N. 14

RECORD OF DECISION

for

GRADIENT CONTROL SYSTEM

Twin Cities Army Ammunition Plant

New Brighton, MN 55112

September 1987

Record of Decision for Gradient Control System

SITE: Twin Cities Army Ammunition Plant (TCAAP) New Brighton/Arden Hills; Ramsey County, Minnesota: a portion of the National Priorities List Site, New Brighton/Arden Hills/St. Anthony

DOCUMENTS REVIEWED

The following documents have been reviewed:

- Summary of Remedial Alternatives Evaluation (attached)
- Responsiveness Summary (attached)
- The U.S. Army Record of Decision dated May 10, 1987 and supporting documents.
- The U.S. Army Record of Decision dated July 18, 1987 and supporting documents.

DESCRIPTION OF SELECTED REMEDY

- Operation of a groundwater extraction system using existing wells with possible expansion of the system as required for the protection of human health and the environment in both the Prairie du Chien/ Jordan and Hillside Sand Aquifers.
- Extraction of contaminated groundwater for hydraulic gradient control at the Southwest boundary of the TCAAP.
- Contaminated groundwater will be treated to meet discharge requirements.
- Prior to 150 days after startup any modifications required to adequately protect both the Hillside Sand and Prairie du Chien/ Jordan aquifers will be evaluated using the data collected in the first 90 days and submitted to U.S. EPA and MPCA.
- 150 days after U.S. EPA and MPCA determine the proposed modifications to be consistent under Part XIV of the TCAAP Federal Facility Agreement, the modifications will be constructed and operated.

DECLARATIONS

Consistent with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Contingency Plan (40 CFR Part 300), I have determined that the immediate operation of a gradient control system (a hydraulic plume interception system) which meets established performance criteria will assist in the protection of public health, welfare, and the

environment, and is an operable unit consistent with future remedial actions. The system will require continuous future operation and maintenance efforts and expense for an indefinite time period. The U.S. Army has agreed in a Federal Facility Agreement to the operation and maintenance of this system for an indefinite period to be determined by the U.S. Environmental Protection Agency (U.S. EPA) and Minnesota Pollution Control Agency (MPCA) pursuant to the Federal Facility Agreement. This document records decision on a gradient control system to prevent migration of VOC contamination in groundwater first proposed by the U.S. Army on May 10, 1987 and resubmitted in modified form on June 18, 1987. This Record of Decision (ROD) includes changes made by U.S. EPA to the proposals submitted by the Army on May 10, 1987 and June 18, 1987.

Since the public comment version of the U.S. Army ROD was made available on May 10, 1987 an Agreement with the U.S. Army has been reached. The TCAAP Federal Facility Agreement (Agreement) will become effective soon after the end of the public comment period on the Agreement. All appropriate submittals and actions undertaken to implement this Record of Decision will be in accordance with the terms of the Agreement. The Agreement requires proposals by the U.S. Army for Boundary Gradient Control Systems. The U.S. EPA is obligated under that Agreement to inform the U.S. Army of requirements for an acceptable proposal. The description of the chosen alternative in the attached Summary of Remedial Alternative Selection describes the requirements of an acceptable plan.

The ROD concurs with the use of the remedial technology selected and system constructed by the U.S. Army at TCAAP for gradient control as set forth in the U.S. Army proposals dated May 10, 1987 and June 18, 1987.

However, this ROD does not fully concur with the plans submitted by the U.S. Army with respect to operating requirements for the gradient control system, specifically: capture criteria to determine adequate interception of the migrating contaminants, discharges, emissions, and the schedule for implementing any necessary modifications to achieve adequate interception of the migrating contaminants.

This Record of Decision thus formulates the process by which the existing circumstances, independent actions and existing hardware can be utilized in the most expeditious manner to prevent further migration of contaminated groundwater from the Southwest boundary of the TCAAP. This Record of Decision for a gradient control system constitutes a final plan within the meaning of 117 (b) of CERCLA/SARA.

The State of Minnesota, through the MPCA, in conjunction with the U.S. Army is continuing its comprehensive Remedial Investigation (RI) for the entire New Brighton/Arden Hills/St. Anthony study area. The MPCA will finish the regional RI and the U.S. Army will perform the on-TCAAP RI and the Site (area wide) Feasibility Study.

The MPCA has already completed a preliminary Remedial Investigation characterizing the site, major migration pathways, and preliminary identification of significant sources. The MPCA and the U.S. Army are planning to complete the remaining tasks of the comprehensive RI/FS in 1988-89 in order to evaluate potential final remedial actions. If additional remedial actions are determined

to be necessary, a Record of Decision will be prepared for approval of the future remedial actions.

Valdas V. Adamkus
Regional Administrator
United States Environmental Protection
Agency, Region

September 25th, 1987
Date

ATTACHMENT 1

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

ATTACHMENT 1

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

Site Location and Description

The New Brighton/Arden Hills/St. Anthony Superfund National Priorities List (NPL) site is located north of the Twin Cities of Minneapolis/St. Paul, Minnesota. This site includes the majority of the New Brighton Quadrangle, which includes parts of Anoka, Hennipen and Ramsey County.

The Twin Cities Army Ammunition Plant (TCAAP) is located at the Northern edge of the NPL site. Fourteen identified source areas exist in the TCAAP and three (3) sites (D, G, and I) are expected to be the source of VOC contamination emanating from the Southwest boundary. The U.S. Army estimates approximately 26 pounds per day of VOC contaminants are migrating off TCAAP in the groundwater at the Southwest boundary of TCAAP. This contamination is migrating in both the Hillside Sand Aquifer and the deeper Prairie du Chien/Jordan Aquifer.

The U.S. Army currently has six wells in the Hillside Sand Aquifer estimated to be capable of interception of VOC contaminants in the groundwater.

Site History

Both the Cities of New Brighton and St. Anthony have had to make modifications to their water supply systems due to groundwater contamination.

From 1982 to 1984 the City of New Brighton shut down six wells (wells one to six) in the Prairie du Chien/Jordan aquifer, deepened two wells (8 and 9) to the Mt. Simon-Hinkley aquifer, and constructed three new wells (10, 11, 12) in the Mt. Simon-Hinkley aquifer. In 1983 the U.S. EPA installed carbon filters on two New Brighton wells (5 and 6) to meet summertime peak demands.

During 1983 a State-lead Interim Remedial Measure connected several private well users adjacent to TCAAP with excessive contaminant levels in their wells to New Brighton's and Arden Hills' water mains.

In 1984 the City of St. Anthony received a temporary water connection to the City of Roseville as a State-lead Interim Remedial Measure. This measure was necessary due to the water shortage experienced by St. Anthony due to contamination and subsequent closure of one of the three St. Anthony wells in the Prairie du Chien/Jordan Aquifers.

Current Site Status

A Record of Decision was signed on June 30, 1986 by U.S. EPA to provide New Brighton with an additional deep well to the Mt. Simon-Hinkley aquifer. Remedial Design is expected to occur in the Fall of 1987.

A Record of Decision was signed by U.S. EPA on March 31, 1987 to provide Carbon Treatment for two of St. Anthony's wells. Remedial Design is expected to occur in fall of 1987.

On May 10, 1987 the U.S. Army proposed in a U.S. Army written "Record of Decision" to implement a plume interception system known as the "Boundary Groundwater Recovery System" or BGRS. The system has been constructed and is ready for operation. On June 18, 1987 a revised proposal on the BGRS was submitted by the U.S. Army to the U.S. EPA and MPCA. This revised U.S. Army proposal contained a responsiveness summary to public comments received during a twenty-one day public comment period (May 10, 1987 through June 1, 1987) held by the Army. U.S. EPA has addressed the comments independently in Attachment 2 to the ROD.

The recommended alternative in this ROD for Interim Remedial Action is to operate the existing U.S. Army designed system, collect operational data, and modify and refine the system as required to ensure adequate interception of contaminated groundwater in both the Hillside Sand and Prairie du Chien/Jordan aquifer.

Enforcement

The Federal Facility Agreement (Agreement) was announced on July 24, 1987 and has been issued for public comment. The effective date of the Agreement will follow the consideration of public comments and incorporation of comments. The Agreement is expected to become effective shortly after the initiation of the first phase of this remedial action.

The enforcement of the adequate operation of the system will be in accordance with the terms of the Federal Facility Agreement on TCAAP and the conditions in this ROD. The general conditions are:

1. Adequate capture of contaminated groundwater in both the Prairie du Chien/Jordan and Hillside Sand Aquifer. Adequate capture will be defined by capture of all contaminated groundwater at the Southwest boundary that does not meet the criteria values in Table 1. The values in Table 1 are based on drinking water standards and other health based standards.

2. Adequate capture will be determined by a monitoring program using the wells previously identified by the U.S. Army, MPCA and U.S. EPA.

3. Treatment of extracted water will initially be by the existing air stripper. The air emissions will be monitored to ensure that air emissions do not exceed health based criteria. Additional study will be conducted within 90 days to establish if health based effects require additional controls.

4. Modifications, if necessary, to achieve criteria values in Table 1 for capture of groundwater and discharge will be implemented.

Community Relations

The recent community relations activities are outlined in the beginning of Attachment 2. In general the community supports an effort to reduce VOC migration in the groundwater from the Southwest Boundary of the TCAAP. Many of the commments submitted during the U.S. Army's public comment period for the proposed gradient control system relate to the adequacy of the proposed system and the desire for approval or oversight by U.S. EPA and MPCA.

The selected alternative utilizes existing equipment but provides for modifications of the existing equipment to ensure protection of public health and the environment following a ninety (90) day trial period. A determination of final performance levels will utilize data from the operation of the existing equipment and an assessment of health risks associated with the ground water not captured by the system.

The concerns regarding oversight are addressed by the TCAAP Federal Facility Agreement. The Agreement calls for review and oversight of the U.S. Army Remedial Action by U.S. EPA and MPCA. Under the Agreement any modifications and performance of the system must be acceptable to U.S. EPA and MPCA.

Alternatives Considered

The U.S. Army document Groundwater Remedial Action Alternative Analysis considers various alternatives including the no action alternative. Summary tables of alternatives are in Attachment 3.

The alternatives considered included:

1. Source removal and no action on the migrating contaminated water.

   The sources of contamination have not been adequately characterized and identification of all the sources may not be complete. Complete source removal can not be accomplished swiftly. Additionally, it would not immediately mitigate the contamination migrating off the base. Contaminates would continue to migrate off TCAAP for years after the source removal. Because no Remedial Investigation has been concluded to adequately identify all sources and the excessive time to reduce contaminant migration after source removal is complete, this alternative was not considered in detail by U.S. EPA.

2. Mechanical barriers - Source control and containment Slurry walls, grout curtains and similar devices have been used

extensively for control of contaminant plumes. They must be used in conjunction with pumping wells to prevent the contaminated groundwater from flowing around the barrier. Additional reduction of the source of the contaminants to the groundwater through capping or removal is also required. It would take one to two years to install such a system. Given the depth and extent of groundwater contamination, these mechanical barriers are technically unacceptable. As a result, U.S EPA did not consider this alternative in detail.

3. Groundwater Extraction System - hydraulic barriers with or without source removal and control.

   The U.S. Army evaluated six varients of hydraulic barriers or gradient control control systems in the document titled Groundwater Remedial Action Alternative Analysis (GRAAA). All alternatives in the GRAAA considered pumping in both the Hillside Sand and Prairie du Chien/Jordan aquifers using data and the detailed analysis found in the Groundwater Remedial Program Plan (GRPP). The U.S. Army designed and constructed a system of Gradient Control that encompasses six wells in only the Hillside Sand aquifer. This system is now ready for operation.

Selected Remedy

The chosen alternative is to use the existing six wells at the boundary constructed by the U.S. Army as part of their Boundary Groundwater Recovery System to begin extracting contaminated groundwater and to begin design of any additional measures required to accomplish complete capture of contaminated groundwater. The U.S. Army estimates that the pumping of these six wells will stop 90% of the migrating VOC contaminantion. Information from the first ninety (90) days of operation will be used by U.S. EPA to determine if the existing six well system is adequate or needs to be modified to adequately protect both the Hillside Sand Aquifer and the Prairie du Chien/Jordan Aquifer from VOC contamination migrating from the TCAAP.

This remedy will ensure at least partial protection immediately and will allow for a more rapid modification, if additional devices are required, rather than creating a new system.

The initial goal of the hydraulic gradient control system will not be restoration of the aquifer to pristine conditions but rather the system is an operable unit to mitigate impacts from further migration of VOC contaminants. The system, with any necessary modifications, will provide for no release of contaminants in excess of criteria levels from the southwest TCAAP boundary.

The U.S. Army prepared an evaluation of various pumping schemes in the documents Groundwater Remedial Action Alternatives Analysis, (GRAA) and Groundwater Remedial

Action Plan (GRPP). The alternatives presented have been evaluated as well as the BGRS system proposed by the U.S. Army on June 18, 1987. Operating the BGRS in a modified manner from that proposed on June 18, 1987 by the U.S. Army will not result in any adverse impacts. It is currently uncertain whether sufficient protection will be given to the Prairie du Chien/Jordan aquifer by the BGRS as currently constructed. As a result the recommended alternative is a two-phase approach.

The first phase will be to operate the existing six-pump out wells, treating the water in the existing air strippers and utilize as much of the extracted water as possible for in-plant use (approximately 300,000 gallons per day). The remainder of the extracted and treated water will be disposed of by re-injection/infiltration through the arsenal sand and gravel pit (gravel pit). The first phase will have as its goal to achieve capture of all groundwater migrating from the southwest corner of TCAAP that has contamination in excess of the criteria levels in Table 1.

The second phase starts after a ninety day trial period, evaluation of data, and construction of modifications. Using actual operating data and monitoring results, the protection given both aquifers will be evaluated. Modifications to the system, if necessary to achieve the criteria levels or protect public health, welfare, the environment, including additional additional wells or carbon treatment, will then be installed. The criteria for capture or treatment may be altered by U.S. EPA for Phase 2 based on a U.S. EPA study of Phase 1 data and results to be conducted prior to final implementation of Phase 2. This alternative and the phased approach is recommended for the following reasons:

1. At least partial protection of the Hillside Sand aquifer can be achieved by pumping the existing wells and using the existing treatment system. This degree of protection can be achieved immediately during the first phase.

2. The operation of the Phase 2 system will prevent further additions of contaminated groundwater to the regional groundwater system.

3. Prevention of further migration of VOC contaminants in groundwater from TCAAP is consistent with any forseen final remedial action alternative.

MONITORING REQUIREMENTS OF SELECTED REMEDY

The monitoring requirements of the initial phase is important in determining if the system is offering sufficient protection in both the Hillside Sand and Prairie du Chien aquifers during the first phase and subsequent phases.

General Monitoring Requirements

1. Representative Sampling.

All discharge, effluent, and air emission samples shall be taken at a point representative of the volume and nature of each discharge.

2. A Monitoring/Sampling Plan and Quality Assurance Project Plan (QAPP) will be submitted within thirty days after the initiation of operation. The test procedures shall be detailed in the QAPP and include calibration, maintenance,and testing procedures and custody procedures.

3. Record Keeping

   At a minimum the following shall be performed:

   a) All samples will be identified as to the exact place, time, date and person performing the sampling.

   b) The date of analyses, person performing the analyses, techniques, procedures and results of analysis.

   c) All records shall be retained and made available to the U.S. EPA upon request.

Monitoring Requirements - Groundwater

Initial Monitoring will be conducted according to a monitoring plan that was submitted in April 1987 and will be finalized within thirty (30) days of initiation of operation to incorporate the additional requirements in this ROD.

Monitoring Requirements - surface water

In the event that discharge to any surface water including Rice Creek is desired in the future a plan will be submitted for determination of nutrient loading. No increase in the base nutrient loading where Rice Creek exits the TCAAP boundary or any surface water shall occur due to discharge of treated water from extraction wells on TCAAP. No discharge to surface water shall occur without U.S. EPA review and approval.

Monitoring Requirements - effluent discharge

Effluent monitoring requirements of discharge are found in Table 2. The discharge flow will be monitored at each point of discharge.

Monitoring Requirements

The Agency for Toxic Substances and Disease Registry (ATSDR) has suggested a program for air monitoring be performed to assure that air emissions do not endanger public health. Many of the VOCs found at TCAAP including Trichloroethene are potent carcinogens when exposure is through inhalation.

U.S. EPA has modified this program to consist of air emissions monitored by an Organic Vapor Analyzer calibrated to trichloroethene (TCE) or similar equipment. The monitoring should occur at the TCAAP boundary and at the outlet of the air stripper stack. Air emissions should not register greater than 2 ppm at the TCAAP boundary and 20 ppm at the stack. Daily calculations of emissions based on air flow influent concentrations and effluent concentrations may be reported instead of OVA measurements at the stack. The frequency of monitoring shall be daily for the first week, and weekly thereafter. If either of these criteria values are exceeded, immediate notification will be given to MPCA and U.S. EPA for a determination based on the health risk imposed if operation of the plume interception system should continue.

Additional monitoring at the nearest down wind resident using a public water system should be performed. The time, date, direction of the wind, approximate wind speed and location of sample will be noted. An air sample will be taken near the dwelling and analyzed for VOC contaminants. This residential monitoring should occur six times during the first ninety (90) days of operation and monthly thereafter. All measurements will be taken while the system is operating. The residential monitoring program will be developed in cooperation with U.S. EPA and MPCA.

SYSTEM PERFORMANCE REQUIREMENTS OF SELECTED REMEDY

Operation - Criteria Level

During Phase 1, operation of the existing system may not fully protect health and the environment. However, some degree of protection will be achieved by reducing the amount of VOC contamination migrating off-TCAAP in the groundwater. This reduction is an immediately achievable and desirable product of operation. The constraints on this operation are to ensure that no endangerment to public health and the environment occurs due to the opertion of the existing system. Thus, the constraints apply to the protection of the receptors of discharges and emissions of the system.

Because the treated water is to be used for drinking water and process water at the plant all the limits at the plant should meet state and federal standards for drinking water. U.S. EPA has decided that the cumulative risk for carcinogens (cancer causing substances) of 10^{-6} (one in a million incremental cancer risk) is a desirable goal. The State of Minnesota has a standard based on 10^{-5} risk levels (Recommended Allowable levels) for private water supplies. The risk associated with the in-plant use of treated water should not exceed 10^{-6} incremental cancer risk. The carcinogenic criteria of a cumulative carcinogenic risk of 1×10^{-6} was choosen based on an assessment of risks. The criteria falls within the acceptable range of 10^{-4} to 10^{-7}. The U.S. EPA "Guidance Document for providing Alternative Water Supplies" (August 1987) suggests 10^{-6} risk level as a common target. Similarly the U.S. EPA "Alternate Concentration Limit Guidance" (Oswer Directive 94981.00-6C, July 1987) defines a level of 10^{-6} as "a point of departure" and requires justification for using a different level of risk for exposure levels at receptors. It is

expected that the additional treatment through the existing carbon filtration system used for in-plant production water supply will ensure that water used on TCAAP will meet a cumulative risk-based criteria of 10^{-6} for carcinogens.

Water from the air stripper will also be discharged to the gravel pit. Water discharged at the gravel pit must at least meet the contaminant specific requirements column of Table 1. The discharged water leaving the boundary should have contaminant levels that add to an excess cancer risk below 1×10^{-6} at the nearest receptor. The demonstration of the achievement of this level of protection shall be the current risk levels used to calculate the total risk from carcinogens as given in Table 1. The risk levels currently used by U.S. EPA shown on Table 1 are subject to modification based on new information on health impacts.

The non-carcinogenic substances at the receptors shall not exceed the values in the Acceptable Risk Column of Table 1. A summary of criteria levels to be applied to the phases of operation is given in Table 3.

System Capture

The specific objective of the system is to prevent migration of VOC contaminated groundwater in both the Hillside Sand Aquifer and the Prairie du Chien/ Jordan Aquifer at the Southwest boundary of TCAAP. The system, after completion of Phase 2, shall prevent migration of all contaminated groundwater in the two aquifers which has concentration of contaminants that exceeds the criteria levels. Additional modifications may be required to achieve the criteria levels. The criteria levels may be changed for the second phase based on an assessment of health impacts by U.S. EPA.

System Treatment

All water discharged after treatment will meet the contaminant specific requirements in Table 1 during Phase 1. During Phase 2, standards may be required based on actual operation data and health risk data. Additionally at no time will a receptor of discharged water be exposed to a cumulative risk due to the discharged water greater than that of 1×10^{-6} for carcinogens or concentrations in excess of the chronic acceptable intake concentrations for non-carcinogens.

Air Emissions

The concentration of TCE in the air emissions is expected to be 76 ug/liter of air measured at the air stripper exit. This emission compares favorably to the Threshold Limit Value - Time Weighted Average (TWA) of 270 ug/liter (270 mg/m^3). The TWA is published by the American Conference of Government Industrial Hygienists and is a value expected not to have adverse affects on nearly all workers exposed to that concentration over a normal work week.

A study by the U.S. EPA of the data collected during the ninety (90) day trial

period in Phase 1 will be conducted, to assess the need for additional controls to adequately protect human health and the environment from long term (chronic) exposure from VOC emissions. No short term or acute health effects are anticipated from the air emissions of the air stripper. The expected concentrations of the emitted TCE (the major carinogen contaminant by volume) are expected to be well below 10^{-6} risk levels at the boundary of TCAAP. Monitoring to assure that no impacts on public health occur is incorporated as part of this ROD.

System Effectiveness

The initial 90 days of operation (Phase I) will be used to collect data on groundwater capture in both aquifers. If groundwater capture does not meet the requirements or the treatment system requires modification, a plan to modify the system to meet the objectives will be submitted to the U.S. EPA and MPCA within sixty (60) days of conclusion of Phase I (150 days from initial operation date).

Within 150 days of acceptance by U.S. EPA, construction and operation of the modifications will begin.

Facilities Operation and Quality Control

Within sixty (60) days of Phase I start-up of the system a detailed operation plan shall be submitted to the U.S. EPA and the system shall be operated in a manner consistent with the following:

a) Maintenance of the treatment facility that will result in degradation of effluent quality shall be scheduled as much as possible during non-critical water quality periods and shall be performed in accordance with a work plan subject to Part XIV of the Agreement, that has passed the Consistency Test.

b) The Operator shall provide an adequate operating staff which is duly qualified to carry out the operation, maintenance and testing functions required to insure compliance with the performance requirements of the system.

c) The system shall at all times be maintained in good working order. The system shall operate as efficiently as possible, all facilities or systems of control installed or used to achieve the necessary levels of control.

d) Necessary in-plant control tests shall be conducted at a frequency adequate to ensure continuous efficient operation of the treatment facility.

e) Solids, or other pollutants removed from or resulting from treatment or control of wastewaters shall be disposed of in such manner as to prevent any pollutant from such materials from entering surface waters. The disposal of such materials shall comply with all applicable Statutes and Regulations.

f) Adequate safeguards to prevent the discharge of untreated or inadequately treated groundwater shall be maintained at all times. System reliability shall be maintained by means of alternate power sources, back-up systems, storage of inadequately treated effluent, or other appropriate methods.

Notification of upsets or emergency situations

If for any reason the system does not meet a discharge requirement or a capture criteria, an emergency situation develops, by-pass is required or the system does not operate as planned notification of the U.S. EPA and MPCA will occur immediately.

The notification shall include:

1. A description of the incident, the amount of discharge and cause.

2. The period of the incident including dates and time, and anticipated time to correction and steps taken or planned.

Gravel Pit Water Balance

Within thirty (30) days, a water balance study to confirm that soil permeability at the gravel pit will accommodate the discharge from the Hillside Sand and Prairie du Chien Aquifers gradient control system will be performed. In order to accommodate rapid implementation, this may be submitted in phases, the first water balance report shall reflect the existing six well gradient control system using estimates . A second water balance shall be submitted at the time of submittal of a proposal for any modifications for Phase 2 using past data.

An annual water balance study shall be submitted incorporating all site meteorological and anthropogenic sources or sinks of water to the infiltration basin. Monthly precipitation, temperature, change in infiltration basin water levels, potential evaporation, effluent discharge and run off received will be incorporated in the water balance study and recharge to the aquifer will be estimated.

Schedule

This summary of operation is as follows:

1. Operate the system for a ninety (90) day trial period and collect data on groundwater capture, air emissions, and the treated water.

2. Within 150 days of initiation of Phase I (60 days after Phase I trial period) submit a plan to U.S. EPA and MPCA which either; a) demonstrates that the system meets the requirement for operation or; b) proposes modifications to the system to achieve the requirement and criteria

in Table 1. The plan shall contain a schedule for implementation of the modification.

3. Within 150 days of the U.S. EPA issuance of notice of an acceptable plan for modifications in Phase 2, the modifications shall be constructed and begin operation.

Studies, Reports and Plans

A schedule of documents to establish the operation characteristics of the system is as follows:

1. Initial operation - Phase 1

Monitoring/Sampling Plan	- 30 days after initiation
QAPP	- 30 days after initiation
Operation and Maintenance Procedure Plan	- 60 days after initiation
Monitoring reports	- periodically as per Table 2

2. Demonstration of adequacy of proposal for modification including: - 150 days after start up of initiation

   Work plan for modification
   Monitoring Plan modification
   Sampling Plan
   QAPP
   Schedule

3. Operation of modification - Phase 2 - 150 days after U.S. EPA issuance of an acceptable plan

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, AND OTHER STANDARDS TO BE CONSIDERED

Two key components of the hydraulic gradient control system require consideration of media-specific environmental laws, regulations and standards. The components are: (1) capture criteria for contaminated groundwater, and (2) water discharges and air emissions. Contaminated groundwater will be captured by the extraction wells for treatment, air emissions will occur into the ambient atmosphere from the air stripper unit and treated water will be discharged from the treatment system into either the infiltration basin or the TCAAP potable and in-plant process water supplies. These activities must be conducted in a manner which complies with all applicable or relevant and appropriate requirements as required by Section 121 of CERCLA, as amended, 42 U.S.C. §9621.

The two medium-specific laws applicable or relevant and appropriate to operation of the hydraulic gradient control system are the Clean Air Act, 42 U.S.C. §7401, et seq, and the Safe Drinking Water Act, 42 U.S.C. §300f, et seq. In addition, the gradient control system shall be operated so as not to create an incremental cancer risk for carcinogens in excess of 1×10^{-6} for human receptors. A summary of capture criteria and discharge and emission limitations to be applied to the gradient control system which were drawn from the Clean Water Act, the Safe Drinking Water Act and incremental cancer risk calculations are listed in Table 3.

AIR

The air stripper shall remove at least 98% of the VOC contamination from the extracted groundwater. To achieve this efficiency the system must discharge VOCs into the ambient air at TCAAP. However, the air stripper must be operated in a manner which causes no unacceptable health risks and which causes no unacceptable degradation of ambient air quality. The system must also be operated in a manner meeting the emission limitations set forth in the System Performance requirements section of this Record of Decision.

The Minneapolis/St. Paul area is treated as an "attainment" area with respect to ozone National Ambient Air Quality Standards ("NAAQS"), 40 CFR Part 81.324, and identical State Ambient Air Quality Standards ("SAAQS") found at Minn. Rules 7005.0080. However, emissions of VOCs from TCAAP must be consistent with the State Implementation Plan designed for maintenance of NAAQS and SAAQS, and with requirements established by the State for new emission sources, Minn. Rules 7005.0115.

Pursuant to federal regulations, the TCAAP facility is currently considered a minor VOC source. A minor source generates less than 100 tons/year of VOC emission. 42 U.S.C. §7602(j). The gradient control system at TCAAP constitutes a modification to a minor emission source. Pursuant to Prevention of Significant Deterioration ("PSD") regulations, 40 CFR Part 52, a newly constructed source or a modification to a minor source may emit up to 250 tons/year of VOCs without being subject to PSD regulations. VOC emissions from the air stripper are estimated to be approximately 5 tons/year (26 lbs/day in groundwater x 365 days = 9490 lbs/year = approx. 5 tons/year). Neither the air stripper component nor the

TCAAP facility will emit VOCs in excess of the 250 tons/year threshold established by U.S. EPA for PSD.

State law is applicable to the air stripper component of the system. State rules provide that an emission facility with potential (worse case) emission in excess of 25 tons/year of criteria pollutant (e.g. VOC) must seek and obtain a State air emission facility permit. Minn. Rules 7001.1210. The State has determined that the TCAAP facility, including the air stripper, will have potential emission capacity of VOC in excess of 25 tons/year.

Pursuant to State requirements found at Minn. Rules 7001.1212, and consistent with Section 121(e) of CERCLA, 42 U.S.C. §9621(e), the Army shall submit a Notice to the State of intention to operate the air stripper. This notice shall provide the State with all information necessary to evaluate the emission source. The information shall include an estimate of VOC emissions from the air stripper under maximum load/worst case conditions as well as an estimate of VOC emissions from the TCAAP facility (including all sources) under maximum load/worst case conditions. This Notice to the State shall stand in lieu of an application for a State air emission facility permit for the air stripper.

In the absence of Section 121(e)(1) of CERCLA, 42 U.S.C. §9621(e)(1), upon review of the Notice and/or data compiled from Phase I operation of the air stripper, the State could issue permit conditions for operation of the air stripper. However, because any such conditions constitute non-promulgated State requirements, any conditions recommended by the State for operation of the air stripper shall be forwarded to U.S. EPA for review. The State's recommendations will be implemented as necessary to ensure adequate protection of human health and the environment.

Additional operating requirements and controls may be requested at any time by U.S. EPA as determined necessary during the useful life of the system. Additional operating requirements may necessitate modification of the system to adequately protect human health and the environment based upon risk calculations using Phase I data from actual operation of the system.

Section 112 of the Clean Air Act, 42 U.S.C. §7412, identifies certain pollutants for which no NAAQS apply, but which cause or contribute to air pollution and which may reasonably be anticipated to result in an increase in mortality, serious irreversible or incapacitating reversible illness. U.S. EPA has established National Emission Standards for Hazardous Air Pollutants ("NESHAPs") to regulate emissions of certain such pollutants.

NESHAPs are source specific (i.e. industrial catagories) regulations promulgated for certain hazardous pollutants including: arsenic, asbestos, benzene, beryllium, mercury, radionuclides and vinyl chloride. Of these pollutants, benzene, radionuclides (primarily radon) and vinyl chloride may be of concern at TCAAP.

NESHAP standards apply to specific industrial sources which do not include the air stripper unit of TCAAP. However, since hazardous air pollutants will be emitted from the system, NESHAP standards are considered relevant and appropriate to operation of the air stripper. The relevant and appropriate NESHAP standards are as follows:

Pollutant	emission standard
benzene	no detectable emission (500 ppm detection limit)
radon 222	proper design and operation of source (applies to mining operations)
vinyl chloride	10 ppm

In addition to the named NESHAP pollutants, U.S. EPA has identified additional suspected hazardous pollutants of concern. A partial list of these pollutants is found at 40 CFR Part 61.02(b). Emissions of named NESHAP pollutants and of suspected hazardous pollutants from the air stripper will be regulated as necessary to protect human health and the environment. A level of protection of at least 1×10^{-6} incremental cancer risk for carcinogens, considering cumulative effects, will be achieved during operation of the system.

Water Discharge

The gradient control system will extract groundwater, treat the groundwater, and discharge the treated groundwater to either the aquifer system via an on-site infiltration basin or to the TCAAP in-plant potable and process water supplies. Both receptors of treated groundwater, the aquifer and the in-plant water system, provide a potential source of drinking water. Therefore, the discharge of treated water must meet or exceed water quality standards established for drinking water supplies.

Discharge limitations for operation of the system have been set forth in the Contaminant Specific Requirements column of Table 1. These discharge limitations have been derived from Maximum Contaminant Levels ("MCLs") and non-zero Maximum Contaminant Level Goals ("MCLGs") of the Safe Drinking Water Act ("SDWA"), recommended allowable limits ("RALs") proposed by the State, and U.S. EPA Health Effects Advisories.

The SDWA establishes Maximum Contaminant Levels ("MCLs") for drinking water supplied from an underground source of drinking water through a public water supply. MCLs are relevant and appropriate standards to apply to discharges from the system because such discharges may combine with drinking water supplies. For those contaminants for which MCLs have not been developed, SDWA non-zero MCLGs, RALs, and U.S. EPA Health Effects Advisories have been utilized as relevant and appropriate requirements to establish discharge limitations.

The discharge limitations set forth in the Contaminant Specific Requirements in Table 1 are sufficient to ensure adequate protection of human health and the environment from acute adverse health effects from discharges from the system to a potential source of drinking water. The discharges of treated water will be sampled as set forth in Table 2 to ensure compliance with the limits set forth in the Contaminant Specific Requirements of Table 1.

In addition to the Contaminant Specific Requirements, no human receptor of drinking water affected by the system (downgradient users of drinking water and users of TCAAP in-plant drinking water) shall be exposed to concentrations of any contaminant which exceeds levels established as Acceptable Risk Levels in Table 1. The receptor-based Acceptable Risk Levels have been established for single carcinogens by determining the maximum allowable concentration for each carcinogen in drinking water which may be ingested in a human receptor's lifetime which will not exceed an incremental cancer risk of 1×10^{-6} for the human receptor. In addition, no human receptor shall be subject to cumulative incremental cancer risk in excess of 1×10^{-6} from multiple carcinogens. Therefore, no receptor shall be exposed to drinking water affected by this system which contains multiple carcinogens at concentrations which create a cumulative lifetime incremental cancer risk in excess of 1×10^{-6}.

The receptor-based Acceptable Risk Limits have been established for non-carcinogen contaminants based on Federal Water Quality Criteria of the Clean Water Act, adjusted for ingestion of drinking water only, and Acceptable Intake Concentrations for chronic health effects. These Acceptable Risk Levels are listed in the Superfund Health Evaluation Manual. (EPA/540/1-86/060 October, 1986).

CAPTURE CRITERIA

In addition to the discharges and emissions from the system, capture criteria are established to determine which groundwaters located at TCAAP must be treated by the system. The Hillside Sand and the Prairie du Chien/Jordan aquifers are primary drinking water supplies. Therefore, VOC capture criteria have also been established using SDWA MCLs and nonzero MCLGs, RALs, and U.S. EPA Health Effects Advisories. The VOC capture criteria are set forth in the Contaminant Specific Requirements for VOCs listed in Table 1.

The gradient control system shall be operated until all groundwater flowing into the capture system, or migrating from the southwest boundary of TCAAP, meets or exceeds the established capture criteria.

Reduction of Toxicity, Mobility or Volume

All alternative pump-out schemes evaluated would result in similar reductions of toxicity, mobility or volume. All systems evalutated rely on an air stripper or carbon filtration or both. The contaminants of concern are VOCs migrating in the groundwater from the southwest boundary of the TCAAP. The design of the system using the existing equipment is to intercept 90% of the VOC contaminant loading in the groundwater. Treated extraction water will be used in-plant including potable water supply and the remainder discharged to the arsenal gravel pit for eventual recharge. Approximately 98% of the VOC contaminants captured will be emitted as air emissions.

Effectiveness of Remedy

The chosen remedy will not immediately reduce the short-term risks to users of

the drinking water aquifer. The velocity of the groundwater is relatively slow and the plume affecting current users, including the Cities of New Brighton and St. Anthony, will not be affected in the very short-term. However, the amount of VOC contaminants leaving the southwest boundary of TCAAP will be reduced immediately. If the system requires modification, the plan for modification will be developed within 150 days of initiation of operation. Operation of the modifications would be scheduled within 150 days of the submitting of an acceptable plan.

The pumping system requires continous operation and maintenance as well as detailed monitoring of both the ground water and the discharges. It is expected to cost approximately $8,1000 per month for groundwater monitoring, operation and routine maintenance in the current configuration. As stated previously, the discharge will meet all drinking water standards during all phases of operation. The VOC contaminant concentration in the groundwater migrating from the southwest TCAAP boundary (groundwater not captured) will at least meet drinking water standards at the conclusion of the final phase (approximately 13 months from initiation). Table 1 lists the pertinent VOC contaminants, the standards and associated carcinogen risks. The carcinogenic risk associated with the contaminant specific requirements total 4.5×10^{-4} under an assumption of additivity of risks. Tables 1, 2 and 3 in conjunction with the BGRS monitoring plan identifies all parameters monitored and the detection limits associated with the monitoring program for hazardous substances.

Implementability and Feasibility of Selected Remedy

This alternative was chosen because hydraulic gradient control systems such as the selected choice are a well known technology with a proven record of reliability. While it is expected by U.S. EPA that full control of the migrating VOCs will require further expansion of the system, the operation of the existing equipment (the six wells, air stripper and related equipment) can provide some some control of the contamination immediately.

Costs

The capital cost of planning, construction and other costs for the system currently existing is approximately 4 Million dollars. Monitoring and operating costs equal eight (8) to ten (10) thousand dollars per month (up to $120 thousand per year).

Further capital expenditures may occur within one year should additional extraction wells be required and significant capital costs will be incurred if treatment of the air emissions of the air stripper or replacement of the air stripper with other technologies is required to achieve adequate treatment of extracted water.

Significant efforts in review and analysis of the results of the initial ninety (90) days will be required by U.S. EPA and other reviewers of the material. Performance of analysis of the system operation and proposed modifications will require intensive efforts to assure timely modifications.

Community Acceptance

The community has expressed a strong support for a system such as the selected remedy. During the public comment period held by the U.S. Army reservations were expressed about the completeness of the system as it is currently designed. The system in its current configuration has a short trial period (90 days) and is scheduled to be fully modified in approximately one year.

Reservations also were expressed during the public comment period about the proposed use of the discharged treated water. The U.S. EPA feels that discharge to the Gravel pit and in-plant use are acceptable end uses for treated water.

State Acceptance

The State of Minnesota through the MPCA concurs with the concepts of a phased approach of a hydraulic gradient control system such as the selected remedy. The MPCA listed water quality standards for discharge at the air stripper are based on a 10^{-5} incremental cancer risk for carcinogens. The U.S. EPA requirements are based on a 10^{-6} incremental cancer risk for carcinogens at the receptor. To some degree, the state requirements are possibly stricter at the receptor due to dilution in the groundwater and the U.S. EPA standards are stricter for the in-plant users. Overall impacts are equivalent for either set of standards.

Overall Protection of Human Health and the Environment

The selected system will be operated so as to provide protection of users of the extracted water discharged in the groundwater and in-plant. The users of groundwater will not immediately have clean groundwater due to the slow travel time of groundwater. It is expected that if the system were 100% effective in halting the migration of VOC contaminants it would take 25-40 years for the remediation to be complete.

During all phases of the remedy the protection of receptors will be based on health criteria, while discharged water will at least meet drinking water standards. The cumulative carcinogen risk-based criteria for receptors of 1×10^{-6} is based on the generally accepted practice for exposure assessments and alternatives remedy development. (See for example Superfund Public Health Evaluation Manual-EPA 540/1-86/060 1986 and Guidance on Feasibility Studies under CERCLA April 1985.

TABLE 1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Substance	Contaminant Specific Requirements(a) (ppb)	Acceptable Risk Level(b) 10^{-6} (ppb)	Expected level in discharge (ppb)
VOLATILE ORGANIC COMPOUNDS (VOC)			
BENZENE	5 (MCL)	0.67	ND
TOULUENE	2000 (MCLGP)	-	ND
CIS 1,2-DICHLOROETHENE plus TRANS 1,2-DICHLOROETHENE	70 (MCLGP)	-	<1
1,1-DICHLOROETHENE	7 (MCL)	0.033	<1
1,1,1-TRICHLOROETHANE	200 (MCL)	22	<1
1,1,2-TRICHLOROETHANE	6.1 (RAL)	0.6	<1
1,2-DICHLOROETHANE	5 (MCL)	0.38	-
1,1,2-TRICHLOROETHENE	5 (MCL)	2.8	<5
1,2-DICHLOROPROPANE	6 (MCLGP)	0.56	-
1,1,2,2-TETRACHLOROETHANE	6.9 (RAL)	0.7	-
CARBON TETRACHLORIDE	5 (MCL)	0.3	-
1,1,2-TRICHLOROTRIFLOUROETHANE	- (GA)	-	-
CHLOROFORM	5 (RAL)	0.19	<1
VINYL CHLORIDE	2 (MCL)	0.015	<2
XYLENE	440 (MCLGP)	-	ND
1,1-DICHLOROETHANE	- (GA)	-	-
METALS			
ARSENIC	50 (MCL)	0.25	NA
BARIUM	1000 (MCL)	1000 (MCL)	NA
CYANIDE	200 (MCL)	200 (WQC)	NA
CADMIUM	5 (MCLP)	10 (WQC)	NA
LEAD	20 (MCLGP)	0.031	NA
NICKEL	150 (HA)	15.4 (WQC)	NA
MERCURY	2 (MCL)	2.0 (MCL)	NA

TABLE 1 - CONTINUATION

Substance	Contaminant specific requirements(a) (ppb)	Acceptable Risk Level(b) 10^{-6} (ppb)	Expected level in discharge (ppb)
CHROMIUM	50 (MCL)	50 (MCL)	NA
ZINC	5000 (MCL)	500 (WQC)	NA
POLYCHLORINATED BIPHENYL			
TOTAL		0.008	NA
RADIONUCLIDES			
total ALPHA EMITTING	15 pci/l (MCL)		
total BETA EMITTING	50 pci/l (MCL)		
total GAMMA EMITTING	50 pci/l		
RADON			
AIR EMISSIONS			
RADON (At stack)			
VOC (total at stack)	20ppm (ATSDR)		
VOC (total at boundary)	2ppm (ATSDR)		
BENZENE	500ppm (CAA § 112)		
VINYL CHLORIDE	10ppm (CAA § 112)		

Notes for Table 1

(a) Applicable to all phases, capture and discharge
(b) Receptor based criteria for Phase 2. Laboratory detection limits may be substituted for criteria levels with U.S. EPA approval. Values are based on 10^{-6} risk level for carcinogens and for non-carinogens the stricter limit determined by MCL, AIC or Water Quality criteria adjusted for ingestion of drinking water only.

* MCL Maximum Contaminant Level
* MCL Maximum Contaminant Level Proposed
* MCLG Maximum Contaminant Level Goal
* MCLGP Maximum Contaminant Level Proposed
* HA Lifetime Health Advisory
* RAL Recommended Allowable Level - State of Minnesota
* SMCL Secondary Maximum Contaminant Level
* ND None detectable
* NA Not significantly affected by remedy - not expected to be migrating from sources and will remain at background levels

* CAA Clean Air Act
* AIC Chronic Acceptable Intake
* WQC Water Quality Criteria - adapted for ingestion of drinking water only - concentrations represent 1 x 10^{-6} risk levels

* GA Group Action Criteria of 10 ppb adopted

* ATSDR Agency for Toxic Substances and Disease Registry recommended action level for BGRS.

Table 2

EFFLUENT MONITORING REQUIREMENTS

Characteristic	Measurement Frequency
Flow-m^3/day (MGD) (influent, effuent)	continous
Influent total VOC (2)	quarterly (1)
Influent trichloroethene	quarterly (1)
Effluent total VOC (2)	quarterly (1)
Effluent trichloroethene	quarterly (1)
Phosphorus-total	monthly
Phosphorus-ortho	monthly
Lead-total	quarterly
Zinc total	quarterly
Chromium total	quarterly
Copper total	quarterly
Nickel total	quarterly
Cyanide	quarterly
Mercury	quarterly
Trichloroethene	quarterly (1)
PH	quarterly (1)
Arochlor 1248	annual (3)
Arochlor 1260	annual (3)
Arochlor 1254	annual (3)
Arochlor 1242	annual (3)
Arochlor 1016	annual (3)
Radionuclide group (4)	
gross alpha scans	quarterly
gross beta scans	quarterly
gross gamma scans	quarterly
radon 222	quarterly/weekly
Substances on Table 1	monthly (5)

(1) Samples shall be be weekly for first 90 days following start-up monthly for the remainder through the first 12 months of operation and quarterly thereafter. More frequent monitoring maybe required on the first 90 days of operation of any modifications of system.

(2) Total VOC includes all parameters on Table 1.

(3) Total sampling frequency shall be monthly for first year an quarterly thereafter.

(4) If substances over criteria table 3 then identify scource compound.

(5) Samples shall be taken at least four times during 90 day trail period (days, 30, 60, 90) and monthly thereafter. Air emission monitoring requirements is given in text.

TABLE 3

SUMMARY OF CRITERIA LEVELS

Period of Operation	Criteria for Substances migrating from TCAAP
Phase I (day 0 - 345)	discharge criteria = contaminant specific
- initial operation (day 0 -90)	capture criteria = none
- data evaluation and modifications proposal (day 90-150)	receptor criteria = 1×10^{-6} or AIC
- U.S. EPA/MPCA review of modification (day 150-345)	
- Construction of modification (day 195-34)	
Phase 2	
- operation of modified system (after day 345)	discharge criteria = contaminant specific capture criteria = contaminant specific receptor criteria = 1×10^{-6} or AIC
Later Phases (not anticipated-required if phase 2 criteria not achieved)	
- operation of further modifications if required to achieve or maintain criteria levels for phase 2	

*** Notes

* discharge criteria applies to discharge of the air stripper and refers to contaminant specific levels (eg MCL) of table 1.

* capture criteria applies to groundwater migrating off-TCAAP in both the Prairie du Chien/Jordan and Hillside Sand aquifers at the southwest boundary of TCAAP.

* receptor criteria applies to only the treated water leaving the carbon treatment system for ON-TCAAP use and to only the treated groundwater at the nearest receptor (generally at the boundary).

* AIC refers to chronic acceptable intake concentration for drinking water only.

* 1×10^{-6} refer to total cumultative risk of all carcinogens estimated to be 1×10^{-6} or less

* contaminant specific refers to contaminant specific requirements (eg MCL, RAL, or AIC)

ATTACHMENT 2

RESPONSIVENESS SUMMARY

TWIN CITIES ARMY AMMUNITION PLANT (TCAAP), NEW BRIGHTON, MINNESOTA
BOUNDARY GROUND-WATER RECOVERY SYSTEM
RESPONSIVENESS SUMMARY

This community relations responsiveness summary is divided into the following sections:

Section I — Overview. This section discusses the U.S. Environmental Protection Agency's (U.S. EPA) preferred alternative for interim action, and likely public reaction to this alternative.

Section II — Background on Community Involvement and Concerns. This section provides a brief history of community interest and concerns at the TCAAP site.

Section III — Summary of Major Comments Received during the Public Comment Period and the U.S. EPA responses to the Comments. Both written and oral comments are categorized by relevant topics. U.S. EPA responses to these major comments are also provided.

Section IV — Remaining Public Concerns. This section describes remaining community concerns that U.S. EPA, MPCA, and U.S. Army should be aware of in conducting the interim action at the TCAAP site.

I. OVERVIEW

As noted previously in this ROD, the TCAAP site is unique in that it is the first ROD signed for a Department of Defense federal facility since the passage of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the first action to be implemented under an inter-agency agreement between the Department of Defense and U.S. EPA. At the time of the public comment period, an agreement had not been reached between U.S. EPA, MPCA, and the U.S. Army regarding each organization's roles, responsibilities, and authority at the site. An agreement was announced between these three organizations on July 24, 1987, and is refered to in this responsiveness summary as the "Agreement."

In May 1987, the U.S. Army held a public comment period on this proposed interim action, which was referred to at that time as a proposed ROD. This proposed interim action consisted of a boundary ground-water recovery system -- a series of six wells that would draw contaminated ground water migrating off the southwest boundary of the TCAAP facility; treat the ground water with air stripping; and use a portion of the treated water for in-plant use after carbon filtration; The remaining portion was to be discharged to the aquifer through a gravel pit on the TCAAP facility. The comments responded to in Section III of this responsiveness summary were initially addressed to the U.S. Army on its proposed interim action, not to U.S. EPA.

U.S. EPA's final alternative for interim action concurs with the U.S. Army's choice of a ground-water recovery system, with modifications to the capture criteria and deadlines for meeting these

criteria. The modifications were, in part, based upon comments received during the public comment period. Additionally, U.S. EPA's final alternative for interim action allows for effluent discharge to points other than the aquifer. This was initially evaluated and proposed by the U.S. Army, who later withdrew it from their preferred interim action.

Judging from the comments received during the comment period, the public would strongly support U.S. EPA's final alternative for interim action as a first step in addressing contamination associated with the site. As detailed in Section IV of this responsiveness summary, however, the public has numerous remaining concerns regarding the site. This action by U.S. EPA supplements the decision proposed by the U.S. Army and presented to the public.

II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Contaminated ground water has been an issue of very high concern in the community since it was initially discovered by MPCA in 1981. In the six years since the initial discovery, a number of residential and municipal wells have been abandoned because of high levels of Volatile Organic Compounds (VOCs).

Under the provisions of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA), U.S. EPA and MPCA have taken a number of actions in the New Brighton/Arden Hills/St. Anthony area, including replacement of municipal wells in New Brighton and St. Anthony and the initiation of a region-wide comprehensive study of the contamination, called a Remedial Investigation/Feasibility Study (RI/FS).

The major suspected source of contamination of the area is the U.S. Army's TCAAP facility. Also beginning in 1981, the U.S. Army began its own investigation of contamination at TCAAP, with the assistance of Honeywell, Inc., which operates a facility under contract at TCAAP. The U.S. Army's investigation, until recently, has been loosely coordinated with MPCA and U.S. EPA.

Although the U.S. Army has taken some steps to address the problem (beginning in 1983 the U.S. Army began supplying bottled water to six residences adjacent to the southwest boundary of TCAAP. Subsequently, these residences, along with others in the area, have been connected to municipal water systems), the general public and elected officials have been vocally and consistently negative towards the U.S. Army's efforts. The public feels that the U.S. Army has attempted to conceal the problem and avoid responsibility. Beginning in 1984, a series of lawsuits were brought against the U.S. Army by the Cities of New Brighton and St. Anthony, and a number of citizens living in the area, for property damage and personal injury. Final outcome of these suits is still pending.

The focus of community concerns has been possible health effects from contamination at the site, the apparent delays in getting the site cleaned up, and the role and responsibility of the U.S. Army in addressing these concerns.

III. SUMMARY OF PUBLIC COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD AND EPA RESPONSES

Comments raised during the TCAAP public comment period are summarized below. The U.S. Army held the public comment period between May 10 and June 1, 1987, to receive comments on the proposed interim action: Phase I Boundary Ground-Water Recovery System, or BGRS. In addition to the public comment period, the U.S. Army held a public meeting on May 20, 1987 to take comments and answer questions. In addition to comments from EPA, the U.S. Army received written comments from 10 individuals. Four other individuals made verbal comments only. These 14 commentors, their affiliations, and date and means of comments are detailed in Appendix A. The comments received during the comment period are categorized by relevant topics.

A. Public Input and Participation

1) The Minnesota Pollution Control Agency (MPCA) commented that the opportunity for public comment on the BGRS should have occurred prior to the design of the system so that the system design could take into consideration MPCA's and the public's comments.

   U.S. EPA Response: Comment noted. U.S. EPA's ROD takes into account the immediate availability of the U.S. Army system and the modifications requested by the State of Minnesota.

2) "Preserve Our Land" commented that the documents that the public was asked to comment on at the May 20, 1987 public meeting were not placed in the St. Anthony Library until several hours prior to the meeting, making it impossible to read before the public meeting.

   U.S. EPA Response: Comment noted.

B. Application of Federal Statutes

1) Briggs & Morgan commented that contrary to the provisions of Section 117 of SARA, the U.S. Army has not provided an analysis of alternative proposals that were considered and rejected. Additionally, "Citizens for a Better Environment" (CBE) commented that it was not clear what other treatment options were considered.

   U.S. EPA Response: The GRAAA prepared by the U.S. Army did provide analysis of alternative remedial actions. U.S. EPA notes that these comments are valid for the text of the ROD, however, U.S. EPA is faced with a completed system vs. alternatives that would take some time to complete. Because U.S. EPA has determined that operation of the existing six wells will provide some degree of protection, it is advisable to start intercepting contaminated ground water now and modify the system as required to provide complete protection of human health and the environment.

2) MPCA commented that the Ground Water Remedial Action Alternatives Analysis (GRAAA) outlines six ground-water extraction scenarios. The BGRS, as described, does not conform to any of the six scenarios. Selection of a remedy that was not discussed as an alternative is inconsistent with the procedures in CERCLA and the NCP.

U.S. EPA Response: This ROD is the U.S. EPA decision. The proposed BGRS is different than the six alternatives in the GRAAA. A decision different than alternatives is not contrary to statute (CERCLA/SARA) or regulation (the NCP). The U.S. EPA decision is to operate the six wells as partial fulfillment of the Hillside Sand aquifer gradient control system required in Attachment 2 of the Interagency Agreement. After 90 days from the time of initial operation the system shall be reviewed for adequacy of control and level of treatment provided in both the Hillside Sand and Prairie du Chien/Jordan aquifers, and modifications will be designed, constructed and operated on schedule.

3) MPCA commented that the BGRS is a remedial action, and, therefore, requires the U.S. EPA Administrator's approval.

U.S. EPA Response: Comment noted and agreed with.

4) Briggs & Morgan commented that the U.S. Army did not establish a Technical Review Committee, as provided for in Section 211 of SARA, to review the BGRS.

U.S. EPA Response: A Technical Review Committee is not required in every instance, and is not an approving body for Remedial Actions. Remedial Actions are a joint decision between the federal agency and U.S. EPA according to Section 120 except in instances of disagreement where the U.S. EPA Administrator makes the final determination. However, it is the understanding of U.S. EPA that the U.S. Army does intend to set up a Technical Review Committee and has begun planning for one.

5) Briggs and Morgan commented that contrary to the provisions of Section 120 of SARA, neither the City of St. Anthony nor the State of Minnesota were invited to participate or included in the planning or selection of the BGRS.

U.S. EPA Response: Comment noted.

6) MPCA commented that the contemplated Phase II and Phase III activities conducted by the U.S. Army must be consistent with the conclusions of the regional MPCA/U.S. EPA RI/FS currently under way and with CERCLA.

U.S. EPA Response: Comment noted. The Agreement will ensure this to be so.

7) MPCA commented that it does not agree with the U.S. Army's interpretation of factors applied in selection of Applicable or Relevant and Appropriate Requirements (ARARs). As stated in CERCLA Section 120(a)(2), "all guidelines, rules, regulations and criteria... applicable to remedial actions...shall also be applicable to facilities which are owned or operated by...the United States..."

U.S. EPA Response: The U.S. Army decision relied only on promulgated rules that are legally applicable. The correct interpretation is that guidelines, rules, regulations and criteria may be relevant and appropriate even if not legally applicable.

8) MPCA commented that ARARs apply both to treatment prior to discharge and ground-water cleanup.

U.S. EPA Response: U.S. EPA agrees with the MPCA comment and has incorporated it into this ROD.

9) CBE commented that water quality criteria and ARARs should be applicable to all phases of the remedial action.

U.S. EPA Response: U.S. EPA agrees with the CBE comment and has incorporated it into this ROD. Drinking water standards will apply to all discharged water. Users of the treated water will be protected to an even greater degree.

C. Application of State Statutes

A number of the comments received regarding the application of state statutes dealt specifically with State permits regarding the BGRS. The U.S. Army was granted State permits for the BGRS by the Minnesota Department of Natural Resources (MDNR) and MPCA. A number of the comments received, therefore, address the BGRS in reference to these permits. The U.S. Army, in responding to these comments, claimed that because the BGRS was a remedial action, it no longer required these permits.

The U.S. Army is correct in that remedial actions do not require a permit. However, the remedial action must meet all substantive and procedural requirements of such permits. In short, all reqirements of a permit must be met, even though the physical paper of a permit is not required.

Exceptions to meeting the requirements are possible with special notices to the State and other conditions. No exception to the permit requirement is desired for the Gradient Control System in this ROD.

1) CBE commented that modification provisions are not specified in the U.S. Army's proposed interim action document. Additionally, MPCA commented that the Army has not submitted documents outlining modification provisions for ensuring capture of VOC-contaminated water in other regional aquifers. The National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) Permit specifically outlines the procedures necessary to address all regional ground-water contamination emanating from TCAAP.

U.S. EPA Response: This ROD incorporates the same type of provisions as the NPDES/SDS permit and the potential need for modifications. A schedule for modifications is incorporated in this ROD. The attachment to the NPDES/SDS permit was adopted from the Agreement then being negotiated. These requirements are now in the signed Agreement.

2) MPCA commented that the MPDES/SDS Permit establishes water criteria for ground-water migrating off TCAAP. The BGRS must be modified, within the appropriate time frames to meet these criteria.

U.S. EPA Response: This ROD incorporates the same type of provisions as the NPDES/SDS permit and the potential need for modifications. A schedule for modifications is incorporated in this ROD and are consistent with that in the Agreement.

3) MPCA commented that the U.S. Army must submit to MPCA an Air Quality Emissions Facility Permit Application. MPCA does not view the BGRS as a separate facility for the purpose of an air quality permit. Rather, the TCAAP facility includes all air emissions sources, including the BGRS. The U.S. Army must consider compliance with Best Available Control Technology (BACT) to address air emissions from the TCAAP facility.

U.S. EPA Response: In consultation with MPCA, this ROD incorporates provisions for emission controls should the need be demonstrated based on the initial 90 days of operation.

4) MDNR commented that it considers the initial 90 days of pumping to be a test of the system and the State Permit (MDNR Appropriation Permit 87-6048) will be amended based on the findings of data collected during this period.

U.S. EPA Response: Comment noted.

5) The City of New Brighton commented that it supports State Disposal System Permit No.: MN0056952, and MDNR Appropriation Permit 87-6048 and believes the U.S. Army should comply with both.

U.S. EPA Response: Comment noted.

6) MPCA and CBE commented that, regarding applicable State standards for raw water supplies and surface water discharges, it appears from review of the U.S. Army's proposed interim action document that the U.S. Army has chosen to use only numeric standards from Chapter 7050 and has not addressed the impact of narrative standards in this Chapter as it would affect ARARs. These narrative sections allow the MPCA to derive criteria and set standards to protect human health consumption of water and aquatic organisms, and protect aquatic life from acute and chronic toxicity, test impairment and bioaccumulation in ground water and surface waters as appropriate. These are essentially the same criteria, which the proposed interim action document has identified as relevant and appropriate on page five as Federal ARARs. MPCA commented that any discharge into Rice Creek would be in direct violation of the NPDES/SDS Permit.

U.S. EPA Response: Comment noted. ARARs are incorporated in with the capture zone (ground-water cleanup) and discharge requirements of this ROD. It should be noted that ARARs are minimum standards and the first priority is the protection of public health and the environment.

7) CBE commented that the U.S. Army BGRS needs to comply with:

- MN Rules Ch. 7050.0210 STANDARDS FOR DISCHARGE TO WATERS OF THE STATE, specifically Subparts 6, 9 and 14.

- MN Rule Ch. 7050.0220 SPECIFIC STANDARDS OF QUALITY AND PURITY FOR DESIGNATED CLASSES OF WATERS OF THE STATE.

- MN Rules Ch. 7060.0600, Subpart 4 Toxic pollutants.

U.S. EPA Response: Comment noted. ARARs are incorporated in with the capture zone (ground-water cleanup) and discharge requirements of this ROD. If should be noted that ARARs are minimum standards and the first priority is the protection of public health and the environment.

D. Regional Extent and Responsibility of Contamination

1) Briggs and Morgan, the City of St. Anthony, Bruce A. Liesch and MPCA, all commented that it is arbitrary to assume that the plume of contaminated ground water only reaches as far as the City of New Brighton, and that significant data exists to indicate that TCAAP contamination extends beyond the New Brighton municipal wells. Several of these commentators go on to say that TCAAP is the source of a regional contaminant plume that has contaminated wells in St. Anthony.

U.S. EPA Response: U.S. EPA and MPCA agree (with each other) that contamination is likely/probably extending from TCAAP to the St. Anthony Area. Differences in constituents and ratio of contaminants are found at St. Anthony and may be explained either as a separate case of contamination, or as the U.S. EPA/MPCA believes, these differences may be explained by degradation of compounds and perhaps comingling of other sources. The Phase I Study is intended to determine if TCAAP is the source of contaminants in St. Anthony.

Under the Agreement, U.S. EPA and MPCA are the determiners of the source of contaminants and will define the plume to be addressed under the TCAAP Feasibility Study.

2) Additionally, the City of New Brighton and Mr. Fuhr commented that a comprehensive final remedy requiring regional clean up of contaminated ground water needs to be reached quickly.

U.S. EPA Response: U.S. EPA agrees, however, a final remedy can be selected only after characterization of contaminants and study of alternatives, as outlined in CERCLA, SARA, and the NCP. This characterization will occur in the Phase IA Remedial Investigation conducted by U.S. EPA/MPCA and the on-TCAAP Remedial Investigation conducted by the U.S. Army.

3) Ms. Winiecki commented that the BGRS does not address the problem of the 14 families who have wells on the east side of Round Lake and that sediment in Round Lake has unusually high concentrations of PCBs.

U.S. EPA Response: The U.S. Army has addressed the wells by sampling wells at the area near Round Lake. The U.S. EPA sewer line pre-study will be finished this fall and will most likely recommend further study be undertaken in an RI/FS to address the PCB contamination in Round Lake.

E. Bedrock Contamination and Monitoring

1) Bruce A. Liesch commented that ground-water contamination has occurred from migration of contaminants through the bedrock system and a bedrock recovery system should be installed immediately to intercept it.

U.S. EPA Response: The U.S. EPA and MPCA analysis does not show sufficient protection of the bedrock (Prairie du Chien/Jordan) aquifer by the U.S. Army's proposal. However, benefits from the operation of the existing system do not warrant waiting to construct a bedrock capture system. This ROD is to operate the existing system and plan modifications using operating data from the first 90 days to adequately protect both the Hillside Sand and Prairie du Chein/Jordan aquifers.

2) Bruce A. Liesch commented that the proposed bedrock recovery system proposed in the Ground Water Remedial Program Plan (GRPP) does not include recovery of the south plume as defined by MPCA in the Multi-Point Source RI. Without interception of the south plume, a bedrock plume will continue to migrate from TCAAP, even after the TGRS is fully implemented.

U.S. EPA Response: The south plume is primarily within the Hillside Sand aquifer at the boundary of TCAAP. The existing six well system will intercept the migration of the VOC contamination. After the first 90 days the system will be modified to insure the adequate protection of both the Hillside Sand and Prairie du Chein/Jordan aquifers.

3) Bruce A. Liesch commented that the U.S. Army proposed to determine the need for bedrock recovery wells along the southwest TCAAP border based on the drawdown influences in the bedrock from BGRS pumping. To do this a series of well nests would need to be present to determine the hydraulic response in the upper, middle and lower units of both bedrock aquifers. This is needed to observe how deep the hydraulic response from the BGRS system operation propagates. The City of St. Anthony adds that it is unclear whether removal of contaminated water from deeper aquifers and upward draw can be accomplished through the BGRS, and, further there is no means to verify whether this is taking place.

U.S. EPA Response: The existing monitoring network is adequate to demonstrate if adequate upward draw from bedrock exists. U.S. EPA expects that the first 90 days of operation and data collection will demonstrate that modifications will be needed (e.g., if bedrock extraction wells need to be constructed and operated).

F. Monitoring of BGRS

1) The City of New Brighton commented that it is crucial that monitoring be able to determine whether the system is effectively intercepting contaminated ground water above the concentrations of concern established by U.S. EPA and MPCA. Such a monitoring program should include:

   a) The ability to determine the 3-dimensional capture zones for individual extraction wells and the gradients control system collectively;

   b) The ability of the gradients control system to respond to short-term and seasonal changes in the ambient hydraulic gradients; and

   c) An ability to locate down gradient monitoring points that can demonstrate that no contaminated ground water is bypassing the gradient control system.

   U.S. EPA Response: U.S. EPA has addressed these concerns in this ROD. U.S. EPA feels the total system performance (as opposed to individual wells) is the most important monitoring requirement. The monitoring system will reflect vertical as well as horizontal performance and reflect seasonal fluctuations in the first year. Planned quarterly monitoring may be modified if short term changes in the first year require more frequent monitoring in the future.

   This monitoring will be performed by the U.S. Army under review and oversight by MPCA and U.S. EPA.

2) Mr. Fuhr commented that the BGRS should be monitored continuously by an outside party, preferably MPCA.

   U.S. EPA Response: U.S. EPA feels that the planned first year monitoring of the system should be sufficient to evaluate total system performance, as well as determine the frequency of monitoring necessary in subsequent years. The monitoring will be performed by the U.S. Army under review and oversight by MPCA and U.S. EPA. Under the Agreement the costs of oversight are reimbursed by the U.S. Army.

G. Effluent Discharge Issues

1) The City of New Brighton commented that the treatment system needs to meet discharge limitations on a consistent basis. An effective monitoring of the gravel pit discharge must include:

   a) A detailed water balance of the TCAAP area;

   b) Ground-water quality downgradient in all directions of the gravel pit discharge;

   c) On-going monitoring of hydraulic gradient response to the recharge in the vicinity of the kame; and

d) Monthly water quality monitoring until the boundary gradient control wells are intercepting effluent-derived ground water.

U.S. EPA Response: A detailed water balance based on calculated values will be required within 30 days prior to operations. Periodically thereafter, based on actual operation data, a water balance will be required. Ground-water quality and gradient monitoring will be required as part of the operation of the systems.

2) MDNR commented it continues its support to use the gravel pit for discharge as a reasonable use of water and as a water conservation measure.

U.S. EPA Response: Comment noted. Under this ROD the gravel pit will be the normal discharge point for BGRS-treated water that is not used for in-plant use.

3) MDNR commented that any discharge of treated water to Rice Creek that reduces the cost-effectiveness of the Rice Creek Watershed District's work, in particular their efforts to reduce phosphorous concentrations, would not be supported.

U.S. EPA Response: The discharge to Rice Creek is allowed and notice is given in this ROD. Discharge requires that nutrients including phosphorus may not be increased from current loadings in Rice Creek as it enters TCAAP. Discharge to any surface water, including Rice Creek, may not occur except in a manner acceptable to U.S. EPA and MPCA.

4) The City of New Brighton commented that the possibility exists that effluent discharge into Rice Creek could improve water quality in Long Lake, and therefore, the possibility of discharging effluent into Rice Creek should be retained, while the concentration of Hillside Sand ground water is studied more thoroughly.

U.S. EPA Response: This ROD allows that discharge to Rice Creek is allowed if required and notice is given. Discharge requires that nutrients including phosphorus may not be increased from current loadings in Rice Creek as it enters TCAAP. The possibility of improving water quality through dilution with treated water can be considered in the future using data collected in earlier phases of operation.

5) Mr. Fuhr commented that there is a need to be very careful about any discharge into Rice Creek because it eventually flows to the Mississippi River, which is a major source of drinking water in the area.

U.S. EPA Response: Comment noted. This ROD allows discharge to Rice Creek or other surface waters only after treatment and an acceptable monitoring plan is in place to prevent the discharge of contaminants or nutrients to any surface water including Rice Creek. The discharge to Rice Creek must be acceptable to U.S. EPA and MPCA.

6) CBE commented that the impacts of high manganese levels should be assessed before any effluent is discharged in Rice Creek.

U.S. EPA Response: Comment noted. This ROD allows discharge to Rice Creek or other surface waters only after treatment and an acceptable monitoring plan is in place to prevent the discharge of contaminants or nutrients to any surface water including Rice Creek.

H. Contingencies

1) MPCA commented that it wished to know the U.S. Army's plans should the BGRS have a breakdown.

U.S. EPA Response: The operating conditions in this ROD ensure the BGRS will not operate unless an acceptable treatment system is in operation prior to discharge. The system will be shut down completely for repairs or during emergencies.

2) MDNR commented that a question has arisen concerning the timing of the installation of additional remedial measures. If the testing of the system shows, for example, that sufficient "upwelling" from the Unit 4 aquifer is not occurring, will the U.S. Army be able to install an additional well or wells this year or will the U.S. Army have to wait for another budget cycle to get the funding. Any delay in improving the system, if it is shown to be necessary, would not be in the mutual best interest of the U.S. Army and the State.

U.S. EPA Response: The U.S. Army has made assurances that funds are available and no delays will occur due to budget cycle constraints.

I. Health Issues

1) MPCA commented that it is unclear how the U.S. Army can assure that air emissions from the BGRS and other TCAAP sources not adversely impact human health, welfare and the environment.

U.S. EPA Response: No acute or chronic health problems are anticipated. After the first 90 days of operation, U.S. EPA will conduct a study to determine if emission control is required. The air emission requirements and monitoring is sufficient to protect public health.

2) Briggs & Morgan commented that the U.S. Army has not proposed a program to monitor the health of the citizens.

U.S. EPA Response: There are several studies currently under way which address the health concerns of citizens in the area. First, as Senator Novak explained at the May 20, 1987 public meeting, the Minnesota Department of Health will be conducting a state-wide cancer surveillance study which will place a special emphasis on areas such as New Brighton and St. Anthony where an environmental event may have occurred. Additionally, a public health evaluation is being

conducted by MPCA as part of their comprehensive study of ground-water contamination in the New Brighton/Arrden Hills/St. Anthony area.

The Agency for Toxic Substance and Disease Registry (ATSDR), established in CERCLA and given additional duties under SARA, is to perform a health assessment at each facility on the National Priorities List (NPL) prior to December 10, 1989. Work on the TCAAP area assessment is in a preliminary planning stage. On May 18, 1987 ATSDR received a citizens' petition from the Village of St. Anthony and 14 individual families asking that the TCAAP area assessment be given priority.

3) Mr. Fuhr commented that a third party should conduct a health study on people living in the area over the past 30 years. Similarly, "Preserve Our Land" commented that any health study conducted should encompass the area affected by the "contaminant plume" as identified in the Volume I Work Plan of MPCA's regional study.

U.S. EPA Response: As noted in the previous response, ATSDR, MDH and MPCA are conducting studies which will address both of these concerns.

J. Specific Comments On Facts and Language used in the Army's Proposed Interim Action Document

1) The Minnesota Department of Health (MDH) commented that the statement "There are no existing Minnesota drinking water standards and criteria which are legally enforceable" contained on page six under the section entitled Raw Water Supply is incorrect. Minnesota Rules, Chapter 4720 contain legally enforceable drinking water standards applicable to public water supplies.

U.S. EPA Response: MDH is correct. Currently, however, there are no enforceable standards for some VOCs. Therefore, for those contaminants where no Maximum Contaminant Levels (MCL) exists, non-zero MCLGs, Health Advisories, or other criteria will be used.

2) MPCA commented that its comments on the BGRS were not evaluated and/or incorporated into design and construction of the system.

U.S. EPA Response: U.S. EPA has worked with MPCA in developing the requirements for operation in this ROD. Modifications to the system will be submitted by the U.S. Army before the 150th day of operation and subject to acceptance by both U.S. EPA and MPCA.

3) MPCA commented that on-TCAAP regional monitoring wells located down gradient of disposal sites have shown VOC-contamination at levels in excess of 40 ppm; private wells located immediately adjacent to an downgradient of TCAAP have VOC-contamination levels in excess of 7 ppm. Therefore, the U.S. Army's references to low contaminant levels is in error.

U.S. EPA Response: MPCA is correct.

4) MPCA commented that previous interim response actions to provide potable water to residents of Arden Hills, New Brighton and St. Anthony were provided by EPA and/or MPCA. Additional response actions are underway to provide or maintain adequate drinking water supplies in New Brighton and Arden Hills as a result of the regional ground-water contamination. Also, it should be noted that the Mingelkoch & Gordon Rendering Plants are using bottled water for drinking water supplies due to the regional contamination. Therefore, the U.S. Army's statement regarding available alternative water supplies is misleading.

U.S. EPA Response: MPCA is correct.

5) MPCA commented that the U.S. Army states that "there are hazardous substances but no known pollutants or contaminants, as defined by SARA, crossing the boundary." MPCA disagrees with this statement given that the definition of "pollutant or contaminant" does include several of the substances found migrating from TCAAP. These substances are known or suspected cancer-causing compounds.

U.S. EPA Response: U.S. EPA is in agreement with this comment, and it has been incorporated into this ROD. Additionally, the difference in category of substances makes no difference in developing a remedial action.

6) MPCA & CBE commented that Minnesota Water Quality Standards are now found in Minnesota Rules, Chapter 7050. Similar incorrect citations are to be found on page six of the U.S. Army's proposed interim action document.

U.S. EPA Response: Comment noted.

7) CBE commented that the table of standards for Rice Creek is incomplete and at least should include the total chromium value of .05 milligrams per liter (mg/l).

U.S. EPA Response: This value will be incorporated in the criteria values and limits for discharge if a discharge to surface waters is requested.

8) CBE commented that it is a contradiction to state that there are no Federal or State ambient air quality standards applicable to the emission of VOCs from the BGRS and to then state the BGRS VOC air emissions are below any known regulated levels.

U.S. EPA Response: Comment noted. The air emission regulations for VOCs only apply to cases where combined emissions total more than 25 tons per year. Control requirements may be applicable (such as Best Available Control Technology) and will be evaluated during the first 90 days of operation.

9) The Metropolitan Waste Control Commission commented that the U.S. Army's proposed interim action document did not address the maintenance of the BGRS air strippers, specifically any bypass to the sanitary sewer.

U.S. EPA Response: Any discharge to the sewer will require prior approval by the Metropolitan Waste Control Commission.

K. Selection and Application of MCLs

1) MDH commented that the estimated TCE intercept level of 10 ppb from the Hillside Sand and Prairie du Chien/Jordan aquifiers at the southwest boundary of TCAAP is unacceptable. EPA has proposed an MCL for TCE at 5 ppb, and it is MDH's position that the BGRS must intercept TCE at levels not exceeding 5 ppb.

U.S. EPA Response: This ROD requires a capture criteria for TCE of 5 ppb or better. Additionally, other substances will also be monitored to insure that no risk occurs from substances other than TCE. See Table 1 for criteria levels.

2) Bruce A. Liesch commented that the proposed system allows VOCs with concentrations that exceed 10 ppb, to move past the north and south borders of the ground-water recovery area.

U.S. EPA Response: The system will be operated for 90 days. If ground water contaminated with VOCs in excess of 5 ppb is not captured, modifications to ensure adequate capture are required.

3) MPCA commented that the U.S. Army states the "BGRS System ... is expected to achieve a zone of capture to 10 ppb TCE at the southwest boundary," however, Honeywell's April 27, 1987 written comments to MPCA contradict this statement. Honeywell estimated that (1) 100 percent removal of VOCs from Unit 3, and (2) 25-100 percent removal of VOCs from Unit 4 would occur.

U.S. EPA Response: The system will be operated for 90 days. If ground water contaminated with VOCs in excess of 5 ppb is not captured, modifications to ensure adequate capture are required.

4) MPCA commented that Section 120 (d) of CERCLA requires the attainment of MCLGs including 2.8 ppb for TCE. It is unclear, therefore, how the 10 ppb TCE aquifier cleanup level was developed and chosen since a health risk assessment was never conducted at TCAAP.

U.S. EPA Response: This ROD requires clean up to the MCL for constituents such as trichloroethene and vinyl chloride that have MCLs established. MCLs are the standards used for municipal drinking water supplies. Some constituents of contamination do not have MCLs, so other standards are used. The criteria values are given in Table 1 of this ROD. Users of water will be protected to U.S. EPA's public health criteria.

5) In a follow up comment, MPCA added, that it is apparent from the U.S. Army's proposed interim action document that the U.S. Army intends to have standards applied to the BGRS treatment system only and will dispense with cleanup standards for the affected aquifier until such time as a health risk assessment is completed through the RI/FS.

U.S. EPA Response: Plume capture criteria are drinking water standards. Additionally, receptors will be protected to a greater degree. This approach assures that the ground water leaving TCAAP at the southwest boundary is appropriate for drinking water aquifers.

6) CBE commented that since TCE and other VOCs are not naturally present in the affected aquifers, no amount should be left in the system.

U.S. EPA Response: No method of ground-water treatment can assure contaminant free ground water once it has been contaminated. However, criteria levels set forth in this ROD will achieve a safe drinking water supply in both aquifers.

L. Other Comments

1) Senator Steve Novak commented that the Minnesota legislature had recently appropriated funds to the State's Attorney General for the purposes of a lawsuit should the site not be cleaned up in a satisfactory manner. Senator Novak noted, however, that he hoped that the State, U.S. EPA, the U.S. Army, and the local community could work together to resolve the issue, and that a lawsuit on the part of the State would only be used as a last resort.

U.S. EPA Response: The Agreement between U.S. EPA, MPCA, and the Army, as well as the provisions of CERCLA, SARA, and the NCP, ensure that both the State, through MPCA (a party to the Agreement), and the local communities through the public participation requirements will have input into any final decisions made, and that the investigation and remediation of the site will take place in a timely manner. The U.S. Army is currently establishing a Technical Review Committee to further local involvement.

2) Every commentor noted that the problems associated with TCAAP have been known for a number of years and that the U.S. Army was not responding to the problem with sufficient speed. All commentors urged that the process be speeded up.

U.S. EPA Response: The Agreement between U.S. EPA, MPCA, and the U.S. Army, as well as the provisions of SARA, call for a timely remediation of the problem, and U.S. EPA believes that cleanup efforts at TCAAP will move forward in a timely manner under these provisions. The Agreement allows for oversight of Army Actions and consistency with U.S. EPA and MPCA standards.

3) Bruce A. Liesch commented that the BGRS should be expanded laterally to intercept ground water exceeding established or proposed drinking water criteria.

U.S. EPA Response: The requirements for capture is based on drinking water standard when such standards exist. If lateral (or vertical) expansion is required to meet criteria, modifications will occur.

4) The City of New Brighton and CBE commented that a final remedy must be reached with the appropriate input and oversight from all concerned regulatory agencies and affected parties.

U.S. EPA Response: The Agreement between U.S. EPA, MPCA and the Army, as well as the provisions of CERCLA, SARA, and the NPL ensure that a full community relations program will be implemented. The Agreement allows for oversight of U.S. Army Actions by U.S. EPA and MPCA and consistency with U.S. EPA and MPCA standards.

5) "Preserve Our Land" commented that Honeywell was the main polluter at the facility and they should be made to bare the brunt of the cleanup costs.

U.S. EPA Response: The goal of the Superfund program established by Congress is to protect public health and the environment. A tool given to EPA was joint and severe liability. At federal facilities EPA holds the "agency" responsible and leaves the contractors involvement up to the "agency." No "equity" considerations are required by the Congressional goal.

6) Mr. Myslajek commented that the contaminated ground water should be left untouched for the next 100 years and the cleanup funds should be used to draw water from the Mississippi River.

U.S. EPA Response: The provisions of CERCLA and SARA are such that the feasibility study on regional ground-water contamination will examine the option of not taking any remedial action to clean up contaminated ground water and will be one of the options the public will have an opportunity to comment on.

7) Ms. Winiecki commented that the families who have wells on the east side of Round Lake should be furnished with uncontaminated water.

U.S. EPA Response: The U.S. Army tested several residential wells in the area of Round Lake. All tests indicate that the wells are acceptable for potable use. Individual well analysis has been sent to the homeowner whose wells were tested.

8) The City of St. Anthony commented that the U.S. Army has not proposed a program to compensate the affected individuals for damage to their health and property.

U.S. EPA Response: Comment noted.

IV. REMAINING PUBLIC CONCERNS

The public took a favorable, if somewhat guarded, reaction to the BGRS. It is their hope that the BGRS is a first step toward a much-delayed cleanup of the source of regional contamination. Specific concerns which remain are:

- The effectiveness of the BGRS and the effectiveness of its monitoring program;
- The ability of U.S. EPA and MPCA to oversee and monitor the U.S. Army;
- The ability for the public to actually have input it the cleanup process;
- Inclusion of St. Anthony in the final remedies;
- Repayment of past-expenses to affected communities and families; and
- Health related concerns.

APPENDIX A

COMMENTORS ON THE U.S. ARMY'S PROPOSED INTERIM ACTION DOCUMENT

In addition to U.S. EPA, there were 14 commentators on the Army's proposed interim action. Each commentator, and the way they are referred to in the Responsiveness Summary is listed below.

- State Senator Steve Novak made verbal comments at the May 20, 1987 public meeting. Comments from Senator Novak are attributed to him by name.

- Barbara Simms, Assistant Executive Director of the Minnesota Pollution Control Agency, made verbal comments at the May 20, 1987 public meeting, and submitted written comments in a letter dated June 1, 1987. Comments from this source are attributed to the Minnesota Pollution Control Agency (MPCA).

- Ron Nargant, Director of the Division of Waters, Minnesota Department of Natural Resources, submitted written comments in a letter dated June 1, 1987. Comments from this source are attributed to the Minnesota Department of Natural Resources (MDNR).

- David Gray of the Minnesota Department of Health submitted written comments in a letter dated May 29, 1987. Comments from this source are attributed to the Minnesota Department of Health (MDH).

- Peter Berglund, Staff Engineer, Industrial Waste Division, Twin Cities Area Metropolitan Waste Control Commission submitted written comments in a letter dated May 28, 1987. Comments from this source are attributed to the Metropolitan Waste Control Commission.

- William R. Skallerud, of the firm LeFevere, Lefler, Kennedy, O'Brien & Drawz, representing the City of New Brighton, submitted written comments in a letter dated June 1, 1987. Comments from this source are attributed to the City of New Brighton.

- David M. Childs, the City Manager for St. Anthony Village, submitted written comments on behalf of the City Council of the City of St. Anthony in a letter dated May 28, 1987. Comments from this source are attributed to the City of St. Anthony.

- David C. McDonald of the firm Briggs & Morgan, on behalf of the City of St. Anthony and various families in the St. Anthony area, made verbal comments at the May 20, 1987 public meeting and submitted comments in a letter dated June 1, 1987. Comments from this source are attributed to Briggs & Morgan.

- Kenneth P. Olson, of the firm Bruce A. Liesch Associates, Inc., technical representatives to the City of St. Anthony and select private citizens down gradient of TCAAP, made verbal comments at the May 20, 1987 public meeting and submitted written comments in a letter dated May 27, 1987. Comments from this source are attributed to Bruce A. Liesch.

- Nickalas Tiedeken, a representative of the organization "Citizens for a Better Environment" made verbal comments at the May 20, 1987 public meeting and submitted written comments in a letter dated June 1, 1987. Part of Mr. Tiedeken's statement and correspondence are in the form of questions about various issues associated with TCAPP, rather than comments on the proposed interim action. Comments on the proposed interim action have been incorporated into the Responsiveness Summary. Mr. Tiedeken's comments are attributed to "Citizen's for a Better Environment" (CBE).

- Gary Payne, a citizen of Minnesota, and a representative of the organization "Preserve Our Land" made verbal comments at the May 20, 1987 public meeting. Additionally, Robert Lohman submitted written comments on behalf of "Preserve Our Land" in a letter dated April 29, 1987. Part of Mr. Lohman's correspondence is in the form of questions about various issues associated with TCAAP, rather than comments on the proposed interim action. Comments on the proposed interim action have been incorporated into the Responsiveness Summary. Mr. Payne's and Mr. Lohman's comments are attributed to "Preserve Our Land."

- Jerry Fuhr, a citizen from New Brighton, made verbal comments at the May 20, 1987 public meeting. Comments from Mr. Fuhr are attributed to him by name.

- John Myslajek made verbal comments at the May 20, 1987 public meeting. Comments from Mr. Myslajek are attributed to him by name.

- Jeanne Winiecki, a citizen of Arden Hills, made verbal comments at the May 20, 1987 public meeting. Comments from Ms. Winiecki are attributed to her by name.

APPENDIX B

DEFINITIONS

ARARs	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency for Toxic Substance and Disease Registry
BACT	Best Available Control Technology
BGRS	Boundary Ground-Water Recovery System
CBE	Citizens for a Better Environment
CERCLA	Comprehensive Environmental Response Compensation and Liability Act of 1980
GRAAA	Ground Water Remedial Action Alternatives Analysis
GRP	Ground Water Remedial Program
GRPP	Ground Water Remedial Program Plan
MCL	Maximum Contaminant Levels
MCLG	Maximum Contaminant Level Goals
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
MWCC	Metropolitan Waste Control Commission
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPDES/SDS	National Pollutant Discharge Elimination System/State Disposal System
PCBs	Polychlorinated Biphenyls
ppb	Parts per billion
ppm	Parts per million
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986

TCAAP	Twin Cities Army Ammunition Plant
TCE	Trichloroethylene
TGRS	Twin Cities Army Ammunition Plant (TCAAP) Ground-Water Recovery System
U.S. EPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

ATTACHMENT 3

PART A

EXECUTIVE SUMMARY and CHAPTER 6

from

GROUNDWATER REMEDIATION PROGRAM PLAN (GRPP)

JUNE 1986

EXECUTIVE SUMMARY

Volatile organic compounds (VOCs) are present in TCAAP groundwater. As a result of this presence, a commitment has been made to remediate TCAAP groundwater.

Remediation of TCAAP groundwater will be done by installing a contaminated groundwater recovery system and a treatment system.

Groundwater recovery involves the installation of a series of recovery wells designed to collect contaminated groundwater.

Treatment alternatives involving air stripping and granular activated carbon (GAC) technologies were evaluated in conjunction with treated water end-use alternatives. Air stripping is demonstrated to be the appropriate treatment technology for groundwater remediation at TCAAP. Treated water would be used as a TCAAP raw water supply in conjunction with alternative end uses of treated water return to contamination source areas, recharge to Arsenal Sand and Gravel Pits or surface discharge.

A Groundwater Remediation Program Plan (GRPP) has been prepared and the plan recommends implementation in three stages:

- Boundary Groundwater Recovery System (BGRS) operated at an estimated 750 gpm is intended to be constructed and operated in 1986.

- TCAAP Groundwater Recovery System (TGRS) operated at an estimated 1275 gpm, represents an expansion of the BGRS. The TGRS is intended to be constructed and operated in 1987.

- Plume Groundwater Recovery System (PGRS). The size and cost of the PGRS is determined by the extent of the VOC plume and remediation criteria. The PGRS is intended be constructed and operated in 1987.

6.0 CONCEPT (TASK 5)

6.1 BGRS

Plan 3 presents a conceptual layout of the BGRS summarized as follows:

- recovery of groundwater at southwest boundary of TCAAP from six Hillside recovery wells at a total estimated rate of 750 gpm (1.08 MGD);

- twelve water level monitoring well nests constructed along the site boundary which in conjunction with existing wells will be used to demonstrate the hydraulic effectiveness of the recovery wells;

- collect and transfer contaminated water to a communal treatment plant located adjacent to the existing TCAAP potable water treatment plant (Building 116);

- treat water;

- supply an average of 0.57 MGD of treated water as a potable water supply to TCAAP;

- inject an average of 0.51 MGD of treated water to the Hillside Sand aquifer at source areas 'D' and 'G'; and

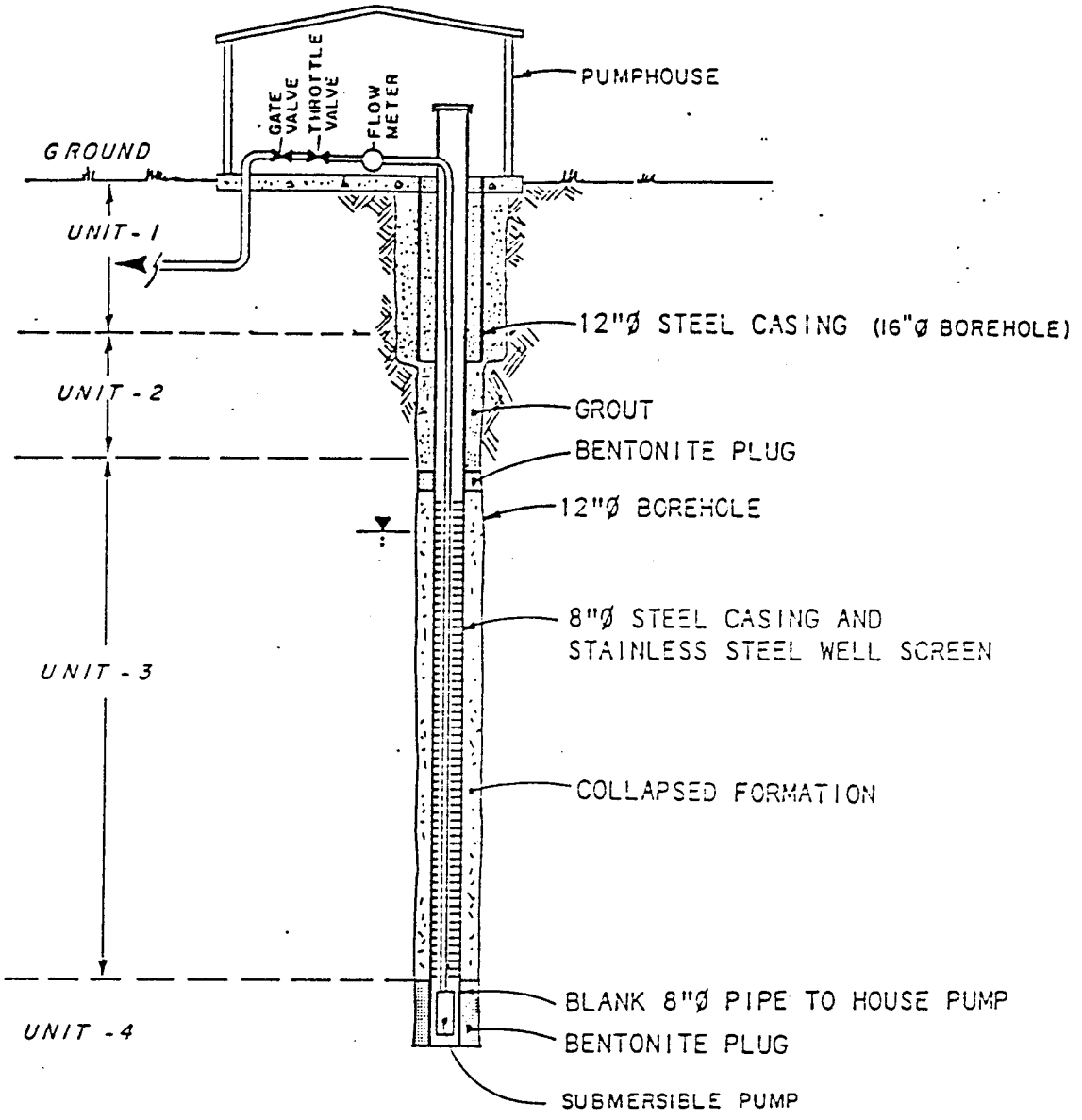
- four water level monitoring wells constructed near the source areas to monitor the head build up resulting from the injection of treated water.

6.1.1 Groundwater Recovery/Injection

Six Hillside Sand aquifer recovery wells are proposed at locations shown on Plan 3. All recovery wells will fully penetrate the Hillside Sand aquifer. Figure 6.1a provides a typical sketch of a recovery well fully penetrating the Hillside aquifer, while a schematic of an injection well is shown on Figure 6.1b.

A cross-section (Figure 6.2) constructed along the southwest site boundary approximately normal to the direction of groundwater flow, shows the proposed recovery wells along with the pumping water level resulting from system operation. Figure 2.4, previously presented in Section 2.0, locates the cross-section. Because of the vertical scale employed, the drawdowns illustrated on Figure 6.2, are exaggerated to demonstrate the conceptual effect of pumping.

The BGRS concept establishes a minimum number of recovery wells at six. Based on available hydrogeologic



NOTE: WHERE THE UNIT 2 TILL IS ABSENT THE BOREHOLE WILL BE COMPLETED WITHOUT THE 12"Ø CASING AT SURFACE

figure 6.1a

SCHEMATIC DESIGN OF FULLY PENETRATING UNIT - 3 RECOVERY WELL
GROUNDWATER REMEDIATION PROGRAM PLAN
[illegible] Army Ammunition Plant

[illegible]

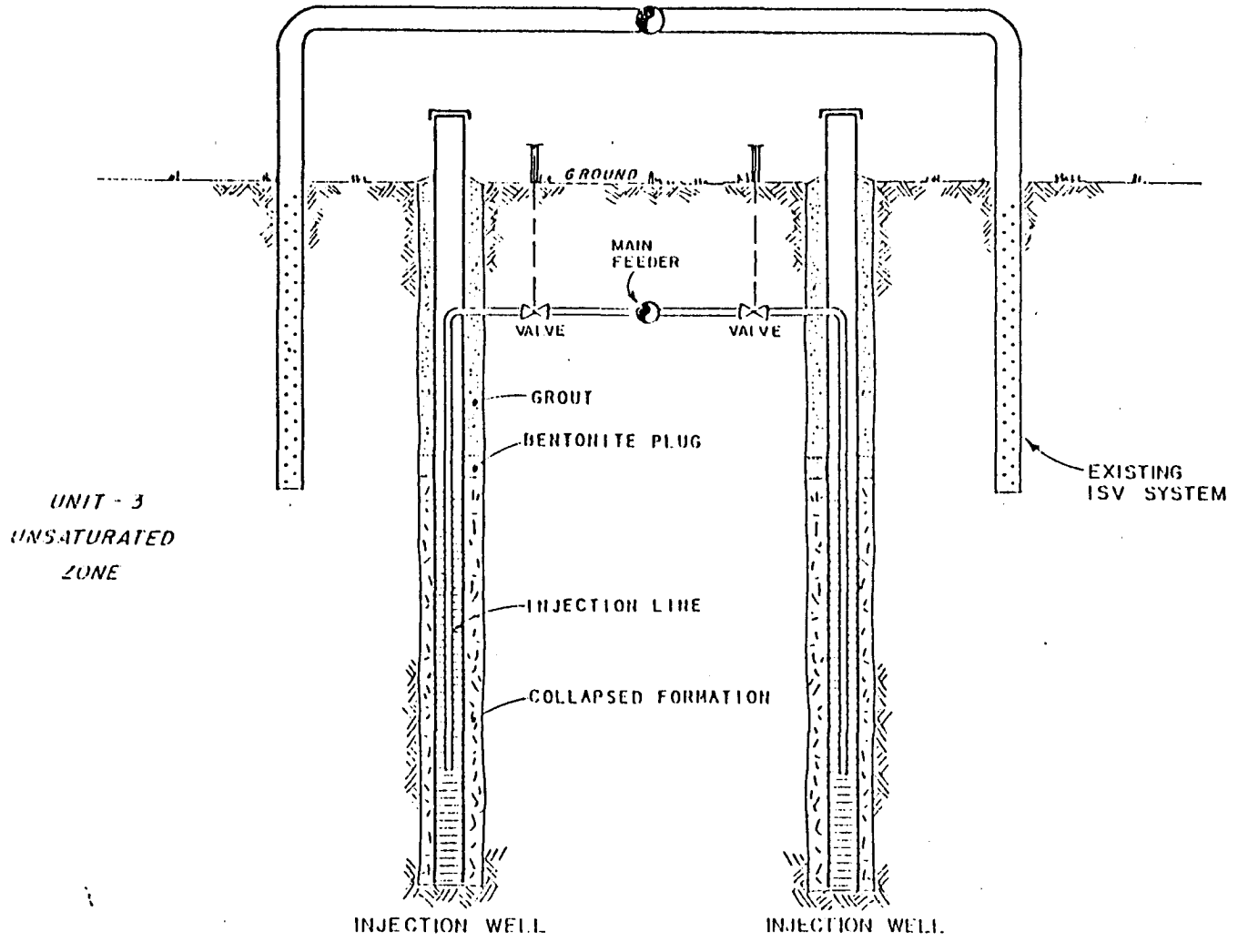


figure 6.1b

SCHEMATIC DESIGN OF UNIT-3 INJECTION WELL
GROUNDWATER REMEDIATION PROGRAM PLAN
Twin Cities Army Ammunition Plant

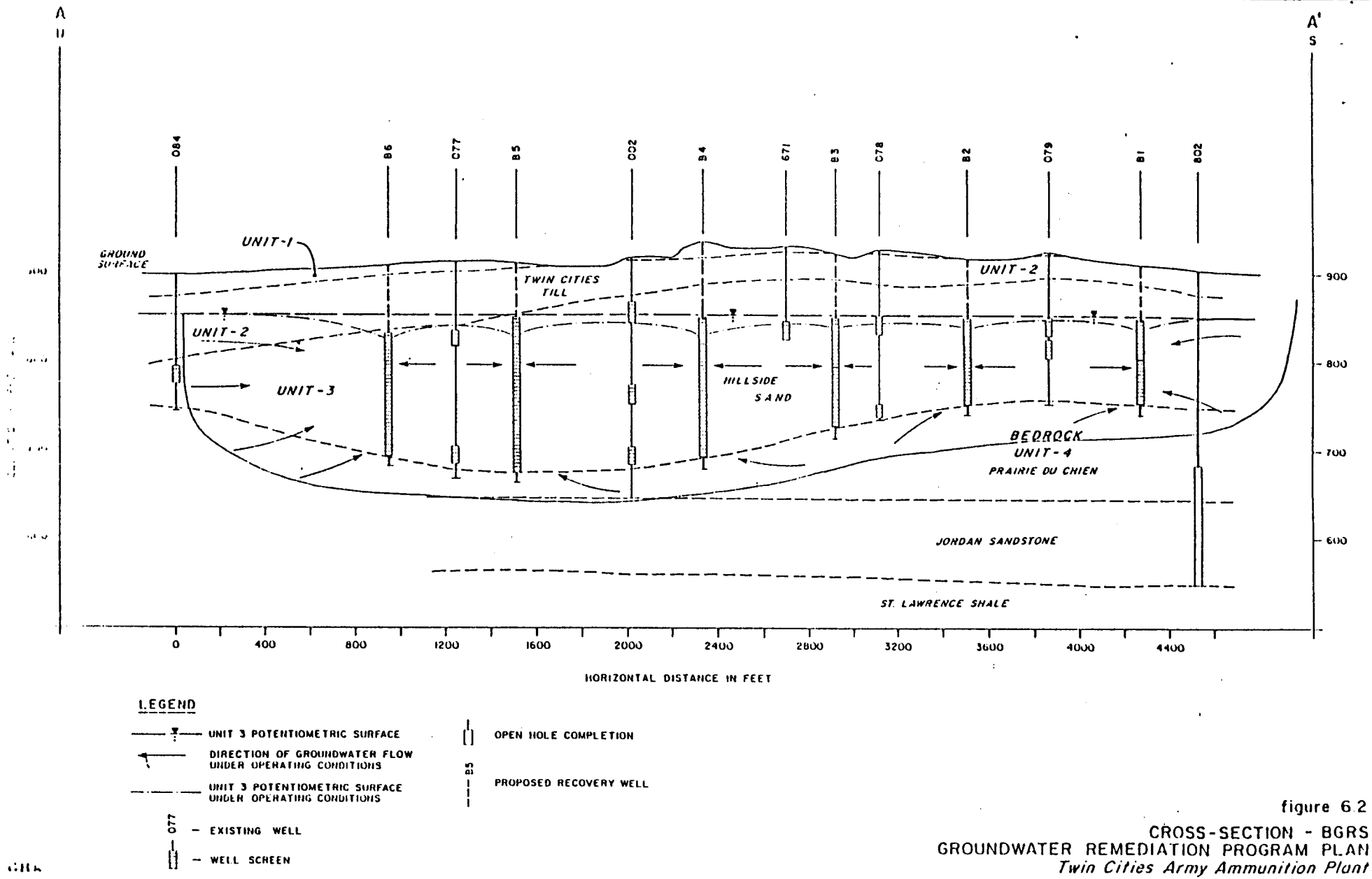


figure 6.2

CROSS-SECTION - BGRS
GROUNDWATER REMEDIATION PROGRAM PLAN
Twin Cities Army Ammunition Plant

data at the southwest boundary of TCAAP, recovery wells would initially be spaced at approximately 500 feet. The BGRS was designed in consideration of the results of the feasibility study represented by the GRAAA (STS 1986). The computer model, GEOFLOW, utilized in the GRAAA was used herein to theoretically confirm the zones of groundwater capture and to select initial pumping rates. This work involved pumping scenarios of the BGRS at rates of 500 gpm and 1000 gpm.

The results of the modeling indicate that the BGRS would effectively capture groundwater within the contaminated portion of the Hillside Sand aquifer. As recognized in the GRAAA, inherent assumptions to modeling such as fixed boundary conditions, uniform aquifer materials and estimated permeabilities, will result in a variance of field performance when compared to modeled results. In order to compensate for these uncertainties, the BGRS would be constructed and monitored progressively as follows:

(1) Two fully penetrating Hillside Sand recovery wells will be constructed (B1 and B4).

(2) A pumping test would be conducted at B1 on the upper Hillside Sand aquifer using packers to isolate this pumping zone. The influence of this partially penetrating pumping test on the lower Hillside Sand

aquifer will be evaluated to determine the potential value of constructing partially penetrating recovery wells to provide selected vertical control on groundwater capture.

(3) A pumping test will be conducted at B4 on the entire thickness of the Hillside Sand aquifer. Aquifer response would be monitored.

(4) Based on the results of pumping tests conducted at B1 and B4, the design (spacing, screened interval and initial pumping rate) for recovery wells B2 and B5 would be finalized and these wells installed.

(5) Pumping tests would be conducted at all four recovery wells to monitor aquifer response.

(6) Based on the results of the pumping test for recovery wells, B1, B2, B4 and B5, the design and construction of recovery wells B3 and B6 would be conducted.

It is recognized that the pumping tests conducted under the BGRS program may identify the necessity for additional recovery wells. This need would be determined by hydraulic monitoring of the BGRS with additional wells added under the TGRS program.

At this time, it is estimated that the BGRS system will be pumped at a total recovery rate of 750 gpm. The final BGRS pumping rate will be determined following evaluation of test and performance data generated during well field operation.

The performance of the BGRS will be monitored by water level measurements obtained from hydraulic monitoring wells strategically located and from existing monitoring wells as shown on Plan 3. Flow rates of individual recovery wells will be controlled to ensure that optimal hydraulic performance of the system is achieved. In addition, VOC levels will be determined by sampling monitoring and recovery wells.

Submersible pumps will recover groundwater at nominal pumping rates of 25, 75 and 150 gpm or greater, if required. Flow rates will be controlled by valves and monitored individually at each well. The pumps will be controlled from a control center located at the treatment plant.

6.1.2 COLLECTION

Plan 3 provides a layout of the groundwater collection system.

A groundwater collection header will be installed to collect water from the BGRS recovery wells. The header will be installed along the line of the recovery wells with provisions to collect water from the TGRS boundary recovery wells.

The collected water will be transferred from the collection header to the existing inactive TCAAP raw water line which presently is complete to and through the TCAAP potable water treatment plant. The raw water line will be modified to suit the air stripping equipment to be located beside the treatment plant.

6.1.3 TREATMENT

An initial composite water quality profile for potential TCAAP groundwater contaminants listed in Table 2.2. of Section 2.0 was developed for the BGRS and is presented in Table 6.1. This profile was developed in consideration of recommended relative pumping rates and using existing water quality data.

TABLE 6.1

ESTIMATED INITIAL WATER QUALITY PROFILE - BGRS

Parameter	Estimated Influent Concentration[a]
Organics	
trichloroethylene	842
1,1,1 trichloroethane	173
cis-1,2-dichloroethylene	75.5
trans-1,2-dichloroethylene	38.3
1,1-dichloroethylene	27.9
1,1-dichloroethane	49.1
methylene chloride	11.9
chloroform	6.1
1,2-dichloroethane	0.25
1,1,2-trichloroethane	7.7
benzene	2.8
carbon tetrachloride	0.3
tetrachloroethylene	17.7
acetone	15.8
di-n-octyl-phthalate	b
Metals	
mercury	<0.4
cadmium	2.6
lead	0.5
nickel	10.8
General Water Quality	
calcium (mg/L)	60
magnesium (mg/L)	28
iron (mg/L)	0.03
manganese	6
TOC (mg/L)	2.3
alkalinity (as $CaCo_3$ mg/L)	342
pH (field)	7.7
conductivity (umhos/cm)	490
temperature (°C)	13
TDS (mg/L)	427

NOTES:

a All concentrations in ug/L unless otherwise specified.
b Insufficient data to estimate influent concentration

ATTACHMENT 3

PART B

CHAPTERS 7 and 8 from

TWIN CITIES ARMY AMMUNITION PLANT

GROUND WATER REMEDIAL ACTION

ALTERNATIVES ANALYSIS

7.0 SUMMARY OF GROUND WATER REMEDIAL ACTION ALTERNATIVES AND COST ANALYSIS

In the following sections, ground water remedial action alternatives are developed from the various extraction scenarios, treatment alternatives, source remediation alternatives, and treated effluent discharge alternatives discussed in Chapters 5.0 and 6.0. Section 7.1 presents the development of the remedial action alternatives and Section 7.2 discusses the associated costs. Appendix C presents details concerning development of the costs and the present worth cost analysis.

7.1 GROUND WATER REMEDIAL ACTION ALTERNATIVES

The various components of the ground water remedial action alternatives have been presented: ground water extraction and control, source control, treatment, and treated effluent discharge. Ground water remedial action alternatives can be assembled based on the treatment requirements and potential effluent discharge options. As discussed previously, the treatment efficiency is dependent on the effluent discharge location in that surface water discharge must meet 10^{-5} human health risk levels, and discharge to the Minneapolis sewer system must meet Metropolitan Waste Control Commission (MWCC) requirements. As a result, the treatment process efficiency should be 99 percent. Discharge to potable water supply systems or reinjection to the ground water should at least meet the 10^{-5} risk level (for study purposes only). This requires 99.9 percent efficiency. These treatment levels can be met with combined air stripping and carbon absorption. Air stripping alone may provide acceptable treatment pending pilot testing.

Table 7.1 provides a summary of treatment efficiency requirements for the various ground water extraction and control scenarios and effluent discharge alternatives. The table identifies the various potential combinations which can be considered among the treatment levels, pumping scenarios, and effluent discharge alternatives.

Source removal alternatives considered in this study, either complete or partial, are applicable to any of the combinations presented in Table 7.1. The primary effect is associated with the duration required for ground water remediation. The available source remediation alternatives prepared by Weston (1984) includes the following:

- In-Place Decontamination
- Waste and Contaminated Soil Disposal
- In-Place Closure
- Land Application/Treatment
- Low Temperature Incineration
- Soil Vaults (Treatment)

As discussed previously, the selection of the partial source remediation alternative is based on estimated mass loading rates which would maintain acceptable water quality at the TCAAP boundary (27 ppb for trichloroethylene). Confirmatory studies are required to assess the actual mass loading rates of the above source remediation alternatives.

The unit costs for ground water treatment were discussed in Chapter 6.0 and are a significant part of the total remediation costs. Costs for the source control alternatives have been developed by Weston (1984). The costs associated with ground water extraction, conveying to the treatment system, and discharge have been estimated for each of the scenarios and are discussed in Appendix C.

Development of the ground water remedial action alternatives is based on selection of the more efficient or economic option available for each component. The two source remediation alternatives selected for this cost comparison are in-place closure and in-place decontamination. In-place closure is considered partial source remediation because continued drainage may occur for a period after recharge is eliminated. Future assessment of the rate, concentration, and duration of this drainage may permit refinement of the mass loading rates to the aquifer and should be compared to the assumptions associated with the partial source remediation analyses. In place-decontamination (including a

multi-layer cap to limit recharge) is intended to remove volatile organic compounds from the soil such that the natural drainage and leaching of contaminants to the ground water is significantly reduced. Therefore, it has been assumed to represent an essentially complete source remediation alternative for this study because mass loading rates would be reduced at the implementation of in-place decontamination and work is anticipated to be completed over a projected period of 36 to 42 months, more rapidly than the 120-month (10-year) period assumed for partial source remediation.

Both combined air stripping and carbon adsorption systems and air stripping systems have been evaluated in the alternatives analysis. The combined air stripping and carbon adsorption system could provide either 99 or 99.9 percent efficiency, while the air stripping system alone was only considered to provide 99 percent efficiency, pending pilot testing.

The most economic means for discharging the treated effluent is through percolation ponds, although injection wells provide a potential benefit of accelerated remediation and both are utilized in developing the ground water remedial action alternatives. As a result, the more attractive pumping scenarios include percolation ponds or injection wells and have been incorporated into the final alternatives. Table 7.2 presents the ten alternatives developed from these combinations of ground water pumping, treatment, discharge, and source control alternatives.

7.2 ALTERNATIVES COST COMPARISON

Comparison of the cost of the various alternatives are based on the present worth analysis presented in Appendix C. Table 7.3 summarizes the present worth analysis for each alternative considering a combined air stripping and carbon adsorption system for a 30-year loan period in accordance with EPA guidelines (EPA, 1984). Table 7.4 provides a summary of the alternatives which require 99 percent treatment efficiency considering an air stripping system alone. Alternatives which require

which require cleanup periods in excess of 30 years reflect only the initial 30-year costs, and the additional operating and maintenance costs for the remainder of the cleanup should be considered when comparing with alternatives having shorter durations.

Alternatives 1 and 2 reflect ground water extraction at the TCAAP southwest boundary (Scenario I) with discharge of treated water to percolation ponds either in the interior of the site or the existing soil and gravel pits. A treatment efficiency of 99 percent is included and in-place decontamination and in-place closure are considered in Alternatives 1 and 2, respectively. The resulting total net worth of Alternative 1 is higher than Alternative 2, the primary difference being the cost of source remediation.

Alternatives 3 and 4 incorporate extraction wells at both the TCAAP boundary and near the source areas, the difference between the two alternatives being source remediation by in-place decontamination and in-place closure, respectively. Treatment efficiency of 99 percent is specified for the two alternatives. As shown in Tables 7.3 and 7.4, this set of alternatives has a higher net present worth than Alternatives 1 and 2; this is associated with additional treatment and pumping costs due to the higher flow rates. However, because the present worth analysis provides for only a 30-year loan period, it does not reflect the costs incurred from Alternatives 1 and 2 for the additional 10 to 15 years of operation required to complete remediation.

Alternatives 5 and 6 consider a higher ground water extraction rate with wells located solely at the TCAAP boundary. Because percolation ponds are utilized for the discharge of the treated effluent, air stripping and carbon absorption with an efficiency of 99 percent is utilized. The difference between the two alternatives is that Alternative 5 considers complete source remediation and Alternative 6 includes partial source remediation. Similar to the previous alternatives, this represents the primary difference in net present worth of the two alternatives.

Alternatives 5 and 6 appear slightly more economic than Alternatives 3 and 4 due to the reduced number of pumping wells, although much of this difference is offset by increased treatment costs associated with the larger volumes of water.

Alternatives 7 and 8 are identical to Alternatives 3 and 4 except for the level of treatment provided (99.9 percent). Alternatives 7 and 8 reflected the incremental increase in net present worth associated with a treatment process at 99.9 percent efficiency. Although this net present worth cost increment is on the order of $500,000, compared to total net present worth for Alternatives 3 and 4 of $12,107,000 and $10,013,000, the initial capital costs are significant and should be considered before selection of the higher treatment efficiency.

The use of injection wells are reflected in Alternatives 9 and 10, where the required treatment process efficiency is 99.9 percent. Extraction wells are located near source areas and represent a lower present worth cost than the other alternatives because of fewer extraction wells. A pressurized injection system would be utilized for discharge of treated effluent in concert with providing TCAAP production water. Treatment costs are higher than for the other alternatives due to the higher efficiency and flow rate. As shown in Table 7-3, the values of net present worth of Alternatives 9 and 10 are less than the others, except Alternatives 1 and 2. However, some inconsistency exists in this analysis in that the treatment process is designed to provide an effluent which should meet 10^{-6} risk levels, while the period for aquifer restoration is based on the 10^{-5} level. A longer period of ground water remedial action to achieve lower aquifer contaminant levels would increase costs and may affect selection of the alternatives.

8.0 CONCLUSIONS OF GROUND WATER REMEDIAL ACTION ALTERNATIVES ANALYSIS

This section provides recommendations for ground water remedial action at TCAAP based on the studies reported herein. Selection of a ground water remedial action alternative is discussed in Chapter 3.0, but is particularly sensitive to the regulatory criteria regarding treatment of extracted water and the acceptable level of ground water quality. Guidance regarding these criteria have been provided by EPA, which recommends that background levels be set as the target for treatment and remediation of ground water quality, although an alternative contamination level may be developed through a complete feasibility study which includes risk analysis and/or endangerment assessments for receptors and potential receptors. The analyses presented herein considered the following aquifer restoration and ground water treatment criteria:

- Restoration of the aquifer to 10^{-5} human health risk levels, or 27 ppb for trichloroethylene.
- Treatment of the extracted ground water to the 10^{-5} levels for surface discharge and to the 10^{-6} levels (for study purposes only) for reinjection into the ground water.

The following conclusions concerning ground water remedial action are based on the studies presented herein:

- Extraction of ground water should include wells in Units 3 and 4 at the southwest TCAAP boundary to intercept contaminated waters. Based on the available hydrologic data, extraction wells should be located on about 300-foot spacings, screened through most of the saturated units, and provide an extraction rate at the boundary of about 500 gpm. These recommendations should be refined based on the results of long-term pumping tests.
- Extraction of ground water should also be performed within the interior of TCAAP, at areas of high concentration near the sources. Extraction rates should be approximately 700 gpm over about

10 wells and screened at least through Unit 3.

- The ground water extraction wells should be operated on a schedule in which upgradient wells are abandoned as contamination levels decrease, and downgradient pumping rates increased with time to optimize extraction efficiency.

- Source remediation is required to permit restoration of contaminated waters on TCAAP. The trichloroethylene mass loading to the ground water from Sites D, G, and I must be reduced significantly compared to present estimated levels (approximately 2 orders of magnitude) to achieve an acceptable average concentration at the TCAAP boundary without ground water interception. The type of source remediation must be evaluated relative to continued mass contributions to the aquifer. It is possible that in-place closure or in-place decontamination may be appropriate.

- A pilot testing program to evaluate air stripping and carbon adsorption treatment processes for contaminated ground water should be performed.

- A combined air stripping and carbon adsorption process with at least 99 percent efficiency should provide necessary treatment of the contaminated ground water. This level of treatment is expected to exceed the 10^{-5} human health criteria for trichloroethylene. Other major volatile organic compounds should also meet this criteria; however, treatment of other constituents, such as metals, have not been considered.

- An air stripping process with at least 99 percent efficiency may also achieve treatment of ground water to the 10^{-5} human health criteria for trichloroethylene. The pilot testing results should be carefully evaluated relative to removal efficiencies for the design volatile organic compounds.

- Treated effluent should be discharged to percolation ponds and utilized for TCAAP production supplies. The pond location should be near or at Sources D and G to accelerate the aquifer restoration program. The sand and gravel quarry also represents a potential discharge location for treated effluent. The capacity for percolation pond recharge to the ground water must be further

evaluated, although it has been estimated that a total pond recharge rate of 700 gpm is possible. Treated effluent not discharged to the pond would be available for TCAAP use or other uses (i.e., ground water reinjection).

- The ground water extraction, treatment, and effluent discharge systems should be designed to accommodate the operational constraints relative to location of structures, and should be capable of maintaining operations throughout the winter months.

- The duration of ground water remedial action to achieve restoration of the aquifer to concentrations of trichloroethylene generally less than 27 ppb is on the order of 25 years, based on available data and ignoring sorption processes. Available data in the literature suggests that adsorption of trichloroethylene on the Unit 3 sands would not be significant.

These conclusions form the basis for development of a remedial action plan. Supplemental data gathering efforts are underway by others, the results of which should be reviewed relative to the conclusions of this report. Additionally, confirmatory testing on parameters which may have significant influence to the remedial action plan should be considered. Sensitivity analyses have shown that the remedial action alternatives are viable for the anticipated ranges of these parameters. Parameters which are most significant in the analysis include hydraulic conductivity of Units 3 and 4 and mass loading rates associated with the sources.

TABLE 7-1

SUMMARY OF GROUND WATER TREATMENT EFFICIENCY[1] REQUIREMENTS FOR VARIOUS GROUND WATER EXTRACTION AND CONTROL SCENARIOS AND TREATED EFFLUENT DISCHARGE ALTERNATIVES

TREATED EFFLUENT DISCHARGE ALTERNATIVE	GROUND WATER EXTRACTION AND CONTROL SCENARIOS				
	I	II	IV	V	VI
1. On-site discharge to Rice Creek	99	99	-[2]	-	-
2. Off-site discharge to Minneapolis sewer system	99[3]	99[3]	-	-	-
3. Off-site discharge to Snail Lake for Shoreview	99	99	-	-	-
4. Off-site discharge to St. Paul Water System	99.9	99.9	-	-	-
5. On-site infiltration via spray irrigation or percolation ponds	-	-	99	99	99
6. On-site reinjection to ground water	-	-	99.9	99.9	99.9
7. Supplemental or replacement production water for TCAAP	99.9	99.9	99.9	99.9	99.9

(1) Efficiency reported in percent removal of trichloroethylene (minimum).

(2) "-" indicates not applicable.

(3) Dependent on Metropolitan Waste Control Commission requirements.

TABLE 7-2

SUMMARY OF GROUND WATER REMEDIAL ACTION ALTERNATIVES

ALTERNATIVE	REMEDIAL ACTION DURATION (years)	SOURCE REMEDIATION	GROUND WATER EXTRACTION/ CONTROL[1]	TREATMENT ALTERNATIVES (EFFICIENCY)	DESIGN CAPACITY (gpm)	EFFLUENT DISCHARGE ALTERNATIVE[2]
1	40	In-Place Decontamination	Scenario I	Air Stripping[3] or Combined Air Stripping and Carbon Adsorption (99%)	1,000	Sand and Gravel Pit
2	45	In-Place Closure	Scenario I	Air Stripping[3] or Combined Air Stripping and Carbon Adsorption (99%)	1,000	Sand and Gravel Pit
3	25	In-Place Decontamination	Scenario IV	Air Stripping[3] or Combined Air Stripping and Carbon Adsorption (99%)	1,500	Percolation Ponds Near Sites D and G
4	30	In-Place Closure	Scenario IV	Air Stripping[3] or Combined Air Stripping and Carbon Adsorption (99%)	1,500	Percolation Ponds Near Sites D and G
5	25	In-Place Decontamination	Scenario VI	Air Stripping[3] or Combined Air Stripping and Carbon Adsorption (99%)	2,000	Percolation Ponds Near Sites D and G
6	30	In-Place Closure	Scenario VI	Air Stripping[3] or Combined Air Stripping and Carbon Adsorption (99%)	2,000	Percolation Ponds Near Sites D and G
7	25	In-Place Decontamination	Scenario IV	Combined Air Stripping and Carbon Adsorption (99.9%)	1,500	Percolation Ponds Near Sites D and G
8	30	In-Place Closure	Scenario IV	Combined Air Stripping and Carbon Adsorption (99.9%)	1,500	Percolation Ponds Near Sites D and G
9	25	In-Place Decontamination	Scenario V	Combined Air Stripping and Carbon Adsorption (99.9%)	1,500	Injection Wells
10	30	In-Place Closure	Scenario V	Combined Air Stripping and Carbon Adsorption (99.9%)	1,500	Injection Wells

(1) Ground water extraction/control consists of extraction wells located at the TCAAP southwest boundary and/or near the source areas.

(2) Effluent discharge alternatives assume that current TCAAP production usage is 800,000 gallons per day and will be supplied by the treatment system.

(3) Air stripping may be considered for the treatment process depending on removal efficiencies achieved during pilot testing.

TABLE 7-3

NET PRESENT WORTH SUMMARY
OF GROUND WATER REMEDIAL ACTION ALTERNATIVES
COMBINED AIR STRIPPING AND CARBON ADSORPTION

ALTERNATIVE	REMEDIATION PERIOD (years)	SOURCE REMEDIATION ($1000's)	PUMPING SCHEME ($1000's)	TREATMENT COSTS ($1000's)	DISCHARGE COSTS ($1000's)	TOTAL NET PRESENT WORTH ($1000's)
1	40	5,068[1]	3,505[3]	1,961[7]	187[9]	10,721[11]
2	45	2,806[2]	3,505[3]	1,961[7]	187[9]	8,459[11]
3	25	5,068[1]	4,580[4]	2,269[7]	190[9]	12,107
4	30	2,806[2]	4,696[4]	2,324[7]	187[9]	10,013
5	25	5,068[1]	4,062[5]	2,773[7]	190[9]	12,093
6	30	2,806[2]	4,175[5]	2,841[7]	187[9]	10,009
7	25	5,068[1]	4,580[4]	2,834[8]	190[9]	12,672
8	30	2,806[2]	4,696[4]	2,893[8]	187[9]	10,582
9	25	5,068[1]	2,875[6]	3,008[8]	83[10]	11,034
10	30	2,806[2]	2,939[6]	3,073[8]	83[10]	8,901

(1) In-place decontamination.

(2) In-place closure.

(3) 13 interceptor well sets with a capacity of 70 gpm/set.

(4) Interceptor (int.) and extraction (ext.) wells

0-10 years 13 int. @ 40 gpm and 10 ext. @ 70 gpm
10-20 years 11 int. @ 65 gpm and 5 ext. @ 100 gpm
20+ years 2 int. @ 75 gpm and 7 ext. @ 150 gpm.

(5) 13 interceptor well sets with a capacity of 140 gpm/set.

(6) 10 extraction wells @ 140 gpm with 13 injection wells at 70 gpm.

(7) 99 percent treatment efficiency.

(8) 99.9 percent treatment efficiency.

(9) Percolation pond construction and reclamation.

(10) Cost of maintaining a pressurized injection system.

(11) Net present worth for the first 30 years of treatment.

TABLE 7-4

NET PRESENT WORTH SUMMARY
OF GROUND WATER REMEDIAL ACTION ALTERNATIVES
AIR STRIPPING

ALTERNATIVE	REMEDIATION PERIOD (years)	SOURCE REMEDIATION ($1000's)	PUMPING SCHEME ($1000's)	TREATMENT COSTS ($1000's)	DISCHARGE COSTS ($1000's)	TOTAL NET PRESENT WORTH ($1000's)
1	40	5,068(1)	3,505(3)	1,412(7)	187(8)	10,172(9)
2	45	2,806(2)	3,505(3)	1,412(7)	187(8)	7,910(9)
3	25	5,068(1)	4,580(4)	1,494(7)	190(8)	11,332
4	30	2,806(2)	4,696(4)	1,494(7)	187(8)	9,183
5	25	5,068(1)	4,062(5)	1,551(7)	190(8)	10,871
6	30	2,806(2)	4,175(5)	1,551(7)	187(8)	8,719

(1) In-place decontamination.

(2) In-place closure.

(3) 13 interceptor well sets with a capacity of 70 gpm/set.

(4) Interceptor (int.) and extraction (ext.) wells

0-10 years 13 int. @ 40 gpm and 10 ext. @ 70 gpm
10-20 years 11 int. @ 65 gpm and 5 ext. @ 100 gpm
20+ years 2 int. @ 75 gpm and 7 ext. @ 150 gpm.

(5) 13 interceptor well sets with a capacity of 140 gpm/set.

(6) 10 extraction wells @ 140 gpm with 13 injection wells at 70 gpm.

(7) 99 percent treatment efficiency.

(8) Percolation pond construction and reclamation.

(9) Net present worth for the first 30 years of treatment.