EPA Region 5 Records Ctr.
233744

Record of Decision
for
Operable Unit (OU) 2 and Operable Unit (OU) 3

Naval Industrial Reserve Ordnance Plant
Fridley, Minnesota

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0003

August 2003

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1.0 DECLARATION

1.1 SITE NAME AND LOCATION

This Record of Decision (ROD) addresses Operable Unit 2 (OU2) and Operable Unit 3 (OU3) at the Naval Industrial Reserve Ordnance Plant Fridley, in Fridley Minnesota. Operable Unit 2 represents land outside the footprint of the main NIROP manufacturing building, but within the legal boundaries of the facility from the ground surface down to groundwater elevations. Operable Unit 3 represents land underneath the main NIROP building and soil at elevations below the groundwater elevation (saturation zone) either under or outside the building, within the legal boundaries of the facility.

See Figure 1-1 for the site location and Figure 1-2 for property boundaries and Operable Unit boundaries. See Figure 1-3 for former industrial process areas, and Figure 1-4 for a site plan map.

The National Superfund Database (CERCLIS) identification number for this facility is MN317002291400. The Administrative Record is at the St. Paul offices of the MPCA.

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy for OU2 and OU3 at NIROP Fridley, in Fridley Minnesota, which was chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Contingency Plan (NCP). This decision is based on the Administrative Record file for this site. The Selected Remedy for Operable Units 2 and 3 was also chosen in accordance with the requirements of the Minnesota Environmental Response and Liability Act, Minnesota Statutes Sections 115B.01 – 24 (MERLA).

The Minnesota Pollution Control Agency (MPCA) concurs with the Selected Remedy.

1.3 ASSESSMENT OF SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 DESCRIPTION OF SELECTED REMEDY

The Selected Remedy to address soil contamination in OU2 and OU3 at the NIROP is Land Use Controls (LUCs), Alternative 2, which are composed of Engineering Controls (EC) and Institutional Controls (IC). The Selected Remedy is recommended over No Action because it provides for overall protection of human health, long term effectiveness and compliance with ARARs for both OU2 and OU3. As explained further in Section 2.2, several remedial actions involving the cleanup of surface and subsurface source areas have already been implemented at OU2. No remedial actions to address the source of subsurface contamination at OU3 have previously been implemented.

The LUC Performance Objectives for Alternative 2 are:

- To restrict the use of the Property to industrial or restricted commercial use, until and unless EPA and MPCA determine that concentrations of hazardous substances in the soils have been reduced to levels that allow for a less restrictive use.

- To prohibit the disturbance of soils deeper than 3 feet below ground surface in those Designated Restricted Areas shown in Figure 2-5 or the removal of any soils excavated in those Areas from the facility without the prior written approval of the U.S. EPA and MPCA.

- To prohibit the disturbance of soils beneath the Designated Restricted Area known as the concrete pit foundations where metal-finishing operations previously occurred at the former Plating Shop within the Main Manufacturing Building without the prior written approval of the US EPA and MPCA.

- To ensure that the concrete pit floor (approximately 8 to 12 feet below grade floor) where metal finishing operations previously occurred at the former Plating Shop within the Main Manufacturing Building is not removed without the prior written approval of U.S.EPA and MPCA. That floor will serve as an Engineering Control.

The Property will be restricted to only industrial or restricted commercial uses. Industrial property uses generally include, but are not limited to, the following types of uses: public utility services, rail and freight services, raw storage facilities, refined material storage facilities, and manufacturing facilities engaged in the mechanical or chemical transformation of materials or substances into new products.

Restricted commercial use is defined as use where access or occupancy by non-employees is less frequent or is restricted, including a wide variety of uses, ranging from non public access and both

outdoor and indoor activities (e.g., large scale warehouse operations), to limited public access and indoor office worker activities (e.g., bank, dentist office). In general, restricted commercial property use excludes uses such as day-care centers, churches, social centers, hospitals, elder care facilities, and nursing homes.

1.5 STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action (unless justified by a waiver), is cost effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

The Selected Remedy for OU2 and OU3 does not satisfy the statutory preference for treatment as a principal element of the remedy for the following reasons:

- Significant excavation and removal activities have already occurred, resulting in the removal of source waste and contaminated soils.
- Facility-wide risk assessment indicated that surface soils, where human exposure would be most likely to occur in the future, do not exceed EPA and MPCA target risk levels.
- Future land use is expected to remain industrial. For this land use, EPA and MPCA target risk levels were only slightly exceeded in subsurface soils.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this site.

- Chemicals of concern and their respective concentrations.
- Baseline risk represented by the chemicals of concern.
- Cleanup levels established for chemicals of concern and the basis for these levels.
- How source materials constituting principal threats are addressed.
- Current and reasonably anticipated future land use assumptions used in the baseline risk assessment and ROD.
- Potential land use that will be available at the site as a result of the Selected Remedy.
- Estimated Capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.
- Key factors that lead to selecting the remedy.

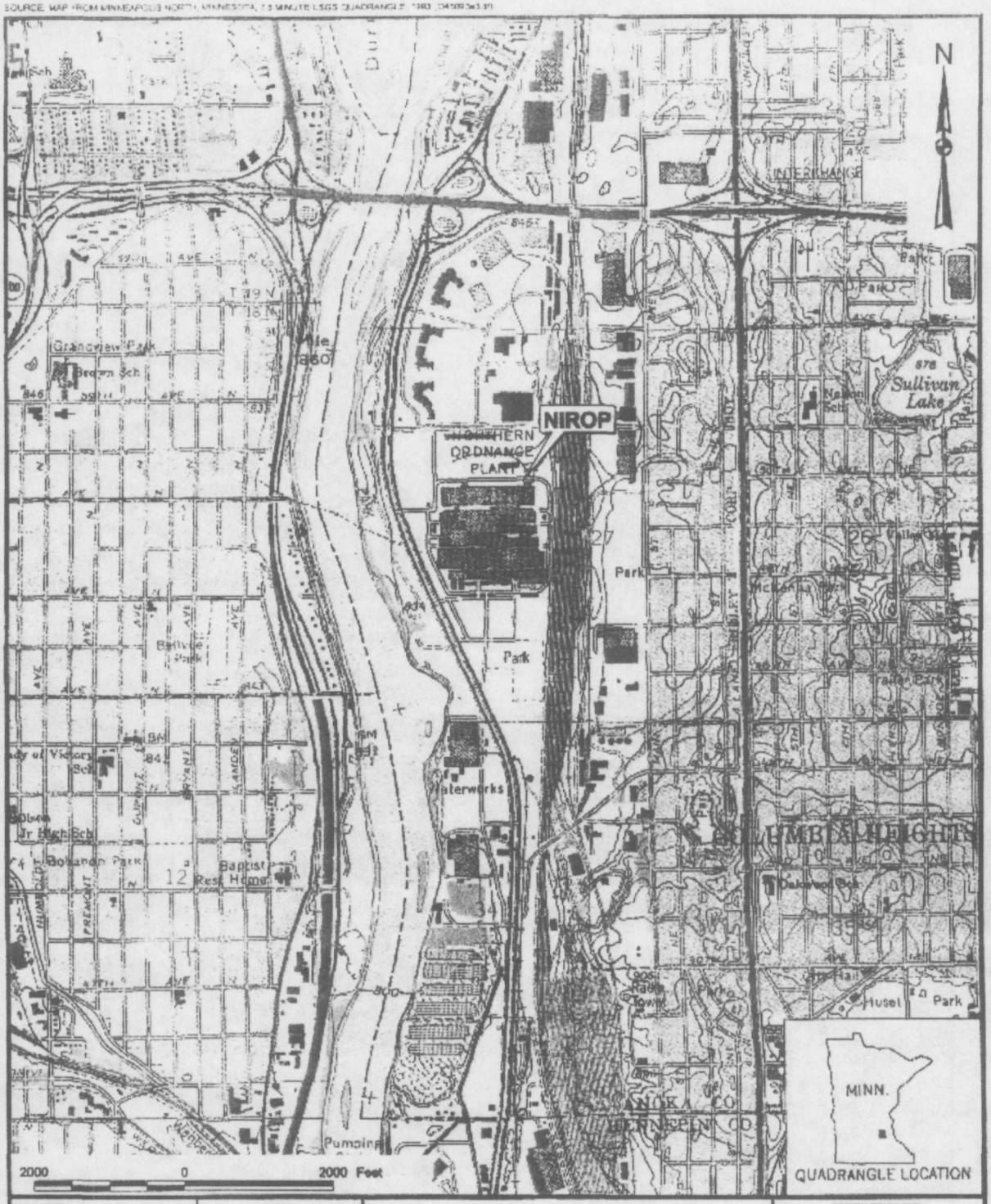
1.7 AUTHORIZING SIGNATURE AND SUPPORT AGENCY ACCEPTANCE OF REMEDY

David W. Anderson, US Navy, Naval Sea Systems Command — Date: 9/12/03

for William E. Muno, US EPA, Region V — Date: 17 Sep 03

Sheryl Corrigan, Minnesota Pollution Control Agency — Date: 9/10/03

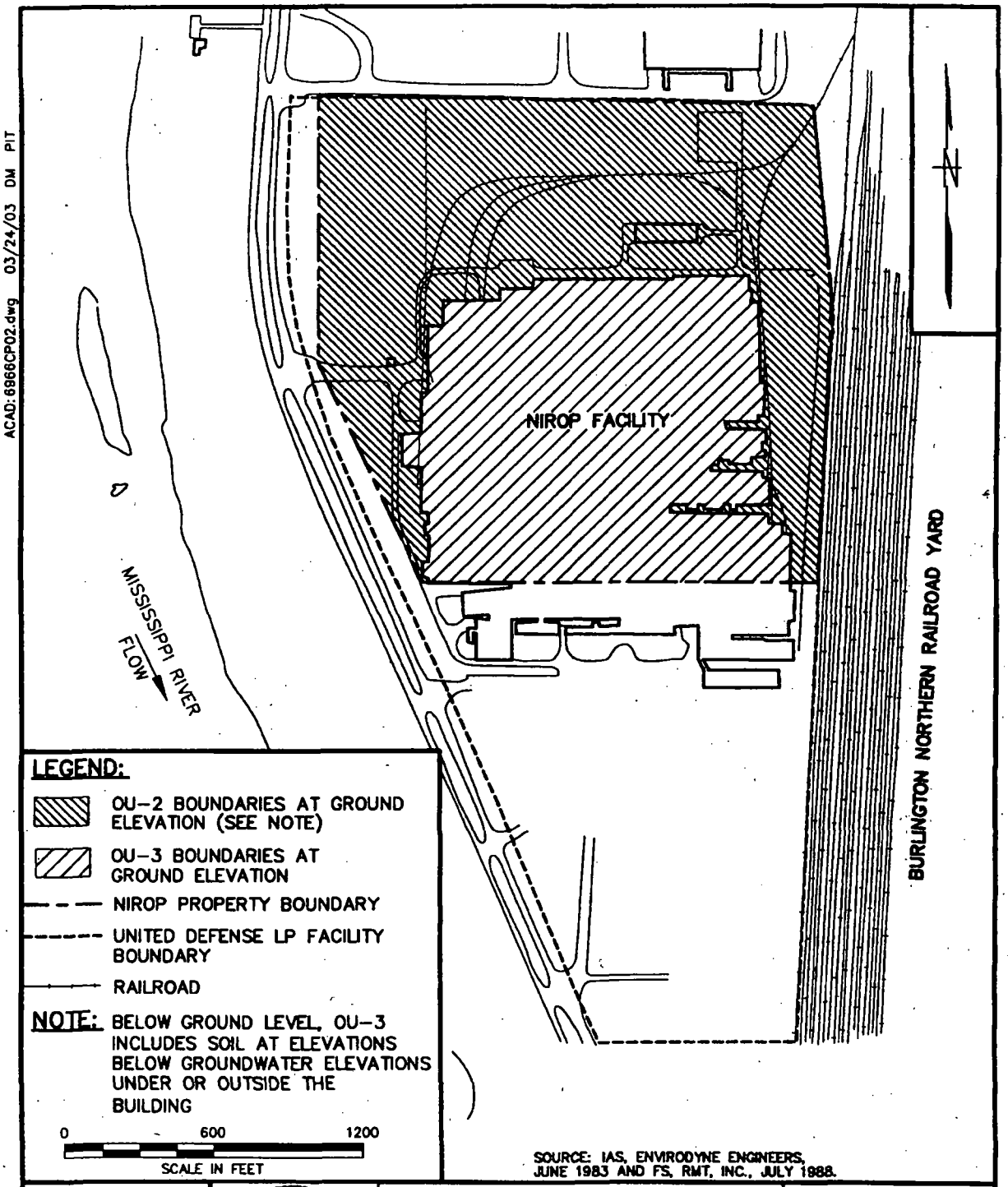
SOURCE: MAP FROM MINNEAPOLIS NORTH, MINNESOTA, 7.5 MINUTE USGS QUADRANGLE, 1983, 04/93 (3x3.3')



DRAWN BY D. PERRY	DATE 12-AUG-98	SITE LOCATION MAP NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT FRIDLEY, MINNESOTA	CONTRACT NUMBER —
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY DATE 8/12/94
SCALE AS NOTED			DRAWING NO. FIGURE 1-1 REV 0

P:\GIS\FRIDLEY\9848_SITE_ASSESSMENT.APR 12-AUG-98 DNP LOCATION MAP LAYOUT

ACAD: 6966CP02.dwg 03/24/03 DM PIT

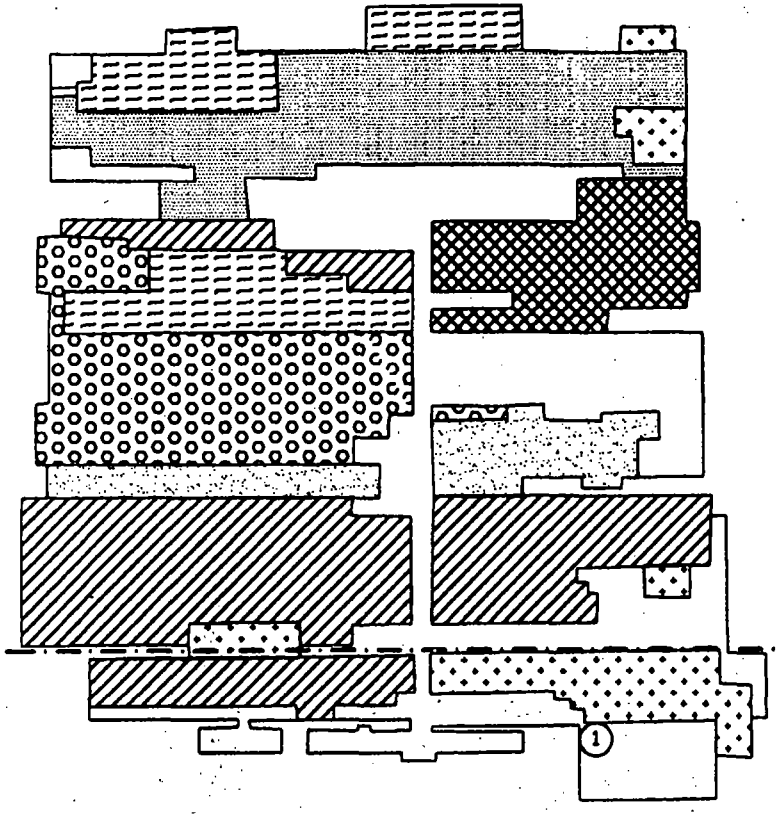


DRAWN BY DM DATE 3/25/03			CONTRACT NO. 6966
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-2 / REV. 0

PROPERTY BOUNDARIES
AND OPERABLE UNIT BOUNDARIES
NAVAL INDUSTRIAL RESERVE
ORDNANCE PLANT
FRIDLEY, MINNESOTA

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

ACAD: 6966/95090501.dwg.DWG 10/09/97 HP



LEGEND

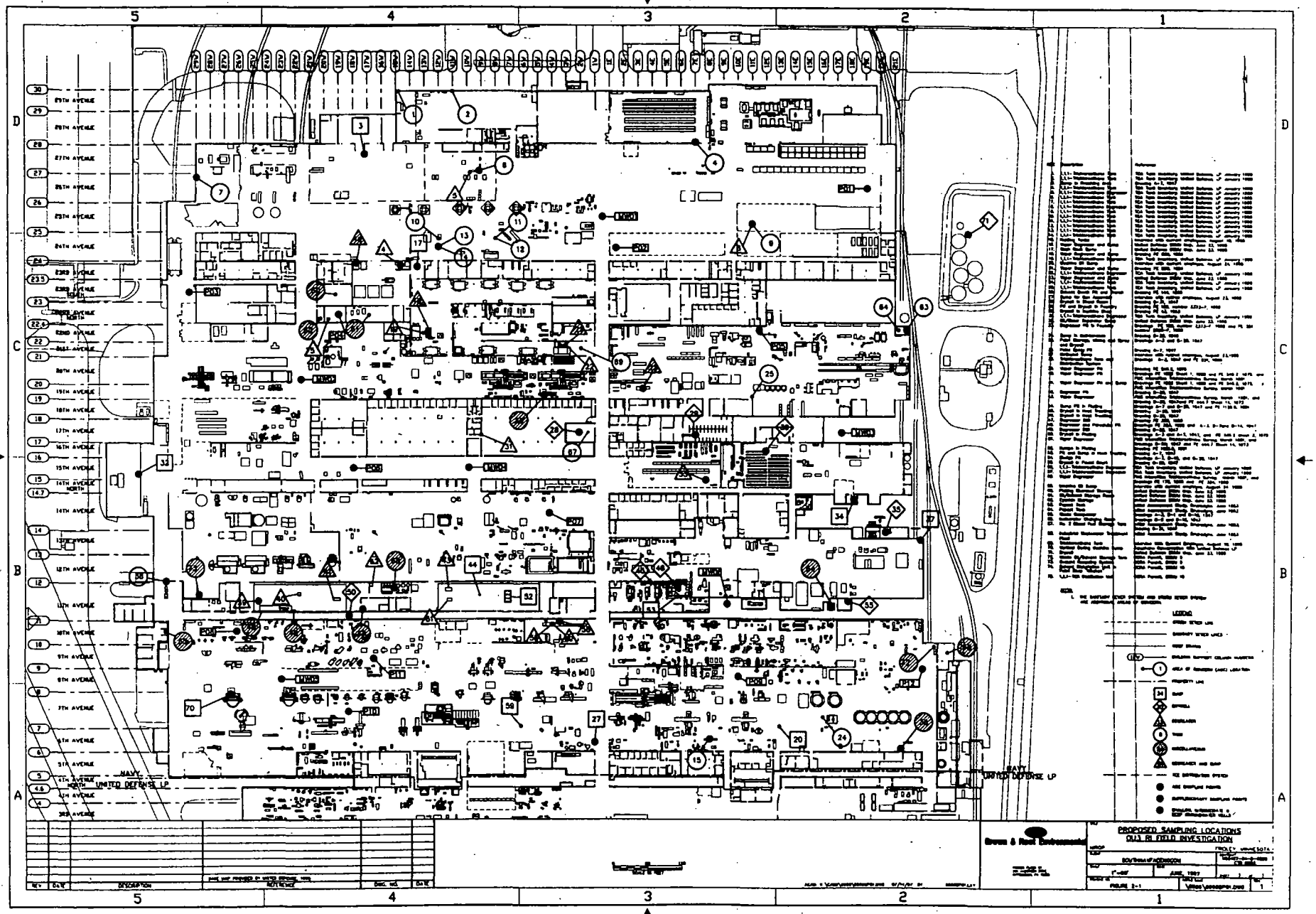
- ASSEMBLY & PAINTING
- FOUNDRY
- WELDING
- HEAT TREAT & PLATING
- MACHINE SHOP
- TEST & INSPECTION & QA
- SHIPPING, RECEIVING & STORAGE
- (1) PHOTO LAB
- PROPERTY LINE

NOTE: LOCATIONS OF THE PRODUCTION AREAS HAVE VARIED OVER TIME. THE DATE OF THE PROCESS AREA LAYOUT SHOWN IS NOT KNOWN.

REFERENCE: REMEDIAL INVESTIGATION REPORT, RMT, JUNE 1987

DRAWN BY HJP DATE 8/18/98	Tetra Tech NUS, Inc.	CONTRACT NO. N62467-94-D-0888	TASK NO. 0034
CHECKED BY DATE	FORMER INDUSTRIAL PROCESS AREAS WITHIN THE MAIN INDUSTRIAL PLANT BUILDING NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT FRIDLEY, MINNESOTA	APPROVED BY	DATE
COST/SCHED-AREA		APPROVED BY	DATE 8/12/99
SCALE N.T.S.		DRAWING NO. FIGURE 1-3	REV. 0

FORM CADD NO. SOUTH_AV.DWG - REV 0 - 02/07/97


PROPOSED SAMPLING LOCATIONS
OU3 RI FIELD INVESTIGATION
NAVY
UNITED DEFENSE LP
NAVY
UNITED DEFENSE LP
Brown & Root Environmental

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

This Record of Decision addresses Operable Unit 2 (OU2) and Operable Unit 3 (OU3) at the Naval Industrial Reserve Ordnance Plant (NIROP), in Fridley Minnesota. OU2 represents land outside the footprint of the main NIROP manufacturing building, but within the legal boundaries of the facility, from the ground surface down to groundwater elevation. Operable Unit 3 represents land underneath the main NIROP building and soil at elevations below the groundwater elevation (saturation zone) either under or outside the building.

The National Superfund Database (CERCLIS) identification number for this facility is MN317002291400.

The US Navy as represented by Southern Division Naval Facilities Engineering Command (SDIVNAVFACENGCOM) is the lead agency at this site. The United States Environmental Protection Agency (US EPA) Region 5 and the Minnesota Pollution Control Agency (MPCA) are support agencies at this site.

The source of cleanup monies at this site is Environmental Restoration, Navy (ER,N) funds. Operable Units 2 and 3 are located on the NIROP facility and EPA has determined that the reasonably anticipated land use for the facility is industrial use.

The NIROP site consists of 82.6 acres of land, of which approximately 50 acres are paved or covered with buildings. The northern part of the main NIROP manufacturing building and the property north of the NIROP building, referred to as the North 40, is owned by the government. The southern part of the NIROP building is owned and operated by UDLP. The NIROP site consists of the government-owned part of the NIROP building, the area outside of the building referred to as the North 40, and the contaminated groundwater plume that has migrated from the NIROP property. The NIROP site is situated approximately 30 feet above and 700 feet east of the Mississippi River. Anoka County Regional Riverfront Park is located between the NIROP and the Mississippi River, which is a 60-acre recreational facility.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

NIROP dates to 1940 when Northern Pump Company, under contract from the US Navy, constructed a new manufacturing plant and began producing five-inch gun mounts for Naval vessels. The arrangement

between the US Navy and Northern Pump Company was unique in that the plant was partially owned by the government and partially by Northern Pump Company. The NIROP was the first Government Owned - Contractor Operated (GOCO) facility. The Northern Pump Company assets, and responsibility for operation of the US Navy part of the facilities, changed hands several times until, in 1997, the Carlisle group purchased United Defense LP (UDLP). The Armament Systems Division of UDLP currently operates the NIROP.

Like private industrial facilities in operation since the 1940s, NIROP Fridley has previously stored and disposed of industrial wastes, scrap materials, drummed wastes, and chemicals at the facility. The following paragraphs summarize the former chemical and waste disposal, storage, and removal practices.

During the late 1960s or early 1970s, two borrow pits were used on a one-time basis for the disposal of drummed wastes on the northeast portion of the NIROP: one near the railroad gate, the other near the first railroad switch. Each of the pits was approximately 8 feet deep and irregularly shaped and contained about 25 barrels containing waste oil, plating sludge, cleaning solvent, and degreasing solvent. In addition to the barrels, the disposal pits contained miscellaneous construction debris, such as metal scraps, lumber, and concrete.

In 1972, two trenches were created at the NIROP for waste disposal purposes in the area north of the main plant building. The trenches were used on a one-time basis. Each trench was approximately 10 feet wide and 8 to 10 feet deep, with a combined length of 75 to 100 feet. Between 50 and 100 drums containing wastes were placed into the trenches on their sides, stacked two or three deep, and covered with excavated soils. Sampling results have indicated that materials disposed of in the drums included the same types of wastes disposed of in the borrow pits.

In 1975, an estimated 150 55-gallon drums of industrial waste were removed from NIROP. Prior to disposal, such waste material was collected and stored at a central waste storage area located outside near the northeastern corner of the NIROP. The area consisted of a 30-foot by 30-foot asphalt and concrete pad graded toward the middle, which drained to a dry well that could be pumped if a spill occurred.

Large quantities of sand are consumed in the casting process at the NIROP. Foundry core butts contain mostly sand with minor amounts of metal and resin or binders. Most foundry core butt disposal operations occurred off Navy property. However, it was reported that core butts were disposed of in the northern portion of the NIROP on a very limited basis. An analysis of the foundry sand, both before and

after use, was performed in November 1978. This analysis indicated that the butts do not qualify as hazardous waste.

Through various geophysical and remote sensing techniques, nine areas were selected for excavation based on their likelihood for containing drummed wastes in the northern portion of the property. These areas were excavated in the fall of 1983 and the spring of 1984. Forty-three excavated drums and 1,200 cubic yards of underlying soil were found to contain volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), oil and grease, pesticides, and metal-bearing wastes. The drums and contaminated soil were disposed of at an offsite US EPA-approved landfill.

The site was proposed for inclusion on the National Priorities List (NPL) on July 14, 1989, and was final on November 21, 1989. The appropriate Federal Register notice appeared on November 21, 1989.

In March 1991, the Navy, US EPA, and MPCA signed a Federal Facilities Agreement (FFA). Per the FFA, the purpose of that agreement was to 'Identify alternatives for Remedial Action for Operable Units which are appropriate for the site prior to the implementation of Final Remedial Actions for the site. Remedial Action alternatives for Operable Units shall be identified and proposed to the parties as early as possible prior to formal proposal of remedial action for Operable Units to the U.S. EPA and the MPCA pursuant to CERCLA and applicable State law. This process is designed to promote cooperation among the parties in identifying and selecting Remedial Action Alternatives for Operable Units prior to selection of Final Remedy Actions.'

Based on the results of a geophysical investigation conducted in 1995, a total of twenty-three 55-gallon drums and 12 smaller containers were found in the north 40 area. These drums were excavated during a removal action conducted in April through June of 1996. Eleven drums were determined to be non-hazardous, 11 drums contained contaminated soil, 1 drum contained hazardous waste, 4 1-gallon containers were determined to be non-hazardous, and 8 quart-sized containers contained ingredients such as brake fluid and paint thinner. The non-hazardous containers were disposed of as scrap metal by the UDLP metal recycling program, and their soil contents were placed in roll-off boxes for disposal as Special Waste [materials containing volatiles but having Toxic Characteristic Leaching Procedure (TCLP) results below hazardous levels as mandated in 40 CFR 261]. The remaining 13 drums and 8 containers, with contents, were sampled for disposal and sent to Emelle, Alabama for disposition and subsequent incineration at Port Arthur, Texas. In addition, approximately 100 cubic yards of soil and debris consisting of trash, scrap metal, tires, construction and demolition rubble, metal casting waste, equipment parts, and cast concrete structures were removed and disposed of as non-hazardous waste.

In April 1995, inside the main manufacturing building, the East Plating Shop was being renovated to accommodate an electrical assembly facility. During the renovation, when all tanks were removed and prior to floor repairs being made, soil and groundwater samples were collected to determine whether past plating activities had impacted soil and groundwater beneath the building. Trichloroethene (TCE), 1,1,1-Trichloroethane (TCA), and 1,2-Dichloroethene (DCE) were found present at elevated levels in soil and groundwater. Elevated metals concentrations were also identified in the vicinity of a former sump.

During a sampling at OU2 in 1996 in the vicinity of a previously unexcavated area near the North 40, free liquids were encountered which resulted in a removal action. A total of 31 drums were sampled and removed in addition to several other empty and crushed drums which were removed with other debris. VOC contamination was reported in subsurface soils.

A risk assessment for OU2 was conducted in 1996. Following a revision of that risk assessment it was determined that in one subarea of OU2 risk was inordinately influenced by one single data point. Therefore, during the summer of 2002, the Navy conducted a time-critical removal action to remove approximately 35 cubic yards of soil around this location with elevated concentrations. This removal was completed in June 2002, and addressed the last known location where there were unacceptable risks in surface soils.

2.3 COMMUNITY PARTICIPATION

The RI Reports and Proposed Plan for OU2 and OU3 at NIROP Fridley, in Fridley Minnesota, were made available to the public in April 2002. They can be found in the Administrative Record file and the information repository maintained by MPCA in St. Paul Minnesota. The notice of availability of the Proposed Plan was published in the Fridley Sun Focus on August 8, 2002. A public comment period was held from August 12 to September 12, 2002. In addition, a public meeting was held on August 22, 2002 to present the Proposed Plan to a broader community audience than those that had already been involved at the site. At this meeting, representatives from the Navy answered questions about problems at the site and the remedial alternatives. The Navy's response to the comments received during this period is included in the Responsiveness Summary, which is part of this Record of Decision.

Since April 1995 when the Navy formed a Restoration Advisory Board (RAB), the Navy has continued to support the RAB which has served to inform the community about the investigation and remedy selection for Operable Units 2 and 3 and to provide a mechanism for community input. Citizens and county and city officials have attended the RAB meetings.

Another community participation effort is the effort to establish the reasonably anticipated future land use for NIROP. EPA, in consultation with the Navy and MPCA, worked with the City of Fridley to establish that the reasonably anticipated future land use for NIROP is industrial use. EPA followed its Office of Solid Waste and Emergency Response (OSWER) Directive No. 9355.7-04 to make this determination. The Selected Remedy complies with the industrial use scenario (see letter dated March 4, 1997 from Tom Bloom, Remedial Project Manager, EPA to William Burns, City Manager, City of Fridley).

2.4 SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

As with many Superfund sites, the problems at NIROP Fridley are complex. As a result, the work has been organized into three OUs:

The Navy has already selected the remedy for OU1 in a ROD signed in September 1990. The OU1 remedy (pump and treat system) captures and treats contaminated groundwater through the use of air stripping towers. This system was upgraded several times, most recently in 2001.

The ROD for OU2 and OU3 addresses soil contamination. Ingestion of soil from these OUs poses potential risk to human health because EPA's and MPCA's acceptable risk ranges are exceeded. The Selected Remedy reflected herein presents the final response action for these sites and addresses the primary risks present at the site. Remedial Actions have been conducted according to CERCLA, in accordance with the March 1991 FFA.

See Figure 1-2 for property boundaries and Operable Unit boundaries. See Figure 2-1 for OU2 sampling locations. See Figure 2-2 for OU3 sampling locations. See Figure 2-3 for East Plating Shop sampling locations. The East Plating Shop is a component of OU3.

Site Conceptual Model

A Site Conceptual Model (CSM) was developed during the Remedial Investigation phase of work. The development of the CSM is an essential component of the exposure assessment. The CSM graphically integrates information regarding the physical characteristics of the site (i.e., the exposure setting), exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify potential exposure routes and receptors evaluated in the risk assessment. A well-defined CSM allows for a better understanding of the risks at a site and aids the risk managers in the identification of the potential need for remediation. The CSM for the NIROP study area under investigation is shown in Figure 2-6.

Exposure Setting

The exposure setting consists of a description of the physical characteristics (climate, meteorology, geology, groundwater hydrology, vegetation, and nearby surface water bodies) of a site. A detailed description of the physical characteristics of NIROP is provided in Section 1.0. A synopsis of the information pertinent to the assessment of potential exposure is presented below.

The site is currently active and consists of 82.6 acres of government-owned land, of which approximately 50 acres are paved or covered with buildings. Access to the NIROP site is strictly limited by an 8-foot high fence and security patrols. The NIROP property and adjacent properties to the north, east, and south are zoned heavy industrial. The Mississippi River lies to the west of the site. Also located west of the site is the Anoka County Riverfront Regional Park. The County Park is separated from the NIROP facility by East River Road, a four-lane highway.

The Mississippi River provides active recreational opportunities to boaters and anglers as well as passive recreation because of its aesthetics and historical significance. The Mississippi River also serves as a source of public and private water supply. The City of Minneapolis waterworks facility is located approximately 2,000 feet south (downstream) of the NIROP. The St. Paul water intake is located approximately 3 1/2 miles upstream from the site.

At the NIROP, four aquifers underlie the site as identified by the Minnesota Geological Survey. These aquifers consist of (from deep to shallow) the Mount Simon/Hinckley/Fond du Lac (MHF) aquifer, the Franconia/Ironton/Galesville (FIG) aquifer, the Prairie du Chien/Jordan aquifer (PCJ), and the surficial Quaternary aquifer. The MHF and the FIG are both confined aquifers. Because of the depth of these aquifers (greater than 400 feet bgs), they are not used for water supply purposes in the immediate vicinity of the NIROP. The MHF, however, is used rather extensively as a water supply source north of the site, where it is more shallow.

Sources of Contamination

The suspected or known source(s) of contamination for OU3 included near-surface and subsurface soils beneath the plant building.

Contaminant Release and Migration Mechanisms

Three primary chemical release mechanisms have been identified for the soil matrix: (1) leachate generation; (2) fugitive dust generation (after exposure of the soils); and (3) emission of VOCs.

Environmental transport media associated with these release mechanisms include air and groundwater. The only secondary chemical release mechanism that has been identified, based on site physical conditions, is the discharge of groundwater to the Mississippi River.

Surface water runoff is not considered a potential migration pathway at OU3 since all of OU3 is located underneath the building.

Volatilization of COPCs from groundwater to outdoor or ambient air will not occur since the building covers all of OU3. Volatilization of COPCs from groundwater to indoor is possible but it is not expected to be a significant exposure pathway. Shallow groundwater at the site is approximately 20 feet below ground surface with the exception of the former east platting shop where shallow groundwater is approximately 15 feet below ground surface. The foundation of the building at NIROP is typically nine to 12 inches thick but can be as thick as 82 inches in some areas. Significant migration of COPCs from groundwater through 15 to 20 feet of soil and nine to 82 inches of concrete is not expected to occur.

Potential Routes of Exposure

A receptor can come into contact with contaminants in a variety of ways, which are generally the result of interactions between a receptor's behavior or lifestyle and an exposure medium. This assessment defines an exposure route as a stylized description of the behavior that brings a receptor into contact with a contaminated medium.

Air

This pathway is based on the scenario that a receptor is immersed in air that contains suspended particulates and volatile organic vapors originating from the source areas as part of daily living. The receptor is exposed upon inhalation of the ambient air.

Direct Contact with Soil

Receptors may come into direct contact with soil contaminated by the release of chemicals from the source areas. During the receptor's period of contact, the individual may be exposed via inadvertent ingestion of a small amount of soil or via dermal absorption of certain contaminants from the soil. Various factors affect the rate of dermal absorption, including the amount of soil on the skin surface, soil characteristics (moisture, pH, organic carbon content, etc.), skin characteristics (thickness, temperature, hydration, etc.), volatilization losses, and chemical-specific properties.

Potential Receptors

Several receptor groups have been defined for this risk assessment in the Remedial Investigation Work Plan. These receptors are as follows:

Typical Industrial Worker - Because the soils being evaluated are underneath the cement slab of the main NIROP Fridley building, this receptor is hypothetical only. The receptor is included for purposes of completeness and because the State of Minnesota has indicated that this receptor should be evaluated to determine if any access restrictions/deed restrictions (i.e., land use restrictions) are necessary.

Major-Infrequent Construction Worker (MPCA Methodology) - Under current site conditions, the construction worker who occasionally contacts soils underlying the building slab is the most plausible receptor for the risk assessment. MPCA exposure assessment methodology will be used to evaluate exposures hypothetically incurred by one type of construction worker, an individual who will be referred to as the major-infrequent construction worker. The exposure estimates developed for this receptor will reflect exposures incurred by independent contractors who perform "major modifications" of the building slab and foundations.

Minor-Frequent Construction Worker (NIROP-Specific) - The second type of construction worker evaluated in the risk assessment will be referred to as the minor-infrequent construction (or maintenance) worker. Exposure estimates developed for this receptor will reflect exposures incurred by a UDLP employee involved in routinely performed "minor maintenance activity" throughout the building.

Under the expected industrial land use scenario and current site conditions, worker exposure to unsaturated soils is limited. Routine worker exposure to soils is limited by a 12-inch reinforced concrete floor inside the building. Thus, typical industrial workers at NIROP Fridley are not currently exposed to soils underlying the cement slab. Routine exposure to soils would only occur if the cement slab was permanently removed. However, construction/utility/maintenance workers may be exposed to soils during construction (e.g., new equipment foundations) or maintenance and repair of underground utilities. Two types of construction/maintenance activities have been described by NIROP personnel: (1) major modifications and (2) minor maintenance activity. A "major construction project or modification" is defined by NIROP Fridley as a disruption of the flooring of the building for the purposes of installation or modification of a foundation for machine tools. Based on historical data, major modification projects can occur 2 to 3 times per year; the work is performed by independent contractors. Major excavation/construction activities may last for periods exceeding 10 days (60 to 90 days was suggested as an upper bound by NIROP personnel). The depth of a major foundation modification is typically 8 feet.

Exposure duration assumptions by MPCA for a construction worker (Table 6-4) are somewhat similar to actual exposure durations experienced by the independent contractors and will be used to calculate exposure estimates for this receptor. In keeping with the MPCA methodology, it will be assumed that the major-infrequent construction worker (working for an independent contractor) is exposed to NIROP soils during one major construction activity only. NIROP personnel indicate that the same contractor and personnel are not used repeatedly. "Minor maintenance activity" is defined by NIROP Fridley as floor modifications where the soil is exposed for periods less than 10 days. Typically, the area exposed is less than 200 square feet. The depth of the soil disruption is around 2 to 4 feet. This type of activity occurs 5 to 8 times a year throughout the building; the work is performed by UDLP employees (i.e., the minor-frequent construction worker). According to NIROP personnel, and in contrast to the major-infrequent construction worker scenario, the same work crews are used repeatedly. Exposure dose assumptions for these industrial worker and construction worker receptors are summarized in the March 2002 OU3 RI Report.

Additional potential exposure pathways could occur under a residential future land use scenario. Such potential exposure routes include ingestion of groundwater or surface water, inhalation of VOCs emitted from surface water or groundwater during showering or other household uses, and dermal contact with surface water or groundwater used for bathing. In addition, the exposure routes identified for the construction and utility workers could also exist under a residential land use scenario. Both adult and child receptors could be exposed under the residential scenarios. These potential exposure pathways were not identified for the site because: (1) land use will be industrial for the foreseeable future; (2) surface water contamination has not been identified for several years; (3) the Navy controls the property over potential source zones; and (4) the Navy is required, under the OU1 Record of Decision, to provide alternative water sources or treatment in the event there is development of the groundwater within the off-site contaminant plume.

Another potential receptor for the site is a trespasser. Potential exposures to soil by a trespasser are not being evaluated because the site is surrounded by a fence and guarded, thereby making it unlikely for an individual to trespass on the property.

Potential exposures to groundwater by construction workers and typical workers will not be evaluated in the risk assessment. Currently there are no exposures to groundwater at the site. Groundwater is not used as a potable drinking water supply. As discussed above, based on interviews with NIROP personal, the depth of major excavations is typically 8 feet. Groundwater at the facility is typically encountered at a depth of approximately 20 feet except in the vicinity of the former east platting shop where depth to

groundwater is approximately 15 feet. Consequently, there are no direct contact exposures to groundwater.

2.5 SITE CHARACTERISTICS

This section describes OU2 and OU3.

Operable Unit 2 (OU2)

The land outside of the main NIROP manufacturing building but within the legal boundaries of the facility, from ground surface down to the groundwater elevation, has been identified as OU2. This land has been further divided into 'subareas' to simplify the risk assessment process. As shown in Figure 2-4, risk was evaluated for Subareas A1, A2, A3, A4, B1, B2, D, E, and F. Additional details about the OU2 analytical results and risk assessment methodology and results are provided in the Supplemental Remedial Investigation Information Report, April 2002. The following items summarize the nature and extent of contamination at OU2: See Figure 2-4 for identification of sub areas.

- The results of the screening analysis risk assessment indicated that Hazard Quotients (HQs) and/or Incremental Cancer Risks (ICRs) for residential receptors exceeded MPCA and EPA risk acceptable levels at all sub areas with the exception of the "Other" sub area.

- HQs and ICRs for typical industrial workers exposed to surface soil and subsurface soil were within MPCA and EPA acceptable risk levels for all sub areas with the exception of subsurface soil at sub area A3 and surface soil at sub area A4. Tetrachloroethane, 1,1,1-trichloroethane, and xylenes in sample AT009D1 (8 to 10 feet bgs) and iron and manganese in sample AT007C (6 to 8 feet bgs) were the major contributors to the risk for subsurface soil at A3. The ICR for typical industrial workers exposed to surface soil at sub area A4 slightly exceeded the MPCA acceptable risk level but was within EPA's target risk range. Carcinogenic PAHs at boring AB032A (1 to 3 feet bgs) were the major contributor to the risk in surface soil at sub area A4. Subsequently, approximately 35 cubic yards of soil were excavated surrounding location AB032, from a depth of 0 to 3 feet.

- HQs and ICRs for minor frequent construction workers exposed to surface soil and subsurface soil were within MPCA and EPA acceptable risk levels for all sub areas with the exception of subsurface soil at sub area A3, surface soil at sub area A4, and surface soil at sub area E. Carcinogenic PAHs in sample AB043D (8 to 10 feet bgs); tetrachloroethene and 1,1,1-trichloroethane in sample AT009D1 (8 to 10 feet bgs); and iron and manganese in sample AT007C (6 to 8 feet bgs) were the major

contributors to the risk for subsurface soil at sub area A3. The ICRs for minor frequent construction workers exposed to surface soil at sub areas A4 and E slightly exceed the MPCA acceptable risk level, although the ICRs were within EPA's target risk range. Carcinogenic PAHs at sampling location AB032A (1 to 3 feet bgs) in sub area A4 and EB004 A (1 to 3 feet bgs) in sub area E were the major contributors to the ICR. Subsequently, approximately 35 cubic yards of soil were excavated surrounding location AB032, from a depth of 0 to 3 feet.

- HQs and/or ICRs for major infrequent construction workers exposed to surface soil and subsurface soil were within MPCA and EPA acceptable risk levels for all sub areas with the exception of sub areas A3 and A4. Antimony, 2-butanone, 1,1-dichloroethane, iron, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, and xylenes were the major contributors to the risk at sub area A3. Carcinogenic PAHs and trichloroethene were the major contributors to the risk at sub area A4. Subsequently, approximately 35 cubic yards of soil were excavated surrounding location AB032, from a depth of 0 to 3 feet.

- Based on the results of the risk assessment, sub areas A1, A2, B1, B2, D, F, and "Other" are not a concern under industrial/restricted commercial use.

- In sub area A3 contamination in the vicinity of sample locations AT009, AT007, and AB042 at depths of approximately 6 to 10 feet bgs were mainly responsible for exceedances of the acceptable risk levels. These sample locations are located in the vicinity of where the drum removal occurred during the OU2 field investigation and where a decontamination pad exists.

- In sub area A4 contamination in the vicinity of sample locations AB032 and AT001 at depths of less than 3 feet bgs and AT004 at depths of 3 to 5 feet were mainly responsible for exceedances of the acceptable risk levels. Subsequently, approximately 35 cubic yards of soil were excavated surrounding location AB032, from a depth of 0 to 3 feet.

- In sub area E contamination in the vicinity of sample location EB004 at a depth of 1 to 3 feet bgs was mainly responsible for exceedances of the acceptable risk levels.

- Based on the bulleted results above residual contamination in sub areas A1, A2, B1, B2, D, F and "Other" are not of concern if the land use is limited to industrial/restricted commercial use. In the remaining sub areas (i.e., A3, A4, and E) localized areas of contamination (i.e., hot spots) result in potential risk levels that exceed levels of concern.

- In sub area A3, VOC contamination in the vicinity of sample locations AT009 and AB043 at depths of 8-10 feet bgs and iron at AT007 at depths of 6-8 feet bgs are largely responsible for the risk exceedance. These sampling locations are located in and near the area where drum removal occurred and where a decontamination pad exists. Examination of these samples indicates a localized area with significantly elevated levels of contamination. For example, at AT009 the concentrations of 1,1,1-trichloroethane, 1,1-dichloroethane, 2-butanone, tetrachloroethene, toluene, trichloroethene, and xylenes correspond to ICR 15 times higher than the acceptable target risk level and hazard indices from approximately 3-14 times the target risk level. The concentrations of these contaminants at this location are also significantly (11-360 times) higher than the next highest concentration in sub area A3 suggesting a hot spot of contamination. In addition, the concentrations of 1,1,1-trichloroethane, tetrachloroethene, and xylenes exceed the default soil saturation limit suggesting that free product may be present. Removal of these sampling data points and recalculation of the 95 percent UCL mean exposure concentration produces risks within target risk levels.

- In subs area A4, cPAH contamination at AB032 at a depth of 1-3 feet bgs is largely responsible for the risk exceedance. Examination of this location indicates a localized are with significantly elevated levels. The concentration of cPAHs (as BaP equivalents) at this location corresponds to risk levels 10-20 times higher than the acceptable target risk level. The concentration is six times higher than the next highest concentration in sub area A4. Removal of this sampling data point and recalculation of the 95 percent UCL mean exposure concentration produces risks within target risk levels. Subsequently, approximately 35 cubic yards of soil were excavated surrounding location AB032, from a depth of 0 to 3 feet.

- In sub area E the number of sampling data points was insufficient to calculate a 95 percent UCL of the mean and therefore maximum concentrations were utilized as exposure concentrations in depth refined risk assessment. Carcinogenic PAHs (as BaP equivalents) at sample location EB004 at a depth of 1-3 feet bgs is largely responsible for the risk exceedance. The concentration of cPAHs (as BaP equivalents) corresponds to approximately 1.5 times the target risk and is approximately two times higher than the next highest concentration in sub area E. Based on the limited data available EB004 does not appear to be a hot spot and the risk level associated with this specific location slightly exceeds the target risk.

Operable Unit 3 (OU3)

The land underneath the main NIROP building, and soil at elevations below the groundwater elevation (the saturated zone) either under the building or outside the building, but within the legal boundaries of the facility has been designated as OU3. The following summarize the nature and extent of contamination at OU3:

- Several VOCs (primarily chlorinated hydrocarbons and aromatic compounds) were detected in surface (0 to 4 feet bgs), shallow subsurface (4 to 12 feet bgs), and deep subsurface (>12 feet bgs) soil samples. However, as illustrated in the following table for VOCs, no consistent pattern of concentrations was evident among the three categories of soil samples. Hence, these COCs do not seem to indicate wide spread soil contamination exceeding risk-based thresholds.

Analyte	Concentration Range (µg/kg)		
	Surface Soils	Shallow Subsurface Soils	Deep Subsurface Soils
1,1,1-Trichloroethane	1-56	1-2	4
1,1-Dichloroethane	2-9	1-11	1
1,2-Dichloroethene (total)	3-15	1-15000	1-290
Bromomethane	2	1-2	ND
Carbon disulfide	1-13	5-14	1-18
Ethylbenzene	1-10	4-720	9-34
Styrene	4-33	1-54	10-72
Tetrachloroethene	1-90	1-760	1-3800
Toluene	1-14	1-1000	1-24
Trichloroethene	1-640	1-1100	1-100000
Xylenes, Total	1-45	1-7300	1-120

ND - not detected

Maximum concentrations of TCE and tetrachloroethene in all three categories of soil samples were detected in samples collected from the East Plating Shop, indicating the possible presence of a "hot spot" of TCE and tetrachloroethene in this area and the likelihood that this area is the source area for TCE (and chromium).

- Several seimvolatile organic compounds (SVOCs), primarily polyaromatic hydrocarbons (PAHs), were sporadically detected in surface and shallow subsurface soil samples. With few exceptions, concentrations and detection frequencies of SVOCs in surface soil samples exceeded those reported

for shallow subsurface soil samples. 4-Chloro-3-methylphenol was detected in a single shallow subsurface soil sample (collected from AOC32, the location of an oil/water separator sump) at a concentration of 11,000 µg/kg. Concentrations of PAHs in shallow subsurface soil samples ranged from 11 µg/kg to 2,300 µg/kg, while concentrations of PAHs in surface soil samples ranged from 10 µg/kg to 5,600 µg/kg.

- Twenty-two metals and cyanide were detected in surface soil samples, and cyanide and twenty metals were detected in the shallow subsurface soil samples underneath the main NIROP building. Concentrations and detection frequencies of metals detected in surface and shallow subsurface samples were very similar. *Concentrations of most metals and cyanide exceeded background* concentrations in one or more soil samples.

- The maximum concentrations of all detected chemicals in soil (0- to 12-feet in depth) at OU3 were less than the MPCA soil reference values (SRVs) for industrial exposures with the exception of lead in one surface soil sample and chromium in one subsurface soil sample. Estimated cancer risks slightly exceed MPCA target levels.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Current land use is industrial, as is adjacent and surrounding land, with the exception of Anoka County Regional Riverfront Park across East River Road to the West of the NIROP. Reasonably anticipated future land use is also industrial.

2.7 SUMMARY OF SITE RISKS

2.7.1 Methodology

To determine whether or not unacceptable risks to human health existed, the Navy conducted a human health risk assessment, and developed three exposure scenarios to represent how people could come in contact with site contaminants.

This section summarizes the results of the human health risk assessment conducted for OU2 and OU3. The risk assessment estimates the potential risks to people who come in contact with site contaminants that remain in surface and subsurface soil. Risk assessments are necessarily complex, and the full risk assessment for the NIROP Fridley cannot be fully reproduced here. However, significant additional detailed definitions, calculations, and discussion of results are available in the appropriate sections of the

Supplemental Remedial Investigation Report and the OU3 RI Report. A summary of the risk assessment results is provided in Table 2-1.

For NIROP Fridley, the exposure scenarios were developed for site and construction workers since these people are most likely to come in contact with soil contamination. The risk scenarios represent a set of assumptions about how workers would come in contact with site soil contaminants. These exposure scenarios included the typical industrial worker, minor frequent construction worker, and major infrequent construction worker. These scenarios differed on magnitude, duration and frequency of contact with contaminated soil. The typical industrial worker was assumed to contact only surface soils, whereas the minor frequent construction worker and the major infrequent construction worker were assumed to contact subsurface soils as well as surface soils. A focus was placed on future construction because these activities typically penetrate below the ground surface allowing potential contact with subsurface contamination. Since it was not known which specific soils would be contacted conservative estimates of the soil contaminant concentrations were utilized in the risk assessment. A screening level risk assessment utilizing a residential exposure scenario was completed. The screening level risk assessment indicated that in its current condition, for potential site residents, an unacceptable risk level exists. However, because reasonably anticipated land use is industrial, this screening level risk assessment for residential exposures was not further developed. A summary of the exposure scenario assumptions is provided in Table 2-2.

In accordance with MPCA methodology and as agreed to by the US Navy and US EPA, a Hazard Quotient (HQ) and an Incremental Cancer Risk (ICR) were used to express the risk to human health to site-related contaminants based on the above described hypothetical exposure scenarios. The ICR is a measure of cancer-related risk, and the HQ is a measure of toxic, non-cancer effects. Where appropriate, the cumulative HI was estimated by adding all chemical specific HQs together regardless of target endpoint (different compounds can target different body organs such as liver or kidneys, and so effects are not always directly additive). The HQs and ICRs were compared to acceptable risks. Table 2-1 presents a summary of ICR and HQ values by subarea (as delineated in Figure 2-4). These risk values represent site conditions after all previously described removal actions have taken place. Shaded HQs and ICRs indicate that the estimated risks exceeded acceptable levels. Table 2-1 also shows the target risk levels, and illustrates that target risk levels were only slightly exceeded.

An ecological risk assessment was also conducted to estimate possible adverse effects to terrestrial biota. The lack of suitable habitat in either OU2 or OU3 makes it unlikely that significant numbers of organisms are or will be affected.

The baseline human health risk assessment (HHRA) summarized in this section was performed to evaluate OU2 and OU3 sampling results using the benchmarks developed to evaluate the OU3 sampling results. This HHRA consists of four components: data selection; selection of chemicals of potential concern (COPCs), screening risk evaluation; and refined risk evaluation. The data selection presents the data that was used in the analysis. The selection of COPCs is a qualitative screening process limiting the number of chemicals that are quantitatively evaluated in the HHRA to those site-related constituents that dominate overall potential risks.

The screening risk evaluation is a qualitative process that uses all available site data to conservatively estimate the potential risk associated with the COPCs. Areas that pass the screening risk evaluation have risks that are within acceptable levels. Areas that fail the screening risk evaluation were further evaluated in the refined risk evaluation and may or may not require remedy evaluation. The need for remedy evaluation will be determined in future documents.

The same receptor groups were evaluated in the HHRA for OU2 and OU3. The HHRA evaluated exposures to soil for three receptor groups: typical industrial workers, minor frequent construction workers, and major infrequent construction workers. MPCA standard default exposure assumptions were used for typical industrial workers and major infrequent construction workers. Site-specific exposure assumptions were used for minor frequent construction workers. Typical industrial workers and minor frequent construction workers were assumed to be exposed to soil to 0 to 4 feet below ground surface (bgs). Major infrequent construction workers were assumed to be exposed to surface and subsurface (0 to 12 feet bgs). Additional information on the risk assessment information methodology is provided in the OU3 RI Report (TtNUS, 2001).

Important toxicological information considered in the risk assessment is provided in Table 2-3 for compounds which can cause cancer, and in Table 2-4 for compounds with non-cancer effects.

2.7.2 Data Selection

Data used in this HHRA was obtained from the following reports.

- Remedial Investigation Report for the Soils Operable Unit at the Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota, September 1993, RMT, Inc.

- Completion Report for Removal Action at North 40, Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota, Revision 1, December 1996, Morrison Knudsen Corporation.

- Final Site Closeout Report Former Storage Area C, Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota, August 1997, Wenck

- Remedial Investigation for Operable Unit 3 at the Naval Industrial Reserve Ordnance Plan, Fridley, Minnesota, April 2002, TtNUS

In the OU3 HHRA, surface soil was defined as 0 to 4 feet bgs, and subsurface was 4-12 feet bgs. Soil samples were collected in the 3 to 5 feet bgs interval during the OU2 RI, consequently, surface soil for OU2 is defined as 0 to 5 feet bgs in this HHRA. Subsurface soil for OU2 is defined as 5 to 12 feet bgs in the HHRA, although for screening purposes, soil depths to 20 feet were considered.

OU2 was divided in to 10 sub areas for evaluation in the HHRA: A1, A2, A3, A4, B1, B2, D, E, and F. An additional sub area designated as "Other" includes all samples that are not located in any of the listed sub areas. The sub areas and soil sampling locations are shown on Figure 2-4.

2.7.3 Selection of COPCs

The selection of COPCs is a semi-qualitative process which identifies chemicals which may be of concern and therefore warrant evaluation in a HHRA. COPCs were selected for each sub area by comparing the maximum detected concentration in surface and subsurface soil to MPCA Tier I soil reference values (SRVs) for residential exposures. The SRVs are derived for most chemicals using a target incremental cancer risk (ICR) level of 1×10^{-6} and a target hazard quotient (HQ) of 0.2. Chemicals were retained as COPCs if the maximum detected concentrations exceeded 10 percent of the SRV (which corresponds to an ICR of 10^{-7} for carcinogens and HQ of 0.02 for noncarcinogens for most chemicals). Using 10 percent of the SRV accounts for the potential additive effects from different chemicals. All surface and subsurface soil samples were used to select COPCs. COPC selection tables for the individual sub areas are presented in Tables 2-5 through 2-14.

For OU3, Table 2-15 presents the chemicals being retained as chemicals-of-concern (COCs) in soil. There are no chemicals being retained as COCs in surface soil. See Table 2-16. Chromium in the former East Plating Shop area was the only chemical retained as a COC in subsurface soil. Although, the maximum detected concentration of lead exceeded the MPCA SRV for industrial exposures and the HQs for arsenic, copper, and mercury exceeded the MPCA acceptable level of 0.2, these chemicals are not being retained as COCs in soil for the following reasons:

- Lead was detected in 111 of 113 surface and subsurface soil samples. The maximum detected lead concentration of 733 mg/kg slightly exceeded the MPCA SRV of 700 mg/kg for industrial exposures. The concentration of lead in all but one of the remaining samples was below EPA's OSWER screening level of 400 mg/kg for residential exposures. Therefore, lead is not considered as a COC since it only slightly exceeded its SRV in one sample and was detected at low concentrations in the remaining samples.

- The HQ of 0.3 for exposure to arsenic in surface and subsurface soil by a major infrequent construction worker slightly exceeded the MPCA acceptable level of 0.2 but was less than the EPA acceptable level of 1.0. Exposures to arsenic in soil by the industrial worker and minor frequent construction worker were within acceptable levels. Arsenic was only detected in two samples at concentrations which were above background. Concentrations of arsenic in 111 of 113 would result in HQs of less than 0.2. Therefore, arsenic is not considered a COC since the HQ exposures to arsenic by the major infrequent construction worker only slightly exceeded the MPCA acceptable level of 0.2, was less than the EPA acceptable level of 1.0, and was detected at low concentrations across the site.

- The HQ of 0.23 for exposure to copper in surface and subsurface soil by a major infrequent construction worker slightly exceeded the MPCA acceptable level of 0.2 but was less than the EPA acceptable level of 1.0. Exposures to copper in soil by the industrial worker and minor frequent construction worker were within acceptable levels. Concentrations of copper in 112 of 113 would result in HQs of less than 0.2. Therefore, copper is not considered a COC since the HQ exposures to copper by the major infrequent construction worker only slightly exceeded the MPCA acceptable level of 0.2, was less than the EPA acceptable level of 1.0, and was detected at low concentrations across the site.

- The HQ of 0.46 for exposure to mercury in surface and subsurface soil by a major infrequent construction worker exceeded the MPCA acceptable level of 0.2 but was less than the EPA acceptable level of 1.0. Exposures to mercury in soil by the industrial worker and minor frequent construction worker were within acceptable levels. Mercury was only detected in 18 of 113 surface and subsurface soil samples. Therefore, mercury is not considered a COC since the HQ exposures to mercury by the major infrequent construction worker was less than the EPA acceptable level of 1.0 and was infrequently detected at low concentrations across the site.

2.7.4 Screening Risk Evaluation

The first step in the HHRA consisted of conducting a screening risk evaluation. The objective of the screening assessment is to identify COCs and areas of concern which warrant a more in depth evaluation. In the HHRA for OU3, typical industrial workers and minor frequent construction workers were assumed only to be exposed to surface soil. Since it is not known if deeper soils will be excavated and brought to the surface at a later date, subsurface soil data was also evaluated in the screening analysis. Residential receptors were also included in the screening risk evaluation for the same reason. Major infrequent construction workers were not evaluated in the screening risk evaluation since this receptor is assumed to be exposed to both surface and subsurface soil. Major infrequent construction workers were evaluated in the refined risk evaluation. The screening risk evaluation was conducted utilizing spreadsheets that were provided by MPCA that compared the maximum detected concentration in surface and subsurface soil at each sub area to Tier I SRVs for residential receptors and Tier II SRVs for industrial receptors. If the screening risk evaluation indicated that hazard quotients (HQs) and/or incremental cancer risks (ICRs) were below MPCA acceptable risk levels (HQ < 0.2, ICR < 10-5) for a receptor (typical industrial workers, minor frequent construction worker, and residents) in a sub area, then no further analysis was required for that receptor (typical industrial workers, minor frequent construction worker, and residents). If the screening risk evaluation indicates that HQs and ICRs exceeded MPCA acceptable risk levels for a receptor in a sub area then that receptor and sub area was evaluated further.

The results of the screening risk evaluation for residential receptors indicated that HQs and/or ICRs exceeded MPCA acceptable risk levels in OU3 and in all OU2 sub areas with the exception of the "Other" sub area. Since the future site use is expected to be limited to industrial, residential receptors were not retained for further evaluation.

HQs and ICRs for typical industrial workers were within MPCA acceptable risk levels for all sub areas with the exception of sub areas A3 and A4. HQs and ICRs for minor frequent construction workers were within MPCA acceptable risk levels for all sub areas with the exception of sub areas A3, A4, and E. Therefore, typical industrial workers at sub areas A3 and A4, and minor frequent construction workers at sub areas A3, A4, and E, were retained for further evaluation. See Tables 2-17 through 2-19.

2.7.5 Refined Risk Evaluation

The screening risk evaluation conservatively estimated ICRs and HQs for typical industrial workers and minor frequent construction workers using the maximum detected concentrations in surface soil and subsurface soil at all sub areas. The results of the screening risk evaluation indicated that HQs and ICRs

exceeded acceptable levels at sub areas A3 and A4, for typical industrial workers and sub areas A3, A4, and E, for minor frequent construction workers. Sub areas identified in the screening risk evaluation as having risks for the typical industrial workers and minor frequent construction workers exceeding MPCA acceptable risk levels were further evaluated in the refined risk evaluation using the 95 percent UCL in surface soil (0 to 5 feet bgs for OU2 and 0 to 4 feet bgs for OU3) as the exposure point concentration. Exposures to surface and subsurface soil at all sub areas by major infrequent construction workers were also evaluated in the refined risk evaluation.

The human health risk assessment addressed potential direct contact with contaminated soil within the top 12 feet. No potential exposures were identified for soil at depths beyond 12 feet, therefore no risks were calculated for potential exposures to soil greater than 12 feet bgs.

Data summary tables for surface soil samples in sub areas A3, A4, and E, and OU3, were already presented in Tables 2-16 through 2-19. A summary of the exposure point concentrations for typical industrial workers and minor frequent construction workers are presented in Table 2-20 for OU2 and Table 2-21 for OU3. Exposure point concentrations for major infrequent construction workers were based on the maximum detected concentration in surface and subsurface soil and are presented in Table 2-22 for OU2 and Table 2-23 for OU3.

2.7.6 Calculation of Site Risks

The following items summarize the results of the human health risk assessment for OU2. Potential exposure pathways for all receptors included incidental ingestion of soil, dermal contact with soil, and inhalation of fugitive and volatile compounds. Cancer risks and hazard indices were estimated following MPCA methodology. See Figure 2-4 for identification of the various OU2 subareas, and see the Supplemental Remedial Investigation Report and the OU3 RI Report for further information.

- The results of a screening analysis indicated that Hazard Quotients (HQ) and/or Incremental Cancer Risks (ICR) for residential receptors exceeded MPCA and EPA risk acceptable levels at all sub areas with the exception of the "Other" sub area.

- *Potential Risks to Industrial Workers* - The calculated ICRs for all sub areas are within the U.S. EPA acceptable ICR range of 1×10^{-4} to 1×10^{-6} and below MPCA's acceptable chronic ICR of 1×10^{-5} with the exception of subsurface soil at are A3. The calculated endpoint specific HI were below both the U.S. EPA and MPCA acceptable HI of 1 and the chemical specific HQs were below the MPCA acceptable HQ of 0.2, again with the exception of subsurface soil at sub area A3. Tetrachloroethane,

1,1,1-trichloroethane, and xylenes in sample AT009D1 (8 to 10 feet bgs) and iron and manganese in sample AT007C (6 to 8 feet bgs) were the major contributors to the risk for subsurface soil at A3. The ICR for typical industrial workers exposed to surface soil at sub area A4 (2×10^{-5}) slightly exceeded MPCA's acceptable risk level but was within EPA's target risk range of 10^{-4} to 10^{-6}. See Table 2-24.

- *Potential Risks to the Minor Frequent Construction Worker* - HQs for minor frequent construction workers exposed to surface soil and subsurface soil were within MPCA and EPA acceptable risk levels for all sub areas. The calculated HI was below both the U.S. EPA and MPCA acceptable HI of 1 and the chemical specific HQs were below the MPCA acceptable HQ of 0.2. The ICRs for minor frequent construction workers exposed to surface soil at sub areas A4 and E (2×10^{-5} at each area) slightly exceed the MPCA acceptable risk level of 1×10^{-5}, although the ICRs were within EPA's target risk range of 1×10^{-4} to 1×10^{-6}. Tetrachloroethene at sampling location AT009D (8 to 10 feet bgs) in sub area A3 and EB004 A (1 to 3 feet bgs) in sub area E were the major contributors to the ICR. See Table 2-24.

- *Potential Risks to the Major Infrequent Construction Worker* - ICRs for major infrequent construction workers exposed to surface soil and subsurface soil were within MPCA and EPA acceptable risk levels for all sub areas with the exception of sub areas A3 (2×10^{-5}) and A4 (2×10^{-6}). The U.S. EPA's acceptable ICR range is 1×10^{-4} to 1×10^{-6} while the MPCA's acceptable subchronic ICR is 1×10^{-6}. HQs for major infrequent construction workers exposed to surface soil and subsurface soil were within MPCA and EPA acceptable risk levels for all sub areas with the exception of sub area A3. Antimony, 2-butanone, 1,1-dichloroethane, iron, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, and xylenes were the major contributors to the risk at sub area A3. See Table 2-25.

- Based on the results of the risk assessment, sub areas A1, A2, B1, B2, D, F, and "Other" are not a concern under industrial/restricted commercial use.

The following information is provided to clarify the findings of the risk assessment:

- In sub area A3 contamination in the vicinity of sample locations AT009, AT007, and AB043 at depths of approximately 6 to 10 feet bgs were mainly responsible for exceedances of the acceptable risk levels. These sample locations are located in the vicinity of where the drum removal occurred during the OU2 field investigation and where a decontamination pad exists. See Table 2-26 through 2-28.

- In sub area A4 contamination in the vicinity of sample location AT004 at depths of 3 to 5 feet was mainly responsible for exceedances of the acceptable risk levels. See Table 2-28.

- In sub area E the number of sampling data points was insufficient to calculate a 95 percent UCL of the mean and therefore maximum concentrations were utilized as exposure concentrations in depth refined risk assessment. Carcinogenic PAHs (as BaP equivalents) at sample location EB004 at a depth of 1-3 feet bgs is largely responsible for the risk exceedance. The concentration of cPAHs (as BaP equivalents) corresponds to approximately 1.5 times the target risk and is approximately two times higher than the next highest concentration in sub area E. Based on the limited data available EB004 does not appear to be a hot spot and the risk level associated with this specific location slightly exceeds the target risk.

The conclusion for the OU2 ecological risk assessment was as follows:

- The lack of suitable habitat and access restrictions makes it unlikely that large numbers of organisms will be affected.

The following items summarize the human health risk assessment for OU3. Potential exposure pathways for all receptors included incidental ingestion of soil, dermal contact with soil, and inhalation of fugitive and volatile compounds. Cancer risks and hazard indices were estimated following MPCA methodology. See Table 2-29. The following bullets summarize the results of the human health risk assessment for soil:

- *Potential Risks to Industrial Workers* – An Incremental Cancer Risk (ICR) of 3.5×10^{-6} was calculated for industrial workers. The calculated ICR is within the U.S. EPA acceptable ICR range of 1×10^{-4} to 1×10^{-6} and below MPCA's acceptable chronic ICR of 1×10^{-5}. The calculated endpoint specific HI were below both the U.S. EPA and MPCA acceptable HI of 1 and the chemical specific HQs were below the MPCA acceptable HQ of 0.2.

- *Potential Risks to the Minor-Frequent Construction Workers* – An ICR of 3.6×10^{-6} was calculated. The calculated ICR is within the U.S. EPA's acceptable ICR range of 1×10^{-4} to 1×10^{-6} and below the MPCA acceptable chronic ICR of 1×10^{-5}. The calculated noncancer chemical specific HQ ranged from <0.001 to 0.016. The calculated HI was below both the U.S. EPA and MPCA acceptable HI of 1 and the chemical specific HQs were below the MPCA acceptable HQ of 0.2.

- *Potential Risks to Major-Infrequent Construction Worker* – An ICR of 2.1 x 10^{-6} was calculated. The calculated ICR is within the U.S. EPA's acceptable ICR range of 1 x 10^{-4} to 1 x 10^{-6} but exceeds the MPCA's acceptable subchronic ICR of 1 x 10^{-6}. The major contributors to the ICR were cPAHs (0.7 x 10^{-6}), arsenic (0.5 x 10^{-6}), and hexavalent chromium (0.9 x 10^{-6}). Only hexavalent chromium produced a HQ, which exceeded the MPCA acceptable subchronic HQ of 1.

The human health risk assessment addressed potential direct contact with contaminated soil within the top 12 feet. No potential exposures were identified for soil at depths beyond 12 feet, therefore no risks were calculated for potential exposures to soil greater than 12 feet bgs.

The conclusion for the OU3 ecological risk assessment was as follows:

- The lack of habitat underneath the NIROP building's concrete floor and access restrictions makes it unlikely any biological organisms will be affected.

The results of the risk assessment for OU2 and OU3 are combined and provided in detail in Table 2-30 and briefly below:

Risk Assessment Summary	OU2	OU2	OU3	OU3
	HI/HQ	ICR	HI/HQ	ICR
Typical Industrial Worker	Acceptable	Acceptable	Acceptable	Acceptable
Minor Frequent Construction Worker	Acceptable	Acceptable	Acceptable	Acceptable
Major Infrequent Construction Worker	Unacceptable	Unacceptable	Unacceptable	Unacceptable

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

2.8 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAO) are site specific, qualitative, cleanup objectives based on the nature and extent of contaminants, resources currently or potentially threatened, and current or future human and ecological exposures. The objectives were developed based on the results of the risk assessments performed at the facility and all applicable or relevant and appropriate requirements (ARARs) for the NIROP.

The overall remediation objective at the NIROP is to protect human health and the environment from unacceptable risks, that may be posed by contaminated soil and/or groundwater. The site specific remedial response objectives are as follows:

- Prevent unacceptable risks due to residential or other unrestricted exposures to contaminated soils at the site.
- Prevent unacceptable risks due to industrial or construction workers due to exposures to contaminated soils at the site.

2.9 DESCRIPTION OF ALTERNATIVES

Based on the low level of potential risk measured at NIROP and the wide distribution of contaminants in soil, only two remedial options were evaluated.

Alternative 1: No Action

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0

Regulations governing the Superfund program generally require that the 'No Action' alternative be evaluated to establish a baseline for comparison. Under this alternative, the US Navy would take no action at the site to prevent exposure to the soil contamination.

Alternative 2: Land Use Controls (Engineering Controls and Institutional Controls)

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $1,609

Because those removal actions described in Section 2.2 resulted in the removal of all contaminated surface soil locations that could result in an unacceptable risk to a typical industrial worker, a minor frequent construction worker, or a major infrequent construction worker, this alternative only addresses the subsurface contamination that remains. Under this alternative, Land Use Controls (LUCs) consisting of both institutional and engineering controls will be used to protect human health and the environment from the risks posed by that contamination.

Institutional controls are non-engineering mechanisms to restrict the use of or access to property. An example is a deed restriction. Institutional controls do not reduce contamination levels and do not allow

monitoring of naturally occurring changes over time. However, institutional controls can prevent or reduce exposure to contaminants.

Engineering controls are physical barriers to exposure and do not include institutional controls. Engineering controls do not reduce contamination levels. However, engineering controls can also effectively prevent or reduce exposure to contaminants.

The LUC Performance Objectives for Alternative 2 are:

- To restrict the use of the Property to industrial or restricted commercial use, until and unless EPA and MPCA determine that concentrations of hazardous substances in the soils have been reduced to levels that allow for a less restrictive use.

- To prohibit the disturbance of soils deeper than 3 feet below ground surface in those Designated Restricted Areas shown in Figure 2-5 or the removal of any soils excavated in those Areas from the facility without the prior written approval of U.S. EPA and MPCA.

- To prohibit the disturbance of soils beneath the Designated Restricted Area known as the concrete pit foundations where metal-finishing operations previously occurred at the former Plating Shop within the Main Manufacturing Building without the prior written approval of the US EPA and MPCA.

- To ensure that the concrete pit floor (approximately 8 to 12 feet below grade floor) where metal finishing operations previously occurred at the former Plating Shop within the Main Manufacturing Building is not removed without the prior written approval of U.S. EPA and MPCA. That floor will serve as an Engineering Control.

Because a key assumption in the risk assessment for OU2 and OU3 was that conversion of the site to residential or recreational land use with unrestricted access to all parts of the site was not likely, the risk assessment focused on the risks that might arise under either industrial or restricted commercial uses of the site, i.e., land uses more or less identical to those currently existing at the site.

The definition of "industrial" and "restricted commercial" land uses as set forth in MPCA's risk assessment guidance are provided in Section 1.4 of this ROD. In order to ensure that the site is restricted to the uses evaluated and found acceptable under the NIROP risk assessment, LUCs to meet the above described LUC Performance Objectives will be implemented at the site and shall be maintained for as long as they are required to prevent unacceptable exposures to contaminated soil and groundwater

or preserve the integrity of the remedy. The Navy or any subsequent owners shall not modify, delete, or terminate any LUC without U.S. EPA and MPCA concurrence. These LUCs shall be maintained until and unless the concentrations of hazardous substances in the soils have been reduced to levels that allow for unlimited exposure and unrestricted reuse.

2.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

The nine criteria specified in the NCP [40 CFR 300.430(e)] are used to evaluate the different remediation alternatives individually and against each other in order to recommend a remedy. This section of the ROD profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other options under consideration. The nine remedy selection criteria provided in the NCP are as follows.

1. Overall Protection of Human Health and the Environment.
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).
3. Long-term Effectiveness and Permanence.
4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment.
5. Short-term Effectiveness.
6. Implementability.
7. Cost.
8. State Acceptance.
9. Community Acceptance.

Nine Criteria	Alternative 1: No Action	Alternative 2: Engineering Controls and Institutional Controls
Overall Protection	Criteria not met. Residential development could result in unacceptable risk to receptors.	Criteria met. Prevents residential development, limits exposure by industrial receptors.
Compliance with ARARs	Not Applicable	Criteria met. Complies with ARARs.
Long Term Effectiveness	Criteria not met. Future industrial or restricted residential development could result in unacceptable risk to receptors.	Criteria met. Land use controls are expected to remain in place long-term.

Nine Criteria	Alternative 1: No Action	Alternative 2: Engineering Controls and Institutional Controls
Reduction of Toxicity, Mobility, or Volume	Criteria not met. No reduction of toxicity, mobility or volume.	Criteria not met. No reduction of toxicity, mobility or volume.
Short Term Effectiveness	Criteria partially met. No current development, but future development could result in unacceptable risk to receptors.	Criteria met. Prevents residential development, limits exposure by industrial receptors.
Implementability	Criteria met. Remedy easily implemented.	Criteria met. Remedy easily implemented.
Cost	Criteria met. $0 over five years.	Criteria met. $8045 over five years.
Regulatory Acceptance	Criteria not met. Regulatory entities not likely to accept waste remaining in place without controls.	Criteria met. Regulatory entities have indicated acceptance of the alternative.
Community Acceptance	Not Applicable	Criteria met. The alternative supports City's intended land use, no adverse comments received at public hearing or during public comment period.

ARARs are provided on Table 2-31. For Short Term Effectiveness, the criteria under Alternative 1 (no action), is partially met because there is no development existing or planned in the OU2 area where any of the industrial receptors are present. However future development is possible, at which time exposure could be an issue.

The US Navy, US EPA, and MPCA have evaluated the first seven criteria. Both US EPA and MPCA agree with the Selected Remedy. The table compares alternatives evaluated for the NIROP. Although the comparison was conducted separately for each Operable Unit, for simplification, the table summarizes the comparison in general terms for each alternative against the evaluation criteria.

Alternatives 1 and 2 do not include treatment as a component of the site remedy. Therefore, these alternatives would not reduce the toxicity, mobility, or volume of contaminants at the site.

2.11 PRINCIPAL THREAT WASTE

The NCP establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable. The 'principal threat' concept is applied to the characterization of 'source materials'. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to ground water, surface water, or air, or acts as a source for direct exposure. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. Based on the contamination concentrations measured in OU2 and OU3 soil at NIROP, and the resulting risk level attributable to this contamination, there are no principal threat wastes in soil at NIROP. Any wastes that meet the definition of Principal Threat Wastes have been removed in previous removal actions.

2.12 SELECTED REMEDY

The Selected Remedy to address soil contamination in OU2 and OU3 at NIROP is Alternative 2, Engineering Controls and Institutional Controls. The Selected Remedy is selected over No Action because it provides for overall protection of human health, long-term effectiveness and compliance with ARARs for both OU2 and OU3. The selected engineering control and institutional controls provide short-term effectiveness, are easily implementable, and are low in cost but do not provide for the reduction of toxicity, mobility, and volume through treatment.

Soil contamination remains at OU2 and OU3 at concentrations that preclude unrestricted reuse; therefore, the selected remedy utilizes LUCs to prevent unacceptable risk. These LUCs shall be maintained until and unless EPA and MPCA determine that the concentrations of hazardous substances in the soils have been reduced to levels that allow for a less restrictive use of the Property.

The LUC Performance Objectives for Alternative 2 are:

- To restrict the use of the Property to industrial or restricted commercial use, until and unless EPA and MPCA determine that concentrations of hazardous substances in the soils have been reduced to levels that allow for a less restrictive use.

- To prohibit the disturbance of soils deeper than 3 feet below ground surface in those Designated Restricted Areas shown in Figure 2-5 or the removal of any soils excavated in those Areas from the facility without the prior written approval of U.S. EPA and MPCA.

- To prohibit the disturbance of soils beneath the Designated Restricted Area known as the concrete pit foundations where metal-finishing operations previously occurred at the former Plating Shop within the Main Manufacturing Building without the prior written approval of the US EPA and MPCA.

- To ensure that the concrete pit floor (approximately 8 to 12 feet below grade floor) where metal finishing operations previously occurred at the former Plating Shop within the Main Manufacturing Building is not removed without the prior written approval of U.S. EPA and MPCA. That floor will serve as an Engineering Control.

The Navy will be responsible for implementing, inspecting, reporting, monitoring, and enforcing the LUCs described in this ROD in accordance with an approved LUC Remedial Design. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity. Should this LUC remedy fail, the Navy will ensure that appropriate actions are taken to reestablish its protectiveness and may initiate legal action to either compel action by a third party(ies) and/or recover the Navy's costs for remedying any discovered LUC violation(s). Within 21 days of ROD signature, the Navy shall prepare and submit to U.S. EPA and MPCA for review and approval, a LUC Remedial Design that shall contain implementation and maintenance actions, including periodic inspections.

See Table 2-31 for Applicable or Relevant and Appropriate Requirements (ARARs).

Costs associated with the implementation and administration of the LUCs could include: deed preparation and recording (should the property be conveyed), LUC inspection and reporting, LUC enforcement, and CERCLA five year review activities including necessary documentation.

NIROP FRIDLEY
OPERABLE UNIT 2 AND OPERABLE UNIT 3
ESTIMATED TOTAL FIVE-YEAR COSTS

Task	Total Hours	Labor Costs	Airfare/Lodging Per Diem/Auto Rental
Routine Administration	100	$ 5000	0
Five Year Review(1)	12	$ 600	$ 1245(3)

Site Visits (2)			
Number 1	12	$ 600	0
Number 2	12	$ 600	0
	136	$ 6800	$ 1245

1 Costs anticipate one overnight trip to NIROP from Charleston SC to inspect the site at the time of the Five Year Review, if necessary.

2 Costs include a contingency amount which would allow for two site visits over a five year period.

3 Breakdown of travel costs: $1000 - air travel; $100 - lodging; $75 - per diem; $70 - auto rental.

The total cost over five years is $8045. The Average cost per year is $1609. Discount rates were not applied because the costs may not be uniformly applied each year, and the overall costs are small.

2.13 STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action (unless justified by a waiver), is cost effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

The remedy in OU2 and OU3 does not satisfy the statutory preference for treatment as a principal element of the remedy for the following reasons:

- Significant excavation and removal activities have already occurred, resulting in the removal of source waste and contaminated soils.

- Risk assessment indicates that surface soils, where the target industrial receptors' exposure would be most likely, do not exceed EPA and MPCA target risk levels.

- The expected future land use is expected to remain industrial. For this land use, EPA and MPCA target risk levels were only slightly exceeded in subsurface soils.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

LUCs, as described above, would be protective and permanent to the extent they remain in place and are enforced, until such time that it can be demonstrated that there is no unacceptable risk posed by unrestricted access and unlimited use of the property.

See Table 2-31 for potential Applicable or Relevant and Appropriate Requirements (ARARs).

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for OU2 and OU3 was released for public comment in August 2002. The Proposed Plan identified Land Use Controls as the Preferred Alternative to address soils contamination. No written or verbal comments were submitted during the public comment period except those discussed at the public meeting on August 22. It was determined that no significant changes to the remedy, as identified in the Proposed Plan, were necessary or appropriate.

TABLE 9-1

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT
NIROP FRIDLEY, MINNESOTA

Exposure Scenario	Target Risk [1]	Target Hazard Quotient[1]	Estimated Risk											
			Operable Unit 1											Operable Unit 3
			Sub Area A1	Sub Area A2	Sub Area A3	Sub Area A4	Area B1	Area B2	Area D	Area E	Area F	Other		
Typical Industrial Worker	1E-06	0.2	HQ < 0.2 ICR = 8E-6	HQ < 0.2 ICR = 6E-6	HQ < 0.2 ICR = 6E-6	HQ < 0.2 ICR = 1E-5	HQ < 0.2 ICR = 6E-6	HQ < 0.2 ICR = 8E-6	HQ < 0.2 ICR = 7E-6	HQ < 0.2 ICR = 1E-5	HQ < 0.2 ICR = 4E-6	HQ < 0.2 ICR = 6E-7		HQ < 0.2 ICR = 3.6E-6
Minor Frequent Construction Worker	1E-06	0.2	HQ < 0.2 ICR = 1E-6	HQ < 0.2 ICR = 6E-6	HQ < 0.2 ICR = 6E-6	HQ < 0.2 ICR = 1E-5	HQ < 0.2 ICR = 7E-6	HQ < 0.2 ICR = 6E-6	HQ < 0.2 ICR = 6E-6	HQ < 0.2 [redacted]	HQ < 0.2 ICR = 4E-6	HQ < 0.2 ICR = 6E-7		HQ < 0.2 ICR = 3.6E-6
Major Infrequent Construction Worker	1E-06	1	HQ < 1 ICR = 1E-7	HQ < 1 ICR = 6E-7	[redacted]	HQ < 1 [redacted]	HQ < 1 ICR = 6E-7	HQ < 1 ICR = 8E-7	HQ < 1 ICR = 6E-7	HQ < 1 ICR = 1E-6	HQ < 1 ICR = 8E-7	HQ < 1 ICR = 6E-8		[redacted]

Notes:
Risks for the major infrequent construction worker are based on the maximum detected concentration for all areas.
For the typical worker and minor frequent construction workers risks for Sub Areas A1, A2, B1, B2, D, F, and Other are based on maximum detected concentration. Risks for OU3 and Sub Areas A3, A4, and E are based on 95 percent UCL concentration.
Shading indicates that the estimated risks exceed acceptable levels.
The typical worker and minor frequent construction worker are exposed to soils 0 to 4 feet deep, the major infrequent construction worker is exposed to soil 0 to 12 feet deep.
1 Values represent MPCA acceptable levels. USEPA target risk range is 1E-6 to 1E-4 and target hazard quotient is 1.

TABLE 2-2

EXPOSURE SCENARIOS
NIROP FRIDLEY, MINNESOTA

Utilization of Site and Adjoining Areas	Environmental Media	Route of Exposure	Example of Exposure	Exposure Model Assumptions[1]	Comments/References
The NIROP Fridley facility is an industrial facility. The reasonably anticipated future land use for the property underlying the NIROP facility is also industrial.	Soils	Ingestion	Incidental ingestion while eating or smoking.	• Soil intake rate (IR) - Typical adult worker - 100 mg/day - Major Infrequent Construction worker - 480 mg/day - Minor Frequent Construction worker - 200 mg/day • Exposure Frequency (EF) - Typical adult worker - 250 days/year - Major Infrequent Construction Worker - 78 days/year - Minor Frequent Construction Worker - 80 days/year • Exposure Duration (ED) - Typical adult worker - 25 years - Major Infrequent Construction worker - 0.25 year - Minor Frequent Construction worker - 25 years • Body Weight (BW) - Adult - 70 kg • Fraction Ingested from Contaminated Area - Worker - 1.0 • AT - Carcinogens - 25,500 days - Noncarcinogens Major Infrequent Construction Worker - 91 days Minor Frequent Construction Worker - 9,125 days	• Exposure assumptions per MPCA guidance except that the ingestion rate for the minor frequent construction worker is based on professional judgment. The exposure frequency for the minor frequent construction worker is based on NIROP- specific information.

TABLE 2-2

EXPOSURE SCENARIOS
NIROP FRIDLEY, MINNESOTA

Utilization of Site and Adjoining Areas	Environmental Media	Route of Exposure	Example of Exposure	Exposure Model Assumptions[1]	Comments/References
(Continued)		Dermal Contact	Dermal Contact with soils/dust while working.	• Skin Surface Area (SA) - Typical adult worker - 3,000 cm^2 - Construction workers - 4,900 cm^2 • Adherence factor of soil to skin (AF) - 0.3 mg/cm^2-event • EF - Typical adult worker - 90 days/year - Major Infrequent Construction Worker - 78 days/year - Minor Frequent Construction Worker - 60 days/year • ED - Typical adult worker - 25 years - Major Infrequent Construction Worker - - 0.25 year - Minor Frequent Construction Worker - - 25 years • BW - Adult - 70 kg • AT - Carcinogens - 25,500 days - Noncarcinogens Major Infrequent Construction Worker - 91 days Minor Frequent Construction Worker - 9,125 days	• Exposure assumptions per MPCA guidance except that the exposure frequency for the minor frequent worker is based on NIROP specific conditions. Chemical absorption factors will be chemical specific.

TABLE 2-2

EXPOSURE SCENARIOS
NIROP FRIDLEY, MINNESOTA

Utilization of Site and Adjoining Areas	Environmental Media	Route of Exposure	Example of Exposure	Exposure Model Assumptions[1]	Comments/References
(Continued)	Soils (Continued)	Inhalation	Inhalation of volatile organics and particulates emitted from soils.	• Inhalation Rate (IR) - Typical adult worker - 20 m^3 - Construction workers - 20 m^3 • EF - Typical adult worker - 250 days/year - Major Infrequent Construction Worker - 78 days/year - Minor Frequent Construction Worker - 80 days/year • ED - Typical adult worker - 25 years - Major Infrequent Construction Worker - 0.25 year - Minor Frequent Construction Worker - 25 years • BW - Adult - 70 kg • Volatilization Factor - Chemical and site specific • Particulate Emission Factor - Chemical and site specific • AT - Carcinogens - 25,500 days - Noncarcinogens Major Infrequent Construction Worker - 91 days Minor Frequent Construction Worker - 9125 days	• Exposure assumptions per MPCA guidance except that the exposure frequency for the NIROP worker is based on NIROP specific conditions.

1 MPCA, 1998b.

TABLE 2-3

CANCER SLOPE FACTORS[1]
NIROP FRIDLEY, MINNESOTA

Chemical	Dermal Absorption Factor	Gastrointestinal Absorption Factor	Cancer Slope Factor		Inhalation Unit Risk	Weight of Evidence
			Oral $(mg/kg\text{-}day)^{-1}$	Dermal $(mg/kg\text{-}day)^{-1}$	$(ug/m^3)^{-1}$	
Volatile Organic Compounds						
1,1,1-Trichloroethane	0.05	0.9	NA	NA	NA	NA
1,1-Dichloroethane	0.05	0.9	5.7E-03	6.3E-03	1.6E-06	C
1,2-Dichloroethene (Total)	0.05	0.9	NA	NA	NA	D
2-Butanone	0.1	0.9	NA	NA	NA	D
2-Hexanone	NA	NA	NA	NA	NA	NA
Acetone	0.1	0.9	NA	NA	NA	D
Benzene	0.01	0.9	2.9E-02	3.2E-02	8.3E-06	A
Bromomethane	0.05	0.9	NA	NA	NA	NA
Carbon Disulfide	0.05	0.9	NA	NA	NA	NA
Chlorobenzene	0.05	0.9	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	B2
Chloromethane	NA	NA	NA	NA	NA	NA
Ethylbenzene	0.05	0.85	NA	NA	NA	D
Methylene Chloride	0.05	0.9	7.0E-03	7.8E-03	4.7E-07	B2
Styrene	0.05	0.9	3.0E-02	3.3E-02	5.7E-07	B2
Tetrachloroethene	0.05	0.9	5.2E-02	5.8E-02	5.8E-08	B2/C
Toluene	0.05	0.9	NA	NA	NA	D
Trichloroethene	0.05	0.9	1.1E-02	1.2E-02	1.7E-06	B2/C
Vinyl Chloride	NA	NA	NA	NA	NA	A
Xylenes (Total)	0.05	0.9	NA	NA	NA	D
Semivolatile Organic Compounds						
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	NA	NA	NA	NA	NA	NA
4-Methyl-2-Pentanone	0.05	0.9	NA	NA	NA	NA
Acenaphthene	0.05	0.8	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA
Anthracene	0.1	0.8	NA	NA	NA	D
Benzo(a)anthracene	0.13	0.8	7.3E-01	9.1E-01	1.7E-04	B2
Benzo(a)pyrene	0.13	0.8	7.3E+00	9.1E+00	1.7E-03	B2

TABLE 2-3

CANCER SLOPE FACTORS[1]
NIROP FRIDLEY, MINNESOTA

Chemical	Dermal Absorption Factor	Gastrointestinal Absorption Factor	Cancer Slope Factor		Inhalation Unit Risk	Weight of Evidence
			Oral $(mg/kg\text{-}day)^{-1}$	Dermal $(mg/kg\text{-}day)^{-1}$	$(ug/m^3)^{-1}$	
Benzo(b)fluoranthene	0.13	0.8	7.3E-01	9.1E-01	1.7E-04	B2
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	0.13	0.8	7.3E-02	9.1E-02	1.7E-05	B2
Bis(2-ethylhexyl)phthalate	0.05	0.7	1.4E-02	2.0E-02	4.0E-06	B2
Butylbenzyl phthalate	0.1	0.9	NA	NA	NA	NA
Carbazole	0.1	0.9	2.0E-02	NA	NA	NA
Chrysene	0.13	0.8	7.3E-03	9.1E-03	1.7E-06	B2
di-n-Butyl Phthalate	0.1	0.9	NA	NA	NA	D
di-n-Octyl Phthalate	0.1	0.9	NA	NA	NA	NA
Dibenzo(a,h)anthracene	0.13	0.8	7.3E+00	9.1E+00	1.7E-03	B2
Dibenzofuran	0.1	0.9	NA	NA	NA	NA
Diethyl Phthalate	NA	NA	NA	NA	NA	NA
Fluoranthene	0.13	0.8	NA	NA	NA	NA
Fluorene	0.1	0.8	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.13	0.8	7.3E-01	9.1E-01	1.7E-04	B2
Naphthalene	0.05	0.8	NA	NA	NA	NA
Pentachlorophenol	0.25	0.9	1.2E-01	1.3E-01	3.4E-05	B2
Phenanthrene	NA	NA	NA	NA	NA	NA
Phenol	0.8	0.9	NA	NA	NA	D
Pyrene	0.1	0.8	NA	NA	NA	D
PCBs						
Aroclor-1016	0.15	0.9	2.0E+00	2.2E+00	2.2E-03	B2
Aroclor-1254	0.15	0.9	2.0E+00	2.2E+00	2.2E-03	B2
Metals						
Aluminum	0.001	0.01	NA	NA	NA	NA
Antimony	0.001	0.05	NA	NA	NA	D
Arsenic	0.03	0.9	1.5E+00	1.7E+00	4.0E-03	A
Barium	0.001	0.05	NA	NA	NA	D
Beryllium	0.001	0.01	NA	NA	2.4E-03	B2
Cadmium	0.01	1	NA	NA	1.8E-03	B1
Calcium	NA	NA	NA	NA	NA	NA
Chromium III	0.01	0.05	NA	NA	NA	NA

TABLE 2-3

CANCER SLOPE FACTORS[1]
NIROP FRIDLEY, MINNESOTA

Chemical	Dermal Absorption Factor	Gastrointestinal Absorption Factor	Cancer Slope Factor		Inhalation Unit Risk	Weight of Evidence
			Oral $(mg/kg\text{-}day)^{-1}$	Dermal $(mg/kg\text{-}day)^{-1}$	$(ug/m^3)^{-1}$	
Chromium VI	0.01	0.05	NA	NA	1.2E-02	A
Cobalt	0.01	0.5	NA	NA	NA	NA
Copper	0.01	0.6	NA	NA	NA	D
Cyanide	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	B2
Magnesium	NA	NA	NA	NA	NA	NA
Manganese	0.001	0.05	NA	NA	NA	D
Mercury (inorganic)	0.05	0.2	NA	NA	NA	D
Nickel	0.01	0.05	NA	NA	4.8E-04	D
Potassium	NA	NA	NA	NA	NA	NA
Selenium	0.01	0.9	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA
Thallium	0.01	0.9	NA	NA	NA	NA
Vanadium	0.01	0.1	NA	NA	NA	D
Zinc	0.01	0.3	NA	NA	NA	D

Notes:
1 - MPCA, 1998b.
NA - Not available.
Cancer Class:
Class A - Known human carcinogen
Class B - Probable human carcinogen (B1 - limited evidence in humans; B2 - inadequate evidence in humans but adequate in animals)
Class C - Possible human carcinogen
Group D - Not Classifiable

TABLE 2-4

REFERENCE DOSES[1]
NIROP FRIDLEY, MINNESOTA
PAGE 1 OF 2

Chemical	Absorption Factor	Gastrointestinal Absorption Factor	Subchronic Toxicity Criteria			Chronic Toxicity Criteria			Target Organ for Noncarcinogenic Effect (2)
			Reference Dose		Inhalation RfC	Reference Dose		Inhalation RfC	
			Oral (mg/kg-day)	Dermal (mg/kg-day)	(mg/m^3)	Oral (mg/kg-day)	Dermal (mg/kg-day)	(mg/m^3)	
Volatile Organic Compounds									
1,1,1-Trichloroethane	0.05	0.9	NA	NA	4.0E+00	3.5E-02	3.2E-02	1.0E+00	CNS/PNS; LIV/GI
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	CV/BLD; IMMUNE; LIV/GI; CANCER
1,1-Dichloroethane	0.05	0.9	1.0E+00	9.0E-01	5.0E+00	1.0E-01	9.0E-02	5.0E-01	KIDN; CANCER
1,2-Dichloroethene (Total)	0.05	0.9	9.0E-03	8.1E-03	8.0E-01	9.0E-03	8.1E-03	3.5E-02	LIV/GI
2-Butanone	0.1	0.9	2.0E+00	1.8E+00	1.0E+00	6.0E-01	5.4E-01	1.0E+00	REPROD
2-Hexanone	NA	NA	NA	NA	NA	NA	NA	NA	Not available
Acetone	0.1	0.9	1.0E+00	9.0E-01	3.1E+01	1.0E-01	9.0E-02	3.5E-01	CNS/PNS; KID; LIV/GI
Benzene	0.01	0.9	NA	NA	6.0E-02	NA	NA	6.0E-03	CV/BLD; CANCER
Bromomethane	0.05	0.9	3.0E-03	2.7E-03	2.0E-01	1.4E-03	1.3E-03	5.0E-03	LIV/GI; RESP
Carbon Disulfide	0.05	0.9	1.0E-01	9.0E-02	7.0E-01	1.0E-01	9.0E-02	7.0E-01	CNS/PNS; REPROD
Chlorobenzene	0.05	0.9	4.0E-01	3.6E-01	2.0E-01	2.0E-02	1.8E-02	2.0E-02	KIDN; LIV/GI
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA	REPROD
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	LIV/GI; CANCER
Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA	WHOLE BODY; CANCER (?)
Ethylbenzene	0.05	0.85	NA	NA	1.3E+00	1.0E-01	8.5E-02	1.0E+00	KIDN; LIV/GI; REPROD
Methylene Chloride	0.05	0.9	6.0E-02	5.4E-02	1.0E-01	6.0E-02	5.4E-02	3.0E+00	LIV/GI; CANCER
Styrene	0.05	0.9	NA	NA	3.0E+00	2.0E-01	1.8E-01	2.0E-01	CV/BLD; CNS/PNS; LIV/GI; CANCER
Tetrachloroethene	0.05	0.9	1.0E-01	9.0E-02	NA	1.0E-02	9.0E-03	4.0E-01	CNS/PNS; KIDN; LIV/GI; CANCER
Toluene	0.05	0.9	2.0E+00	1.8E+00	1.0E+00	2.0E-01	1.8E-01	4.0E-01	CNS/PNS; KIDN; LIV/GI; RESP
Trichloroethene	0.05	0.9	2.0E-03	1.8E-03	5.0E-01	NA	NA	NA	CANCER
Xylenes (Total)	0.05	0.9	2.0E-01	1.8E-01	3.0E+00	2.0E+00	1.8E+00	3.0E-01	CNS/PNS; RESP; WHOLE BODY
Semivolatile Organic Compounds									
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA	CV/BLD; CNS/PNS
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	Not available
4-Chloro-3-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	Not available
4-Methyl-2-Pentanone	0.05	0.9	8.0E-01	NA	8.0E-01	8.0E-02	NA	8.0E-02	Not available
Acenaphthene	0.05	0.8	6.0E-01	4.8E-01	NA	6.0E-02	4.8E-02	2.1E-01	LIV/GI
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	Not available
Anthracene	0.1	0.8	3.0E+00	2.4E+00	NA	3.0E-01	2.4E-01	NA	NOT AVAILABLE
Benzo(a)anthracene	0.13	0.8	NA	NA	NA	NA	NA	NA	CANCER
Benzo(a)pyrene	0.13	0.8	NA	NA	NA	NA	NA	NA	CANCER
Benzo(b)fluoranthene	0.13	0.8	NA	NA	NA	NA	NA	NA	CANCER
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA	Not available
Benzo(k)fluoranthene	0.13	0.8	NA	NA	NA	NA	NA	NA	CANCER
Bis(2-ethylhexyl)phthalate	0.05	0.7	NA	NA	NA	2.0E-02	1.4E-02	NA	LIV/GI; CANCER
Butylbenzyl phthalate	0.1	0.9	2.0E+00	1.8E+00	NA	2.0E-01	1.8E-01	NA	LIV/GI
Carbazole	0.1	0.9	NA	NA	NA	NA	NA	NA	Not available
Chrysene	0.13	0.8	NA	NA	0.0E+00	NA	NA	NA	CANCER
di-n-Butyl Phthalate	0.1	0.9	1.0E+00	9.0E-01	NA	1.0E-01	9.0E-02	NA	WHOLE BODY
di-n-Octyl Phthalate	0.1	0.9	2.0E-02	1.8E-02	NA	2.0E-02	1.8E-02	NA	KIDN; LIV/GI
Dibenzo(a,h)anthracene	0.13	0.8	NA	NA	NA	NA	NA	NA	CANCER
Dibenzofuran	0.1	0.9	NA	NA	NA	4.0E-03	3.6E-03	NA	Not available
Fluoranthene	0.13	0.8	4.0E-01	3.2E-01	NA	4.0E-02	3.2E-02	NA	CV/BLD; KIDN; LIV/GI
Fluorene	0.1	0.8	4.0E-01	3.2E-01	NA	4.0E-02	3.2E-02	1.4E-01	CV/BLD
Indeno(1,2,3-cd)pyrene	0.13	0.8	NA	NA	NA	NA	NA	NA	CANCER

TABLE 2-4

REFERENCE DOSES[1]
NIROP FRIDLEY, MINNESOTA
PAGE 2 OF 2

Chemical	Absorption Factor	Gastrointestinal Absorption Factor	Subchronic Toxicity Criteria: Reference Dose Oral (mg/kg-day)	Subchronic Toxicity Criteria: Reference Dose Dermal (mg/kg-day)	Subchronic Toxicity Criteria: Inhalation RfC (mg/m³)	Chronic Toxicity Criteria: Reference Dose Oral (mg/kg-day)	Chronic Toxicity Criteria: Reference Dose Dermal (mg/kg-day)	Chronic Toxicity Criteria: Inhalation RfC (mg/m³)	Target Organ for Noncarcinogenic Effect (2)
Naphthalene	0.05	0.8	2.0E-02	1.6E-02	4.0E-01	4.0E-02	3.2E-02	1.0E-03	CV/BLD; EYE, RESP
Pentachlorophenol	0.25	0.9	3.0E-02	2.7E-02	NA	3.0E-02	2.7E-02	2.0E-04	KIDN; LIV/GI; CANCER
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	Not available
Phenol	0.8	0.9	6.0E-01	5.4E-01	NA	6.0E-01	5.4E-01	NA	REPRO
Pyrene	0.1	0.8	3.0E-01	2.4E-01	NA	3.0E-02	2.4E-02	1.1E-01	KIDN
Polychlorinated biphenyls									
Aroclor-1016	0.15	0.9	5.0E-05	4.5E-05	NA	2.0E-05	1.8E-05	NA	EYE, IMMUNE, REPROD, CANCER
Aroclor-1254	0.15	0.9	5.0E-05	4.5E-05	NA	2.0E-05	1.8E-05	NA	EYE, IMMUNE, REPROD, CANCER
Metals									
Aluminum	0.001	0.01	NA	NA	NA	1.0E+00	1.0E-02	NA	CNS/PNS/REPROD
Antimony	0.001	0.05	4.0E-04	2.0E-05	2.0E-04	4.0E-04	2.0E-05	2.0E-04	CV/BLD, WHOLE BODY
Arsenic	0.03	0.9	3.0E-04	2.7E-04	NA	3.0E-04	2.7E-04	5.0E-04	CV/BLD; CNS/PNS; SKIN; CANCER
Barium	0.001	0.05	7.0E-02	3.5E-03	5.0E-03	7.0E-02	3.5E-03	5.0E-04	CS/BLD, REPROD
Beryllium	0.001	0.01	5.0E-03	5.0E-05	NA	2.0E-03	5.0E-05	4.8E-05	Not available; CANCER
Cadmium	0.01	1	NA	NA	NA	1.0E-03	1.0E-03	2.0E-04	KIDN; CANCER
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	Not available
Chromium III	0.01	0.05	1.0E+00	5.0E-02	NA	1.0E+00	5.0E-02	NA	Not available
Chromium VI	0.01	0.05	2.0E-02	1.0E-03	2.0E-05	5.0E-03	2.5E-04	2.0E-05	Not available; CANCER
Cobalt	0.01	0.5	NA	NA	3.0E-05	6.0E-02	3.0E-02	1.0E-03	CV/BLD; IMMUN; RESP
Copper	0.01	0.5	3.7E-02	2.2E-02	NA	3.7E-02	2.2E-02	NA	LIV/GI
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	CNS/PNS; THYROID; WHOLE BODY
Iron	NA	NA	NA	NA	NA	NA	NA	NA	Not available
Lead	NA	NA	NA	NA	NA	NA	NA	NA	CV/BLD; CNS/PNS; REPRO; CANCER
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	Not available
Manganese	0.001	0.05	1.4E-01	7.0E-03	NA	4.7E-02	2.4E-03	5.0E-05	CNS/PNS
Mercury (inorganic)	0.05	0.2	3.0E-03	6.0E-04	3.0E-04	3.0E-04	6.0E-05	3.0E-04	CNS/PNS; IMMUNE
Nickel	0.01	0.05	2.0E-02	1.0E-03	NA	2.0E-02	1.0E-03	NA	WHOLE BODY; CANCER
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	Not available
Selenium	0.01	0.9	5.0E-03	4.5E-03	NA	5.0E-03	4.5E-03	NA	CV/BLD; CNS/PNS; LIV/GI; SKIN
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	Not available
Thallium	0.01	0.9	8.0E-04	7.2E-04	NA	8.0E-05	7.2E-05	NA	CV/BLD; HAIR; REPROD
Vanadium	0.01	0.1	7.0E-03	7.0E-04	NA	7.0E-03	7.0E-04	NA	Not available
Zinc	0.01	0.3	3.0E-01	9.0E-02	NA	3.0E-01	9.0E-02	NA	CV/BLD

Notes:
1 - MPCA, 1998.
2 - ADREN - adrenal; CV/BLD - cardiovascular/blood system; CNS/PNS - central/peripheral nervous system; EYE; IMMUN - immune system; KIDN - kidney; LIV/GI - liver/gastrointestinal system; REPRO - reproductive system (incl. teratogenic/developmental effects); RESP - respiratory system; SKIN - skin irritation or other effects; SPLEEN; WHOLE BODY - increased mortality, decreased growth rate, etc.
RfC - Reference concentration.

TABLE 2-5

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA A1
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Volatile Organics (ug/kg)								
1,2-Dichloroethene (total)	1/6	2	10 - 12	AB040A	2	8000	0.0003	No
Acetone	4/6	600 - 2700	4 - 11	AB041A	2700	320000	0.008	No
Ethylbenzene	1/6	3	10 - 12	AB040A	3	200000	0.00002	No
Xylenes, Total	1/6	5	10 - 12	AB040A	5	110000	0.00005	No
Semivolatile Organics (ug/kg)								
Benzo(g,h,i)perylene	1/4	350	340 - 390	AB041C	350	NA	NA	NA
Inorganics (mg/kg)								
Aluminum	4/4	1410 - 4190	NA	AB041A	4190	26000	0.2	Yes
Arsenic	3/4	1.4 - 3.4	0.64 - 0.98	AB042A	3.4	10	0.3	Yes
Barium	3/4	21.9 - 113	10.3 - 10.4	AB041A	113	1200	0.09	No
Calcium	4/4	12600 - 37300	NA	AB042G	37300	NA	NA	NA
Chromium	4/4	4.7 - 13.6	NA	AB041C	13.6	71	0.2	Yes
Copper	2/4	6.7 - 10.3	4.3 - 5.1	AB042A	10.3	100	0.1	Yes
Iron	4/4	5110 - 24300	NA	AB042A	24300	7000	3.5	Yes
Lead	4/4	1.5 - 5.6	NA	AB041A	5.6	400	0.01	No
Magnesium	4/4	1600 - 10500	NA	AB042G	10500	NA	NA	NA
Manganese	4/4	162 - 927	NA	AB041A	927	1400	0.7	Yes
Nickel	2/4	12.1 - 14.7	8.6 - 9.5	AB042G-D	14.7	520	0.03	No
Potassium	1/4	208	104 - 327	AB041A	208	NA	NA	NA
Sodium	1/4	141	103 - 165	AB041A	141	NA	NA	NA
Vanadium	3/4	12.7 - 14	10.3 - 10.4	AB042A	14	210	0.07	No
Zinc	4/4	8 - 26	NA	AB042A	26	8700	0.003	No

Notes:
Shading indicates that the maximum detected concentration exceeds 10 percent of the Tier I SRV.
SRV = Soil Reference Value.
NA = No SRV available.

Associated samples:

AB040A	AB042A
AB040D	AB042G
AB041A	AB042G-AVG
AB041C	AB042G-D

TABLE 2-6

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA A2
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Volatile Organics (ug/kg)								
1,2-Dichloroethene (total)	1/14	2	10 - 1500	AB202B	2	8000	0.0003	No
Acetone	2/14	170 - 410	6 - 1500	AB222C	410	320000	0.001	No
Tetrachloroethene	6/14	0.7 - 35	10 - 1500	AB222A-D	35	72000	0.0005	No
Trichloroethene	9/14	0.9 - 4100	10 - 11	AB025B	4100	29000	0.1	Yes
Semivolatile Organics (ug/kg)								
BaP Equivalents	1/4	340.52	350 - 400	AB024A	340.52	2000	0.2	Yes
Benzo(a)anthracene	1/4	140	350 - 400	AB024A	140	NA	NA	NA
Benzo(a)pyrene	1/4	120	350 - 400	AB024A	120	NA	NA	NA
Benzo(b)fluoranthene	1/4	130	350 - 400	AB024A	130	NA	NA	NA
Benzo(k)fluoranthene	1/4	87	350 - 400	AB024A	87	NA	NA	NA
Chrysene	1/4	150	350 - 400	AB024A	150	NA	NA	NA
Fluoranthene	1/4	290	350 - 400	AB024A	290	1080000	0.0003	No
Phenanthrene	1/4	180	350 - 400	AB024A	180	NA	NA	NA
Pyrene	1/4	290	350 - 400	AB024A	290	890000	0.0003	No
Total cPAHs	1/4	627	350 - 400	AB024A	627	NA	NA	NA
Total PAHs	1/4	1387	350 - 400	AB024A	1387	NA	NA	NA
Pesticides (ug/kg)								
4,4'-DDD	2/4	4.4 - 4.8	3.5 - 3.6	AB025A	4.8	56000	0.0001	No
4,4'-DDE	2/4	5.3 - 9.6	3.5 - 3.6	AB025A	9.6	40000	0.0002	No
4,4'-DDT	3/4	4.5 - 28	3.5	AB025A	28	15000	0.0019	No
Inorganics (mg/kg)								
Aluminum	4/4	1470 - 5270	NA	AB024A	5270	26000	0.2	Yes
Arsenic	4/4	1.4 - 8.3	NA	AB025B	8.3	10	0.8	Yes
Barium	3/4	43.6 - 227	10.4	AB025B	227	1200	0.2	Yes
Calcium	4/4	8180 - 67400	NA	AB025B	67400	NA	NA	NA
Chromium	4/4	4.2 - 11.3	NA	AB024A	11.3	71	0.2	Yes
Copper	3/4	11.1 - 158	4.5	AB024A	158	100	1.6	Yes
Iron	4/4	4160 - 18000	NA	AB025B	18000	7000	2.6	Yes
Lead	4/4	1.8 - 143	NA	AB024A	143	400	0.4	Yes

TABLE 2-6

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA A2
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Magnesium	4/4	2400 - 7830	NA	AB024G	7830	NA	NA	NA
Manganese	4/4	230 - 2230	NA	AB025B	2230	1400	1.6	Yes
Nickel	4/4	10.7 - 24.2	NA	AB024G	24.2	520	0.05	No
Vanadium	4/4	10.9 - 19.7	NA	AB025B	19.7	210	0.09	No
Zinc	4/4	12 - 141	NA	AB024A	141	8700	0.02	No

Notes:
Shading indicates that the maximum detected concentration exceeds 10 percent of the Tier I SRV.
Individual cPAH compounds included in BaP equivalent concentration
SRV = Soil Reference Value.
NA = No SRV available.

Associated Samples:

AB024A	AB201A	AB222A	AB223A
AB024G	AB201H	AB222A-AVG	AB223C
AB025A	AB202A	AB222A-D	AB230A
AB025B	AB202B	AB222C	AB230B

TABLE 2-7

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA A3
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Volatile Organics (ug/kg)								
1,1,1-Trichloroethane	36/91	0.4 - 2600000	10 - 71	AT009D1	2600000	140000	19	Yes
1,1,2-Trichloroethane	1/81	3	10 - 67000	AB214C	3	9000	0.0003	No
1,1-Dichloroethane	18/91	0.5 - 34000	10 - 1300	AT009D1	34000	34000	1.0	Yes
1,2-Dichloroethane	1/81	4	10 - 67000	AB043D	4	4000	0.001	No
1,2-Dichloroethene (total)	49/91	1 - 1800	10 - 67000	AB043D	1800	8000	0.2	Yes
2-Butanone	1/81	3500000	3 - 1300	AT009D1	3500000	1400000	2.5	Yes
2-Hexanone	1/81	2	10 - 67000	AT008D	2	NA	NA	NA
4-Methyl-2-pentanone	1/81	1	10 - 67000	AT008D	1	NA	NA	NA
Acetone	1/81	210 - 12000	2 - 67000	AB043H	12000	320000	0.04	No
Benzene	2/81	1 - 14	10 - 67000	AT007C	14	1500	0.009	No
Ethylbenzene	3/91	25 - 140000	10 - 1300	AT009D1	140000	200000	0.7	Yes
Tetrachloroethene	31/91	0.8 - 1200000	10 - 56	AT009D1	1200000	72000	17	Yes
Toluene	4/91	27 - 190000	1 - 1300	AT009D1	190000	107000	1.8	Yes
Trichloroethene	78/91	0.6 - 120000	10 - 13	AT009D1	120000	29000	4.1	Yes
Xylenes, Total	6/81	17 - 580000	4 - 110	AT009D1	580000	110000	5.3	Yes
Semivolatile Organics (ug/kg)								
Acenaphthene	2/31	120 - 160	340 - 13000	AB037A	160	1200000	0.0001	No
Anthracene	3/21	330 - 660	340 - 13000	AB043D	660	7880000	0.00008	No
BaP Equivalents	5/31	216.897 - 3166.1	340 - 13000	AB043D	3166.1	2000	1.6	Yes
Benzo(a)anthracene	4/31	39 - 2100	340 - 13000	AB043D	2100	NA	NA	NA
Benzo(a)pyrene	4/31	36 - 1700	340 - 13000	AB043D	1700	NA	NA	NA
Benzo(b)fluoranthene	5/31	24 - 1800	340 - 13000	AB043D	1800	NA	NA	NA
Benzo(g,h,i)perylene	3/21	340 - 1100	340 - 13000	AB043D	1100	NA	NA	NA
Benzo(k)fluoranthene	4/31	45 - 1400	340 - 13000	AB043D	1400	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	3/21	1300 - 20000	340 - 13000	AT009D1	20000	570000	0.04	No
Carbazole	1/31	240	340 - 13000	AB037A	240	700000	0.0003	No
Chrysene	4/31	47 - 2100	340 - 13000	AB043D	2100	NA	NA	NA
Dibenzofuran	1/21	110	340 - 13000	AB036A	110	58000	0.002	No
Fluoranthene	6/21	110 - 4400	340 - 13000	AB043D	4400	1080000	0.004	No

TABLE 2-7

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA A3
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Fluorene	2/21	170 - 240	340 - 13000	AB036A	240	850000	0.0003	No
Indeno(1,2,3-cd)pyrene	4/31	18 - 1100	340 - 13000	AB043D	1100	NA	NA	NA
Naphthalene	1/21	2700	340 - 13000	AT009D1	2700	10000	0.3	Yes
Phenanthrene	5/21	180 - 2700	340 - 13000	AB043D	2700	NA	NA	NA
Phenol	3/31	1000 - 1300	340 - 13000	AB036A	1300	1100000	0.001	No
Pyrene	7/31	27 - 5100	340 - 13000	AB043D	5100	890000	0.006	No
Total cPAHs	5/31	24 - 10200	340 - 13000	AB043D	10200	NA	NA	NA
Total PAHs	9/31	29 - 24160	340 - 13000	AB043D	24160	NA	NA	NA
Pesticides (ug/kg)								
4,4'-DDD	7/21	21 - 220	3.4 - 89	AB037A	220	56000	0.004	No
4,4'-DDD	7/21	21 - 220	3.4 - 89	AT009B1-D	220	56000	0.004	No
4,4'-DDE	9/21	8.5 - 450	3.4 - 89	AB037A	450	40000	0.01	No
4,4'-DDT	8/21	6.3 - 430	3.4 - 89	AT009B1-D	430	15000	0.03	No
Aldrin	1/21	3.1	1.8 - 46	AB036A	3.1	1000	0.003	No
Dieldrin	2/21	4 - 43	3.4 - 89	AT009D1	43	800	0.05	No
Endosulfan II	2/21	37 - 54	3.4 - 89	AT009B1-D	54	NA	NA	NA
Gamma-Chlordane	1/21	3.4	1.8 - 46	AB036A	3.4	NA	NA	NA
Heptachlor Epoxide	1/21	2.6	1.8 - 46	AB036A	2.6	400	0.007	No
delta-BHC	1/21	2.6	1.8 - 46	AT009D2	2.6	NA	NA	NA
Inorganics (mg/kg)								
Aluminum	21/21	1010 - 6370	NA	AT007C	6370	26000	0.2	Yes
Antimony	1/31	22.5 - 105	0.3 - 3.9	AT008D-D	105	14	7.5	Yes
Arsenic	20/21	0.91 - 6.6	0.61	AT007C	6.6	10	0.7	Yes
Barium	21/31	3.9 - 327	10.2 - 10.9	AT007C	327	1200	0.3	Yes
Cadmium	10/31	0.04 - 5.3	0.04 - 2	AB043D	5.3	35	0.2	Yes
Calcium	21/21	3710 - 61800	NA	AT007C	61800	NA	NA	NA
Chromium	31/31	2.3 - 114	NA	AT008D-D	114	71	1.6	Yes
Cobalt	2/21	12.3 - 34.5	10.2 - 12.2	AT007C	34.5	2000	0.02	No
Copper	23/31	2 - 1290	4.1 - 4.4	AT008D-D	1290	100	13	Yes
Cyanide	2/31	5.3 - 5.4	0.1 - 3.1	AT007C	5.4	62	0.09	No

TABLE 2-7

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA A3
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Iron	21/21	2990 - 275000	NA	AT007C	275000	7000	39	Yes
Lead	31/31	0.99 - 453	NA	AT008D	453	400	1.1	Yes
Magnesium	21/21	1730 - 20600	NA	AB043D	20600	NA	NA	NA
Manganese	21/21	155 - 20700	NA	AT007C	20700	1400	15	Yes
Mercury	2/31	0.04 - 0.19	0.03 - 0.2	AT009B1-D	0.19	0.7	0.3	Yes
Nickel	24/31	5.1 - 142	8.2 - 8.4	AT008D-D	142	520	0.3	Yes
Potassium	8/21	113 - 497	102 - 1000	AT007C	497	NA	NA	NA
Selenium	2/21	0.82 - 2	0.61 - 0.74	AT007C	2	170	0.01	No
Silver	3/31	4.4 - 11.8	0.19 - 2.5	AB043D	11.8	170	0.07	No
Sodium	3/21	122 - 195	102 - 197	AB043D	195	NA	NA	NA
Vanadium	9/21	13.6 - 32.9	10.2 - 10.9	AT007C	32.9	210	0.2	Yes
Zinc	31/31	6.2 - 329	NA	AB043D	329	8700	0.04	No

Notes:
Shading indicates that the maximum detected concentration exceeds 10 percent of the Tier I SRV.
Individual cPAH compounds included in BaP equivalent concentration.
SRV = Soil Reference Value.
NA = No SRV available.

Associated Samples:

AB035A	AB213A-D	AB236A	AB246A	AT008D-AVG
AB036A	AB213B	AB236H	AB246B	AT008D-D
AB036H	AB214A	AB237A	AB247A	AT009B1
AB037A	AB214C	AB237C	AB247C	AT009B1-AVG
AB037D	AB215A	AB238A	AB248A	AT009B1-D
AB039A	AB215H	AB238H	AB248C	AT009D1
AB039H	AB216A	AB238H-AVG	AB248C-AVG	AT009D2
AB039H-AVG	AB216D	AB238H-D	AB248C-D	AT009D3
AB039H-D	AB217A	AB239A	AB251A	AT009E1
AB043D	AB217D	AB239G	AB251C	AT009E2

TABLE 2-7

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA A3
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
AB043H	AB218A		AB240A		AB252A		SA1-SCS-01	
AB044D	AB218H		AB240H		AB252H		SA1-SCS-01-AVG	
AB044H	AB231A		AB241A		AB253A		SA1-SCS-01-D	
AB209A	AB231H		AB241C		AB253H		SA1-SCS-02	
AB209B	AB233A		AB242A		AB254A		SA1-SCS-03	
AB210A	AB233H		AB242B		AB254A-AVG		SA2-SCS-027	
AB210D	AB234A		AB244A		AB254A-D		SA2-SCS-028	
AB211A	AB234A-AVG		AB244H		AB254C		SA2-SCS-029	
AB211B	AB234A-D		AB244H-AVG		AT007A		SB28-SCS-04	
AB212A	AB234D		AB244H-D		AT007C		SB28-SCS-05	
AB212B	AB235A		AB245A		AT008A		SB30-SCS-06	
AB213A	AB235H		AB245G		AT008D		SB30-SCS-07	
AB213A-AVG								

TABLE 2-8

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA A4
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Volatile Organics (ug/kg)								
1,1,1-Trichloroethane	6/73	0.8 - 8	10 - 14	AB028G	8	140000	0.00006	No
1,1,2,2-Tetrachloroethane	2/62	2	10 - 62	AB031A	2	3500	0.0006	No
1,1,2,2-Tetrachloroethane	2/62	2	10 - 62	AT004B	2	3500	0.0006	No
1,1,2-Trichloroethane	2/62	3 - 7	10 - 62	AT004B	7	9000	0.0008	No
1,1-Dichloroethane	2/73	0.4 - 2	10 - 62	AB243B	2	34000	0.00006	No
1,2-Dichloroethene (total)	29/73	1 - 14000	10 - 14	SA3-SCS-40-D	14000	8000	1.8	Yes
Acetone	3/62	190 - 1200	3 - 87	AB038A	1200	320000	0.004	No
Ethylbenzene	3/73	72 - 3400	10 - 62	AB031G	3400	200000	0.02	No
Tetrachloroethene	17/73	0.6 - 2700	10 - 13	AT004B	2700	72000	0.04	No
Toluene	4/73	10 - 45	0.6 - 62	AB031G	45	107000	0.0004	No
Trichloroethene	56/73	0.8 - 96000	0.9 - 12	SA3-SCS-40-D	96000	29000	3.3	Yes
Xylenes, Total	3/62	550 - 28000	2 - 62	AB031G	28000	110000	0.3	Yes
Semivolatile Organics (ug/kg)								
2-Methylnaphthalene	4/32	170 - 3400	330 - 4100	AB031A	3400	NA	NA	NA
Acenaphthene	6/43	23 - 450	330 - 4100	AB026A	450	1200000	0.000	No
Acenaphthylene	1/32	380	330 - 4100	AB030A	380	NA	NA	NA
Anthracene	9/32	130 - 1100	330 - 4100	AB030A	1100	7880000	0.000	No
BaP Equivalents	21/43	188.34 - 10410	340 - 4100	AB030A	10410	2000	5	Yes
Benzo(a)anthracene	16/43	130 - 6900	340 - 4100	AB030A	6900	NA	NA	NA
Benzo(a)pyrene	17/43	73 - 7400	340 - 4100	AB030A	7400	NA	NA	NA
Benzo(b)fluoranthene	18/43	22 - 7200	340 - 4100	AB030A	7200	NA	NA	NA
Benzo(g,h,i)perylene	15/32	210 - 5800	340 - 4100	AB030A	5800	NA	NA	NA
Benzo(k)fluoranthene	15/43	100 - 7200	340 - 4100	AB030A	7200	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	3/32	140 - 7200	330 - 3700	AT004B	7200	570000	0.01	No
Carbazole	11/43	25 - 1300	330 - 4100	AT001A	4900	700000	0.007	No
Chrysene	18/43	18 - 7800	340 - 4100	AB030A	43000	NA	NA	NA
Dibenzo(a,h)anthracene	5/43	20 - 7800	330 - 4100	AB029A	7800	NA	NA	NA
Dibenzofuran	3/32	55 - 220	330 - 4100	AB026A	220	58000	0.00	No
Fluoranthene	16/32	240 - 20000	340 - 4100	AT001A	20000	1080000	0.0	No
Fluorene	6/32	110 - 530	330 - 4100	AB031A	530	850000	0.001	No
Indeno(1,2,3-cd)pyrene	14/43	84 - 5200	340 - 4100	AB030A	5200	NA	NA	NA
Naphthalene	2/32	950 - 1100	330 - 4100	AB031G	1100	10000	0.1	Yes

TABLE 2-8

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA A4
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Phenanthrene	15/32	130 - 7400	340 - 4100	AB030A	7400	NA	NA	NA
Pyrene	23/43	22 - 18000	340 - 4100	AB030A	18000	890000	0.0	No
Total cPAHs	21/43	22 - 42700	340 - 4100	AB030A	42700	NA	NA	NA
Total PAHs	24/43	44 - 90380	340 - 4100	AB030A	90380	NA	NA	NA
Pesticides (ug/kg)								
4,4'-DDD	14/32	3.7 - 2900	3.4 - 41	AT001A	2900	56000	0.05	No
4,4'-DDE	12/32	22 - 1900	3.4 - 37	AT001A	1900	40000	0.05	No
4,4'-DDT	16/32	4.2 - 1400	3.4 - 36	AT006A	1400	15000	0.09	No
Alpha-Chlordane	2/32	2.8 - 36	1.7 - 45	AT001A	36	13000	0.003	No
Dieldrin	1/32	4	3.4 - 88	AB038A	4	800	0.005	No
Endosulfan Sulfate	3/32	4.8 - 15	3.3 - 88	AB028A	15	NA	NA	NA
Endrin	2/32	8.7 - 14	3.3 - 88	AB034A	14	8000	0.002	No
Endrin Aldehyde	2/32	5.9 - 7.1	3.3 - 88	AT005A	7.1	NA	NA	NA
Gamma-Chlordane	1/32	3	1.7 - 45	AB026A	3	NA	NA	NA
Heptachlor Epoxide	1/32	30	1.7 - 45	AT001A	30	400	0.08	No
Methoxychlor	1/32	19	17 - 450	AB031G	19	11000	0.002	No
delta-BHC	1/32	25	1.7 - 45	AT004B	25	NA	NA	NA
Inorganics (mg/kg)								
Aluminum	32/32	1130 - 6830	NA	AT003B	6830	26000	0.3	Yes
Antimony	1/43	2.3	0.3 - 2.6	AB026A	2.3	14	0.2	Yes
Arsenic	28/32	0.86 - 11.4	0.62 - 1	AB031G	11.4	10	1.1	Yes
Barium	34/43	3.9 - 306	10.3 - 12	AB026A	306	1200	0.3	Yes
Cadmium	9/43	0.04 - 0.39	0.04 - 1.3	SA3-SCS-40	0.39	35	0.01	No
Calcium	32/32	4290 - 34900	NA	AB034D	34900	NA	NA	NA
Chromium	43/43	2.5 - 22.6	NA	AB031A	22.6	71	0.3	Yes
Copper	33/43	1.3 - 1900	4.1 - 5.3	AB026A	1900	100	19	Yes
Cyanide	4/43	0.16 - 4.6	0.1 - 3.3	AT006A	4.6	62	0.07	No
Iron	32/32	3080 - 38100	NA	AT003B	38100	7000	5.4	Yes
Lead	43/43	0.86 - 274	NA	AB028A	274	400	0.7	Yes
Magnesium	32/32	1750 - 13900	NA	AB034D	13900	NA	NA	NA
Manganese	32/32	165 - 5950	NA	AT005C-D	5950	1400	4.3	Yes
Mercury	1/43	0.12	0.02 - 0.13	AB034A	0.12	0.7	0.2	Yes
Nickel	37/43	3.5 - 32.3	8.2 - 9.6	AB026A	32.3	520	0.06	No

TABLE 2-6

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA A4
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Potassium	20/32	121 - 582	104 - 473	AT002B-D	582	NA	NA	NA
Selenium	1/32	1.3	0.61 - 0.78	AB026A	1.3	170	0.008	No
Sodium	4/32	112 - 162	103 - 131	AB031G	162	NA	NA	NA
Vanadium	24/32	12.1 - 26.1	10.3 - 12	AT002A	26.1	210	0.1	Yes
Zinc	43/43	5.5 - 489	NA	AT001A	489	8700	0.06	No

Notes:
Shading indicates that the maximum detected concentration exceeds 10 percent of the Tier I SRV.
Individual cPAH compounds included in BaP equivalent concentration.
SRV = Soil Reference Value.
NA - No SRV available.

Associated Samples:

AB026A	AB034A	AB208A-D	AB229A	AT006A
AB026G	AB034D	AB208H	AB229H	AT006B
AB027A	AB038A	AB219A	AB243A	SA3-SCS-40
AB027H	AB038G	AB219F	AB243B	SA3-SCS-40-AVG
AB028A	AB203A	AB220A	AT001A	SA3-SCS-40-D
AB028G	AB203B	AB220G	AT001C	SA3-SCS-42
AB029A	AB204A	AB221A	AT002A	SA4-SCS-43
AB029H	AB204A-AVG	AB221G	AT002B	SA4-SCS-44
AB030A	AB204A-D	AB224A	AT002B-AVG	SA5-SCS-023
AB030G	AB204B	AB224H	AT002B-D	SA5-SCS-024
AB030G-AVG	AB205A	AB226B	AT003A	SA5-SCS-024-AVG
AB030G-D	AB205G	AB226G	AT003B	SA5-SCS-024-D
AB031A	AB206A	AB227A	AT004A	SA5-SCS-025
AB031G	AB206B	AB227A-AVG	AT004B	SA6-SCS-21
	AB207A	AB227A-D	AT005A	SA6-SCS-22
AB032D	AB207H	AB227G	AT005C	SB20-SCS-037
AB033B	AB208A	AB228A	AT005C-AVG	SB20-SCS-038
AB033H	AB208A-AVG	AB228F	AT005C-D	

TABLE 2-9

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA B1
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Volatile Organics (ug/kg)								
1,1-Dichloroethane	1/18	2	10 - 170	BB002B	2	34000	0.00006	No
1,2-Dichloroethene (total)	2/18	120 - 160	10 - 15	BB002B	160	8000	0.02	No
Acetone	5/18	130 - 2600	5 - 100	BB001C	2600	320000	0.008	No
Tetrachloroethene	1/18	14	10 - 170	BB204G	14	72000	0.0002	No
Trichloroethene	2/18	4 - 27	10 - 170	BB204G	27	29000	0.0009	No
Semivolatile Organics (ug/kg)								
Anthracene	2/11	89 - 150	340 - 970	BT001A	150	7880000	0.00002	No
BaP Equivalents	3/11	336.16 - 759.3	350 - 970	BT001A	759.3	2000	0.4	Yes
Benzo(a)anthracene	3/11	140 - 450	350 - 970	BT001A	450	NA	NA	NA
Benzo(a)pyrene	3/11	120 - 450	350 - 970	BT001A	450	NA	NA	NA
Benzo(b)fluoranthene	3/11	140 - 490	350 - 970	BT001A	490	NA	NA	NA
Benzo(g,h,i)perylene	1/11	290	340 - 970	BT001A	290	NA	NA	NA
Benzo(k)fluoranthene	3/11	98 - 380	350 - 970	BT001A	380	NA	NA	NA
Carbazole	1/11	77	340 - 970	BT001A	77	700000	0.0001	No
Chrysene	3/11	180 - 500	350 - 970	BT001A	500	NA	NA	NA
Fluoranthene	5/11	110 - 990	350 - 480	BT001A	990	1080000	0.0009	No
Fluorene	1/11	51	340 - 970	BT001A	51	850000	0.00006	No
Indeno(1,2,3-cd)pyrene	1/11	310	340 - 970	BT001A	310	NA	NA	NA
Phenanthrene	3/11	170 - 580	350 - 970	BT001A	580	NA	NA	NA
Pyrene	5/11	110 - 810	350 - 480	BT001A	810	890000	0.0009	No
Total cPAHs	3/11	678 - 2580	350 - 970	BT001A	2580	NA	NA	NA
Total PAHs	5/11	220 - 5400	350 - 480	BT001A	5400	NA	NA	NA
Pesticides (ug/kg)								
4,4'-DDD	3/11	26 - 180	3.5 - 9.7	BB002B	180	56000	0.003	No
4,4'-DDE	3/11	37 - 160	3.5 - 9.7	BB002B	160	40000	0.004	No
4,4'-DDT	4/11	8.2 - 160	3.5 - 9.7	BB002B	160	15000	0.01	No
Alpha-Chlordane	1/11	4.8	1.8 - 5	BT001A	4.8	13000	0.0004	No
Endosulfan Sulfate	1/11	7.7	3.4 - 9.7	BB002B	7.7	NA	NA	NA
Endrin	2/11	4.7 - 5.1	3.4 - 9.7	BT001A	5.1	8000	0.0006	No
Endrin Aldehyde	2/11	5.8 - 5.9	3.4 - 9.7	BB002B	5.9	NA	NA	NA

TABLE 2-9

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA B1
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Inorganics (mg/kg)								
Aluminum	11/11	1160 - 4580	NA	BB003A	4580	26000	0.2	Yes
Antimony	1/11	2.3	2.1 - 7	BT001A	2.3	14	0.2	Yes
Arsenic	10/11	1.2 - 9.4	0.64 - 0.66	BB001C	9.4	10	0.9	Yes
Barium	10/11	22.5 - 197	10.7 - 11	BT002B	197	1200	0.2	Yes
Calcium	11/11	682 - 25500	NA	BB001C	25500	NA	NA	NA
Chromium	10/11	3.3 - 12.8	7	BB002B	12.8	71	0.2	Yes
Copper	8/11	7.6 - 43.1	4.3 - 14	BB002B	43.1	100	0.4	Yes
Iron	11/11	2700 - 12300	NA	BB003A	12300	7000	1.8	Yes
Lead	10/11	2.6 - 37	2.1	BB002B	37	400	0.09	No
Magnesium	11/11	720 - 7230	NA	BB002B	7230	NA	NA	NA
Manganese	11/11	55.6 - 1560	NA	BT002B	1560	1400	1.1	Yes
Nickel	6/11	9.1 - 17.2	8.6 - 28.1	BT002B	17.2	520	0.03	No
Potassium	7/11	157 - 465	107 - 1000	BB002B	465	NA	NA	NA
Selenium	1/11	1.3	0.64 - 2.1	BT002B	1.3	170	0.008	No
Sodium	1/11	536	107 - 153	BB001C	536	NA	NA	NA
Vanadium	6/11	10.8 - 24.6	10.7 - 35.1	BB003D	24.6	210	0.1	Yes
Zinc	10/11	6.6 - 49.6	14	BB002B	49.6	8700	0.006	No

Notes:
Shading indicates that the maximum detected concentration exceeds 10 percent of the Tier I SRV.
Individual cPAH compounds includedin BaP equivalent concentration.
SRV = Soil Reference Value.
NA = No SRV available.

Associated Samples:

BB001A	BB003D	BB206A-AVG
BB001B	BB202B	BB206A-D
BB001C	BB204A	BB206G
BB002B	BB204G	BT001A
BB002G	BB205A	BT001B
BB002G-AVG	BB205G	BT002A
BB002G-D	BB206A	BT002B
BB003A		

TABLE 2-10

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA B2
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Semivolatile Organics (ug/kg)								
BaP Equivalents	1/2	399.268	360 - 390	BT004A	399.268	2000	0.200	Yes
Benzo(a)anthracene	1/2	64	360 - 390	BT004A	64	NA	NA	NA
Benzo(b)fluoranthene	1/2	130	360 - 390	BT004A	130	NA	NA	NA
Chrysene	1/2	68	360 - 390	BT004A	68	NA	NA	NA
Fluoranthene	1/2	86	360 - 390	BT004A	86	1080000	0.00008	No
Pyrene	1/2	96	360 - 390	BT004A	96	890000	0.0001	No
Total cPAHs	1/2	262	360 - 390	BT004A	262	NA	NA	NA
Total PAHs	1/2	444	360 - 390	BT004A	444	NA	NA	NA
Pesticides (ug/kg)								
4,4'-DDD	1/2	11	3.6 - 3.9	BT004A	11	56000	0.0002	No
4,4'-DDE	1/2	18	3.6 - 3.9	BT004A	18	40000	0.0005	No
4,4'-DDT	1/2	3.7	3.6 - 3.9	BT004A	3.7	15000	0.0002	No
Inorganics (mg/kg)								
Aluminum	2/2	1110 - 3960	NA	BT004A	3960	26000	0.2	Yes
Arsenic	2/2	1.8 - 3	NA	BT004D-D	3	10	0.3	Yes
Barium	1/2	93.9	11 - 11.5	BT004A	93.9	1200	0.08	No
Calcium	2/2	1160 - 7220	NA	BT004A	7220	NA	NA	NA
Chromium	2/2	2.7 - 7.8	NA	BT004A	7.8	71	0.1	Yes
Copper	1/2	11.5	4.4 - 4.6	BT004A	11.5	100	0.1	Yes
Iron	2/2	3330 - 9910	NA	BT004A	9910	7000	1.4	Yes
Lead	2/2	2 - 12	NA	BT004A	12	400	0.03	No
Magnesium	2/2	703 - 2870	NA	BT004A	2870	NA	NA	NA
Manganese	2/2	29.7 - 747	NA	BT004A	747	1400	0.5	Yes
Nickel	1/2	14.1	8.8 - 9.2	BT004A	14.1	520	0.03	No
Potassium	1/2	246	110 - 1000	BT004A	246	NA	NA	NA
Vanadium	1/2	13.8	11 - 11.5	BT004A	13.8	210	0.07	No
Zinc	2/2	30.5 - 49.9	NA	BT004D-D	49.9	8700	0.006	No

Notes:
Shading indicates that the maximum detected concentration exceeds 10 percent of the Tier I SRV.
Individual cPAH compounds included in BaP equivalent concentration.
SRV = Soil Reference Value.
NA = No SRV available.

Associated Samples:

BT003A	BT004A	BT004D-AVG
BT003D	BT004D	BT004D-D

TABLE 2-11

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNT 2 - SUB AREA D
NIROP FRIDLEY, MINNESOTA
PAGE 1 OF 2

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Volatile Organics (ug/kg)								
1,1,1-Trichloroethane	2/18	0.8 - 2	10 - 53	DB034C	2	140000	0.00001	No
Acetone	4/18	130 - 1400	4 - 82	DB034C	1400	320000	0.004	No
Tetrachloroethene	7/18	1 - 43	10 - 25	CB13-97(04-08)	43	72000	0.0006	No
Trichloroethene	5/18	7 - 140	10 - 53	CB13-97(04-08)	140	29000	0.005	No
Semivolatile Organics (ug/kg)								
Anthracene	1/12	85	340 - 3600	DB029A	85	7880000	0.00001	No
BaP Equivalents	1/12	1594.46	340 - 3600	DB029A	1594.46	2000	0.8	Yes
Benzo(a)anthracene	1/12	520	340 - 3600	DB029A	520	NA	NA	NA
Benzo(a)pyrene	1/12	980	340 - 3600	DB029A	980	NA	NA	NA
Benzo(b)fluoranthene	1/12	1600	340 - 3600	DB029A	1600	NA	NA	NA
Benzo(g,h,i)perylene	1/12	990	340 - 3600	DB029A	990	NA	NA	NA
Benzo(k)fluoranthene	1/12	760	340 - 3600	DB029A	760	NA	NA	NA
Carbazole	1/12	84	340 - 3600	DB029A	84	700000	0.0001	No
Chrysene	1/12	860	340 - 3600	DB029A	860	NA	NA	NA
Dibenzo(a,h)anthracene	1/12	310	340 - 3600	DB029A	310	NA	NA	NA
Fluoranthene	2/12	170 - 680	340 - 3600	DB029A	680	1080000	0.0006	No
Indeno(1,2,3-cd)pyrene	1/12	840	340 - 3600	DB029A	840	NA	NA	NA
Phenanthrene	1/12	220	340 - 3600	DB029A	220	NA	NA	NA
Pyrene	2/12	140 - 960	340 - 3600	DB029A	960	890000	0.001	No
Total cPAHs	1/12	5870	340 - 3600	DB029A	5870	NA	NA	NA
Total PAHs	2/18	310 - 8805	25 - 3600	DB029A	8805	NA	NA	NA
Pesticides (ug/kg)								
4,4'-DDD	3/12	7.4 - 70	3.4 - 3.8	DB031A	70	56000	0.001	No
4,4'-DDE	5/12	4.8 - 140	3.4 - 3.7	DB031A	140	40000	0.004	No
4,4'-DDT	6/12	5.4 - 200	3.4 - 3.7	DB033A	200	15000	0.01	No
Dieldrin	1/12	16	3.4 - 3.8	DB029A	16	800	0.02	No
Endrin	1/12	15	3.4 - 3.8	DB029A	15	8000	0.002	No
Inorganics (mg/kg)								
Aluminum	12/12	1570 - 5420	NA	DB032A	5420	26000	0.2	Yes
Arsenic	12/12	0.88 - 6	NA	DB032A	6	10	0.6	Yes
Barium	10/12	16.6 - 129	10.3 - 10.4	DB033A	129	1200	0.1	Yes

TABLE 2-11

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNT 2 - SUB AREA D
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Cadmium	1/12	4.3	1 - 1.2	DB029A	4.3	35	0.1	Yes
Calcium	12/12	3060 - 23900	NA	DB033A	23900	NA	NA	NA
Chromium	12/12	3 - 43.2	NA	DB029A	43.2	71	0.6	Yes
Cobalt	1/12	11	10.3 - 11.6	DB029A	11	2000	0.006	No
Copper	12/12	5.6 - 937	NA	DB029A	937	100	9.4	Yes
Iron	12/12	3890 - 30100	NA	DB029A	30100	7000	4.3	Yes
Lead	12/12	1 - 373	NA	DB029A	373	400	0.9	Yes
Magnesium	12/12	1300 - 6250	NA	DB032A	6250	NA	NA	NA
Manganese	12/12	66.5 - 1960	NA	DB029A	1960	1400	1.4	Yes
Nickel	6/12	9.5 - 40.7	8.3 - 8.9	DB029A	40.7	520	0.08	No
Potassium	7/12	104 - 509	103 - 1000	DB029A	509	NA	NA	NA
Sodium	2/12	107 - 251	103 - 116	DB029A	251	NA	NA	NA
Vanadium	12/12	10.7 - 21.4	NA	DB032A	21.4	210	0.1	Yes
Zinc	12/12	7.3 - 325	NA	DB029A	325	8700	0.04	No

Notes:
Shading indicates that the maximum detected concentration exceeds 10 percent of the Tier I SRV.
Individual cPAH compounds included in BaP equivalent concentration.
SRV = Soil Reference Value.
NA = No SRV available.

Associated Samples:

B97(12-16)	DB030A
B97(16-20)	DB030E
CB13-97(00-04)	DB031A
CB13-97(04-08)	DB031F
CB20-97(00-04)	DB032A
CB20-97(04-08)	DB032C
DB029A	DB033A
DB029E	DB033E
DB029E-AVG	DB034A
DB029E-D	DB034C

TABLE 2-12

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA E
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Volatile Organics (ug/kg)								
1,2-Dichloroethene (total)	2/20	4 - 33	10 - 53	EB208F	33	8000	0.004	No
Acetone	2/20	120	9 - 84	EB004A	120	320000	0.0004	No
Acetone	2/20	120	9 - 84	EB004D	120	320000	0.0004	No
Tetrachloroethene	4/20	0.7 - 3	10 - 53	EB004D	3	72000	0.00004	No
Trichloroethene	11/20	0.6 - 31	10 - 53	EB203A	31	29000	0.001	No
Semivolatile Organics (ug/kg)								
Acenaphthene	3/8	55 - 380	340 - 390	EB004A	380	1200000	0.0003	No
Anthracene	4/8	120 - 860	340 - 390	EB004A	860	7880000	0.0001	No
BaP Equivalents	4/8	360.47 - 4148.4	340 - 390	EB004A	4148.4	2000	2.1	Yes
Benzo(a)anthracene	4/8	100 - 3300	340 - 390	EB004A	3300	NA	NA	NA
Benzo(a)pyrene	4/8	140 - 2900	340 - 390	EB004A	2900	NA	NA	NA
Benzo(b)fluoranthene	4/8	170 - 3400	340 - 390	EB004A	3400	NA	NA	NA
Benzo(g,h,i)perylene	4/8	300 - 2000	340 - 390	EB004A	2000	NA	NA	NA
Benzo(k)fluoranthene	4/8	83 - 2000	340 - 390	EB004A	2000	NA	NA	NA
Carbazole	3/8	82 - 250	340 - 390	EB001A	250	700000	0.0004	No
Chrysene	4/8	140 - 3400	340 - 390	EB004A	3400	NA	NA	NA
Dibenzofuran	2/8	50 - 160	340 - 390	EB004A	160	58000	0.003	No
Fluoranthene	4/8	260 - 7600	340 - 390	EB004A	7600	1080000	0.007	No
Fluorene	2/8	130 - 390	340 - 390	EB004A	390	850000	0.0005	No
Indeno(1,2,3-cd)pyrene	3/8	300 - 1800	340 - 390	EB004A	1800	NA	NA	NA
Phenanthrene	4/8	150 - 3100	340 - 390	EB004A	3100	NA	NA	NA
Pyrene	4/8	300 - 6600	340 - 390	EB004A	6600	890000	0.007	No
Total cPAHs	4/8	633 - 16800	340 - 390	EB004A	16800	NA	NA	NA
Total PAHs	4/8	1863 - 37340	340 - 390	EB004A	37340	NA	NA	NA
Pesticides (ug/kg)								
4,4'-DDD	2/8	42 - 110	3.4 - 35	EB002A	110	56000	0.002	No
4,4'-DDE	3/8	69 - 700	3.4 - 3.9	EB001A	700	40000	0.02	No
4,4'-DDT	2/8	500 - 930	3.4 - 37	EB001A	930	15000	0.06	No
Endrin	1/8	5.3	3.4 - 37	EB004D	5.3	8000	0.0007	No
Gamma-Chlordane	1/8	1.8	1.8 - 19	EB004D	1.8	NA	NA	NA

TABLE 2-12

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA E
NIROP FRIDLEY, MINNESOTA
PAGE 2 OF 2

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Inorganics (mg/kg)								
Aluminum	8/8	1530 - 4620	NA	EB003A	4620	26000	0.2	Yes
Arsenic	7/8	0.83 - 3.5	0.62	EB004A	3.5	10	0.4	Yes
Barium	6/8	19 - 62.9	10.3 - 10.6	EB003A	62.9	1200	0.05	No
Cadmium	1/8	2.3	1 - 1.2	EB004A	2.3	35	0.07	No
Calcium	8/8	4500 - 41900	NA	EB001A	41900	NA	NA	NA
Chromium	8/8	2.3 - 28.3	NA	EB004A	28.3	71	0.4	Yes
Copper	8/8	6 - 176	NA	EB004A	176	100	1.8	Yes
Iron	8/8	3810 - 14500	NA	EB003F	14500	7000	2.1	Yes
Lead	8/8	1.2 - 292	NA	EB004A	292	400	0.7	Yes
Magnesium	8/8	1440 - 15000	NA	EB002A	15000	NA	NA	NA
Manganese	8/8	82.3 - 387	NA	EB003A	387	1400	0.3	Yes
Nickel	5/8	12.4 - 26.7	8.2 - 8.5	EB004A	26.7	520	0.05	No
Potassium	2/8	383 - 1090	1000	EB003A	1090	NA	NA	NA
Selenium	1/8	0.73	0.62 - 0.7	EB003F	0.73	170	0.004	No
Sodium	4/8	129 - 921	103 - 106	EB003A	921	NA	NA	NA
Vanadium	7/8	11.1 - 23.4	10.6	EB003F	23.4	210	0.1	Yes
Zinc	8/8	8.6 - 232	NA	EB004A	232	8700	0.03	No

Notes:
Shading indicates that the maximum detected concentration exceeds 10 percent of the Tier I SRV.
Individual cPAH compounds included in BaP equivalent concentration.
SRV = Soil Reference Value.
NA = No SRV available.

Associated Samples:

EB001A	EB203A	EB208A-D
EB001E	EB203B	EB208F
EB002A	EB206A	EB209A
EB002D	EB206E	EB209B
EB003A	EB207A	EB210A
EB003F	EB207F	EB210A-AVG
EB004A	EB208A	EB210A-D
EB004D	EB208A-AVG	EB210E

TABLE 2-13

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA F
NIROP FRIDLEY, MINNESOTA
PAGE 1 OF 2

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Volatile Organics (ug/kg)								
Acetone.	4/9	180 - 1600	5 - 140	FB003E	1600	320000	0.005	No
Semivolatile Organics (ug/kg)								
BaP Equivalents	1/9	490.83	330 - 3700	FB001A	490.83	2000	0.2	Yes
Benzo(a)anthracene	1/9	200	330 - 3700	FB001A	200	NA	NA	NA
Benzo(a)pyrene	1/9	170	330 - 3700	FB001A	170	NA	NA	NA
Benzo(b)fluoranthene	1/9	240	330 - 3700	FB001A	240	NA	NA	NA
Benzo(k)fluoranthene	1/9	160	330 - 3700	FB001A	160	NA	NA	NA
Chrysene	1/9	230	330 - 3700	FB001A	230	NA	NA	NA
Fluoranthene	2/9	96 - 390	330 - 3700	FB001A	390	1080000	0.0004	No
Phenanthrene	1/9	220	330 - 3700	FB001A	220	NA	NA	NA
Pyrene	2/9	79 - 410	330 - 3700	FB001A	410	890000	0.0005	No
Total cPAHs	1/9	1000	330 - 3700	FB001A	1000	NA	NA	NA
Total PAHs	2/9	175 - 2020	330 - 3700	FB001A	2020	NA	NA	NA
Pesticides (ug/kg)								
4,4'-DDD	1/9	30	3.3 - 5	FB003A	30	56000	0.0005	No
4,4'-DDE	3/9	6.5 - 18	3.3 - 3.8	FB001A	18	40000	0.0005	No
4,4'-DDT	2/9	9.9 - 21	3.3 - 3.8	FB001A	21	15000	0.001	No
Inorganics (mg/kg)								
Aluminum	9/9	1240 - 5920	NA	FB003A	5920	26000	0.2	Yes
Arsenic	7/9	0.7 - 4.8	0.62 - 0.63	FB001A	4.8	10	0.5	Yes
Barium	5/9	34.6 - 173	10.4 - 10.8	FB003A	173	1200	0.1	Yes
Calcium	9/9	2880 - 25900	NA	FB003E	25900	NA	NA	NA
Chromium	9/9	4.5 - 18.2	NA	FB003A	18.2	71	0.3	Yes
Cobalt	1/9	11	10.4 - 12.9	FB002H	11	2000	0.006	No
Copper	8/9	4.5 - 26.2	4.3	FB001A	26.2	100	0.3	Yes
Iron	9/9	3490 - 16200	NA	FB001A	16200	7000	2.3	Yes
Lead	9/9	1.3 - 22.4	NA	FB001A	22.4	400	0.06	No
Magnesium	9/9	1150 - 8100	NA	FB003E	8100	NA	NA	NA
Manganese	9/9	87.2 - 1610	NA	FB003A	1610	1400	1.2	Yes

TABLE 2-13

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - SUB AREA F
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Nickel	7/9	9.3 - 26.8	8.6 - 8.7	FB002H	26.8	520	0.05	No
Potassium	5/9	106 - 457	104 - 1000	FB001A	457	NA	NA	NA
Sodium	1/9	167	104 - 129	FB003A	167	NA	NA	NA
Vanadium	4/9	16.9 - 20.7	10.4 - 10.8	FB002C	20.7	210	0.10	No
Zinc	9/9	8 - 66.7	NA	FB001A	66.7	8700	0.008	No

Notes:
Shading indicates that the maximum detected concentration exceeds 10 percent of the Tier I SRV.
Individual cPAH compounds included in BaP equivalent concentration.
SRV = Soil Reference Value.
NA = No SRV available.

Associated Samples:

FB001A	FB003A
FB001E	FB003E
FB002A	FB004A
FB002C	FB004G
FB002H	

TABLE 2-14

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
OPERABLE UNIT 2 - OTHER
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Maximum Detected Concentration	Tier I SRV	Maximum/ SRV	Retained as a COPC?
Volatile Organics (ug/kg)								
Trichloroethene	1/13	1	10 - 12	SB12-SCS-19-D	1	29000	0.00003	No
Semivolatile Organics (ug/kg)								
2-Chlorophenol	1/13	24	340 - 410	SB5-SCS-14	24	12600	0.002	No
4-Chloro-3-methylphenol	1/13	20	340 - 410	SB5-SCS-14	20	NA	NA	NA
BaP Equivalent	1/13	221.159 - 235.979	330 - 410	SB12-SCS-19-D	235.979	[illegible]	[illegible]	[illegible]
Benzo(a)anthracene	1/13	22 - 36	330 - 410	SB12-SCS-19-D	36	NA	NA	NA
Benzo(a)pyrene	1/13	22 - 28	330 - 410	SB12-SCS-19-D	28	NA	NA	NA
Benzo(k)fluoranthene	1/13	32	330 - 410	SB12-SCS-19-D	32	NA	NA	NA
Chrysene	1/13	29 - 39	330 - 410	SB12-SCS-19-D	39	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1/13	22	330 - 410	SB12-SCS-19-D	22	NA	NA	NA
Pentachlorophenol	1/13	30	850 - 1000	SB5-SCS-14	30	71000	0.0004	No
Pyrene	2/13	28 - 65	330 - 410	SB12-SCS-19-D	65	890000	0.00007	No
Total cPAHs	1/13	73 - 157	330 - 410	SB12-SCS-19-D	157	NA	NA	NA
Total PAHs	2/13	28 - 222	330 - 410	SB12-SCS-19-D	222	NA	NA	NA
Inorganics (mg/kg)								
Antimony	2/13	0.31 - 0.55	0.3 - 0.34	SB12-SCS-19-D	0.55	14	0.04	No
Barium	13/13	3 - 261	NA	SA9-SCS-031	261	1,700	[illegible]	Yes
Cadmium	8/13	0.04 - 0.13	0.04	SA9-SCS-030	0.13	35	0.004	No
Chromium	13/13	3.1 - 6.9	NA	SB12-SCS-19-D	6.9	71	0.10	No
Copper	13/13	1.6 - 8.3	NA	SB12-SCS-19-D	8.3	100	0.08	No
Cyanide	1/13	0.13 - 0.14	0.1 - 0.11	SB5-SCS-15	0.14	62	0.002	No
Lead	13/13	0.91 - 16.3	NA	SB12-SCS-19-D	16.3	400	0.04	No
Nickel	13/13	4 - 9.8	NA	SA9-SCS-030	9.8	520	0.02	No
Zinc	13/13	7.3 - 21.1	NA	SB12-SCS-19-D	21.1	8700	0.002	No

Notes:
Shading indicates that the maximum detected concentration exceeds 10 percent of the Tier I SRV.
Individual cPAH compounds included in BaP equivalent concentration.
SRV = Soil Reference Value.
NA = No SRV available.

Associated Samples:

SA7-SCS-09	SA9-SCS-030	SB12-SCS-19
SA7-SCS-10	SA9-SCS-031	SB12-SCS-19-AVG
SA8-SCS-11	SB11-SCS-16	SB12-SCS-19-D
SA8-SCS-12	SB11-SCS-17	SB5-SCS-14
SA8-SCS-13	SB12-SCS-18	SB5-SCS-15

TABLE 2-15

CHEMICALS OF POTENTIAL CONCERN (COPCs)
SURFACE AND SUBSURFACE SOIL
NIROP FRIDLEY, MINNESOTA

Chemical	Surface Soil (0 to 4 Feet)	Subsurface Soil (4 to 12 Feet)	Subsurface Soil (>12 Feet)
VOLATILE ORGANIC COMPOUNDS			
1,1,1-Trichloroethane	X	X	X
1,1,2-Trichloroethane		X	
1,1-Dichloroethane	X	X	X
1,2-Dichloroethene (total)	X	X	X
2-Butanone	X	X	X
2-Hexanone	X	X	X
4-Methyl-2-pentanone	X	X	X
Acetone	X	X	X
Benzene		X	
Bromomethane	X	X	
Carbon Disulfide	X	X	X
Chlorobenzene			X
Chloromethane			X
Ethylbenzene	X	X	X
Styrene	X	X	X
Tetrachloroethene	X	X	X
Toluene	X	X	X
Trichloroethene	X	X	X
Xylenes, Total	X	X	X
SEMIVOLATILE ORGANIC COMPOUNDS			
2-Methylnaphthalene	X	X	
4-Chloro-3-methylphenol		X	
4-Methylphenol			X
Acenaphthene	X	X	
Acenaphthylene	X	X	
Anthracene	X	X	
Benzo(a)anthracene	X	X	
Benzo(a)pyrene	X	X	
Benzo(b)fluoranthene	X	X	
Benzo(g,h,i)perylene	X	X	
Benzo(k)fluoranthene	X	X	
Bis(2-Ethylhexyl)phthalate	X	X	X
Butylbenzyl Phthalate	X	X	
Carbazole	X	X	
Chrysene	X	X	
Di-n-butyl phthalate	X	X	X
Di-n-octyl phthalate	X	X	
Dibenzo(a,h)anthracene	X	X	
Dibenzofuran	X	X	
Fluoranthene	X	X	
Fluorene	X	X	
Indeno(1,2,3-cd)pyrene	X	X	

TABLE 2-15

CHEMICALS OF POTENTIAL CONCERN (COPCs)
SURFACE AND SUBSURFACE SOIL
NIROP FRIDLEY, MINNESOTA

Chemical	Surface Soil (0 to 4 Feet)	Subsurface Soil (4 to 12 Feet)	Subsurface Soil (>12 Feet)
Naphthalene	X	X	
Pentachlorophenol		X	
Phenanthrene	X	X	
Phenol	X	X	
Pyrene	X	X	
POLYCHLORINATED BIPHENYLS			
Aroclor-1016	X		
Aroclor-1254	X		
INORGANICS			
Aluminum	X	X	X
Antimony	X		
Arsenic	X	X	X
Barium	X	X	X
Beryllium	X	X	X
Cadmium	X	X	
Calcium	X	X	X
Chromium	X	X	X
Cobalt	X	X	X
Copper	X	X	X
Cyanide	X	X	X
Hexavalent Chromium	X		
Iron	X	X	X
Lead	X	X	X
Manganese	X	X	X
Manganese	X	X	X
Mercury	X	X	
Nickel	X	X	X
Potassium	X	X	X
Selenium	X	X	
Sodium	X	X	X
Thallium	X		
Vanadium	X	X	X
Zinc	X	X	X

Notes:
In accordance with MPCA guidance any chemical detected in at least one sample is considered a COPC.
An X indicates that the chemical was retained as a chemical of potential concern.

TABLE 2-16

SUMMARY OF SOIL ANALYTICAL RESULTS
NIROP FRIDLEY, MINNESOTA
PAGE 1 OF 4

Analyte	Surface Soil (<4 Feet)[1]			Subsurface Soil (4 to 12 Feet)[2]			Subsurface Soil (>12 Feet)[3]		
	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection
Volatile Organic Compounds (ug/kg)									
1,1,1-Trichloroethane	4/57	1-56	003-SB-058-01	3/73	1-2	003-SB-035-02/ 003-SB-054-02	1/97	4	003-SB-058-05-BR
1,1,2-Trichloroethane	0/57	ND[5]	ND	2/73	8-9	SB-02-0406	0/97	ND	ND
1,1-Dichloroethane	1/57	2-9	003-SB-058-01	2/73	1-11	003-SB-032-03	1/97	1	003-SB-023-15-BR
1,2-Dichloroethene (total)	4/57	3-15	003-SB-073-01	4/73	1-15000	003-SB-032-03	15/97	1-290	003-SB-32D-08
2-Butanone	32/57	1-190	003-SB-30D-01	37/73	1-210	003-SB-29D-01	61/97	1-370	003-SB-28D-08
2-Hexanone	3/57	1-26	003-SB-P11-01-D	6/73	1-4	003-SB-037-03	4/97	3-16	003-SB-33D-11
4-Methyl-2-pentanone	30/57	1-120	003-SB-30D-01	47/73	1-150	003-SB-028-02	59/97	2-260	003-SB-32D-04
Acetone	28/57	3-770	003-SB-32D-01	38/73	3-1700	003-SB-032-03	55/97	4-1000	003-SB-32D-07
Benzene	0/57	ND	ND	2/73	1-24	003-SB-032-03	0/97	ND	ND
Bromomethane	1/57	2	003-SB-054-01	3/73	1-2	003-SB-063-03	0/97	ND	ND
Carbon Disulfide	8/57	1-13	003-SB-029-01	4/73	5-14	003-SB-054-02	11/97	1-18	003-SB-31D-12
Chlorobenzene	0/57	ND	ND	0/73	ND	ND	1/97	1	003-SB-P06-05-BR
Chloromethane	0/57	ND	ND	0/73	ND	ND	1/97	1	SB-06-1214
Ethylbenzene	4/57	1-10	003-SB-32D-01	5/73	4-720	003-SB-032-03	11/97	9-34	003-SB-29D-06
Styrene	3/57	4-33	003-SB-32D-01	2/73	1-54	003-SB-29D-01	12/97	10-72	003-SB-29D-06
Tetrachloroethene	9/57	1-90	SB-02-0204	9/73	1-760	SB-02-0406	5/97	1-3800	SB-07-1416
Toluene	21/57	1-14	003-SB-039-01	31/73	1-1000	003-SB-032-03	43/97	1-24	003-SB-28D-11
Trichloroethene	24/57	1-640	SB-01-0001	20/73	1-1100	SB-03-1012/ SB-05-1012	37/97	1-100000	SB-07-1416
Xylenes, Total	19/57	1-45	003-SB-32D-01	30/73	1-7300	003-SB-032-03	50/97	1-120	003-SB-29D-06
Semivolatile Organic Compounds (ug/kg)									
2-Methylnaphthalene	4/55	12-1000	003-SB-028-01	5/58	13-720	003-SB-032-03	0/7	ND	ND
4-Chloro-3-methylphenol	0/55	ND	ND	1/58	11000	003-SB-032-03	0/7	ND	ND
4-Methylphenol	0/55	ND	ND	0/58	ND	ND	1/7	320	SB-07-1416
Acenaphthene	8/55	11-650	003-SB-028-01	1/58	59	003-SB-054-02	0/7	ND	ND
Acenaphthylene	2/55	19-760	003-SB-017-01	1/58	20	003-SB-054-02	0/7	ND	ND
Anthracene	9/53	20-640	003-SB-017-01	3/57	12-510	003-SB-032-03	0/5	ND	ND
Benzo(a)anthracene	14/53	11-3500	003-SB-P03-01	3/57	18-280	003-SB-054-02	0/5	ND	ND
Benzo(a)pyrene	13/53	15-1700	003-SB-017-01	3/57	11-190	003-SB-054-02	0/5	ND	ND
Benzo(b)fluoranthene	13/53	12-3600	003-SB-P03-01	3/57	14-230	003-SB-054-02	0/5	ND	ND
Benzo(g,h,i)perylene	13/53	12-820	003-SB-P03-01	2/57	18-150	003-SB-054-02	0/5	ND	ND
Benzo(k)fluoranthene	14/53	14-1300	003-SB-017-01	3/57	15-190	003-SB-054-02	0/5	ND	ND
Bis(2-Ethylhexyl)phthalate	10/53	17-1200	SB-02-0204-D	13/57	16-4400	SB-02-0406	4/5	45-210	SB-07-1416
Butylbenzyl Phthalate	1/53	16	003-SB-P06-01	2/57	110-3600	003-SB-032-03	0/5	ND	ND
Carbazole	7/53	16-530	003-SB-P03-01	1/57	67	003-SB-054-02	0/5	ND	ND

TABLE 2-16

SUMMARY OF SOIL ANALYTICAL RESULTS
NIROP FRIDLEY, MINNESOTA

Analyte	Surface Soil (<4 Feet)[1]			Subsurface Soil (4 to 12 Feet)[2]			Subsurface Soil (>12 Feet)[3]		
	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection
Chrysene	15/53	11-1700	003-SB-017-01	4/57	13-240	003-SB-054-02	0/5	ND	ND
Di-n-butyl phthalate	3/53	13-28	003-SB-017-01	4/57	15-140	SB-02-0406	1/5	43	SB-07-1416
Di-n-octyl phthalate	2/53	12-40	003-SB-073-01	1/57	84	003-SB-030-02	0/5	ND	ND
Dibenzo(a,h)anthracene	9/53	11-400	003-SB-017-01	1/57	50	003-SB-054-02	0/5	ND	ND
Dibenzofuran	3/53	11-250	003-SB-017-01	2/57	41-78	SB-02-0406	0/5	ND	ND
Fluoranthene	18/53	10-5600	003-SB-017-01	6/57	12-840	003-SB-054-02	0/5	ND	ND
Fluorene	8/53	15-760	003-SB-028-01	1/57	44	003-SB-054-02	0/5	ND	ND
Indeno(1,2,3-cd)pyrene	12/53	15-1100	003-SB-P03-01	2/57	20-120	003-SB-054-02	0/7	ND	ND
Naphthalene	2/55	55-78	003-SB-P03-01	4/58	56-2300	003-SB-032-03	0/5	ND	ND
Pentachlorophenol	0/53	ND	ND	1/57	50	003-SB-054-02	0/5	ND	ND
Phenanthrene	12/53	29-5000	003-SB-P03-01	7/57	23-570	003-SB-054-02	0/5	ND	ND
Phenol	2/55	45-54	003-SB-046-01-D	1/58	120	003-SB-058-03	0/7	ND	ND
Pyrene	19/53	12-4800	003-SB-P03-01	7/57	11-590	003-SB-054-02	0/5	ND	ND
Polychlorinated Biphenyls (ug/kg)									
Aroclor-1016	1/51	150	003-SB-030-01	0/55	ND	ND	0/4	ND	ND
Aroclor-1254	2/51	230-290	003-SB-050-01-D	0/55	ND	ND	0/4	ND	ND
Inorganics (mg/kg)									
Aluminum	55/55	498-7830	003-SB-037-01-D	58/58	1090-7090	003-SB-035-02	7/7	1700-5450	SB-01-1416
Antimony	5/49	2.8-3.4	003-SB-017-01	0/51	ND	ND	0/7	ND	ND
Arsenic	52/55	0.42-13.8	003-SB-071-01	48/58	0.25-13.6	003-SB-032-03	7/7	0.46-2.8	SB-07-1416
Barium	55/55	7.3-201	SB-03-0001	57/58	5.4-70.4	003-SB-032-03	3/7	12-55.2	SB-01-1416
Beryllium	34/55	0.07-0.7	003-SB-058-01	35/58	0.05-0.44	003-SB-035-02	5/7	0.17-0.23	SB-01-1416
Cadmium	3/55	0.46-0.75	003-SB-035-01	1/58	0.38	003-SB-039-03	0/7	ND	ND
Calcium	55/55	768-34100	003-SB-028-01	58/58	791-46600	003-SB-038-03	7/7	3490-31900	SB-07-1416
Chromium	55/55	3.6-91	003-SB-036-01	54/58	3.7-618	SB-02-0406	2/7	12.7-15.9	SB-01-1416
Cobalt	52/55	2.4-10.4	003-SB-058-01-D	55/58	1.6-11.4	003-SB-P09-03	7/7	2.2-5.4	SB-07-1416
Copper	50/55	0.8-1360	003-SB-035-01	52/58	0.69-57.7	SB-07-0406	5/7	4.8-11.8	SB-01-1416
Cyanide	2/55	1.1-90.4	SB-02-0204-D	2/59	140-148	SB-07-0406	1/7	2.9	SB-01-1416
Hexavalent Chromium	3/17	2-6	003-SB-035-01	0/18	ND	ND	NA[7]	NA	NA
Iron	55/55	2430-48400	003-SB-017-01	58/58	3400-23300	003-SB-032-03	7/7	3920-11100	SB-01-1416
Lead	55/55	1.6-733	003-SB-017-01	56/58	0.86-515	SB-07-0406	7/7	1.1-5.2	SB-07-1416
Magnesium	55/55	153-14100	003-SB-035-01	58/58	286-20000	003-SB-038-03	7/7	1480-11400	SB-01-1416
Manganese	55/55	31.2-2490	SB-03-0001	58/58	35.2-1160	003-SB-055-02	7/7	79.7-406	SB-07-1416
Mercury	9/55	0.05-0.19	003-SB-013-01	8/58	0.06-0.32	003-SB-013-02	0/7	ND	ND
Nickel	51/55	4.9-33.5	003-SB-035-01	52/58	3.6-24.7	003-SB-P09-03	1/7	20.5	SB-01-1416
Potassium	55/55	147-1130	003-SB-037-01	58/58	154-1350	003-SB-035-02	7/7	198-1130	SB-07-1416
Selenium	1/47	0.8-1.3	003-SB-058-01	1/49	0.4	003-SB-004-03	0/7	ND	ND

TABLE 2-16

SUMMARY OF SOIL ANALYTICAL RESULTS
NIROP FRIDLEY, MINNESOTA

Analyte	Surface Soil (<4 Feet)[1]			Subsurface Soil (4 to 12 Feet)[2]			Subsurface Soil (>12 Feet)[3]		
	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection
Sodium	54/55	36.7-364	003-SB-028-01	50/58	41.9-487	003-SB-068-03	4/7	81.8-337	SB-07-1416
Thallium	4/53	0.18-0.24	003-SB-047-01	0/56	ND	ND	0/7	ND	ND
Vanadium	55/55	2-35.6	003-SB-058-01-D	58/58	4.9-35.3	003-SB-032-03	7/7	9.4-23.4	SB-01-1416
Zinc	51/55	7.9-479	003-SB-035-01	52/58	8.7-207	003-SB-028-02	5/7	11.6-29.5	SB-07-1416
Miscellaneous (mg/kg)									
Total Organic Carbon	12/12	740-19000	003-SB-016-01	13/13	480-2200	003-SB-004-03	NA	NA	NA
pH	14/14	6.85-11.51	SB-01-0001	7/7	5.63-9.24	SB-01-0608	7/7	7.55-8.66	SB-07-1416

1 Includes samples:

003-SB-003-01	003-SB-023-01	003-SB-037-01-D	003-SB-063-01	003-SB-P04-01	SB-01-0001
003-SB-004-01	003-SB-026-01	003-SB-038-01	003-SB-068-01	003-SB-P05-01	SB-01-0001-D
003-SB-004-01-D	003-SB-027-01	003-SB-039-01	003-SB-070-01	003-SB-P06-01	SB-02-0001
003-SB-006-01	003-SB-028-01	003-SB-046-01	003-SB-071-01	003-SB-P07-01	SB-02-0204
003-SB-007-01	003-SB-029-01	003-SB-046-01-D	003-SB-073-01	003-SB-P08-01	SB-02-0204-D
003-SB-008-01	003-SB-030-01	003-SB-047-01	003-SB-074-01	003-SB-P09-01	SB-03-0001
003-SB-013-01	003-SB-032-01	003-SB-050-01	003-SB-074-01-D	003-SB-P09-01-D	SB-04-0001
003-SB-015-01	003-SB-033-01	003-SB-050-01-D	003-SB-30D-01	003-SB-P10-01	SB-05-0001
003-SB-015-01-D	003-SB-034-01	003-SB-054-01	003-SB-32D-01	003-SB-P10-01-D	SB-06-0002
003-SB-016-01	003-SB-035-01	003-SB-055-01	003-SB-P01-01	003-SB-P11-01	
003-SB-017-01	003-SB-036-01	003-SB-058-01	003-SB-P02-01	003-SB-P11-01-D	
003-SB-018-01	003-SB-037-01	003-SB-058-01-D	003-SB-P03-01	003-SB-P12-01	

2 Includes samples:

003-SB-003-02	003-SB-027-03	003-SB-039-03	003-SB-074-03	003-SB-P06-02-BR	SB-05-1012
003-SB-004-03	003-SB-028-02	003-SB-046-03	003-SB-28D-01	003-SB-P06-03	SB-06-0608
003-SB-006-03	003-SB-029-02	003-SB-047-03	003-SB-29D-01	003-SB-P07-03	SB-07-0406
003-SB-007-02	003-SB-030-02	003-SB-050-02	003-SB-31D-01	003-SB-P08-03	
003-SB-007-03	003-SB-030-03	003-SB-054-02	003-SB-31D-02	003-SB-P09-02	
003-SB-008-02	003-SB-032-03	003-SB-055-02	003-SB-33D-01	003-SB-P09-03	
003-SB-013-02	003-SB-033-03	003-SB-055-03	003-SB-33D-02	003-SB-P10-03	
003-SB-015-03	003-SB-034-03	003-SB-058-02	003-SB-P01-02	003-SB-P11-03	

2 Includes samples: (continued)

003-SB-016-03	003-SB-035-02	003-SB-058-03	003-SB-P01-03-BR	003-SB-P12-03
003-SB-017-03	003-SB-036-02	003-SB-063-03	003-SB-P02-02	SB-01-0608
003-SB-018-02	003-SB-036-03	003-SB-068-03	003-SB-P02-03	SB-02-0406
003-SB-023-03	003-SB-037-02	003-SB-070-03	003-SB-P03-03	SB-02-0608

TABLE 2-16

SUMMARY OF SOIL ANALYTICAL RESULTS
NIROP FRIDLEY, MINNESOTA
PAGE 4 OF 4

Analyte	Surface Soil (<4 ·ot)[1]			Subsurface Soil (4 to 12 Feet)[2]			Subsurface Soil (>12 Feet)[3]		
	Frequency of Detection[4]	Concentratic.. Range[5]	Location of Maximum Detection	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection	Frequency of Detection[4]	Concentration Range[5]	Location of Maximum Detection
003-SB-026-03	003-SB-037-03		003-SB-071-03		003-SB-P04-03		SB-03-1012		
003-SB-027-02	003-SB-038-03		003-SB-073-03		003-SB-P05-02		SB-04-1012		
3 Includes samples:									
003-SB-007-05-BR	003-SB-28D-04		003-SB-29D-11		003-SB-31D-08		003-SB-32D-12		003-SB-P06-05-BR
003-SB-007-11-BR	003-SB-28D-05		003-SB-29D-12		003-SB-31D-09		003-SB-32D-12-D		003-SB-P06-07-BR
003-SB-023-05-BR	003-SB-28D-06		003-SB-29D-13		003-SB-31D-09-D		003-SB-32D-13		003-SB-P09-05-BR
003-SB-023-15-BR	003-SB-28D-07		003-SB-29D-14		003-SB-31D-10		003-SB-33D-03		003-SB-P09-09-BR
003-SB-027-05-BR	003-SB-28D-08		003-SB-30D-02		003-SB-31D-11		003-SB-33D-04		003-SB-P12-05-BR
003-SB-027-06-BR	003-SB-28D-09		003-SB-30D-03		003-SB-31D-12		003-SB-33D-05		003-SB-P12-11-BR
003-SB-030-04-BR	003-SB-28D-10		003-SB-30D-04		003-SB-31D-13		003-SB-33D-06		SB-01-1416
003-SB-036-05-BR	003-SB-28D-10-D		003-SB-30D-05		003-SB-32D-02		003-SB-33D-06-D		SB-03-1214
003-SB-036-05-BR-D	003-SB-28D-11		003-SB-30D-06		003-SB-32D-02-D		003-SB-33D-07		SB-04-1214
003-SB-036-07-BR	003-SB-29D-02		003-SB-30D-07		003-SB-32D-03		003-SB-33D-08		SB-05-1315
003-SB-037-05-BR	003-SB-29D-03		003-SB-30D-08		003-SB-32D-04		003-SB-33D-09		SB-06-1214
003-SB-037-10-BR	003-SB-29D-04		003-SB-30D-09		003-SB-32D-05		003-SB-33D-10		SB-07-1416
003-SB-055-05-BR	003-SB-29D-05		003-SB-30D-10		003-SB-32D-05-D		003-SB-33D-11		SB-07-2830
003-SB-058-05-BR	003-SB-29D-06		003-SB-31D-03		003-SB-32D-06		003-SB-33D-12		
003-SB-058-05-BR-D	003-SB-29D-06-D		003-SB-31D-04		003-SB-32D-07		003-SB-P01-05-BR		
003-SB-058-15-BR	003-SB-29D-07		003-SB-31D-05		003-SB-32D-08		003-SB-P01-09-BR		
003-SB-063-04-BR	003-SB-29D-08		003-SB-31D-05-D		003-SB-32D-09		003-SB-P02-05-BR		
003-SB-063-14-BR	003-SB-29D-09		003-SB-31D-06		003-SB-32D-10		003-SB-P02-05-BR-D		
003-SB-28D-03	003-SB-29D-10		003-SB-31D-07		003-SB-32D-11		003-SB-P02-15-BR		

4 Frequency of detection determined considering a duplicate pair as one sample.
5 Concentration range determined considering duplicate sample results as individual data points.
6 Not Detected.
7 Not Analyzed.

TABLE 2-17

SUMMARY OF SOIL ANALYTICAL RESULTS
SUB AREA A3 - SURFACE SOIL (0 TO 5 FEET)
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Retained for Further Evaluation?
Volatile Organics (ug/kg)					
1,1,1-Trichloroethane	18/45	0.8 - 1200	10 - 13	AT009B1-D	Yes
1,1-Dichloroethane	7/45	1 - 73	10 - 54	AT009B1	Yes
1,2-Dichloroethene (total)	25/45	1 - 710	10 - 14	AT009B1-D	Yes
Tetrachloroethene	11/45	0.8 - 25000	10 - 54	AT009B1-D	Yes
Toluene	1/45	27	1 - 57	AB039A	Yes
Trichloroethene	39/45	0.8 - 4100	10 - 13	AB254A	Yes
Xylenes, Total	1/43	230 - 520	4 - 54	AT009B1-D	Yes
Semivolatile Organics (ug/kg)					
Anthracene	2/7	330 - 370	340 - 2100	AB037A	No
BaP Equivalent	2/9	1278.65 - 1726.5	340 - 2100	AB037A	Yes
Benzo(a)anthracene	2/9	860 - 1300	340 - 2100	AB037A	No
Benzo(a)pyrene	2/9	720 - 1200	340 - 2100	AB037A	No
Benzo(b)fluoranthene	2/9	690 - 1200	340 - 2100	AB037A	No
Benzo(g,h,i)perylene	2/7	340 - 870	340 - 2100	AB037A	No
Benzo(k)fluoranthene	2/9	580 - 1200	340 - 2100	AB037A	No
Carbazole	1/9	240	340 - 2100	AB037A	No
Chrysene	2/9	850 - 1500	340 - 2100	AB037A	No
Dibenzofuran	1/7	110	340 - 2100	AB036A	No
Fluoranthene	4/7	110 - 3000	340 - 2100	AB037A	No
Fluorene	2/7	170 - 240	340 - 2100	AB036A	No
Indeno(1,2,3-cd)pyrene	2/9	370 - 830	340 - 2100	AB037A	No
Phenanthrene	3/7	180 - 1900	340 - 2100	AB036A	No
Phenol	1/9	1300	340 - 2100	AB036A	No
Pyrene	4/9	120 - 3000	340 - 2100	AB037A	No
Total CPAH	2/9	4070 - 7230	340 - 2100	AB037A	No
Total PAH	4/9	230 - 16430	340 - 2100	AB037A	No
Pesticides (ug/kg)					
4,4'-DDD	3/7	86 - 220	3.4 - 3.8	AB037A	No
4,4'-DDD	3/7	86 - 220	3.4 - 3.8	AT009B1-D	No
4,4'-DDE	6/7	8.5 - 450	3.5	AB037A	No
4,4'-DDT	5/7	6.3 - 430	3.4 - 3.5	AT009B1-D	No
Aldrin	1/7	3.1	1.8 - 22	AB036A	No
Dieldrin	1/7	4	3.4 - 42	AB036A	No
Endosulfan II	1/7	37 - 54	3.4 - 36	AT009B1-D	No
Gamma-Chlordane	1/7	3.4	1.8 - 22	AB036A	No
Heptachlor Epoxide	1/7	2.6	1.8 - 22	AB036A	No
Inorganics (mg/kg)					
Aluminum	7/7	2450 - 5050	NA	AB035A	Yes
Arsenic	7/7	1.5 - 4.5	NA	AB036A	Yes
Barium	9/9	5.7 - 188	NA	AB039A	Yes
Cadmium	3/9	0.07 - 2.7	1.1 - 1.2	AT009B1-D	Yes
Calcium	7/7	3710 - 21800	NA	AB036A	No
Chromium	9/9	2.3 - 16.8	NA	AB036A	Yes
Copper	9/9	2.1 - 204	NA	AB039A	Yes
Iron	7/7	7330 - 19200	NA	AT009B1-D	Yes
Lead	9/9	1.2 - 54.9	NA	AB036A	Yes
Magnesium	7/7	2040 - 11200	NA	AB036A	No

TABLE 2-17

SUMMARY OF SOIL ANALYTICAL RESULTS
SUB AREA A3 - SURFACE SOIL (0 TO 5 FEET)
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Retained for Further Evaluation?
Manganese	7/7	214 - 2060	NA	AB039A	Yes
Mercury	1/9	0.19	0.03 - 0.12	AT009B1-D	Yes
Nickel	9/9	8.6 - 25.5	NA	AB036A	Yes
Potassium	6/7	216 - 305	1000	AT007A	No
Selenium	1/7	0.82	0.63 - 0.73	AB036A	No
Sodium	1/7	189	106 - 122	AB035A	No
Vanadium	5/7	13.6 - 23.1	10.6 - 10.8	AB035A	Yes
Zinc	9/9	8.1 - 80.8	NA	AB037A	No

Notes:
Shading indicates that the chemical exceeded 10 percent of Tier I soil reference value in the screening risk evaluation and was retained for evaluation in the refined risk evaluation.
Individual cPAH compounds included in BaP equivalent concentration.
NA = Not applicable.

Associated Samples:

AB035A	AB217A	AB246A
AB036A	AB218A	AB246B
AB037A	AB231A	AB247A
AB039A	AB233A	AB248A
AB209A	AB234A	AB251A
AB209B	AB234A-AVG	AB252A
AB210A	AB234A-D	AB253A
AB211A	AB235A	AB254A
AB211B	AB236A	AB254A-AVG
AB212A	AB237A	AB254A-D
AB212B	AB238A	AT007A
AB213A	AB239A	AT008A
AB213A-AVG	AB240A	AT009B1
AB213A-D	AB241A	AT009B1-AVG
AB213B	AB242A	AT009B1-D
AB214A	AB242B	SB28-SCS-04
AB215A	AB244A	SB28-SCS-05
AB216A	AB245A	

TABLE 2-18

SUMMARY OF SOIL ANALYTICAL RESULTS
SUB AREA A4 - SURFACE SOIL (0 TO 5 FEET)
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Retained for Further Evaluation?
Volatile Organics (ug/kg)					
1,1,1-Trichloroethane	4/50	0.8 - 2	10 - 14	AB206B	No
1,1,1-Trichloroethane	4/50	0.8 - 2	10 - 14	AB243B	No
1,1,1-Trichloroethane	4/50	0.8 - 2	10 - 14	AT004B	No
1,1,2,2-Tetrachloroethane	2/39	2	10 - 14	AB031A	No
1,1,2,2-Tetrachloroethane	2/39	2	10 - 14	AT004B	No
1,1,2-Trichloroethane	2/39	3 - 7	10 - 14	AT004B	No
1,1-Dichloroethane	2/50	0.4 - 2	10 - 14	AB243B	No
1,2-Dichloroethene (total)	22/50	1 - 14000	10 - 14	SA3-SCS-40-D	Yes
Acetone	1/39	1200	5 - 69	AB038A	No
Ethylbenzene	2/50	72 - 380	10 - 14	AB031A	No
Tetrachloroethene	10/50	0.6 - 2700	10 - 13	AT004B	No
Toluene	3/50	10 - 20	0.7 - 14	AT004B	No
Trichloroethene	37/50	1 - 96000	10 - 12	SA3-SCS-40-D	Yes
Xylenes, Total	2/39	550 - 2000	2 - 14	AT004B	Yes
Semivolatile Organics (ug/kg)					
2-Methylnaphthalene	3/20	170 - 3400	330 - 4100	AB031A	No
Acenaphthene	7/31	23 - 3400	330 - 4100	AB032A	No
Acenaphthylene	2/20	380 - 2600	330 - 4100	AB032A	No
Anthracene	10/20	130 - 15000	330 - 4100	AB032A	No
BaP Equivalent	19/31	188.34 - 60733	340 - 4100	AB032A	Yes
Benzo(a)anthracene	16/31	130 - 43000	340 - 4100	AB032A	No
Benzo(a)pyrene	15/31	120 - 41000	340 - 4100	AB032A	No
Benzo(b)fluoranthene	18/31	22 - 46000	340 - 4100	AB032A	No
Benzo(g,h,i)perylene	12/20	240 - 34000	350 - 4100	AB032A	No
Benzo(k)fluoranthene	15/31	100 - 29000	340 - 4100	AB032A	No
Bis(2-Ethylhexyl)phthalate	1/20	7200	330 - 3700	AT004B	No
Carbazole	12/31	25 - 4900	330 - 4100	AB032A	No
Chrysene	18/31	18 - 43000	340 - 4100	AB032A	No
Dibenzo(a,h)anthracene	6/31	20 - 7700	330 - 4100	AB032A	No
Dibenzofuran	4/20	55 - 5500	330 - 4100	AB032A	No
Fluoranthene	15/20	250 - 160000	350 - 4100	AB032A	Yes
Fluorene	7/20	110 - 8400	330 - 4100	AB032A	No
Indeno(1,2,3-cd)pyrene	14/31	84 - 28000	340 - 4100	AB032A	No
Naphthalene	1/20	950	330 - 4100	AB032A	Yes
Phenanthrene	14/20	130 - 95000	350 - 4100	AB032A	No
Pyrene	20/31	22 - 130000	340 - 4100	AB032A	Yes
Total CPAH	19/31	22 - 237700	340 - 4100	AB032A	No
Total PAH	20/31	44 - 678650	340 - 4100	AB032A	No
Pesticides (ug/kg)					
4,4'-DDD	12/20	11 - 2900	3.5 - 41	AT001A	No
4,4'-DDE	12/20	22 - 1900	3.5 - 37	AT001A	No
4,4'-DDT	13/20	18 - 1400	3.5 - 36	AT006A	No
Alpha-Chlordane	2/20	2.8 - 36	1.7 - 45	AT001A	No
Dieldrin	1/20	4	3.5 - 88	AB038A	No
Endosulfan Sulfate	3/20	4.8 - 15	3.3 - 88	AB028A	No
Endrin	2/20	8.7 - 14	3.3 - 88	AB034A	No
Endrin Aldehyde	1/20	7.1	3.3 - 88	AT005A	No
Gamma-Chlordane	1/20	3	1.7 - 45	AB026A	No
Heptachlor Epoxide	1/20	30	1.7 - 45	AT001A	No
delta-BHC	1/20	25	1.7 - 45	AT004B	No

TABLE 2-18

SUMMARY OF SOIL ANALYTICAL RESULTS
SUB AREA A4 - SURFACE SOIL (0 TO 5 FEET)
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Retained for Further Evaluation?
Inorganics (mg/kg)					
Aluminum	20/20	2270 - 6830	NA	AT003B	Yes
Antimony	1/31	2.3	0.3 - 2.6	AB026A	Yes
Arsenic	19/20	1.3 - 10.1	0.68	AB029A	Yes
Barium	31/31	3.9 - 306	NA	AB026A	Yes
Cadmium	9/31	0.04 - 0.39	0.04 - 1.3	SA3-SCS-40	No
Calcium	20/20	4290 - 28200	NA	AB033B	No
Chromium	31/31	2.5 - 22.6	NA	AB031A	Yes
Copper	30/31	1.3 - 1900	4.5	AB026A	Yes
Cyanide	4/31	0.16 - 4.6	0.1 - 3.2	AT006A	No
Iron	20/20	5010 - 38100	NA	AT003B	Yes
Lead	31/31	0.86 - 274	NA	AB028A	No
Magnesium	20/20	1750 - 11600	NA	AB034A	No
Manganese	20/20	201 - 2050	NA	AT002B	Yes
Mercury	1/31	0.12	0.02 - 0.13	AB034A	Yes
Nickel	28/31	3.5 - 32.3	8.2 - 9	AB026A	No
Potassium	13/20	138 - 582	113 - 473	AT002B-D	No
Selenium	1/20	1.3	0.61 - 0.77	AB026A	No
Sodium	2/20	112 - 113	104 - 128	AB038A	No
Vanadium	20/20	12.1 - 26.1	NA	AT002A	Yes
Zinc	31/31	5.5 - 489	NA	AT001A	No

Notes:
Shading indicates that the chemical exceeded 10 percent of Tier I soil reference value in the screening risk evaluation and was retained for evaluation in the refined risk evaluation.
Individual cPAH compounds included in BaP equivalent concentration.
NA = Not applicable.

Associated Samples:

AB026A	AB208A-AVG	AT004A
AB027A	AB208A-D	AT004B
AB028A	AB219A	AT005A
AB029A	AB220A	AT006A
AB030A	AB221A	AT006B
AB031A	AB224A	SA3-SCS-40
AB032A	AB226B	SA3-SCS-40-AVG
AB033B	AB227A	SA3-SCS-40-D
AB034A	AB227A-AVG	SA3-SCS-42
AB038A	AB227A-D	SA4-SCS-43
AB203A	AB228A	SA4-SCS-44
AB203B	AB229A	SA5-SCS-023
AB204A	AB243A	SA5-SCS-024
AB204A-AVG	AB243B	SA5-SCS-024-AVG
AB204A-D	AT001A	SA5-SCS-024-D
AB204B	AT002A	SA5-SCS-025
AB205A	AT002B	SA6-SCS-21
AB206A	AT002B-AVG	SA6-SCS-22
AB206B	AT002B-D	SB20-SCS-037
AB207A	AT003A	SB20-SCS-038
AB208A	AT003B	

TABLE 2-19

SUMMARY OF SOIL ANALYTICAL RESULTS
SUB AREA E - SURFACE SOIL (0 TO 5 FEET)
NIROP FRIDLEY, MINNESOTA

Chemical	Frequency of Detection	Range of Detection	Range of Non Detects	Location of Maximum	Retained for Further Evaluation?
Volatile Organics (ug/kg)					
1,2-Dichloroethene (total)	1/12	4	11 - 53	EB004A	No
Acetone	1/12	120	10 - 84	EB004A	No
Tetrachloroethene	2/12	2	11 - 53	EB203B	No
Tetrachloroethene	2/12	2	11 - 53	EB207A	No
Trichloroethene	7/12	0.7 - 31	11 - 53	EB203A	No
Semivolatile Organics (ug/kg)					
Acenaphthene	3/4	55 - 380	390	EB004A	No
Anthracene	3/4	130 - 860	390	EB004A	No
BaP Equivalent	3/4	775.93 - 4148.4	390	EB004A	Yes
Benzo(a)anthracene	3/4	460 - 3300	390	EB004A	No
Benzo(a)pyrene	3/4	460 - 2900	390	EB004A	No
Benzo(b)fluoranthene	3/4	510 - 3400	390	EB004A	No
Benzo(g,h,i)perylene	3/4	300 - 2000	390	EB004A	No
Benzo(k)fluoranthene	3/4	340 - 2000	390	EB004A	No
Carbazole	3/4	82 - 250	390	EB001A	No
Chrysene	3/4	530 - 3400	390	EB004A	No
Dibenzofuran	2/4	50 - 160	370 - 390	EB004A	No
Fluoranthene	3/4	1200 - 7600	390	EB004A	No
Fluorene	2/4	130 - 390	370 - 390	EB004A	No
Indeno(1,2,3-cd)pyrene	3/4	300 - 1800	390	EB004A	No
Phenanthrene	3/4	610 - 3100	390	EB004A	No
Pyrene	3/4	1000 - 6600	390	EB004A	No
Total CPAH	3/4	2600 - 16800	390	EB004A	No
Total PAH	3/4	5895 - 37340	390	EB004A	No
Pesticides (ug/kg)					
4,4'-DDD	2/4	42 - 110	3.9 - 35	EB002A	No
4,4'-DDE	3/4	69 - 700	3.9	EB001A	No
4,4'-DDT	2/4	500 - 930	3.9 - 37	EB001A	No
Inorganics (mg/kg)					
Aluminum	4/4	3000 - 4620	NA	EB003A	Yes
Arsenic	4/4	0.97 - 3.5	NA	EB004A	Yes
Barium	4/4	37.4 - 62.9	NA	EB003A	No
Cadmium	1/4	2.3	1 - 1.2	EB004A	No
Calcium	4/4	26300 - 41900	NA	EB001A	No
Chromium	4/4	8.9 - 28.3	NA	EB004A	Yes
Copper	4/4	13.6 - 176	NA	EB004A	Yes
Iron	4/4	8400 - 10700	NA	EB004A	Yes
Lead	4/4	5.4 - 292	NA	EB004A	No
Magnesium	4/4	5980 - 15000	NA	EB002A	No
Manganese	4/4	293 - 387	NA	EB003A	Yes
Nickel	4/4	12.4 - 26.7	NA	EB004A	No
Potassium	1/4	1090	1000	EB003A	No
Sodium	3/4	129 - 921	104	EB003A	No
Vanadium	4/4	13.8 - 21.2	NA	EB003A	Yes
Zinc	4/4	37.9 - 232	NA	EB004A	No

TABLE 2-19

SUMMARY OF SOIL ANALYTICAL RESULTS
SUB AREA E - SURFACE SOIL (0 TO 5 FEET)
NIROP FRIDLEY, MINNESOTA

Notes:
Shading indicates that the chemical exceeded 10 percent of Tier I soil reference value in the screening risk evaluation and was retained for evaluation in the refined risk evaluation.
Individual cPAH compounds included in BaP equivalent concentration.
NA = Not applicable.

Associated Samples:

EB001A	EB206A	EB209A
EB002A	EB207A	EB209B
EB003A	EB208A	EB210A
EB004A	EB208A-AVG	EB210A-AVG
EB203A	EB208A-D	EB210A-D
EB203B		

TABLE 2-20

OU-2 EXPOSURE POINT CONCENTRATIONS[1]
TYPICAL INDUSTRIAL WORKERS AND MINOR FREQUENT CONSTRUCTION WORKERS
SUB AREAS A3, A4, & E - SURFACE SOIL (0 TO 5 FEET)
NIROP FRIDLEY, MINNESOTA

Chemicals	Exposure Unit		
	Sub Area A3	Sub Area A4	Sub Area E
Volatile Organics Compounds (mg/kg)			
1,1,1-Trichloroethane	0.012	NA	NA
1,1-Dichloroethane	0.008	NA	NA
1,2-Dichloroethene (total)	0.026	0.090	NA
2-Butanone	ND	NA	NA
Ethylbenzene	ND	NA	NA
Tetrachloroethene	0.025	NA	NA
Toluene	0.009	NA	NA
Trichloroethene	0.280	0.594	NA
Xylenes, Total	0.010	0.264	NA
Semivolatile Organics Compounds (mg/kg)			
BaP Equivalent	1.73 (2)	3.01	4.15 (2)
Fluoranthene	NA	14.2	NA
Naphthalene	ND	ND	NA
Pyrene	NA	9.53	NA
Inorganics (mg/kg)			
Aluminum	5050 (2)	4620	4620 (2)
Antimony	ND	1.41	NA
Arsenic	4.5 (2)	5.40	3.5 (2)
Barium	188 (2)	198	NA
Cadmium	1.65 (2)	NA	NA
Chromium	16.8 (2)	12.6	28.3 (2)
Copper	204 (2)	642	176 (2)
Iron	16200 (2)	17946	10700 (2)
Lead	54.9 (2)	NA	NA
Manganese	2060 (2)	1343	387 (2)
Mercury	0.125 (2)	0.061	NA
Nickel	25.5 (20	NA	NA
Vanadium	23.1 (2)	19.6	21.2 (2)

Notes:
Includes all samples collected from a depth of 0 to 5 feet.
1 - Exposure point concentrations are the 95 percent UCL unless otherwise noted.
2 - There was an insufficient number of samples to calculate an UCL therefore the maximum detected concentration was used as the exposure point concentration.
ND - Identified as a COPC in screening analysis but was not detected in surface soil.
NA - Not applicable, not a COPC for this exposure unit.

TABLE 3-21

OU-3 EXPOSURE POINT CONCENTRATIONS FOR INDUSTRIAL WORKERS AND MINOR FREQUENT CONSTRUCTION WORKERS
NIROP FRIDLEY, MINNESOTA

Parameter	Units	Frequency of Detection	Average Concentration	W Statistic Normal Distribution	W Statistic Lognormal Distribution	W TEST	UCL Normal Distribution	UCL Lognormal Distribution	Maximum Detected Concentration	Distribution (1)	Exposure Point Concentration (2)
Volatile Organic Compounds											
1,1,1-Trichloroethane	µg/kg	3/61	26.5	0.7557	0.7927	0.9620	31.3	44.7	28.0	Undefined	28.0
1,1-Dichloroethane	µg/kg	1/61	26.2	0.7308	0.7294	0.9620	31.1	40.0	5.50	Undefined	5.50
1,2-Dichloroethene (Total)	µg/kg	4/61	26.5	0.7470	0.7655	0.9620	31.3	40.3	15.0	Undefined	15.0
2-Butanone	µg/kg	36/61	36.8	0.7007	0.9123	0.9620	46.9	70.9	210	Undefined	70.9
2-Hexanone	µg/kg	3/61	25.6	0.7509	0.7930	0.9620	30.5	42.5	26.0	Undefined	26.0
4-Methyl-2-Pentanone	µg/kg	34/61	28.1	0.8091	0.9260	0.9620	34.5	54.2	120	Undefined	54.2
Acetone	µg/kg	30/61	119	0.6312	0.9767	0.9620	158	226	960	Undefined	226
Bromomethane	µg/kg	1/61	26.2	0.7367	0.7561	0.9620	31.1	40.7	2.00	Undefined	2.00
Carbon Disulfide	µg/kg	8/61	24.1	0.7407	0.8305	0.9620	29.0	44.3	13.0	Undefined	13.0
Ethylbenzene	µg/kg	5/61	24.5	0.7378	0.8067	0.9620	29.4	40.6	19.0	Undefined	19.0
Styrene	µg/kg	4/61	25.9	0.7375	0.7496	0.9620	30.7	39.2	54.0	Undefined	39.2
Tetrachloroethene	µg/kg	9/61	27.4	0.7672	0.8427	0.9620	32.6	51.6	90.0	Undefined	51.6
Toluene	µg/kg	25/61	17.4	0.7100	0.8946	0.9620	21.9	34.1	14.0	Undefined	14.0
Trichloroethene	µg/kg	24/61	40.0	0.5418	0.9202	0.9620	52.5	82.4	640	Undefined	82.4
Xylenes, Total	µg/kg	23/61	20.8	0.7441	0.8873	0.9620	25.2	38.0	71.0	Undefined	38.0
Semivolatile Organic Compounds											
2-Methylnaphthalene	µg/kg	4/55	184	0.1989	0.3157	0.9800	210	209	1000	Undefined	209
Acenaphthene	µg/kg	8/55	174	0.4588	0.4661	0.9800	193	224	650	Undefined	224
Acenaphthylene	µg/kg	2/55	212	0.1851	0.3169	0.9800	263	228	760	Undefined	228
Anthracene	µg/kg	9/53	175	0.4640	0.5815	0.9800	196	214	640	Undefined	214
Benzo(a)anthracene	µg/kg	14/53	300	0.2830	0.6289	0.9800	440	340	3500	Undefined	340
Benzo(a)pyrene	µg/kg	13/53	238	0.3235	0.6358	0.9800	319	281	1700	Undefined	281
Benzo(b)fluoranthene	µg/kg	13/53	291	0.2737	0.6053	0.9800	424	318	3600	Undefined	318
Benzo(g,h,i)perylene	µg/kg	13/53	199	0.3463	0.6964	0.9800	257	264	820	Undefined	264
Benzo(k)fluoranthene	µg/kg	14/53	214	0.3535	0.6935	0.9800	261	270	1300	Undefined	270
Bis(2-ethylhexyl)phthalate	µg/kg	10/53	350	0.1381	0.6345	0.9800	646	325	1200	Undefined	325
Butylbenzyl Phthalate	µg/kg	1/53	202	0.1338	0.2554	0.9800	252	219	16.0	Undefined	16.0
Carbazole	µg/kg	7/53	202	0.2595	0.5468	0.9800	254	247	530	Undefined	247
Chrysene	µg/kg	15/53	238	0.3310	0.6549	0.9800	321	306	1700	Undefined	306
Di-N-Butyl Phthalate	µg/kg	3/53	197	0.1712	0.3896	0.9800	248	230	28.0	Undefined	28.0
Di-N-Octyl Phthalate	µg/kg	2/53	199	0.1484	0.3131	0.9800	249	223	40.0	Undefined	40.0
Dibenzo(a,h)anthracene	µg/kg	9/53	196	0.2570	0.5928	0.9800	247	238	400	Undefined	238
Dibenzofuran	µg/kg	3/53	203	0.1447	0.2767	0.9800	253	225	250	Undefined	225
Fluoranthene	µg/kg	18/53	368	0.2298	0.7144	0.9800	601	405	5600	Undefined	405
Fluorene	µg/kg	8/53	183	0.4977	0.5439	0.9800	207	243	760	Undefined	243
Indeno(1,2,3-cd)pyrene	µg/kg	12/53	213	0.3398	0.6572	0.9800	276	260	1100	Undefined	260
Naphthalene	µg/kg	2/55	200	0.1361	0.3030	0.9800	248	206	78.0	Undefined	78.0
Phenanthrene	µg/kg	12/53	365	0.2324	0.5395	0.9800	570	339	5000	Undefined	339
Phenol	µg/kg	2/55	199	0.1399	0.3163	0.9800	248	208	54.0	Undefined	54.0

TABLE 2-21

OU-3 EXPOSURE POINT CONCENTRATIONS FOR INDUSTRIAL WORKERS AND MINOR FREQUENT CONSTRUCTION WORKERS
NIROP FRIDLEY, MINNESOTA

Parameter	Units	Frequency of Detection	Average Concentration	W Statistic Normal Distribution	W Statistic Lognormal Distribution	W TEST	UCL Normal Distribution	UCL Lognormal Distribution	Maximum Detected Concentration	Distribution (1)	Exposure Point Concentration (2)
Pyrene	µg/kg	19/53	324	0.2379	0.7259	0.9800	513	373	4800	Undefined	373
Polychlorinated biphenyls											
Aroclor-1016	µg/kg	1/51	21.3	0.1866	0.2511	0.9800	26.2	22.0	150	Undefined	22
Aroclor-1254	µg/kg	2/51	27.6	0.2222	0.2864	0.9800	38.3	27.0	290	Undefined	27
Inorganics											
Aluminum	mg/kg	55/55	3419	0.9386	0.8777	0.9800	3705	3835	7830	Undefined	3835
Antimony	mg/kg	5/49	2.11	0.6874	0.7821	0.9470	2.36	2.32	3.40	Undefined	2.32
Arsenic	mg/kg	52/55	2.34	0.6798	0.9549	0.9800	2.81	3.08	13.8	Undefined	3.08
Barium	mg/kg	55/55	43.8	0.8099	0.9795	0.9800	52.2	56.4	201	Undefined	56.4
Beryllium	mg/kg	34/55	0.165	0.7282	0.9689	0.9800	0.187	0.186	0.700	Undefined	0.186
Cadmium	mg/kg	3/55	0.253	0.4626	0.6395	0.9800	0.301	0.273	0.750	Undefined	0.273
Calcium	mg/kg	55/55	10632	0.9116	0.9588	0.9800	12480	15437	34100	Undefined	15437
Chromium	mg/kg	55/55	14.5	0.4591	0.7870	0.9800	18.5	15.7	91.0	Undefined	15.7
Hexavalent Chromium	mg/kg	3/27	1.37	0.3484	0.3678	0.9230	1.77	1.55	6.00	Undefined	1.55
Cobalt	mg/kg	52/55	5.33	0.9752	0.8148	0.9800	5.73	6.09	10.4	Undefined	6.09
Copper	mg/kg	50/55	35.3	0.1242	0.8762	0.9800	76.4	24.2	1360	Undefined	24.2
Cyanide	mg/kg	2/55	1.72	0.0979	0.3186	0.9800	4.29	0.377	90.4	Undefined	0.377
Iron	mg/kg	55/55	9474	0.5850	0.9376	0.9800	10991	10576	48400	Undefined	10576
Lead	mg/kg	55/55	26.1	0.2014	0.7860	0.9800	49.2	18.9	733	Undefined	18.9
Magnesium	mg/kg	55/55	4043	0.8793	0.9280	0.9800	4648	5182	14100	Undefined	5182
Manganese	mg/kg	55/55	421	0.7018	0.9892	0.9800	522	591	2490	Lognormal	591
Mercury	mg/kg	9/55	0.034	0.4673	0.6373	0.9800	0.042	0.037	0.190	Undefined	0.037
Nickel	mg/kg	51/55	12.3	0.8529	0.9794	0.9800	13.7	13.8	33.5	Undefined	13.8
Potassium	mg/kg	55/55	346	0.7997	0.9644	0.9800	381	380	1130	Undefined	380
Selenium	mg/kg	1/47	0.167	0.5577	0.7061	0.9460	0.209	0.190	1.05	Undefined	0.19
Sodium	mg/kg	54/55	118	0.8284	0.9727	0.9800	134	136	364	Undefined	136
Thallium	mg/kg	4/53	0.147	0.5823	0.7120	0.9800	0.175	0.164	0.240	Undefined	0.164
Vanadium	mg/kg	55/55	14.0	0.8874	0.8774	0.9800	15.2	15.6	35.6	Undefined	15.6
Zinc	mg/kg	51/55	29.6	0.2219	0.8299	0.9800	43.9	30.0	479	Undefined	30

Notes:

The Shapiro-Wilk W-test (Gilbert, 1987) was used to to determine the distribution of the dataset.

UCL = *95th percentile upper confidence limit on the mean concentration.*

1 - The data is consider to be normally distributed if the W statistic for a normal distribution is greater than the W-test statistic and the data is considered to be lognormally distributed if the W statistic for a lognormal distribution is greater than the W-test statistic. If both the W statistic for the normal distribution and lognormal distribution are less than the W-test statistic then the distribution is undefined.

2 - The exposure point concentration is the UCL for a normal distribution if the data is normally distributed or the UCL for a lognormal distribution if the data is lognormally distributed. If the distribution is undefined then the UCL for a lognormal distribution is used for the exposure point concentration. If the UCL exceeded the maximum detected concentration then the maximum detected concentration was used as the exposure point concentration.

TABLE 2-21

OU-3 EXPOSURE POINT CONCENTRATIONS FOR INDUSTRIAL WORKERS AND MINOR FREQUENT CONSTRUCTION WORKERS
NIROP FRIDLEY, MINNESOTA

Parameter	Units	Frequency of Detection	Average Concentration	W Statistic Normal Distribution	W Statistic Lognormal Distribution	W TEST	UCL Normal Distribution	UCL Lognormal Distribution	Maximum Detected Concentration	Distribution (1)	Exposure Point Concentration (2)

The following samples were used in the calculation of the exposure point concentration.

003-SB-003-01
003-SB-004-01-AVG
003-SB-006-01
003-SB-007-01
003-SB-008-01
003-SB-013-01
003-SB-015-01-AVG
003-SB-016-01
003-SB-017-01
003-SB-018-01
003-SB-023-01
003-SB-026-01
003-SB-027-01
003-SB-028-01
003-SB-029-01
003-SB-030-01
003-SB-032-01
003-SB-033-01
003-SB-034-01
003-SB-035-01
003-SB-036-01
003-SB-037-01-AVG
003-SB-038-01
003-SB-039-01
003-SB-046-01-AVG
003-SB-047-01
003-SB-050-01-AVG
003-SB-054-01
003-SB-055-01
003-SB-058-01-AVG
003-SB-063-01
003-SB-068-01
003-SB-070-01
003-SB-071-01
003-SB-073-01
003-SB-074-01-AVG
003-SB-30D-01
003-SB-32D-01
003-SB-P01-01
003-SB-P02-01
003-SB-P03-01
003-SB-P04-01
003-SB-P05-01
003-SB-P06-01
003-SB-P07-01
003-SB-P08-01
003-SB-P09-01-AVG
003-SB-P10-01-AVG
003-SB-P11-01-AVG
003-SB-P12-01
SB-01-0001-AVG
SB-02-0001
SB-02-0204-AVG
SB-03-0001
SB-04-0001
SB-05-0001
SB-06-0002

TABLE 2-21

OU-3 EXPOSURE POINT CONCENTRATIONS FOR INDUSTRIAL WORKERS AND MINOR FREQUENT CONSTRUCTION WORKERS
NIROP FRIDLEY, MINNESOTA

Parameter	Units	Frequency of Detection	Average Concentration	W Statistic Normal Distribution	W Statistic Lognormal Distribution	W TEST	UCL Normal Distribution	UCL Lognormal Distribution	Maximum Detected Concentration	Distribution (1)	Exposure Point Concentration (2)
Pyrene	µg/kg	19/53	324	0.2379	0.7259	0.9800	513	373	4800	Undefined	373
Polychlorinated biphenyls											
Aroclor-1016	µg/kg	1/51	21.3	0.1868	0.2511	0.9800	26.2	22.0	150	Undefined	22
Aroclor-1254	µg/kg	2/51	27.6	0.2222	0.2864	0.9800	38.3	27.0	290	Undefined	27
Inorganics											
Aluminum	mg/kg	55/55	3419	0.9386	0.8777	0.9800	3705	3835	7830	Undefined	3835
Antimony	mg/kg	5/49	2.11	0.6874	0.7821	0.9470	2.36	2.32	3.40	Undefined	2.32
Arsenic	mg/kg	52/55	2.34	0.6798	0.9549	0.9800	2.81	3.08	13.8	Undefined	3.08
Barium	mg/kg	55/55	43.8	0.8099	0.9795	0.9800	52.2	56.4	201	Undefined	56.4
Beryllium	mg/kg	34/55	0.165	0.7282	0.9689	0.9800	0.187	0.186	0.700	Undefined	0.186
Cadmium	mg/kg	3/55	0.253	0.4626	0.6395	0.9800	0.301	0.273	0.750	Undefined	0.273
Calcium	mg/kg	55/55	10632	0.9116	0.9588	0.9800	12480	15437	34100	Undefined	15437
Chromium	mg/kg	55/55	14.5	0.4591	0.7870	0.9800	18.5	15.7	91.0	Undefined	15.7
Hexavalent Chromium	mg/kg	3/27	1.37	0.3464	0.3678	0.9230	1.77	1.55	6.00	Undefined	1.55
Cobalt	mg/kg	52/55	5.33	0.9752	0.8148	0.9800	5.73	6.09	10.4	Undefined	6.09
Copper	mg/kg	50/55	35.3	0.1242	0.8762	0.9800	76.4	24.2	1360	Undefined	24.2
Cyanide	mg/kg	2/55	1.72	0.0979	0.3186	0.9800	4.29	0.377	90.4	Undefined	0.377
Iron	mg/kg	55/55	9474	0.5850	0.9376	0.9800	10991	10576	48400	Undefined	10576
Lead	mg/kg	55/55	26.1	0.2014	0.7860	0.9800	49.2	18.9	733	Undefined	18.9
Magnesium	mg/kg	55/55	4043	0.8793	0.9280	0.9800	4648	5182	14100	Undefined	5182
Manganese	mg/kg	55/55	421	0.7018	0.9892	0.9800	522	591	2490	Lognormal	591
Mercury	mg/kg	9/55	0.034	0.4673	0.6373	0.9800	0.042	0.037	0.190	Undefined	0.037
Nickel	mg/kg	51/55	12.3	0.8529	0.9794	0.9800	13.7	13.8	33.5	Undefined	13.8
Potassium	mg/kg	55/55	346	0.7997	0.9644	0.9800	381	380	1130	Undefined	380
Selenium	mg/kg	1/47	0.167	0.5577	0.7081	0.9460	0.209	0.190	1.05	Undefined	0.19
Sodium	mg/kg	54/55	118	0.8284	0.9727	0.9800	134	136	364	Undefined	136
Thallium	mg/kg	4/53	0.147	0.5823	0.7120	0.9800	0.175	0.164	0.240	Undefined	0.164
Vanadium	mg/kg	55/55	14.0	0.8874	0.8774	0.9800	15.2	15.6	35.6	Undefined	15.6
Zinc	mg/kg	51/55	29.6	0.2219	0.8299	0.9800	43.9	30.0	479	Undefined	30

Notes:

The Shapiro-Wilk W-test (Gilbert, 1987) was used to to determine the distribution of the dataset.

UCL = 95th percentile upper confidence limit on the mean concentration.

1 - The data is consider to be normally distributed if the W statistic for a normal distribution is greater than the W-test statistic and the data is considered to be lognormally distributed if the W statistic for a lognormal distribution is greater than the W-test statistic. If both the W statistic for the normal distribution and lognormal distribution are less than the W-test statistic then the distribution is undefined.

2 - The exposure point concentration is the UCL for a normal distribution if the data is normally distributed or the UCL for a lognormal distribution if the data is lognormally distributed. If the distribution is undefined then the UCL for a lognormal distribution is used for the exposure point concentration. If the UCL exceeded the maximum detected concentration then the maximum detected concentration was used as the exposure point concentration.

TABLE 2-21

OU-3 EXPOSURE POINT CONCENTRATIONS FOR INDUSTRIAL WORKERS AND MINOR FREQUENT CONSTRUCTION WORKERS
NIROP FRIDLEY, MINNESOTA

Parameter	Units	Frequency of Detection	Average Concentration	W Statistic Normal Distribution	W Statistic Lognormal Distribution	W TEST	UCL Normal Distribution	UCL Lognormal Distribution	Maximum Detected Concentration	Distribution (1)	Exposure Point Concentration (2)
The following samples were used in the calculation of the exposure point concentration.											
003-SB-003-01		003-SB-030-01		003-SB-063-01		003-SB-P08-01					
003-SB-004-01-AVG		003-SB-032-01		003-SB-068-01		003-SB-P09-01-AVG					
003-SB-006-01		003-SB-033-01		003-SB-070-01		003-SB-P10-01-AVG					
003-SB-007-01		003-SB-034-01		003-SB-071-01		003-SB-P11-01-AVG					
003-SB-008-01		003-SB-035-01		003-SB-073-01		003-SB-P12-01					
003-SB-013-01		003-SB-036-01		003-SB-074-01-AVG		SB-01-0001-AVG					
003-SB-015-01-AVG		003-SB-037-01-AVG		003-SB-30D-01		SB-02-0001					
003-SB-016-01		003-SB-038-01		003-SB-32D-01		SB-02-0204-AVG					
003-SB-017-01		003-SB-039-01		003-SB-P01-01		SB-03-0001					
003-SB-018-01		003-SB-046-01-AVG		003-SB-P02-01		SB-04-0001					
003-SB-023-01		003-SB-047-01		003-SB-P03-01		SB-05-0001					
003-SB-026-01		003-SB-050-01-AVG		003-SB-P04-01		SB-06-0002					
003-SB-027-01		003-SB-054-01		003-SB-P05-01							
003-SB-028-01		003-SB-055-01		003-SB-P06-01							
003-SB-029-01		003-SB-058-01-AVG		003-SB-P07-01							

TABLE 2-22

OU-2 EXPOSURE POINT CONCENTRATIONS[1]
MAJOR INFREQUENT CONSTRUCTION WORKERS
NIROP FRIDLEY, MINNESOTA

Chemicals	Exposure Unit									
	Sub Area A1	Sub Area A2	Sub Area A3	Sub Area A4	Sub Area B1	Sub Area B2	Sub Area D	Sub Area E	Sub Area F	Other
Volatile Organics Summary (mg/kg)										
1,1,1-Trichloroethane	--	--	2600	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	34	--	--	--	--	--	--	--
1,2-Dichloroethene (total)	--	--	1.8	14	--	--	--	--	--	--
2-Butanone	--	--	3500	--	--	--	--	--	--	--
Ethylbenzene	--	--	140	--	--	--	--	--	--	--
Tetrachloroethene	--	--	1200	--	--	--	--	--	--	--
Toluene	--	--	190	--	--	--	--	--	--	--
Trichloroethene	--	4.1	120	96	--	--	--	--	--	--
Xylenes, Total	--	--	580	28	--	--	--	--	--	--
Semivolatile Organics Summary (mg/kg)										
Bap Equivalent	--	0.341	3.17	60.7	0.759	0.40	1.59	4.15	0.491	0.236
Fluoranthene	--	--	--	160	--	--	--	--	--	--
Naphthalene	--	--	2.7	1.1	--	--	--	--	--	--
Pyrene	--	--	--	130	--	--	--	--	--	--
Inorganics (mg/kg)										
Aluminum	4190	5270	6370	6830	4580	3960	5420	4620	5920	--
Antimony	--	--	105	2.3	2.3	--	--	--	--	--
Arsenic	3.4	8.3	6.6	11.4	9.4	3	6	3.5	4.8	--
Barium	--	227	327	306	197	--	129	--	173	261
Cadmium	--	--	5.3	--	--	--	4.3	--	--	--
Chromium	13.6	11.3	114	22.6	12.8	7.8	43.2	28.3	18.2	--
Copper	10.3	158	1290	1900	43.1	11.5	937	176	26.2	--
Iron	24300	18000	275000	38100	12300	9910	30100	14500	16200	--
Lead	--	143	453	274	--	--	373	292	--	--
Manganese	927	2230	20700	5950	1560	747	1960	387	1610	--
Mercury	--	--	0.19	0.12	--	--	--	--	--	--
Nickel	--	--	142	--	--	--	--	--	--	--
Vanadium	--	--	32.9	26.1	24.6	--	21.4	23.4	--	--

Notes:
1 - The exposure point concentration is the maximum detected concentration in surface and subsurface soil.
-- Chemical was not a COPC for this sub area.

TABLE 2-23

OU-3 EXPOSURE POINT CONCENTRATIONS
FOR MAJOR INFREQUENT CONSTRUCTION WORKERS
NIROP FRIDLEY, MINNESOTA
PAGE 1 OF 2

Parameter	Maximum Detected Concentration	Location of Maximum
Volatile Organic Compounds (ug/kg)		
1,1,1-Trichloroethane	56	003-SB-058-01
1,1,2-Trichloroethane	9	SB-02-0406
1,1-Dichloroethane	11 J	003-SB-032-03
1,2-Dichloroethene (total)	15000	003-SB-032-03
2-Butanone	210 J	003-SB-29D-01
2-Hexanone	26 J	003-SB-P11-01-D
4-Methyl-2-pentanone	150	003-SB-028-02
Acetone	1700	003-SB-032-03
Benzene	24 J	003-SB-032-03
Bromomethane	2 J	003-SB-054-01
Carbon Disulfide	14	003-SB-054-02
Ethylbenzene	720	003-SB-032-03
Styrene	54 J	003-SB-29D-01
Tetrachloroethene	760	SB-02-0406
Toluene	1000	003-SB-032-03
Trichloroethene	1100	SB-05-1012
Xylenes, Total	7300	003-SB-032-03
Semivolatile Organic Compounds (ug/kg)		
2-Methylnaphthalene	1000 J	003-SB-028-01
4-Chloro-3-methylphenol	11000	003-SB-032-03
Acenaphthene	650 J	003-SB-028-01
Acenaphthylene	760	003-SB-017-01
Anthracene	640	003-SB-017-01
Benzo(a)anthracene	3500	003-SB-P03-01
Benzo(a)pyrene	1700	003-SB-017-01
Benzo(b,j,k)fluoranthene	3600	003-SB-P03-01
Benzo(g,h,i)perylene	820	003-SB-P03-01
Benzo(k)fluoranthene	1300	003-SB-017-01
Bis(2-Ethylhexyl)phthalate	4400	SB-02-0406
Butylbenzyl Phthalate	3600 J	003-SB-032-03
Carbazole	530	003-SB-P03-01
Chrysene	1700	003-SB-017-01
Di-n-butyl phthalate	140	SB-02-0406
Di-n-octyl phthalate	84 J	003-SB-030-02
Dibenzo(a,h)anthracene	400	003-SB-017-01
Dibenzofuran	250 J	003-SB-017-01
Fluoranthene	5600	003-SB-017-01
Fluorene	760 J	003-SB-028-01
Indeno(1,2,3-cd)pyrene	1100	003-SB-P03-01
Naphthalene	2300 J	003-SB-032-03
Pentachlorophenol	50 J	003-SB-054-02
Phenanthrene	5000	003-SB-P03-01

TABLE 2-23

OU-3 EXPOSURE POINT CONCENTRATIONS
FOR MAJOR INFREQUENT CONSTRUCTION WORKERS
NIROP FRIDLEY, MINNESOTA

Parameter	Maximum Detected Concentration	Location of Maximum
Phenol	120 J	003-SB-058-03
Pyrene	4800	003-SB-P03-01
Polychlorinated biphenyls (ug/kg)		
Aroclor-1016	150	003-SB-030-01
Aroclor-1254	290	003-SB-050-01-D
Inorganics (mg/kg)		
Aluminum	7830	003-SB-037-01-D
Antimony	3.4 J	003-SB-017-01
Arsenic	13.8	003-SB-071-01
Barium	201	SB-03-0001
Beryllium	0.7 J	003-SB-058-01
Cadmium	0.75	003-SB-035-01
Calcium	46500 J	003-SB-038-03
Chromium	618	SB-02-0406
Hexavalent Chromium	6	003-SB-035-01
Cobalt	11.4 J	003-SB-P09-03
Copper	1360	003-SB-035-01
Cyanide	148	SB-07-0406
Iron	48400 J	003-SB-017-01
Lead	733 J	003-SB-017-01
Magnesium	20000 J	003-SB-038-03
Manganese	2490	SB-03-0001
Mercury	0.32 J	003-SB-013-02
Nickel	33.5 J	003-SB-035-01
Potassium	1350 J	003-SB-035-02
Selenium	1.3 J	003-SB-058-01
Sodium	487 J	003-SB-068-03
Thallium	0.24 J	003-SB-047-01
Vanadium	35.6 J	003-SB-058-01-D
Zinc	479 J	003-SB-035-01

TABLE 2-24

OU-2 SUMMARY OF REFINED RISK ANALYSIS
TYPICAL INDUSTRIAL WORKERS AND MINOR FREQUENT CONSTRUCTION WORKERS
SUB AREAS A3, A4, & E - SURFACE SOIL (0 TO 5 FEET)
NIROP FRIDLEY, MINNESOTA

Exposure Scenario	Sub Area A3	Sub Area A4	Sub Area E	Sub Area E Excluding Sample EB004
Typical Industrial Worker	HQ < 0.2 ICR = 6E-6	HQ < 0.2 ICR = 1E-5	Not Assessed Screening analysis indicated that the risks were within acceptable levels.	Not Assessed Screening analysis indicated that the risks were within acceptable levels.
Minor Frequent Construction Worker	HQ < 0.2 ICR = 8E-6	HQ < 0.2 ICR = 1E-5	HQ < 0.2 [redacted]	HQ < 0.2 ICR = 8E-6

Notes:
Shading indicates that the estimated risks exceed MPCA acceptable levels (ICRs > 1E-5, HQs > 0.2) for chronic exposures.

TABLE 2-25

SUMMARY OF REFINED RISK ANALYSIS
MAJOR INFREQUENT CONSTRUCTION WORKERS
NIROP FRIDLEY, MINNESOTA

Exposure Scenario	Estimated Risk									
	Sub Area A1	Sub Area A2	Sub Area A3	Sub Area A4	Area B1	Area B2	Area D	Area E	Area F	Other
Major Infrequent Construction Worker	HQ < 1	HQ < 1	[illegible]	HQ < 1 Iron	HQ < 1	HQ < 1	HQ < 1	HQ < 1	HQ < 1	HQ < 1
	ICR = 1E-7	ICR = 5E-7	ICR = 2E-5 (1,1-DCA, PCE, TCE)	[illegible]	ICR = 5E-7	ICR = 2E-7	ICR = 6E-7	ICR = 1E-6	ICR = 3E-7	ICR = 5E-8

Notes:
Screening evaluation is based on the maximum detected concentration of all soil samples collected in each sub area.
Shading indicates that the estimated risks exceed MPCA acceptable levels (ICRs > 1E-6, HQs > 1) for subchronic exposures.
ICR = Incremental cancer risks.
HQ = Hazard Quotient.
1,1-DCA = 1,1-Dichloroethane.
PCE = Tetrachloroethane.
TCE = Trichloroethene.
1,1,1-TCA = 1,1,1-Trichloroethane.
cPAHs = Carcinogenic PAHs.

TABLE 2-26

OU-2 MAJOR CONTRIBUTORS TO CANCER RISK AND HAZARD INDICES
TYPICAL INDUSTRIAL WORKERS
NIROP FRIDLEY, MINNESOTA

Sub Area A3 - Subsurface Soil						
Chemical	Sample	Depth	Concentration	Units	ICR	HQ
Tetrachloroethene	AT009D1	8 - 10	1,200,000	ug/kg	9E-05	0.9
1,1,1-Trichloroethane	AT009D1	8 - 10	2,600,000	ug/kg	NA	1
Trichloroethene	AT009D1	8 - 10	120,000	ug/kg	3E-05	NA
	AB043D	8 - 10	69,000	ug/kg	2E-05	NA
Xylenes	AT009D1	8 - 10	580,000	ug/kg	NA	0.5
Iron	AT007C	6 - 8	275,000	mg/kg	NA	1
Manganese	AT007C	6 - 8	20,700	mg/kg	NA	0.7

Notes:
ICR = Incremental cancer risk.
HQ = Hazard Quotient.

TABLE 2-27

OU-2 MAJOR CONTRIBUTORS TO CANCER RISK AND HAZARD INDICES
MINOR FREQUENT CONSTRUCTION WORKERS
NIROP FRIDLEY, MINNESOTA

Sub Area A3 - Subsurface Soil						
Chemical	Sample	Depth	Concentration	Units	ICR	HQ
Tetrachloroethene	AT009D1	8 - 10	1,200,000	ug/kg	4E-05	0.4
1,1,1-Trichloroethane	AT009D1	8 - 10	2,600,000	ug/kg	NA	0.4
BaP Equivalents	AB043D	8 - 10	3,166	ug/kg	1E-05	NA
Iron	AT007C	6 - 8	275,000	mg/kg	NA	1
Manganese	AT007C	6 - 8	20,700	mg/kg	NA	0.6

Sub Area E - Surface Soil						
Chemical	Sample	Depth	Concentration	Units	ICR	HQ
BaP Equivalents	EB004A	1 - 3	4,148	ug/kg	1E-05	NA

Notes:
ICR = Incremental cancer risk.
HQ = Hazard Quotient.

TABLE 2-28

OU-2 MAJOR CONTRIBUTORS TO CANCER RISK AND HAZARD INDICES
MAJOR INFREQUENT CONSTRUCTION WORKER
NIROP FRIDLEY, MINNESOTA

Sub Area A3 - All Soil						
Chemical	**Sample**	**Depth**	**Concentration**	**Units**	**ICR**	**HQ**
1,1,1-Trichloroethane	AT009D1	8 - 10	2,600,000	ug/kg	NA	6
1,1-Dichloroethane	AT009D1	8 - 10	34,000	ug/kg	1E-06	0.04
2-Butanone	AT009D1	8 - 10	3,500,000	ug/kg	NA	3
Tetrachloroethene	AT009D1	8 - 10	1,200,000	ug/kg	1E-05	0.8
Toluene	AT009D1	8 - 10	190,000	ug/kg	NA	0.8
Trichloroethene	AT009D1	8 - 10	120,000	ug/kg	4E-06	NA
	AB043D	8 - 10	69,000	ug/kg	2E-06	NA
Xylenes	AT009D1	8 - 10	580,000	ug/kg	NA	6
Antimony	AT008D-D (1)	8 - 10	105	mg/kg	NA	2
	AT008D	8 - 10	22.5	mg/kg	NA	0.4
Iron	AT007C	6 - 8	275,000	mg/kg	NA	9
Manganese	AT007C	6 - 8	20,700	mg/kg	NA	0.9

Sub Area A4 - All Soil						
Chemical	**Sample**	**Depth**	**Concentration**	**Units**	**ICR**	**HQ**
BaP Equivalents	AB030A	1 - 3	10,410	ug/kg	2E-06	NA
	AT001A	1 - 3	10,361	ug/kg	2E-06	NA
Trichloroethene	SA3-SCS-40-D (2)	3 - 5	96,000	ug/kg	3E-06	NA
	SA3-SCS-40	3 - 5	0.11	ug/kg	4E-09	NA
	AT004B	3 - 5	47,000	ug/kg	2E-06	NA

Notes:
ICR = Incremental cancer risk.
HQ = Hazard Quotient.
1 - Sample AT008D-D is a duplicate to sample AT008D.
2 - Sample SA3-SCS-40-D is a duplicate to sample SA3-SCS-40

TABLE 2-29

SUMMARY OF SOIL RISK CHARACTERIZATION AND IDENTIFICATION OF COCS FOR OU3
NIROP FRIDLEY, MINNESOTA

Receptor	Cancer Risk			Noncancer Risk				
	Target Risk (1)	Calculated Risk	COCs (2)	Target Hazard Index (3)	Calculated Hazard Index	Target Hazard Quotient (3)	Calculated Hazard Quotient	COCs (2)
Baseline Evaluation								
0 - 4 feet depth: Chronic exposure to 95% UCL average concentration throughout building								
Typical Industrial Worker	1×10^{-5}	0.35×10^{-5}	--	1	< 1	0.2	< 0.2	--
Minor Frequent Construction Worker	1×10^{-5}	0.36×10^{-5}	--	1	< 1	0.2	< 0.2	--
0 - 12 feet depth: Short-term exposure to maximum concentration in localized areas								
Major Infrequent Construction Worker	1×10^{-6}	2.1×10^{-6}	Maximum concentrations at different locations. Risks at individual locations less than 1×10^{-6}.	1	2.9	1	1.35	Chromium (located > 4 feet deep in East Plating Shop AOC. Evaluated as hexavalent chromium)
Screening Evaluation								
0 - 12 feet depth: Chronic exposure to maximum concentrations in localized areas								
Typical Industrial Worker	1×10^{-5}	2×10^{-5}	Maximum concentrations at different locations. Risks at individual locations less than 1×10^{-5}.	1	< 1	0.2	0.8	Chromium (located > 4 feet deep in East Plating Shop AOC. Evaluated as hexavalent chromium)
Minor Frequent Construction Worker	1×10^{-5}	1.8×10^{-5}	Maximum concentrations at different locations. Risks at individual locations less than 1×10^{-5}.	1	< 1	0.2	0.37	Chromium (located > 4 feet deep in East Plating Shop AOC. Evaluated as hexavalent chromium)

Notes:
1 Values presented are MPCA acceptable cancer risk levels. USEPA target risk range is 1×10^{-6} to 1×10^{-4}.
2 COPCs significantly contributing to calculated risks exceeding target risk levels were identified as COCs.
3 Values presented are MPCA acceptable levels. USEPA target noncancer risk levels are a Hazard Index of 1 for multiple contaminants and a Hazard Quotient of 1 for individual contaminants.

TABLE 2-30

SUMMARY OF SOIL RISK CHARACTERIZATION AND IDENTIFICATION OF COCS FOR OU3 & OU2
NIROP FRIDLEY, MINNESOTA

Receptor	Cancer Risk			Noncancer Risk				
	Target Risk (1)	Calculated Risk	COCs (2)	Target Hazard Index (3)	Calculated Hazard Index	Target Hazard Quotient (3)	Calculated Hazard Quotient	COCs (2)
Baseline Evaluation OU3								
0 - 4 feet depth: Chronic exposure to 95% UCL average concentration throughout building								
Typical Industrial Worker	1×10^{-6}	0.35×10^{-6}	--	1	< 1	0.2	< 0.2	--
Minor Frequent Construction Worker	1×10^{-6}	0.36×10^{-6}	--	1	< 1	0.2	< 0.2	--
0 - 12 feet depth: Short-term exposure to maximum concentration in localized areas								
Major Infrequent Construction Worker	1×10^{-6}		Maximum concentrations at different locations. Risks at individual locations less than 1×10^{-6}.	1		1		Chromium (located > 4 feet deep in East Plating Shop AOC. Evaluated as hexavalent chromium)
Screening Evaluation for OU3								
0 - 12 feet depth: Chronic exposure to maximum concentrations in localized areas								
Typical Industrial Worker	1×10^{-6}		Maximum concentrations at different locations. Risks at individual locations less than 1×10^{-6}.	1	< 1	0.2	0.8	Chromium (located > 4 feet deep in East Plating Shop AOC. Evaluated as hexavalent chromium)
Minor Frequent Construction Worker	1×10^{-6}		Maximum concentrations at different locations. Risks at individual locations less than 1×10^{-6}.	1	< 1	0.2	0.4	Chromium (located > 4 feet deep in East Plating Shop AOC. Evaluated as hexavalent chromium)
Refined Risk Evaluation for OU2 - Sub Areas A3, A4, and E (4)								
0 - 5 feet depth: Chronic exposure to 95% UCL average concentration								
Typical Industrial Worker	1×10^{-6}	1×10^{-6}	--	1	< 1	0.2	< 0.2	--
Minor Frequent Construction Worker	1×10^{-6}	1×10^{-6}	cPAHs in Sub Area E	1	< 1	0.2	< 0.2	--
0 - 12 feet depth: Short-term exposure to maximum concentration in localized areas								
Major Infrequent Construction Worker	1×10^{-6}		1,1-DCA, PCE, & TCE in Sub Area A3, TCE & cPAHs in Sub Area A4	1		1		Antimony, Iron, Manganese, 2-Butanone, PCE, 1,1,1-TCA, Toluene, & Xylene in Sub Area A3.

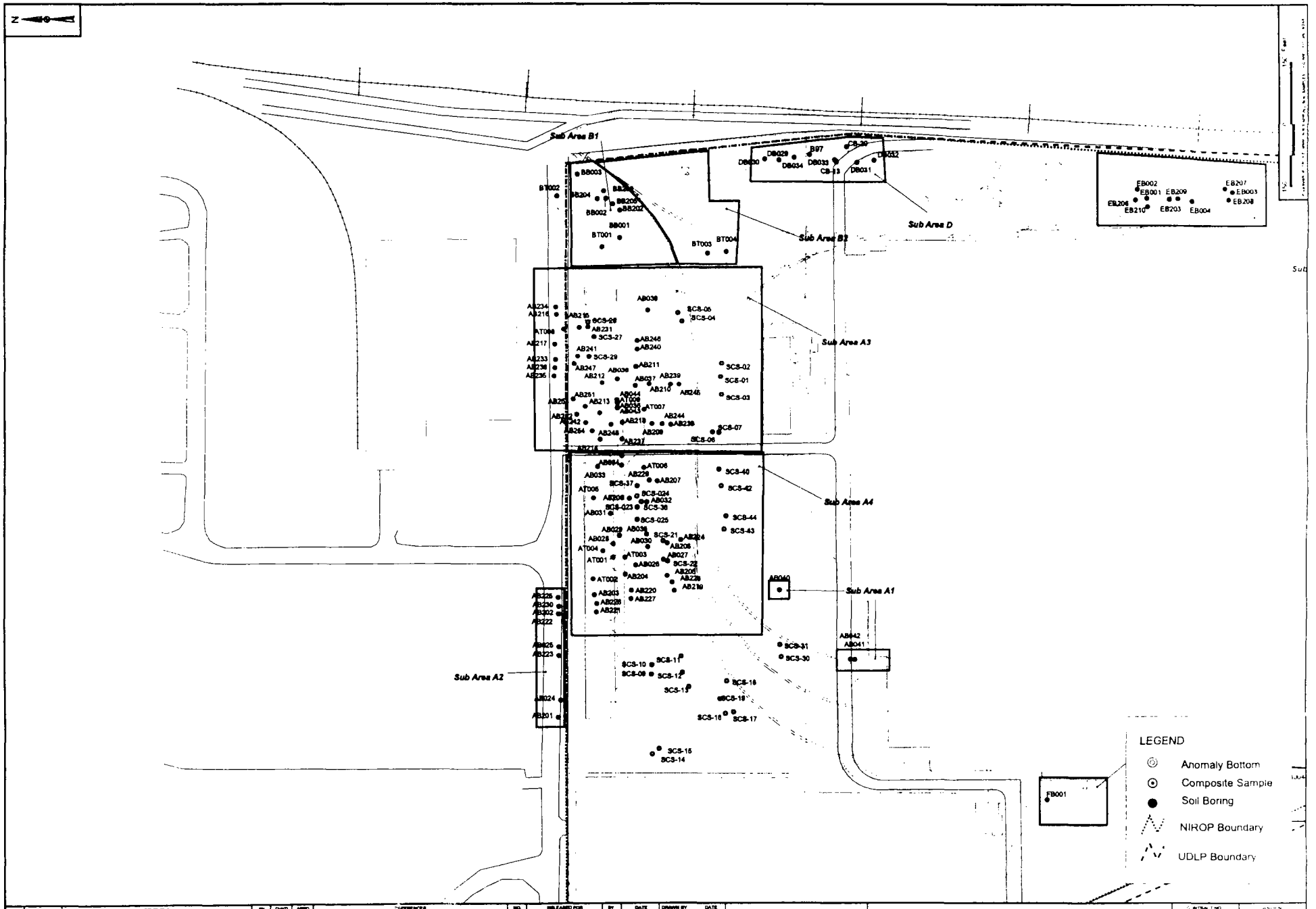
Notes:
1 - Values presented are MPCA acceptable cancer risk levels. USEPA target risk range is 1×10^{-6} to 1×10^{-4}.
2 - COPCs significantly contributing to calculated risks exceeding target risk levels were identified as COCs.
3 - Values presented are MPCA acceptable levels. USEPA target noncancer risk levels are a Hazard Index of 1 for multiple contaminants and a Hazard Quotient of 1 for individual contaminants.
4 - Only sub areas identified in the screening risk evaluation as requiring further analysis were evaluated in the refined risk evaluation.
1,1-DCA = 1,1-Dichloroethane.
PCE = Tetrachloroethane.
TCE = Trichloroethene.
1,1,1-TCA = 1,1,1-Trichloroethane.
cPAHs = Carcinogenic PAHs.

TABLE 2-31

POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDEREDS
FOR THE PROPOSED REMOVAL ACTION
NIROP FRIDLEY, MINNESOTA

I. State Requirements

Operable Unit	ARAR	Comment	
Minnesota Department of Public Service			
ONE CALL EXCAVATION NOTICE SYSTEM			
1, 2, 3	Minn. Stat. 216D		-- Establishment of Notification Center -- Notice of excavation -- Damage to facilities



NO	DATE	REVISIONS	BY	CHKD	APPD

REFERENCES	NO.	RELEASED FOR	BY	DATE

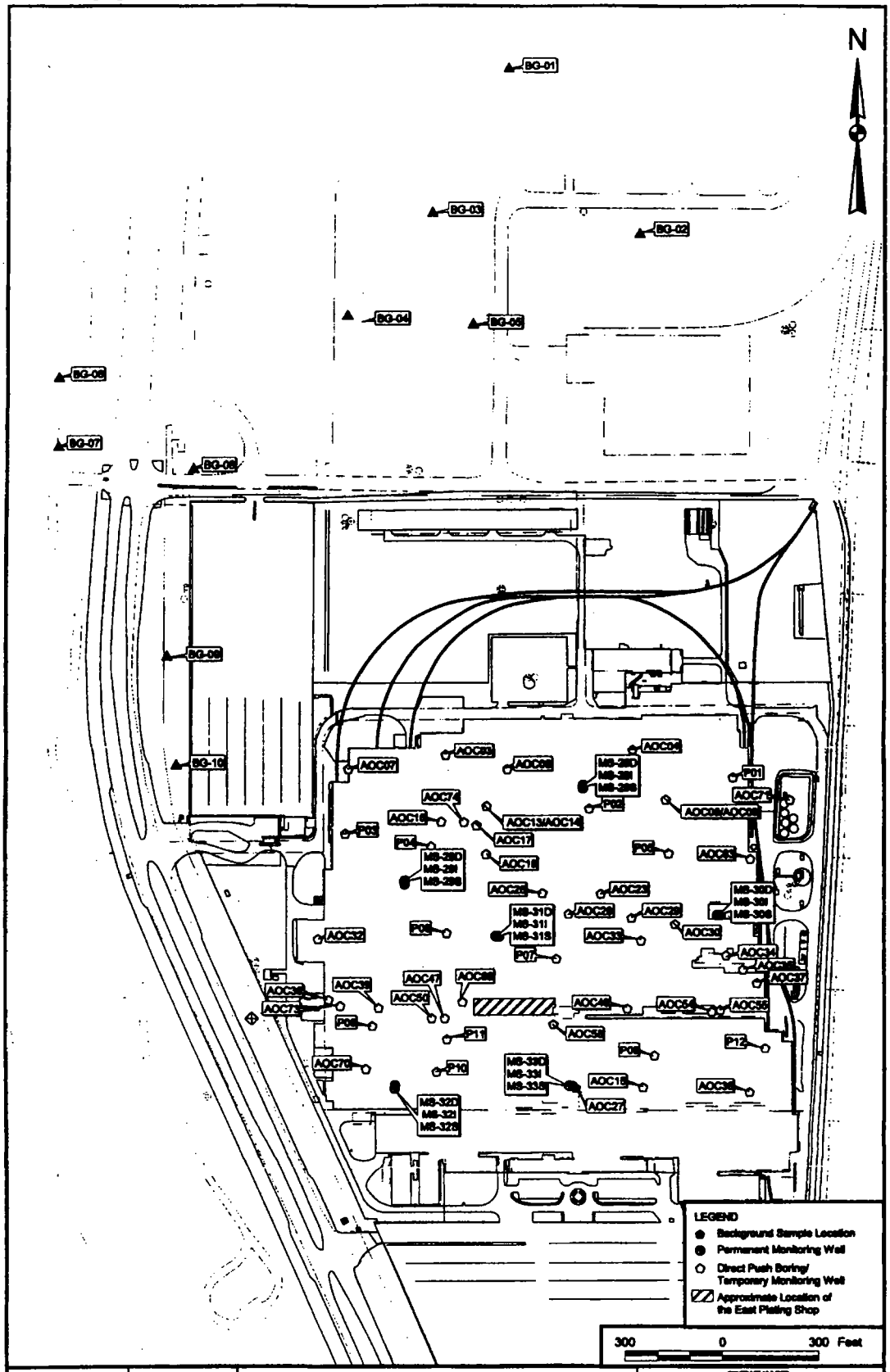
DRAWN BY J. BELLONE DATE 3/15/01
CHECKED BY DATE
COST/SCHEDULE-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

SOIL SAMPLE LOCATION MAP
OU2
NIROP FRIDLEY, MINNESOTA

FIGURE 2-1

P:\GIS\FRIDLEY\6999_SITE_ASSESSMENT APR 13-AUG-99 DNP SAMPLE LOCATION W/ BACKGROUND LAYOUT



DRAWN BY D. PERRY	DATE 13-AUG-99	
CHECKED BY	DATE	
CONVERSION/LAYOUT		
SCALE AS NOTED		

SAMPLE LOCATION MAP
OU3 REMEDIAL INVESTIGATION/FEASIBILITY STUDY
NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT
FRIDLEY, MINNESOTA

CONTRACT NUMBER

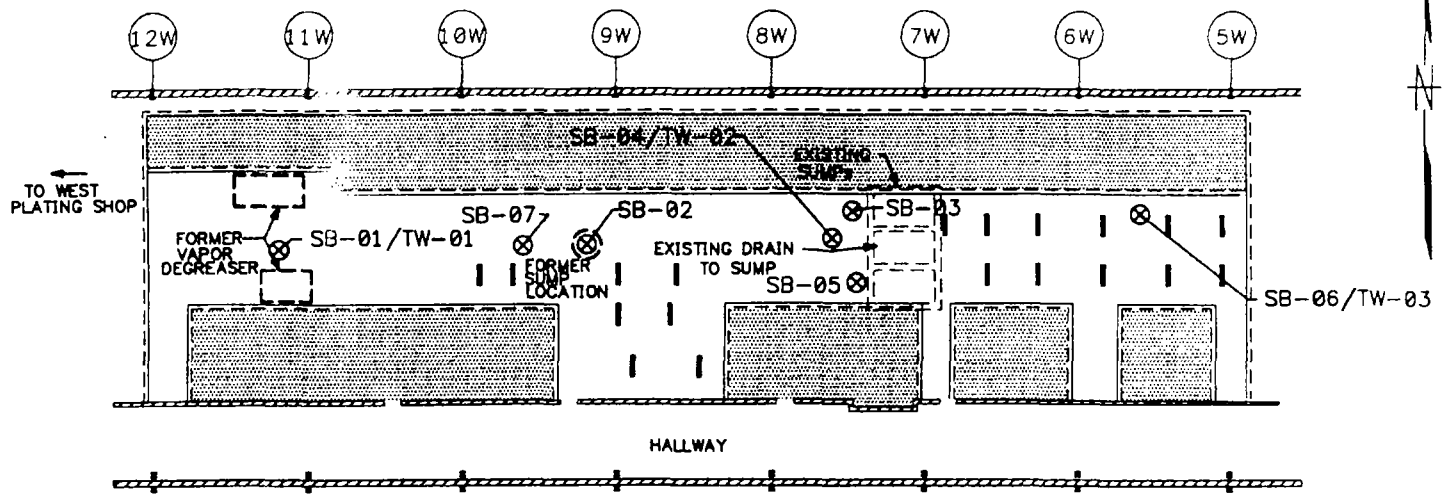
APPROVED BY | DATE

APPROVED BY | DATE 8/13/99

DRAWING NO. FIGURE 2-2 | REV 0

ACAD: 6966gm09.dwg 08/17/98 HJP

DRAFT



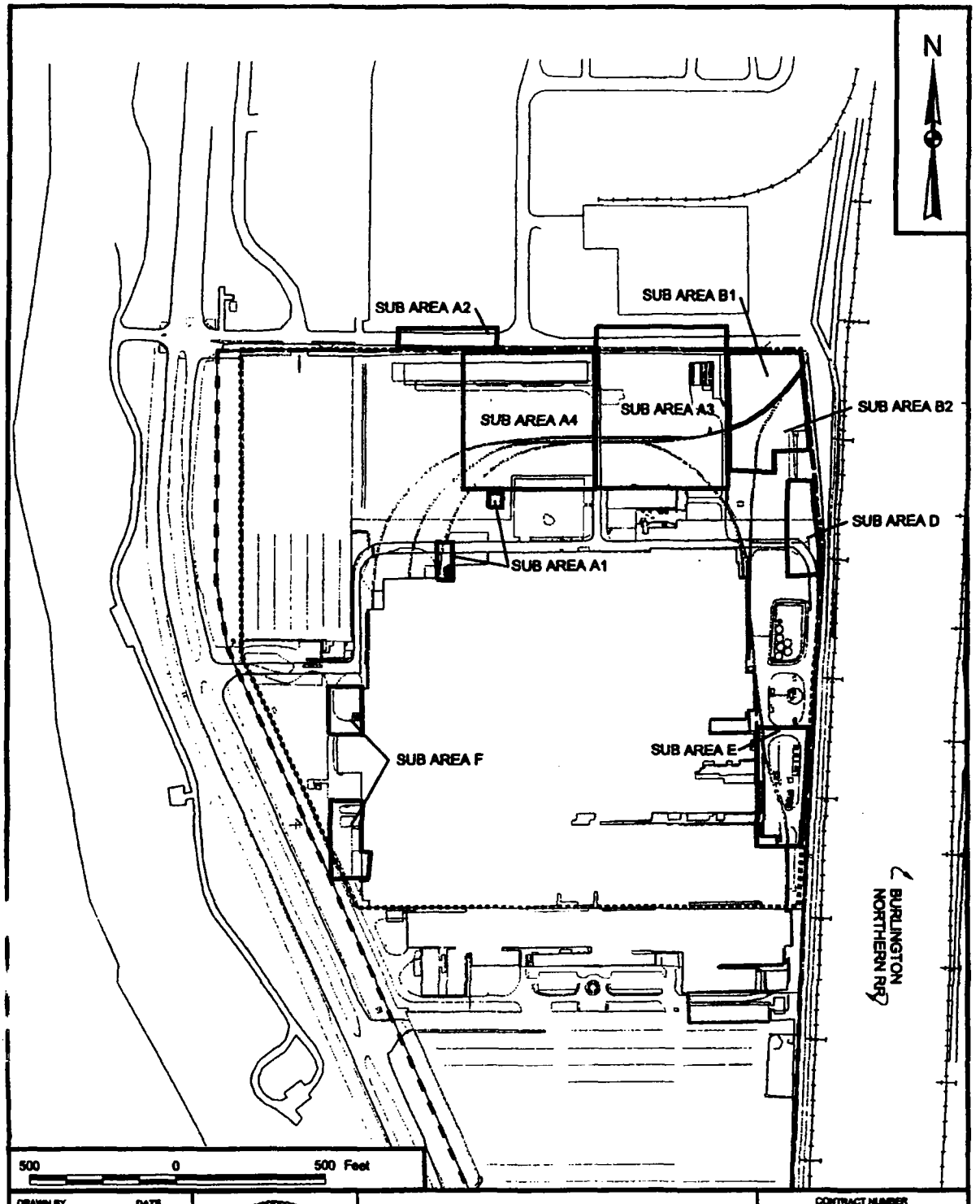
LEGEND

(9W)	BUILDING COLUMN
	CONCRETE PIER
	FORMER SUMP LOCATION (PRE-1973)
	FORMER VAPOR DEGREASER LOCATION
⊗ SB-01/TW-01	SOIL BORING/ TEMPORARY WELL LOCATION

0 30 60
SCALE IN FEET

DRAWN BY HJP DATE 8/17/98	SOIL BORING AND TEMPORARY WELL LOCATIONS EAST PLATING SHOP SOIL AND GROUNDWATER INVESTIGATION NIROP, FRIDLEY	CONTRACT NO. 6966	
CHECKED BY DATE		APPROVED BY DATE	
COST/SCHED-AREA		APPROVED BY DATE 8/17/99	
SCALE AS NOTED		DRAWING NO. FIGURE 2-3	REV. 0

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



DRAWN BY K. PEILA	DATE 8/26/02	SUB AREA LOCATION MAP NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT FRIDLEY, MINNESOTA	CONTRACT NUMBER 6966
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-4 REV 0

P:\Q2SN\ROP_FRIDLEY\APR\6966_SOILS.APR PROPOSED PLAN 7/2/02 IGMP

FOR EXACT RESTRICTION LANGUAGE, SEE ROD TEXT

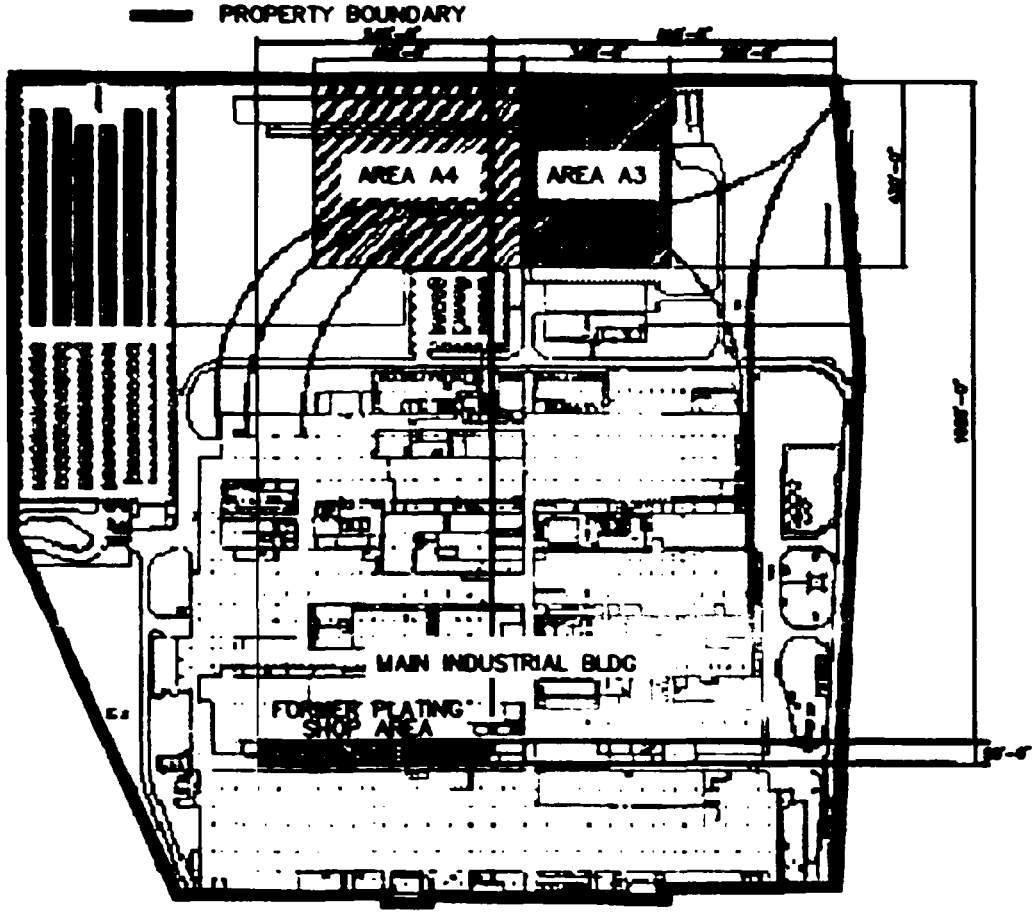
DESIGNATED RESTRICTED AREAS

FORMER PLATING SHOP AREA:
NO DISTURBANCE OF SOILS BELOW CONCRETE PIT FLOORS WITHOUT PRIOR WRITTEN APPROVAL OF EPA AND MPCA.

AREA A3:
NO DISTURBANCE OF SOILS THREE (3) FEET OR GREATER BELOW GROUND SURFACE WITHOUT PRIOR WRITTEN APPROVAL OF EPA AND MPCA.

AREA A4:
NO DISTURBANCE OF SOILS (3) FEET OR GREATER BELOW GROUND SURFACE WITHOUT PRIOR WRITTEN APPROVAL OF EPA AND MPCA.

PROPERTY BOUNDARY

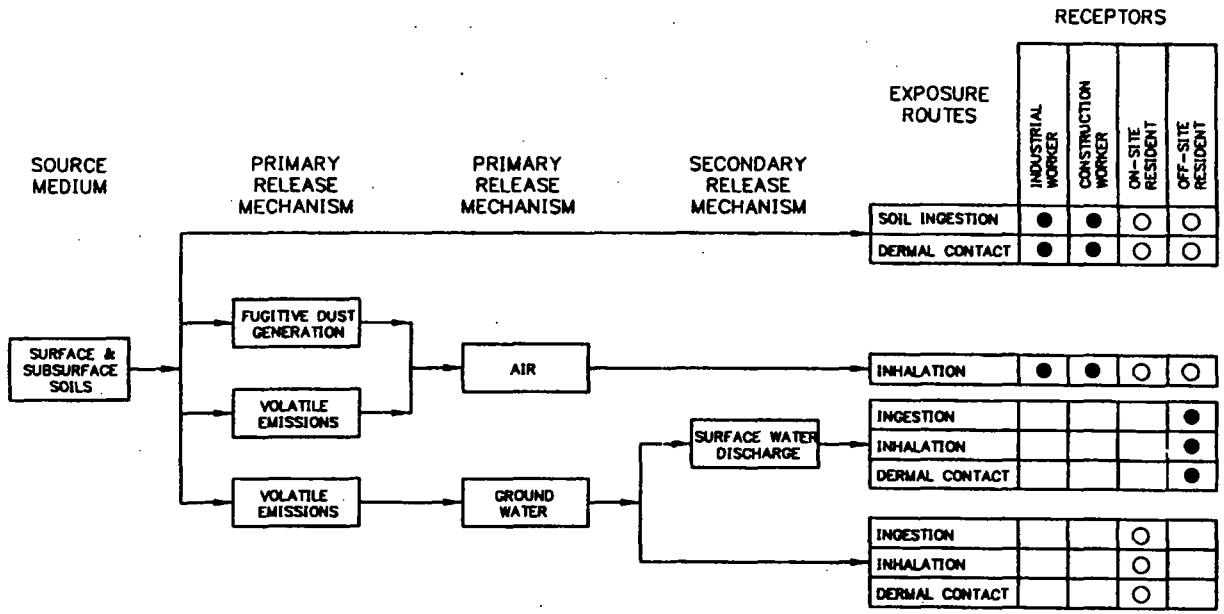


DRAWN BY MF DATE 7/1/02		DESIGNATED RESTRICTED AREAS NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT FRIDLEY, MINNESOTA	CONTRACT NO. 6966
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE NOT TO SCALE			DRAWING NO. FIGURE 2-5 REV. 0

ACAD: 6966OP01.dwg 07/01/02 MF Pit

FORM CA38 NO. SBV_AV.BVG - REV 3 - 1/28/98

ACAD: 6966KH03.dwg 05/10/00 MF



LEGEND:

● POTENTIALLY COMPLETE EXPOSURE PATHWAY

○ INCOMPLETE HYPOTHETICAL EXPOSURE PATHWAY

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 5/10/00
CHECKED BY DATE
COST/SCHED-AREA
SCALE NONE

CONCEPTUAL SITE MODEL
OPERABLE UNIT 3
NIROP, FRIDLEY

CONTRACT NO. 6966
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-6
REV. 0

FORM CASS NO. SSIV_BKRVG - REV 0 - 1/26/98

3.0 RESPONSIVENESS SUMMARY

3.1 STAKEHOLDER COMMENTS AND LEAD AGENCY RESPONSES

A Proposed Plan for Operable Unit 2 (OU2) and Operable Unit 3 (OU3) at the Naval Industrial Reserve Ordnance Plant (NIROP) in Fridley, Minnesota was issued in August 2002. Subsequent to this, the Navy solicited input from the community on the selected alternative. The Navy set a public comment period from August 12, 2002 through September 12, 2002. This Responsiveness Summary is a concise and complete summary of significant comments received from the public and includes responses to these comments. The Responsiveness Summary was prepared in accordance with guidance in "Community Relations in Superfund: A Handbook" (EPA/540/R-92-009, January 1992). This Responsiveness Summary provides the decision-makers with information about the views of the community. It also documents how the Navy, EPA, and MPCA considered public comments during the decision-making process and provides answers to significant comments.

3.1.1 Overview

The Proposed Plan as presented to the public identified Land Use Controls (LUCs) as the preferred remedial alternative. Land use controls would consist of the following:

- Designating the site as an industrial or restricted commercial area.
- Allow no soil disturbance deeper than 3 feet below ground surface (bgs) in designated areas.
- Allow no disturbance of soils beneath the concrete pit foundations where metal-finishing operations previously occurred at the former Plating Shop within the Main Industrial Building.

These LUCs would be protective and permanent to the extent they remain in place, until such time that it can be demonstrated that there is no unacceptable risk posed by unrestricted access and unlimited use of the property. A statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

3.1.2 Background on Community Involvement

The public comment period for the proposed action for OU2 and OU3 began on August 12, 2002 and ended on September 12, 2002. A public meeting was held on August 22, 2002 at the Fridley Municipal Center on Fifth Street in Fridley, Minnesota to accept verbal comments on the proposed action. None of the comments received would require a revision to the Selected Remedy.

3.1.3 Summary of Comments Received During the Public Comment Period and Navy Responses

Following is a summary of the responses to comments received during the public comment period.

1. **Comment:** Are there any other sites in the Fridley area that were contaminated and redeveloped when there were restrictions placed on the land?

   Response: Yes. The Joslyn Superfund site in Brooklyn Center, not far from NIROP Fridley. It was a former pole treating plant site.

2. **Comment:** The expected continued zoning of OU2 and OU3 is industrial or commercial. If that were to change, would the local government be the enforcement agency on such a change?

   Response: The City of Fridley would have zoning authority over NIROP Fridley if the federal government sells the property. In that case, however, zoning authority would not override any deed restrictions that would likely be in place as a result of LUCs implemented pursuant to the Record of Decision for the site. Specifically, the property will be limited to industrial/restricted commercial uses unless prior written approval of MPCA is obtained for other uses. Note that the Navy considered the City's future intended land use for this site during the development of the Record of Decision for the site.

3. **Comment:** The alternatives presented in the Proposed Plan consist of No Action or Land Use Controls. Why was there no alternative for excavation or for soil remediation?

   Response: The Navy, working with MPCA and EPA, has been proactive with actions at OU2 and OU3. A significant amount of contaminated soil and a number of drums and other containers that contained liquids were removed previously. Geophysical techniques, and historical records were used to locate areas with the highest contamination. These removal actions focused on surface soil (that remaining does not pose a problem for industrial workers) and contaminant sources that could contribute to groundwater contamination. Therefore, the most contaminated surface and subsurface soil is now gone, and the top six feet of soil is not problematic. However, some contaminated soil remains below 6 feet bgs.

4. **Comment:** Have there been any studies regarding natural attenuation? If so, how long would natural attenuation take (10 years, 100 years, forever) to reduce all risk?

   Response: A pilot scale treatability study is in effect at Anoka County Park, evaluating the use of enhanced natural attenuation for contaminated groundwater. A similar study is being considered for contaminated groundwater underneath the main NIROP building. It is unknown how long these types of actions would take to reduce all risk.

   However, the scope of this proposed plan is limited to soil. Natural attenuation is not expected to be an effective option for the NIROP soil, based on the type of contamination.

5. **Comment:** Has the option of burning the soils to remove contaminants been looked at?

   Response: Yes. In the past, soil has been sent to Emile Alabama for incineration. Two ways to remove remaining soil contamination would be 1) to excavate and incinerate the soil, or 2) soil venting or injecting vapor in the ground. Both options were considered, but would be technically and/or economically not feasible.

6. **Comment:** Is the area containing residual contamination underneath the building?

   Response: There are three areas of residual contamination. Two areas have contaminants about six feet below ground surface. The area underneath the former plating shop building is the third area that could cause an unacceptable risk if exposure were to occur. LUCs will be in effect at all three areas

3.2 TECHNICAL AND LEGAL ISSUES

No technical or legal issues to be addressed were identified.