wells				
Sampling Labor	80	hr	$65	$5,200
Analysis	72	ea	$455	$32,760
Reporting	40	hr	$65	$2,600
Existing Boundary Containment System				
Labor	104	hr	$65	$6,800
Electric Power	30,000	Khr	$0.06	$1,800
System Maintenance	1	ls	$1,000	$1,000
System Sampling Analysis	108	ea	$485	$52,400
Sanitary Sewer Discharge	4	ea	$12,600	$50,400
Chlorine Shock Treatment	9	ea	$3,600	$32,400
Reporting	104	hr	$65	$6,800
	TOTAL O & M COSTS			$192,200
	PRESENT WORTH OF O&M COSTS			$1,349,200
FUTURE COSTS (10 YR)				
5-YEAR COSTS				
Interim Evaluation	1	ls	$10,000	$10,000
	TOTAL 5 YR FUTURE COSTS			$10,000
10-YEAR COSTS				
Dismantle System				
Dismantle Pipe and Control Building	1	ls	$5,500	$5,500
Abandon Wells	18	ea	$500	$9,000
Field Oversight	10	hr	$65	$650
Project Management	4	hr	$100	$400
	TOTAL 10 YR FUTURE COSTS			$15,600
	PRESENT WORTH OF FUTURE COSTS			$15,100
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$2,294,100

COST ESTIMATE
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SITE A - ALTERNATIVE 2
SHALLOW GROUNDWATER
BOUNDARY CONTAINMENT

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Decontamination Facility	Construction of decon facility suitable for light equipment (Source: RACER)
Source Characterization/Remediation	(Source: Montgomery Watson Estimate)
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	8% of Construction Cost
Services During Construction (8% of CC)	12% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
Contingency (30% of SCC)	30% of Subtotal Capital Cost
O & M COSTS (10 YR)	
Long term Monitoring of 18 Boundary Wells	
Sampling Labor	Assume Assoc. Engineer labor rate, 20 hrs. per sampling event, 4 times/year (Source: Montgomery Watson Estimate)
Analysis	18 boundary wells, 4 time/year, $105 VOCs, $350 metals (Source: Vendor Estimate)
Reporting	40 hrs. at Assoc. eng. labor rate (Source: Montgomery Watson Estimate)
Existing Boundary Containment System	
Labor	13 days at an 8 hour day, Assoc. Eng. labor rate (Source: Montgomery Watson Estimate)
Electric Power	Based on 1995 cost of $100-$200/month. (Source: 1995 Costs)
System Maintenance	Miscellaneous Maintenance (meters/pumps/valves) (Source: 1995 Costs)
System Sampling Analysis	9 (recovery wells+discharge point sampled monthly ($105 VOCs, $350 metals, $30 Nitrate & SS)
Sanitary Sewer Discharge	Shoreview-Arden Hills and MCES Sewer/POTW use charges based on 40 gpm. (Source: 1995 Costs)
Chlorine Shock Treatment	$3600/every 6 weeks (Source: 1995 Costs)
Reporting	13 days at an 8 hour day, Assoc. Eng. labor rate (Source: Montgomery Watson Estimate)
	O&M * 7.02 ((P/A factor for cost incurred annually for n = 10 Yr P/A @ 7%)
FUTURE COSTS (10 YR)	
5-YEAR COSTS	
Interim Evaluation	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
10-YEAR COSTS	
Dismantle System	
Dismantle Pipe and Control Building	Demolition of 2200LF pipe and building (Source: 1995 Means)
Abandon Wells	Source: Vendor Estimate
Field Oversight	Source: Montgomery Watson Estimate
Project Management	Source: Montgomery Watson Estimate
	5 Yr FC * 0.713 (P/F factor for cost incurred after n =5 Years @ 7%) 10 Yr FC * 0.5083 (P/F factor for cost incurred after n =10 Years @ 7%)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
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SITE A- ALTERNATIVE 3
SHALLOW GROUNDWATER
BOUNDARY CONTAINMENT
WITH AIR SPARGING

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	1	mo	$400	$400
Decontamination Facility	1	ls	$8,000	$8,000
Demobilization	1	ls	$5,000	$5,000
Source Characterization/Remediation	1	ls	$500,000	$500,000
AIR SPARGING/SVE SYSTEM				
Bench Scale Study	1	ls	$50,000	$50,000
Pilot Study	1	ls	$15,000	$15,000
Install Air Sparging Points	65	ea	$2,280	$148,200
Compressor for Air Sparge System	14	ea	$4,475	$62,700
Install Soil Vapor Extraction System	21	ea	$1,360	$28,600
280 cfm blowers for SVE System	2	ea	$8,172	$16,300
Sampling and Analysis at Start-up	1	ls	$6,370	$6,400
	Total Construction Costs			$840,600
Engineering & Design (8% of CC)				$67,200
Permitting & Legal (12% of CC)				$100,900
Services During Construction (8% of CC)				$67,200
	Total Engineering and Construction Costs			$1,075,900
Contingency (10% of ECC)				$107,600
	Subtotal Capital Costs			$1,183,500
Contingency (30% of SCC)				$355,100
	TOTAL CAPITAL COSTS			$1,538,600
O & M COSTS (10 YR)				
Long term Monitoring of 18 Boundary Wells				
Sampling Labor	80	hr	$65.00	$5,200
Analysis	72	ea	$430.00	$31,000
Reporting	40	hr	$65.00	$2,600
Existing Boundary Containment System				
Labor	104	hr	$65.00	$6,760
Electric Power	30,000	Khr	$0.06	$1,800
System Maintenance	1	ls	$1,000	$1,000
System Sampling Analysis	108	ea	$485	$52,400
Sanitary Sewer Discharge	4	ea	$12,600	$50,400
Chlorine Shock Treatment	9	ea	$3,600	$32,400
Reporting	104	hr	$65.00	$6,800
Air Sparging/SVE System				
Electric Power	268,600	Khr	$0.06	$16,100
System Maintenance	1	ls	$5,225	$5,200
Sampling and Analysis	1	ls	$5,150	$5,200
	TOTAL O & M COSTS			$216,860
	PRESENT WORTH OF O&M COSTS			$1,522,357
FUTURE COSTS (10 YR)				
5-YEAR COSTS				
Interim Evaluation	1	ls	$10,000	$10,000
	TOTAL 10 YR FUTURE COSTS			$10,000
10-YEAR COSTS				
Dismantle System				
Dismantle Pipe and Control Building	1	ls	$5,500	$5,500
Abandon Wells	18	ea	$500	$9,000
Field Oversight	10	hr	$65	$650
Project Management	4	hr	$100	$400
	TOTAL 10 YR FUTURE COSTS			$15,600
	PRESENT WORTH OF FUTURE COSTS			$15,100
PRESENT WORTH	Discount Rate	7.00%		
	TOTAL PRESENT WORTH			$3,076,100

COST ESTIMATE
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SITE A- ALTERNATIVE 3
SHALLOW GROUNDWATER
BOUNDARY CONTAINMENT
WITH AIR SPARGING

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assumes 2 trailers at monthly rental cost of $200 each. (Source: 1995 Means)
Decontamination Facility	Construction of decon facility suitable for light equipment (Source: RACER)
Demobilization	Estimated allowance for all activities assoc. with mob/demob. (Source: Montgomery Watson Estimate)
Source Characterization/Remediation	Montgomery Watson Estimate
AIR SPARGING/SVE SYSTEM	
Bench Scale Study	Montgomery Watson Estimate
Pilot Study	One sparge point and two piezometers installed. System operated and monitored for 1 week (Source: RACER)
Install Air Sparging Points	2" PVC, 40-ft deep, all assoc piping (Source: RACER)
Compressor for Air Sparge System	Source: RACER
Install Soil Vapor Extraction System	Source: RACER
280 cfm blowers for SVE System	Source: RACER
Sampling and Analysis at Start-up	Source: RACER
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	8% of Construction Cost
Services During Construction (8% of CC)	12% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
Contingency (30% of SCC)	30% of Subtotal Capital Cost
O & M COSTS (10 YR)	
Long term Monitoring of 18 Boundary Wells	
Sampling Labor	Assume Assoc. Engineer labor rate, 20 hrs. per sampling event, 4 times/year
Analysis	18 boundary wells, 4 time/year, $105 VOCs, $350 metals (Source: Vendor Estimate)
Reporting	40 hrs. at Assoc. eng. labor rate (Source: Montgomery Watson Estimate)
Existing Boundary Containment System	
Labor	13 days at an 8 hour day, Assoc. Eng. labor rate (Source: Montgomery Watson Estimate)
Electric Power	Based on 1995 cost of $100-$200/month. (Source: 1995 Costs)
System Maintenance	Miscellaneous Maintenance (meters/pumps/valves) (Source: 1995 Costs)
System Sampling Analysis	9 (recovery wells+discharge point sampled monthly ($105 VOCs, $350 metals, $30 Nitrate & SS)
Sanitary Sewer Discharge	Shoreview-Arden Hills and MCES Sewer/POTW use charges based on 40 gpm. (Source: 1995 Costs)
Chlorine Shock Treatment	$3600/every 6 weeks (Source: 1995 Costs)
Reporting	13 days at an 8 hour day, Assoc. Eng. labor rate (Source: Montgomery Watson Estimate)
Air Sparging/SVE System	
Electric Power	Source: RACER
System Maintenance	Source: RACER
Sampling and Analysis	Source: RACER
	O&M * 7.02 ((P/A factor for cost incurred annually for n = 10 Yr P/A @ 7%)
FUTURE COSTS (10 YR)	
5-YEAR COSTS	
Interim Evaluation	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
10-YEAR COSTS	
Dismantle System	
Dismantle Pipe and Control Building	Demolition of 2200LF pipe and building (Source: 1995 Means)
Abandon Wells	Source: Vendor Estimate
Field Oversight	Source: Montgomery Watson Estimate
Project Management	Source: Montgomery Watson Estimate
	5 Yr FC * 0.713 (P/F factor for cost incurred after n =5 Years @ 7%)
	10 Yr FC * 0.5083 (P/F factor for cost incurred after n =10 Years @ 7%)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
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SITE A - ALTERNATIVE 4
SHALLOW GROUNDWATER
BOUNDARY CONTAINMENT
WITH INFILTRATION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
GENERAL				
Construction Trailer (rental)	1	mo	$400	$400
Decontamination Facility	1	ls	$8,000	$8,000
Mobilization/Demobilization of General Equipment	1	ls	$5,000	$5,000
Source Characterization/Remediation	1	ls	$500,000	$500,000
TREATMENT COST				
Bench Scale Study	1	ls	$50,000	$50,000
Air Stripping	1	ls	$32,175	$32,200
Infiltration Gallery	1	ls	$47,360	$47,400
Analytical at Start-up	1	ls	$1,500	$1,500
	Total Construction Costs			$644,500
Engineering & Design (8% of CC)				$51,600
Permitting & Legal (12% of CC)				$77,300
Services During Construction (8% of CC)				$51,600
	Total Engineering and Construction Costs			$825,000
Contingency (10% of ECC)				$82,500
	Subtotal Capital Costs			$907,500
Contingency (30% of SCC)				$272,300
	TOTAL CAPITAL COSTS			$1,179,800
O & M COSTS (10 YRS)				
Long Term (Quarterly) Monitoring of 4 wells				
Sampling Labor	80	hr	$65	$5,200
Analysis	72	ea	$455	$32,800
Reporting	40	hr	$65	$2,600
Existing Boundary Containment System				
Labor	104	hr	$65	$6,800
Electric Power	30,000	Khr	$0.06	$1,800
System Maintenance	1	ls	$1,000	$1,000
System Sampling Analysis	108	ea	$485	$52,400
Chlorine Shock Treatment	9	ea	$3,600	$32,400
Reporting	104	hr	$65	$6,800
Additional Maintenance for Air Stripping System	1	ls	$5,580	$5,600
Additional Maintenance for Infiltration Gallery	1	ls	$1,500	$1,500
	TOTAL O & M COSTS			$148,900
	PRESENT WORTH OF O&M COSTS			$1,045,300
FUTURE COSTS (10 YRS)				
5-YEAR COSTS				
Interim Evaluation	1	ls	$10,000	$10,000
	TOTAL 5 YR COSTS			$10,000
10-YEAR COSTS				
Dismantle System				
Dismantle Pipe and Control Building	1	ls	$5,500	$5,500
Abandon Wells	18	ea	$500	$9,000
Field Oversight	10	hr	$65	$650
Project Management	4	hr	$100	$400
	TOTAL 10 YR COSTS			$15,600
	PRESENT WORTH OF FUTURE COSTS			$15,100
PRESENT WORTH	Discount Rate = 7.00%			
	TOTAL PRESENT WORTH			$2,240,200

COST ESTIMATE
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SITE A - ALTERNATIVE 4
SHALLOW GROUNDWATER
BOUNDARY CONTAINMENT
WITH INFILTRATION

Item/Description	Comments
CAPITAL COSTS	
GENERAL	
Construction Trailer (rental)	Assumes 2 trailers at monthly rental cost of $200 each. (Source: 1995 Means)
Decontamination Facility	Construction of decon facility suitable for light equipment (Source: RACER)
Mobilization/Demobilization of General Equipment	Estimated allowance for all activities assoc. with mob/demob. (Source: Montgomery Watson Estimate)
Source Characterization/Remediation	Montgomery Watson Estimate
TREATMENT COST	
Bench Scale Study	Montgomery Watson Estimate
Air Stripping	Source: RACER
Infiltration Gallery	Source: RACER
Analytical at Start-up	Source: RACER
Engineering & Design (8% of CC)	8% of Construction Cost
Permitting & Legal (12% of CC)	8% of Construction Cost
Services During Construction (8% of CC)	12% of Construction Cost
Contingency (10% of ECC)	10% of Engineering and Construction Cost
Contingency (30% of SCC)	30% of Subtotal Capital Cost
O & M COSTS (10 YRS)	
Long Term (Quarterly) Monitoring of 4 wells	
Sampling Labor	Assume Assoc. Engineer labor rate, 20 hrs. per sampling event, 4 times/year
Analysis	18 boundary wells, 4 time/year, $105 VOCs, $350 metals (Source: Vendor Estimate)
Reporting	40 hrs. at Assoc. eng. labor rate (Source: Montgomery Watson Estimate)
Existing Boundary Containment System	
Labor	13 days at an 8 hour day, Assoc. Eng. labor rate (Source: Montgomery Watson Estimate)
Electric Power	Based on 1995 cost of $100-$200/month. (Source: 1995 Costs)
System Maintenance	Miscellaneous Maintenance (meters/pumps/valves) (Source: 1995 Costs)
System Sampling Analysis	9 (recovery wells+discharge point sampled monthly ($105 VOCs, $350 metals, $30 Nitrate & SS)
Chlorine Shock Treatment	$3600/every 6 weeks (Source: 1995 Costs)
Reporting	13 days at an 8 hour day, Assoc. Eng. labor rate (Source: Montgomery Watson Estimate)
Additional Maintenance for Air Stripping System	Source: RACER
Additional Maintenance for Infiltration Gallery	Source: RACER
	O&M * 7.02 ((P/A factor for cost incurred annually for n = 10 Yr P/A @ 7%)
FUTURE COSTS (10 YRS)	
5-YEAR COSTS	
Interim Evaluation	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs at Admin. level
10-YEAR COSTS	
Dismantle System	
Dismantle Pipe and Control Building	Demolition of 2200LF pipe and building (Source: 1995 Means)
Abandon Wells	Source: Vendor Estimate
Field Oversight	Source: Montgomery Watson Estimate
Project Management	Source: Montgomery Watson Estimate
	5 Yr FC * 0.713 (P/F factor for cost incurred after n =5 Years @ 7%)
	10 Yr FC * 0.5083 (P/F factor for cost incurred after n =10 Years @ 7%)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
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SITE I
SHALLOW GROUNDWATER
NO ACTION

Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COST				
None				
TOTAL CAPITAL COST				$0
ANNUAL OPERATION AND MAINTENANCE (30 YR)				
Groundwater Sampling/Reporting	100	hours	$60	$6,000
Laboratory Analysis	11	each	$160	$1,800
TOTAL ANNUAL COST				$7,800
PRESENT WORTH OF ANNUAL COSTS				$96,800
FUTURE COSTS				
Five Year Site Review	1	lump sum	$10,000	$10,000
TOTAL FUTURE COST				$10,000
PRESENT WORTH OF FUTURE COSTS				$21,600
PRESENT WORTH	Interest Rate: 7%			
Contingency (20%)				$23,700
TOTAL PRESENT WORTH				$142,000

COST ESTIMATE
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SITE I
SHALLOW GROUNDWATER
EXTRACTION WITH POTW
DISCHARGE

Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COST				
Mob/Demob	1	lump sum	$4,000	$4,000
Pump/Controls/Electric Service	1	lump sum	$3,000	$3,000
Drain Chamber	1	lump sum	$4,000	$4,000
Piping/Trenching	90	foot	$40	$3,600
Restoration	1	lump sum	$1,500	$1,500
TOTAL CAPITAL COST				$16,100
ANNUAL OPERATION & MAINTENANCE (30 YR)				
Sampling & Reporting*	1	lump sum	$13,800	$13,800
POTW Discharge	790	Mgal	$2.94	$2,300
Electric Usage	4,000	kw-hr	$0.06	$240
Extraction Well/Pump O & M	1	lump sum	$3,000	$3,000
Inspection	1	lump sum	$2,000	$2,000
TOTAL ANNUAL COST				$21,300
PRESENT WORTH OF ANNUAL COSTS				$264,300
FUTURE COSTS				
Five Year Site Review	1	lump sum	$10,000	$10,000
Total 5 Yr Costs (every 5 yrs for 30 yrs)				$10,000
Abandon Well	1	each	$500	$500
Dismantle Controls	1	lump sum	$1,000	$1,000
Total 30 Yr Costs (one time)				$1,500
PRESENT WORTH OF FUTURE COSTS				$21,800
PRESENT WORTH	Interest Rate:	7%		
Engineering(10%)				$30,200
Contingency (20%)				$60,400
TOTAL PRESENT WORTH				$393,000

*Includes groundwater and discharge monitoring

COST ESTIMATE
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SITE I
SHALLOW GROUNDWATER
EXTRACTION WITH AIR
STRIPPING

Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COST				
Mob/Demob	1	lump sum	$10,000	$10,000
Trenching/Pipe	630	foot	$40	$25,200
Restoration	1	lump sum	$11,000	$11,000
Iron Pretreatment System	1	lump sum	$1,000	$1,000
NPDES Permit	1	lump sum	$8,000	$8,000
TOTAL CAPITAL COST				$55,200
ANNUAL OPERATION AND MAINTENANCE (30 YR)				
Sampling & Reporting*	1	lump sum	$20,400	$20,400
Electrical Usage	4,000	kw-hr	$0.06	$240
Iron Pretreatment Chemicals	12	month	$100	$1,200
Air Stripping Tower O & M	1	lump sum	$15,000	$15,000
Extraction Well/Pump O & M	1	lump sum	$3,000	$3,000
Inspection	1	lump sum	$2,000	$2,000
TOTAL ANNUAL COST				$41,800
PRESENT WORTH OF ANNUAL COSTS				$518,700
FUTURE COSTS				
Five Year Site Review	1	lump sum	$10,000	$10,000
Total 5 Yr Costs(every 5 yrs for 30 yrs)				$10,000
Abandon Well	1	each	$500	$500
Dismantle Controls	1	lump sum	$2,000	$2,000
Total 30 Yr Costs (one time)				$2,500
PRESENT WORTH OF FUTURE COSTS				$21,900
PRESENT WORTH	Interest Rate:	7%		
Engineering (10%)				$59,600
Contingency (20%)				$119,200
TOTAL PRESENT WORTH				$775,000

'udes groundwater and treatment system monitoring

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE I
SHALLOW GROUNDWATER
AIR SPARGING - VERTICAL WELLS

Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COST				
Control Building	1	lump sum	$4,000	$4,000
Interior Piping	100	foot	$15	$1,500
Piping to Wells	1200	foot	$20	$24,000
AS Well Installation	12	each	$2,000	$24,000
SVE Well Installation	3	each	$1,000	$3,000
SVE Vapor Probes	6	each	$1,100	$6,600
SVE System - Instrumentation	1	lump sum	$5,000	$5,000
AS System - Instrumentation	1	lump sum	$5,000	$5,000
Controls/Electrical	1	lump sum	$5,000	$5,000
Pilot Test	1	lump sum	$40,000	$40,000
System Startup	1	lump sum	$16,000	$16,000
TOTAL CAPITAL COST				$134,100
ANNUAL OPERATION & MAINTENANCE (3 YR)				
Electrical Usage	80,000	kW-hr	$0.06	$4,800
Air Sampling & Reporting	1	lump sum	$12,000	$12,000
Air Sparging System O&M	1	lump sum	$15,000	$15,000
TOTAL ANNUAL COST				$31,800
PRESENT WORTH OF 3 YR ANNUAL COSTS				$83,500
ANNUAL OPERATION & MAINTENANCE (30 YR)				
Groundwater Sampling & Reporting	1	lump sum	$7,800	$7,800
TOTAL ANNUAL COST				$7,800
PRESENT WORTH OF 30 YR ANNUAL COSTS				$96,800
FUTURE COSTS				
Five Year Site Review	1	lump sum	$10,000	$10,000
Total 5 Yr Costs (every 5 yrs for 30 yrs)				$10,000
Dismantle System	1	lump sum	$10,000	$10,000
Total 3 Yr Costs (one time)				$10,000
PRESENT WORTH OF FUTURE COSTS				$29,700
PRESENT WORTH	Interest Rate:	7%		
Engineering (20%)				$68,800
Contingency (20%)				$68,800
TOTAL PRESENT WORTH*				$482,000

* This estimate does not include an off-gas treatment system. The cost is subject to change based on the need for off-gas treatment.

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE I
SHALLOW GROUNDWATER
AIR SPARGING - HORIZONTAL WELLS

Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COST				
Control Building	1	lump sum	$4,000	$4,000
Interior Piping	100	foot	$15	$1,500
AS Well Installation	1500	foot	$300	$450,000
SVE Well Installation	900	foot	$300	$270,000
SVE Vapor Probes	6	each	$1,100	$6,600
SVE System - Instrumentation	1	lump sum	$5,000	$5,000
AS System - Instrumentation	1	lump sum	$5,000	$5,000
Controls/Electrical	1	lump sum	$5,000	$5,000
Pilot Test	1	lump sum	$40,000	$40,000
System Startup	1	lump sum	$16,000	$16,000
TOTAL CAPITAL COST				$803,100
ANNUAL OPERATION & MAINTENANCE (3 YR)				
Electrical Usage	80,000	kW-hr	$0.06	$4,800
Air Sampling & Reporting	1	lump sum	$12,000	$12,000
Air Sparging System O&M	1	lump sum	$15,000	$15,000
TOTAL ANNUAL COST				$31,800
PRESENT WORTH OF 3YR ANNUAL COSTS				$83,500
ANNUAL OPERATION & MAINTENANCE (30 YR)				
Groundwater Sampling & Reporting	1	lump sum	$7,800	$7,800
TOTAL ANNUAL COST				$7,800
PRESENT WORTH OF 30 YR ANNUAL COSTS				$96,800
FUTURE COSTS				
Five Year Site Review	1	lump sum	$10,000	$10,000
Total 5 Yr Costs (every 5 yrs for 30 yrs)				$10,000
Dismantle System	1	lump sum	$10,000	$10,000
Total 3 Yr Costs (one time)				$10,000
PRESENT WORTH OF FUTURE COSTS				$29,700
PRESENT WORTH	Interest Rate:	7%		
Engineering (20%)				$202,600
Contingency (20%)				$202,600
TOTAL PRESENT WORTH*				$1,418,000

* This estimate does not include an off-gas treatment system. The cost is subject to change based on the need for off-gas treatment.

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COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE K
SHALLOW GROUNDWATER
NO ACTION

Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COST				
None				
TOTAL CAPITAL COST				$0
ANNUAL OPERATION AND MAINTENANACE (30 YR)				
Groundwater Sampling/Reporting	110	hours	$60	$6,600
Laboratory Analysis	17	each	$150	$2,600
TOTAL ANNUAL COST				$9,200
PRESENT WORTH OF ANNUAL COSTS				$114,200
FUTURE COSTS				
Five Year Site Review	1	lump sum	$10,000	$10,000
TOTAL FUTURE COST				$10,000
PRESENT WORTH OF FUTURE COSTS				$21,600
PRESENT WORTH	Interest Rate:	7%		
Contingency (20%)				$27,200
TOTAL PRESENT WORTH				$163,000

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE K
SHALLOW GROUNDWATER
EXTRACTION/CONTAINMENT
WITH AIR STRIPPING

Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COST				
Mob/Demob	1	lump sum	$10,500	$10,500
Shallow Tray Air Stripper	1	lump sum	$23,000	$23,000
Housing	1	lump sum	$11,000	$11,000
Piping/Control Modifications	1	lump sum	$11,000	$11,000
TOTAL CAPITAL COST				$55,500
ANNUAL OPERATION & MAINTENANCE (30 YR)				
Electrical Usage	11,300	kw-hr	$0.06	$680
Sampling & Reporting*	1	lump sum	$33,600	$33,600
Air Stripper O & M	1	lump sum	$3,500	$3,500
Pump O & M	1	lump sum	$1,500	$1,500
TOTAL ANNUAL COST				$39,300
PRESENT WORTH OF ANNUAL COSTS				$487,700
FUTURE COSTS				
Five Year Site Review	1	lump sum	$10,000	$10,000
TOTAL FUTURE COST				$10,000
PRESENT WORTH OF FUTURE COSTS				$21,600
PRESENT WORTH	Interest Rate:	7%		
Engineering (10%)				$56,500
Contingency (20%)				$113,000
TOTAL PRESENT WORTH				$734,000

*Includes groundwater and treatment system monitoring

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COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE K
SHALLOW GROUNDWATER
EXTRACTION/CONTAINMENT WITH
AIR SPARGING - VERTICAL WELLS

Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COST				
Control Building	1	lump sum	$4,000	$4,000
Interior Piping	100	foot	$15	$1,500
Piping to Wells	6500	foot	$20	$130,000
AS Well Installation	160	each	$2,000	$320,000
SVE Well Installation	20	each	$1,000	$20,000
SVE Vapor Probes	8	each	$1,100	$8,800
SVE System - Instrumentation	1	lump sum	$10,000	$10,000
AS System - Instrumentation	1	lump sum	$25,000	$25,000
Controls/Electrical	1	lump sum	$5,000	$5,000
Pilot Test	1	lump sum	$40,000	$40,000
System Startup	1	lump sum	$18,000	$18,000
TOTAL CAPITAL COST				$582,300
ANNUAL OPERATION & MAINTENANCE (7 YR)				
Electrical Usage	300,000	kW-hr	$0.06	$18,000
Air Sampling & Reporting	1	lump sum	$12,000	$12,000
Air Sparging System O&M	1	lump sum	$35,000	$35,000
TOTAL ANNUAL COST				$65,000
PRESENT WORTH OF 7 YR ANNUAL COSTS				$350,300
ANNUAL OPERATION & MAINTENANCE (30 YR)				
Electrical Usage	11,300	kW-hr	$0.06	$680
Groundwater/Air Stripper Sa	1	lump sum	$33,600	$33,600
Air Stripping Tower O & M	1	lump sum	$24,500	$24,500
Pumping O & M	1	lump sum	$1,500	$1,500
TOTAL ANNUAL COST				$60,280
PRESENT WORTH OF 30 YR ANNUAL COSTS				$748,000
FUTURE COSTS				
Five Year Site Review	1	lump sum	$10,000	$10,000
Total 5 Yr Costs (every 5 yrs for 30 yrs)				$10,000
Dismantle System	1	lump sum	$30,000	$30,000
Total 7 Yr Costs (one time)				$30,000
PRESENT WORTH OF FUTURE COSTS				$40,300
PRESENT WORTH	Interest Rate:	7%		
Engineering (10%)				$172,100
Contingency (20%)				$344,200
TOTAL PRESENT WORTH*				$2,237,000

* This estimate does not include an off-gas treatment system. The cost is subject to change based on the need for off-gas treatment.

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

SITE K
SHALLOW GROUNDWATER
EXTRACTION/CONTAINMENT WITH
AIR SPARGING - HORIZONTAL

Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COST				
Control Building	1	lump sum	$4,000	$4,000
Interior Piping	100	foot	$20	$2,000
AS Well Installation	3,600	foot	$300	$1,080,000
SVE Well Installation	1,500	foot	$300	$450,000
SVE Vapor Probes	8	each	$1,100	$8,800
SVE System - Instrumentation	1	lump sum	$10,000	$10,000
AS System - Instrumentation	1	lump sum	$25,000	$25,000
Controls/Electrical	1	lump sum	$5,000	$5,000
Pilot Test	1	lump sum	$50,000	$50,000
System Startup	1	lump sum	$18,000	$18,000
TOTAL CAPITAL COST				$1,652,800
ANNUAL OPERATION & MAINTENANCE (7YR)				
Electrical Usage	300,000	kW-hr	$0.06	$18,000
Air Sampling & Reporting	1	lump sum	$12,000	$12,000
Air Sparging System O&M	1	lump sum	$25,000	$25,000
TOTAL ANNUAL COST				$55,000
PRESENT WORTH OF 7 YR ANNUAL COSTS				$296,400
ANNUAL OPERATION & MAINTENANCE (30 YR)				
Electrical Usage	11,300	kW-hr	$0.06	$680
Groundwater/Air Stripper Sa	1	lump sum	$33,600	$33,600
Air Stripping Tower O & M	1	lump sum	$24,500	$24,500
Pumping O & M	1	lump sum	$1,500	$1,500
TOTAL ANNUAL COST				$60,280
PRESENT WORTH OF 30 YR ANNUAL COSTS				$748,000
FUTURE COSTS				
Five Year Site Review	1	lump sum	$10,000	$10,000
Total 5 Yr Costs (every 5 yrs for 30 yrs)				$10,000
Dismantle System	1	lump sum	$30,000	$30,000
Total 7 Yr Costs (one time)				$30,000
PRESENT WORTH OF FUTURE COSTS				$40,300
PRESENT WORTH	Interest Rate:	7%		
Engineering (10%)				$273,800
Contingency (20%)				$547,500
TOTAL PRESENT WORTH*				$3,559,000

* This estimate does not include an off-gas treatment system. The cost is subject to change based on the need for off-gas treatment.

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ALTERNATIVE COST ESTIMATES
FOR
UNITS 3 AND 4 DEEP GROUNDWATER

OPERABLE UNIT 2 FEASIBILITY STUDY
TWIN CITIES ARMY AMMUNITION PLANT

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COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

ALTERNATIVE 1
UNIT 3 AND 4 GROUNDWATER
NO ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
	TOTAL CAPITAL COSTS			$0
OPERATING AND MAINTENANCE COSTS (30 YR)				
Monitoring and Reporting	1	ls	$185,000	$185,000
	TOTAL O&M COSTS			$185,000
	PRESENT WORTH OF O&M COSTS			$2,294,000
FUTURE COSTS (30 YR)				
5 Year Review	1	ea	$10,000	$10,000
	TOTAL FUTURE COSTS			$10,000
	PRESENT WORTH OF FUTURE COSTS			$21,577
PRESENT WORTH	Interest Rate	7.00%		
	TOTAL PRESENT WORTH			$2,315,577

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

ALTERNATIVE 1
UNIT 3 AND 4 GROUNDWATER
NO ACTION

Item/Description	Comments
CAPITAL COSTS	No capital costs associated with this alternative
OPERATING AND MAINTENANCE COSTS (30 YR)	
Monitoring and Reporting	Source: CSR information O&M * 12.4 (P/A factor for costs incurred annually for n=30 Yrs @ 7 %) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
5 Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs. at Admin. level (Source: Montgomery Watson Estimate) 5 Yr FC * 2.1577 (P/F factor for costs incurred at n=5 Yrs for 30 Yr@ 7 %) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

ALTERNATIVE 2
UNIT 3 AND 4 GROUNDWATER
NO FURTHER ACTION

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
	TOTAL CAPITAL COSTS			$0
OPERATING AND MAINTENANCE COSTS (30 YR)				
Electric Power	3,529,000	kWh	$0.06	$211,700
System Maintenance	1	ls	$324,000	$324,000
Monitoring & Reporting	1	ls	$197,000	$197,000
	TOTAL O&M COSTS			$732,700
	PRESENT WORTH OF O&M COSTS			$9,092,074
FUTURE COSTS (30 YR)				
5 Year Review	1	ea	$10,000	$10,000
Pump Replacement - 10 hp	5	ea	$8,500	$42,500
Pump Replacement - 15 hp	12	ea	$9,100	$109,200
	TOTAL FUTURE COSTS			$161,700
	PRESENT WORTH OF FUTURE COSTS			$348,900
PRESENT WORTH	Interest Rate	7.00%		
	TOTAL PRESENT WORTH			$9,441,000

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

ALTERNATIVE 2
UNIT 3 AND 4 GROUNDWATER
NO FURTHER ACTION

Item/Description	Comments
CAPITAL COSTS	No capital costs associated with this alternative
OPERATING AND MAINTENANCE COSTS (30 YR)	
Electric Power	30 hp added to current power requirements
System Maintenance	Current costs + 6%
Monitoring & Reporting	Current costs + 6%
	O&M * 12.4 (P/A factor for costs incurred annually for n=30 Yrs @ 7 %) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
5 Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs. at Admin. level
Pump Replacement - 10 hp	Furnished & Installed every 5 yrs
Pump Replacement - 15 hp	Furnished & Installed every 5 yrs
	5 Yr FC * 2.1577 (P/F factor for costs incurred at n=5 Yrs for 30 Yr@ 7 %) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative

COST ESTIMATE
OU-2 FEASIBILITY STUDY
WTGAAP

ALTERNATIVE 3
UNIT 3 AND 4 GROUNDWATER
SOURCE CONTAINMENT

Item/Description	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
	TOTAL CAPITAL COSTS			$0
OPERATION AND MAINTENANCE COSTS (30 YR)				
Electric Power	3,529,000	kWh	$0.06	$211,700
System Maintenance	1	ls	$324,000	$324,000
Monitoring & Reporting	1	ls	$197,000	$197,000
	TOTAL O&M COSTS			$732,700
	PRESENT WORTH OF O&M COSTS			$9,092,074
FUTURE COSTS (30 YR)				
5 Year Review	1	ea	$10,000	$10,000
Pump Replacement - 10 hp	5	ea	$8,500	$42,500
Pump Replacement - 15 hp	12	ea	$9,100	$109,200
Technology Review	1	ls	$25,000	$25,000
	TOTAL FUTURE COSTS			$186,700
	PRESENT WORTH OF FUTURE COSTS			$402,843
PRESENT WORTH	Interest Rate	7.00%		
	TOTAL PRESENT WORTH			$9,494,900

COST ESTIMATE
OU-2 FEASIBILITY STUDY
TCAAP

ALTERNATIVE 3
UNIT 3 AND 4 GROUNDWATER
SOURCE CONTAINMENT

Item/Description	Comments
CAPITAL COSTS	No capital costs associated with this alternative
OPERATION AND MAINTENANCE COSTS (30 YR)	
Electric Power	30 hp added to current power requirements
System Maintenance	Current costs + 6%
Monitoring & Reporting	Current costs + 6%
	O&M * 12.4 (P/A factor for costs incurred annually for n=30 Yrs @ 7 %) (Source: Civil Engineering Reference Manual 1986)
FUTURE COSTS (30 YR)	
5 Year Review	Cost for generating a Performance Report. Assumes 100 hrs at Prof. level & 20 hrs. at Admin. level
Pump Replacement - 10 hp	Furnished & Installed every 5 yrs
Pump Replacement - 15 hp	Furnished & Installed every 5 yrs
Technology Review	Review of current technologies for applicability at site
	5 Yr FC * 2.1577 (P/F factor for costs incurred at n=5 Yrs for 30 Yr@ 7 %) (Source: Civil Engineering Reference Manual 1986)
PRESENT WORTH	Present worth of alternative