FINAL

EXPLANATION OF SIGNIFICANT DIFFERENCES #3
CHANGE IN GROUNDWATER TREATMENT SYSTEM AND ADDITION OF

1,4-DIOXANE AS A CONTAMINANT OF CONCERN

NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE

Twin Cities Army Ammunition Plant *October 15, 2020*

1.0 INTRODUCTION AND STATEMENT OF PURPOSE

An Explanation of Significant Differences (ESD) is required for Operable Unit (OU) 2 at the New Brighton/Arden Hills Superfund Site ("NB/AH Superfund Site", also referred to as the Twin Cities Army Ammunition Plant or "TCAAP" site) to modify the 1997 OU2 Record of Decision (ROD) due to a change in the groundwater treatment technology used in the extraction and treatment system for deep groundwater. The change does not alter the overall cleanup approach documented in the 1997 OU2 ROD. This ESD also documents the addition of 1,4-dioxane to the list of contaminants of concern (COCs). This ESD was prepared in accordance with Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 and Section 300.435(c)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The ROD was originally signed in October 1997 and was amended in 2007, 2009, 2012, 2014, and 2018. In addition, two previous ESDs were issued in 2009. Of these, only the original 1997 OU2 ROD and ESD #1 (2009) pertain to deep groundwater at OU2. This ESD will become part of the Administrative Record (AR) for TCAAP and will be available to the public at the following location(s):

Location	Address	Phone Number	Hours of Operation
Minnesota Army National Guard (MNARNG) Building	4761 Hamline Ave North Arden Hills, MN 55112	651-282-4420	Access can be arranged by contacting Mary Lee at mary.l.lee.civ@mail.mil, or 651-282-4420
Ramsey County Library, New Brighton Branch	400 10th St NW, New Brighton, MN	651-724-6002	Mon: 10 a.m. - 5 p.m. Tue: 10 a.m. - 8 p.m. Wed: 1 p.m. - 8 p.m. Thu-Sat: 10 a.m. - 5 p.m. Sun: Closed

1.1 Site Name and Location

The New Brighton/Arden Hills (NB/AH) Superfund Site consists of the former TCAAP facility in Arden Hills, Minnesota, as well as groundwater contamination underlying several surrounding communities. The NB/AH Superfund Site is subdivided into three OUs (OU1 through OU3) as shown in Figure 1. OU2, the subject of this ESD, includes soil, sediment, surface water, and groundwater contamination in the area that comprised the TCAAP facility in 1983, when the NB/AH Site was placed on the National Priorities List (NPL). OU2 also includes the shallow Site A groundwater plume that extends off the north end of the former TCAAP facility. OU1 and OU3 encompass deep groundwater contamination located outside the OU2 boundary. OU1 and OU3 are sometimes referred to as the “North Plume” and “South Plume”, respectively.

1.2 Identification of Lead and Support Agencies

Cleanup of the TCAAP site is conducted by the Army as the lead agency under the Federal Facility Agreement (FFA) signed in 1987 by the Army, United States Environmental Protection Agency (USEPA), and Minnesota Pollution Control Agency (MPCA). Environmental investigations and remedial actions at the TCAAP site are conducted under the structure of the CERCLA. Specifically, Section 117c of CERCLA, as well as Section 300.435(c)(2)(i) of the NCP.

The deep groundwater remedial actions were chosen in accordance with CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) (Title 42, United States Code, sections 9601 to 9675) and, to the extent practicable, the NCP (Title 40 of the Code of Federal Regulations [CFR], Part 300).

1.3 Summary of Circumstance Requiring an Explanation of Significant Differences

The Army has prepared this ESD to document the change in groundwater treatment technology for the source wells to treat an additional COC: 1,4-dioxane.

This ESD was prepared in accordance with the guidelines presented in *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (United States Environmental Protection Agency [USEPA] 1999), and includes all items listed in Highlight 7-2 of that document: Sample Outline and Checklist for ESDs and ROD Amendments (see Table 1 for a summary of this checklist).

Table 1. USEPA Checklist for ESDs

Component	ESD Checklist Item	Where Item is Addressed in the SD032 ESD
Introduction to the Site and Statement of Purpose	Site name and location.	Section 1.1, "Site Name and Location"
	Identification of lead and support agencies.	Section 1.2, "Identification of Lead and Supporting Agencies"
	Citation of CERCLA §117(c) and NCP §300.435(c)(2)(i)	Section 1.2, "Identification of Lead and Supporting Agencies"

Table 1. USEPA Checklist for ESDs

Component	ESD Checklist Item	Where Item is Addressed in the SD032 ESD
	Include date of ROD signature.	Section 1.0, “Introduction and Statement of Purpose"
	Summary of circumstances that led to the need for an ESD.	Section 1.3, "Summary of Circumstances Requiring an Explanation of Significant Differences"
	Statement that ESD will become a part of the Administrative Record file (NCP 300.825(a)(2)).	Section 1.0, “Introduction and Statement of Purpose"
	Address of location where the files is available and hours of availability.	Section 1.0, “Introduction and Statement of Purpose"
Site History, Contamination, and Selected Remedy	Brief summary of contamination problems and site history.	Section 2.1, "Site and Contamination History"
	Present the Selected Remedy, as originally described in the ROD.	Section 2.2, "Selected Remedy"
Basis for the Document	Summarize information that prompted and supports significant differences from the Selected Remedy, including the results of the treatability studies or other information developed or provided during the remedial design process.	Section 3, "Basis for the Explanation of Significant Differences"
	Reference any information in the Administrative Record that supports the need for the change.	Section 3, "Basis for the Explanation of Significant Differences"
Description of Significant Differences or New Alternatives	Describe the significant differences between the remedy as presented in the ROD and the action now proposed, highlighting scope, performance, and cost.	Section 4.1, "Significant Differences"
	Describe any changes in Expected Outcomes that will result from the ESD.	Section 4.2, "Changes in Expected Outcomes"
Support Agency Comments	Include a summary of support agency comments on the ESD.	Section 5, "Support Agency Comments"
Statutory Determinations	State that the modified remedy satisfies CERCLA §121.	Section 6, "Affirmation of Statutory Determinations"
Public Participation Compliance	Document that the public participation requirements set out in NCP §300.435(c)(2)(i) have been met.	Section 7, "Public Participation"

Notes:

Components and checklist items are from highlight 7-2 of A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (USEPA 1999)
§ - Section
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
ESD - Explanation of Significant Differences
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
ROD - Record of Decision
USEPA - United States Environmental Protection Agency

2.0 SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

This section describes site history and contamination, specifically the deep groundwater impacts at OU2. The remedy for OU2 deep groundwater is also summarized.

2.1 Site and Contamination History

The former TCAAP facility was constructed between August 1941 and January 1943 in the northern portion of the Minneapolis – St. Paul metropolitan area, in Ramsey County, Minnesota, surrounded by the cities of New Brighton, Arden Hills, Mounds View, and Shoreview. The former TCAAP facility primarily produced and tested small-caliber ammunition and related materials for the Army. Other uses included manufacture of munitions-related components, handling/storage of strategic and critical materials for other government agencies, and various non-military activities. Production began in 1942, and operations alternated between periods of activity and standby related to wars until manufacturing ceased in 2005.

During operations, solvents were used as part of some manufacturing operations. Disposal of solvents and other wastes at the former TCAAP facility resulted in on-site soil impacts and groundwater contamination that migrated beyond the original TCAAP boundary. Groundwater impacts were first discovered in July 1981, leading to soil and groundwater investigations on and off former TCAAP property. It was determined that the former TCAAP facility was the source of contamination, and the former TCAAP property and area of affected groundwater contamination were placed on the NPL in 1983 as the NB/AH Superfund Site.

2.2 Selected Remedy for OU2

The 1997 OU2 ROD was amended in 2007, 2009, 2012, 2014, and 2018. The remedial action requirements for OU2 soil and groundwater were set forth in the 1997 OU2 ROD and amendments:

- ROD Amendment #1 related to Site C-2 (2007),
- ROD Amendment #2 related to Site I groundwater (2009),
- ROD Amendment #3 related to various soil sites (2009),
- ESD #1 related to groundwater (2009),
- ESD #2 related to various soil sites (2009),
- ROD Amendment #4 related to Building 102 shallow groundwater, aquatic sites, and various soil sites (2012), and
- ROD Amendment #5 related to various soil sites (2014).
- ROD Amendment #6 related to Site A groundwater (2018)

As summarized in the 1997 OU2 ROD, an Interim Response Action Plan for TCAAP (USEPA 1987) was prepared providing specific criteria for the Boundary Groundwater Recovery System, (BGRS) which started on October 19, 1987. Initially operated as six extraction wells on the southwest OU2 boundary, the BGRS was later expanded between 1987 and 1989 to include six additional extraction and five source control wells and was renamed as the TCAAP Groundwater Recovery System (TGRS). The TGRS has largely hydraulically contained contaminated groundwater at the southwest boundary of the former TCAAP facility, capturing contaminated groundwater that originated at the OU2 source areas (Sites D, G and I) and minimizing the migration of Trichloroethene (TCE)-impacted groundwater into OU1. Since the TCE plume has narrowed since the start of operation, select wells positioned outside the current plume footprint or that did not contribute substantive capture benefit have been turned off. As of

2020, the TGRS operates with 11 wells including eight boundary extraction wells and three source control wells.

The selected remedy for Deep Groundwater in the 1997 OU2 ROD consists of five remedial components that include continued use of the TGRS, with modifications to improve VOC contaminant removal from the source area. It also includes an annual review of new and emerging technologies potentially applicable to the Deep Groundwater. ESD #1 (2009) added land use controls to the selected remedy to protect groundwater monitoring, extraction, and treatment system infrastructure and to prohibit groundwater use. Figure 2 presents the remedy selected in the 1997 OU2 ROD.

Since 1987, TCE-impacted groundwater has been effectively treated by air stripping to meet the cleanup requirements. Treated effluent is discharged to the Arsenal Sand and Gravel Pit where it recharges overburden sands. The TGRS was designed to operate at a maximum capacity of 2,900 gallons per minute (gpm), which includes a significant safety margin above its current operational flow rate to accommodate potential fluctuations in system operation.

Operation of the TGRS remedy has been effective in reducing the TCE concentrations at nearly all OU2 monitoring wells by approximately one order of magnitude. Significant reductions in TCE concentrations were evident during the early 1990s; however, slower relative declines in TCE concentration have occurred over the last 10 to 20 years as anticipated.

3.0 BASIS FOR THE EXPLANATION OF SIGNIFICANT DIFFERENCES

Since the 1997 OU2 ROD and amendments were signed, Annual Performance Reviews (APRs) and five-year reviews (1999, 2004, 2009, 2014, 2019) have been issued to summarize the status of remedy implementation and address how the remedies are performing for each of the three operable units related to the New Brighton/Arden Hills (NB/AH) Superfund Site. In early 2015, an emerging contaminant, 1,4-dioxane, was detected in New Brighton's water supply (with detections up to 6.8 micrograms per liter [µg/L]). New Brighton notified the Minnesota Department of Health (MDH) and temporarily ceased operation of the New Brighton Contaminated Groundwater Recovery System (NBCGRS) that discharges treated groundwater to the city's public water supply until a supplemental investigation could be performed and 1,4-dioxane treatment system could be designed and installed. NBCGRS operation was stopped on April 15, 2015.

A supplemental, full groundwater sampling event at OU1, OU2 and OU3 monitoring wells was completed in 2015 and 2016 for 1,4-dioxane. Since then, detections of 1,4-dioxane in groundwater continue to be monitored on an annual basis, and reporting has been expanded to include 1,4-dioxane concentrations and contours. Flow from the overburden to bedrock and within bedrock is complex and controls the TCE and 1,4-dioxane groundwater plume distributions within the overburden and bedrock downgradient of historical sources. The highest 1,4-dioxane concentrations were observed in wells near Site G, which exceed the current MDH Health Risk Limit (HRL) of 1 microgram/liter (µg/L) by over two orders of magnitude.

In 2017, the Army and the City of New Brighton selected a new treatment technology for removing 1,4-dioxane from NBCGRS effluent: Ultraviolet (UV)/Peroxide Advanced Oxidation

(AO). OU1 upgrades were completed first because the New Brighton Water Treatment Plant (NBWTP) provides drinking water to local residents. In November 2018, pumping at NBCGRS' six municipal wells were restarted with UV/AO treatment.

The existing OU2 treatment system, TGRS, was not designed to treat the emerging COC 1,4-dioxane. In 2017, the Army performed a remedy review with the USEPA and MPCA. The review determined that 1,4-dioxane concentrations are highest at Site G and recommended targeted treatment be installed at Site G. In 2019, the Army performed an optimization study consisting of several vertical aquifer profile borings located downgradient of Sites G and D and within Site I to determine the location of new source wells and increase the recovery of the contaminant.

Based on the optimization study, five new source wells (SC-6 through SC-10) will be installed. The new source wells, and one existing source area well (SC-5), will be rerouted to the new AO system. The AO system, named Source Groundwater Recovery System (SGRS), will be installed to remove and treat the highest concentrations of 1,4-dioxane and TCE. Effluent from the SGRS will then be routed to a collocated new air stripper to remove residual VOC contaminants not completely treated by the AO system (e.g., 1,1,1-trichloroethane and TCE).

The SGRS will consist of the AO system and the new air stripper and will be located between SC-5 and SC-3.The new source wells, along with the AO system, will optimize and increase contaminant collection site wide. Treated groundwater from the SGRS will be tied into the existing water discharge line and discharged to the gravel pit.

The remaining groundwater pumped from extraction wells along the boundary will continue to be treated with the existing TGRS air stripper. The boundary wells have a much lower TCE and 1,4-dioxane load.

4.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES

The Army prepared this ESD to address the following:

- Addition of 1,4-dioxane as a COC and
- Addition of remedial technologies to treat 1,4-dioxane.

4.1 Significant Differences

The 1997 OU2 ROD states that the remedial action objective for the former TCAAP facility is to mitigate the potential risk of exposure of human and ecological receptors to onsite COCs in soil, groundwater, and surface water. The selected remedy for deep groundwater was groundwater extraction and treatment via the TGRS.

Operation of the OU2 remedy (using an air stripper) has been effective in reducing the concentrations of TCE and other chlorinated VOCs in groundwater.

The discovery of 1,4-dioxane requires the treatment train to be updated because air stripping is not an effective treatment for 1,4-dioxane. Data has also shown that 1,4-dioxane is most elevated downgradient of Site G. The optimization review evaluated the overall containment remedy relative to both source removal and OU2 boundary control and identified optimization

steps to enhance TCE mass removal, focus groundwater containment, and provide 1,4-dioxane treatment.

The optimization study demonstrated that the SGRS will reduce concentrations of 1,4-dioxane and TCE from extracted groundwater at Sites D, G, and I (SC5 through SC10) to below 1 µg/L for 1,4-dioxane and 5 µg/L for TCE at a design flow rate of up to 600 gpm. The AO system effluent will be discharged to the gravel pit.

Routine influent and effluent sampling from the SGRS will be performed to monitor influent 1,4-dioxane and TCE (and other constituent) concentration trends and verify overall treatment system efficiency. Analytical data will be used to optimize extraction rates as part of the adaptive design approach.

An adaptive design approach will be used to incorporate flexibility in the volume of water that is processed through the SGRS (e.g., variable frequency drives on motors, bypass piping, etc.). The SGRS equipment and control infrastructure will be designed to allow for modifications and/or upgrades based on future influent flow and concentration conditions. Additionally, an adaptive operation and management approach (e.g., routine monitoring and sampling, extraction well and system flow tracking) will be used to allow for changes to the AO system operation that will optimize operation while still achieving all required regulatory treatment and discharge criteria objectives.

4.2 Changes in Expected Outcomes

As described, groundwater extracted from the source control wells will be conveyed to and treated using the SGRS, which will treat the groundwater from the source control wells separately from the groundwater from the existing boundary control wells treated by the TGRS. SGRS effluent will be tied into the existing water discharge line and combine with TGRS effluent before discharging to the gravel pit.

Groundwater extracted from the existing boundary control wells will continue to be treated by the TGRS and discharged to the gravel pit using existing infrastructure. The TGRS meets the current discharge criteria for TCE and other COCs but does not remove 1,4-dioxane. Significant reductions in air emissions will be realized after the source control well inputs to the TGRS are removed.

The SGRS treating extracted groundwater from the source control wells will reduce elevated concentrations of 1,4-dioxane, TCE, and other COCs to below the current discharge criteria of 5 ug/L for TCE and reduce 1,4-dioxane concentrations to less than 1 µg/L prior to mixing with discharge from the TGRS.

Improvements in groundwater quality data will be leveraged to continuously refine capture operations to maximize mass recovery throughout OU2 (e.g., discontinue redundant or unnecessary extraction wells, manipulate current monitoring infrastructure and refine primary extraction well locations). Source control will enhance continued COC concentration reduction within OU2 groundwater, and data will be used to assess when TGRS operations can be further

reduced or eventually discontinued – with source zone extraction serving for stand-alone OU2 COC control.

5.0 SUPPORT AGENCY COMMENTS

USEPA and MPCA have ongoing involvement in the decision-making process associated with the modification to the remedy for OU2. Their comments and edits were addressed before this ESD was finalized and submitted for signatures. The Army will also obtain concurrence from USEPA and MPCA on the pending Work Plan which will present the proposed modifications to the treatment system to address 1,4-dioxane.

6.0 AFFIRMATION OF STATUTORY DETERMINATIONS

The proposed change to the selected remedy will continue to satisfy the requirements under Section 121 of CERCLA. The modified remedy will remain protective of human health and the environment and will continue to comply with federal and state Applicable or Relevant and Appropriate Requirements and be cost effective. Figure 3 presents the modified remedy.

7.0 PUBLIC PARTICIPATION

A notification to the public concerning this ESD will be made in the local newspaper after signature. The 1997 OU2 ROD and this ESD are available to the public at the following locations, as part of the Administrative Record:

- MNARNG, 4761 Hamline Ave North Arden Hills, MN 55112, 651-294-4930
- Ramsey County Library – New Brighton Branch, 400 10th St NW, New Brighton, MN 55112, 651-724-6002

8.0 REFERENCES

PIKA-Arcadis JV. 2018a. Deep Groundwater Characterization Report. January 31.

PIKA-Arcadis JV. 2018b. TCAAP Operable Unit Remedy Review. June 22.

PIKA-Arcadis JV. 2020. Source Investigation and Completion Letter Report. September.

USEPA. 1987. Interim Response Action Plan. 1987.

USEPA. 1999. A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents. EPA 540-R-98-031. Washington, D.C. July.

03 DEC 2020

Alicia M. Masson
Colonel, Commander
U.S. Army Environmental Command

Date

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DOUGLAS BALLOTTI
Date: 2021.03.22 13:31:35
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3/22/21

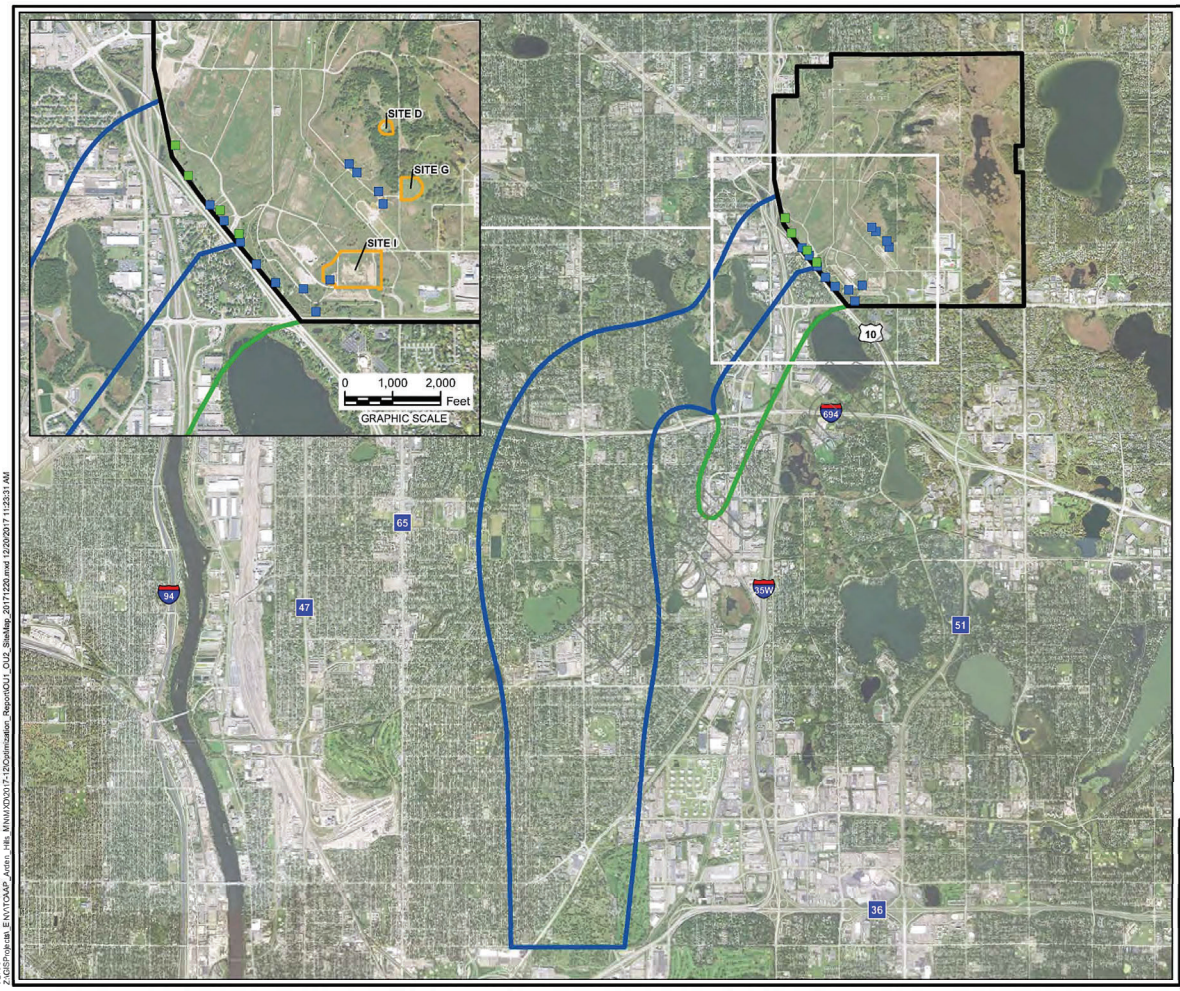
Douglas Ballotti
Director
Superfund and Emergency Management Division
U.S. Environmental Protection Agency
Region 5

Date

Kathryn J. Sather, Director
Remediation Division
Minnesota Pollution Control Agency

2/8/2021
Date

LIST OF FIGURES



LEGEND:

- TGRS BEDROCK EXTRACTION WELL
- TGRS OVERBURDEN EXTRACTION WELL
- OPERABLE UNIT 1
- OPERABLE UNIT 2
- OPERABLE UNIT 3
- SITE BOUNDARIES

0 4,000 8,000 Feet

GRAPHIC SCALE

NOTES:

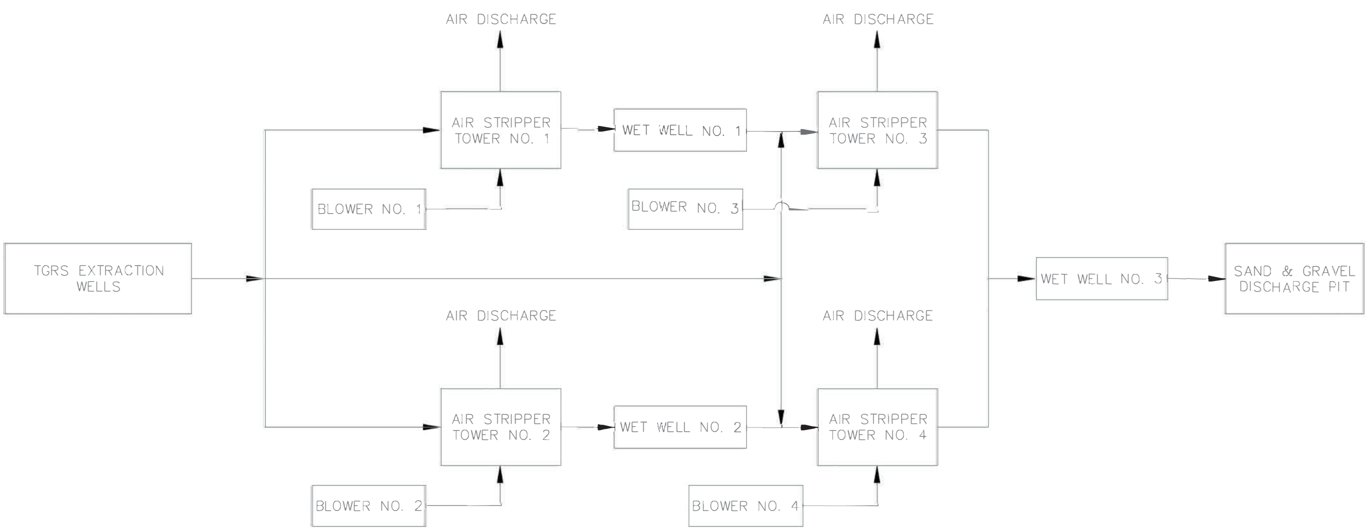
1. ALL LOCATIONS ARE APPROXIMATE
2. 2015 AERIAL PHOTOGRAPH (SOURE: NAIP)

TWIN CITIES ARMY AMMUNITION PLANT
ARDEN HILLS, MINNESOTA

SITE LOCATION MAP

PIKA
ARCADIS a joint venture

FIGURE
1

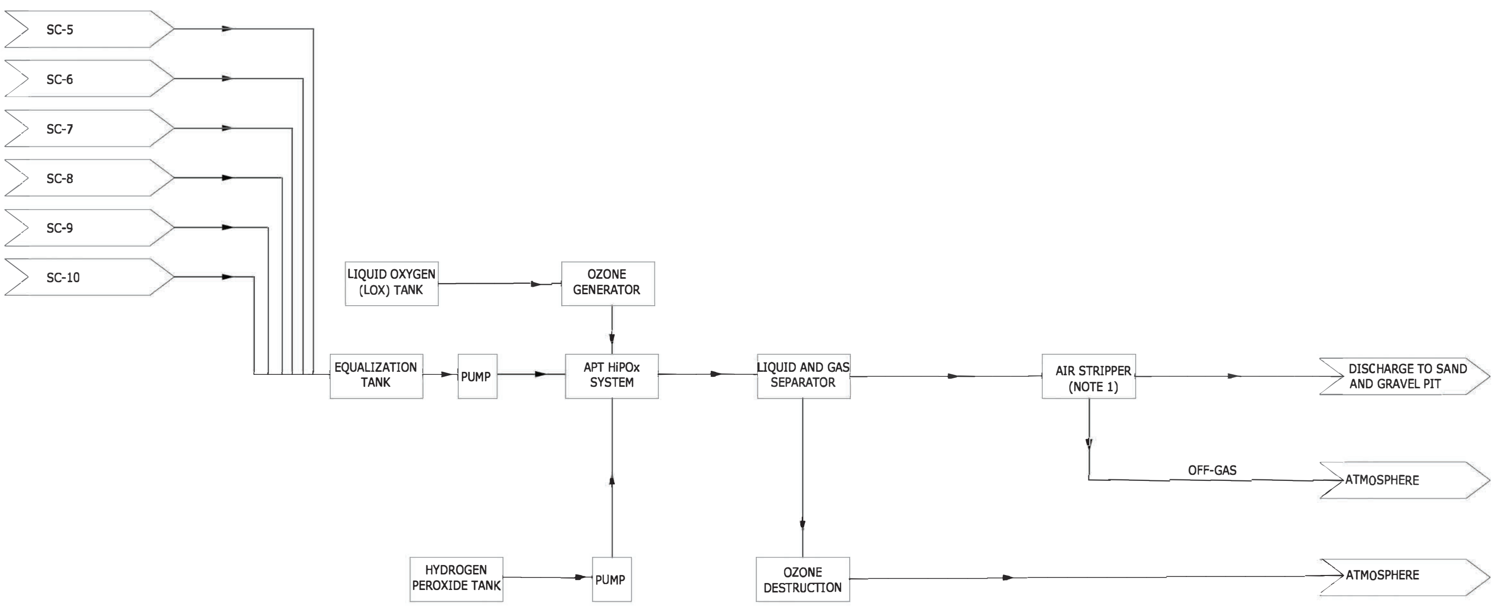


TWIN CITIES ARMY AMMUNITION PLANT
ARDEN HILLS, MN

**SELECTED REMEDY:
PROCESS FLOW DIAGRAM: TREATMENT
SYSTEM FOR BOUNDARY WELLS**

PIKA
ARCADIS
a joint venture

FIGURE
2



NOTE:

1. PUMPS ON AIR STRIPPER SKID WILL DISCHARGE TREATED WATER TO SAND AND GRAVEL PIT.

TWIN CITIES ARMY AMMUNITION PLANT
ARDEN HILLS, MN

MODIFIED REMEDY: PROCESS FLOW DIAGRAM: TREATMENT SYSTEM FOR SOURCE AREA WELLS

PIKA ARCADIS a joint venture

FIGURE
3