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U.S. Army Toxic and Hazardous Materials Agency

Tooele Army Depot—North Area

Final Memorandum on Remedial-Action Objectives for Operable Units 4-10

DECEMBER, 1992

Prepared for
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland 21010-5401

Contract No. DAAA-90-D-0007

Prepared by
SEC Donohue, Inc.
Grand Junction, Colorado 81506

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The Final Memorandum on Remedial Action Objectives(MRAO) summarizes the response objectives, remedial action objectives, and general response actions developed for each operable unit at Tooele Army Depot - North Area(TEAD-N). This process was the first step in the development of remedial action alternatives required to complete a Feasibility Study (FS) under CERCLA. Objectives are presented for each potentially contaminated medium within an operable unit including soil, surface water, groundwater, and air. Response actions summarize the types of remedial actions available that can be used to meet or exceed cleanup goals and satisfy the response objectives.

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Final Memorandum on Remedial-Action Objectives for Operable Units 4-10

December 1992

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Prepared for

U. S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY (USATHAMA)
ABERDEEN PROVING GROUND, MARYLAND

Prepared by

SEC Donohue, Inc.
(Formerly Chem-Nuclear Environmental Services, Inc.)
Grand Junction, Colorado 81506

EXECUTIVE SUMMARY

This document is the Final Memorandum on Remedial-Action Objectives (MRAOs) for Operable Units (OUs) 4 through 10 of Tooele Army Depot —North Area (TEAD-N), Tooele, Utah. The MRAOs have been prepared by SEC Donohue, Inc. (formerly Chem-Nuclear Environmental Services, Inc.), as deliverables under a Federal Facilities Agreement (FFA) between TEAD, the State of Utah, and the Environmental Protection Agency (EPA). The FFA requires the completion of a Remedial Investigation/ Feasibility Study (RI/FS) for 17 sites contained within 7 OUs at TEAD-N.

The purpose of an MRAO is to develop response objectives, remedial-action objectives, and general-response actions for each OU at TEAD-N. This process is the first step in the development of remedial-action alternatives required to complete an FS under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by SARA (1986). Each MRAO was prepared separately then combined to form this document. Divider tabs have been provided for easy access to individual MRAOs.

The general location of each OU is shown in Figure 1 of this summary. Detailed descriptions of sites within each OU are provided in the individual MRAOs. Included, where applicable, are maps showing the locations of proposed RI sampling activities to be completed in the fall of 1992. Results of these activities, when available, may result in the need to revise the MRAOs. Subsequent revisions may include changes in response objectives, remedial-action objectives, and/or general-response actions.

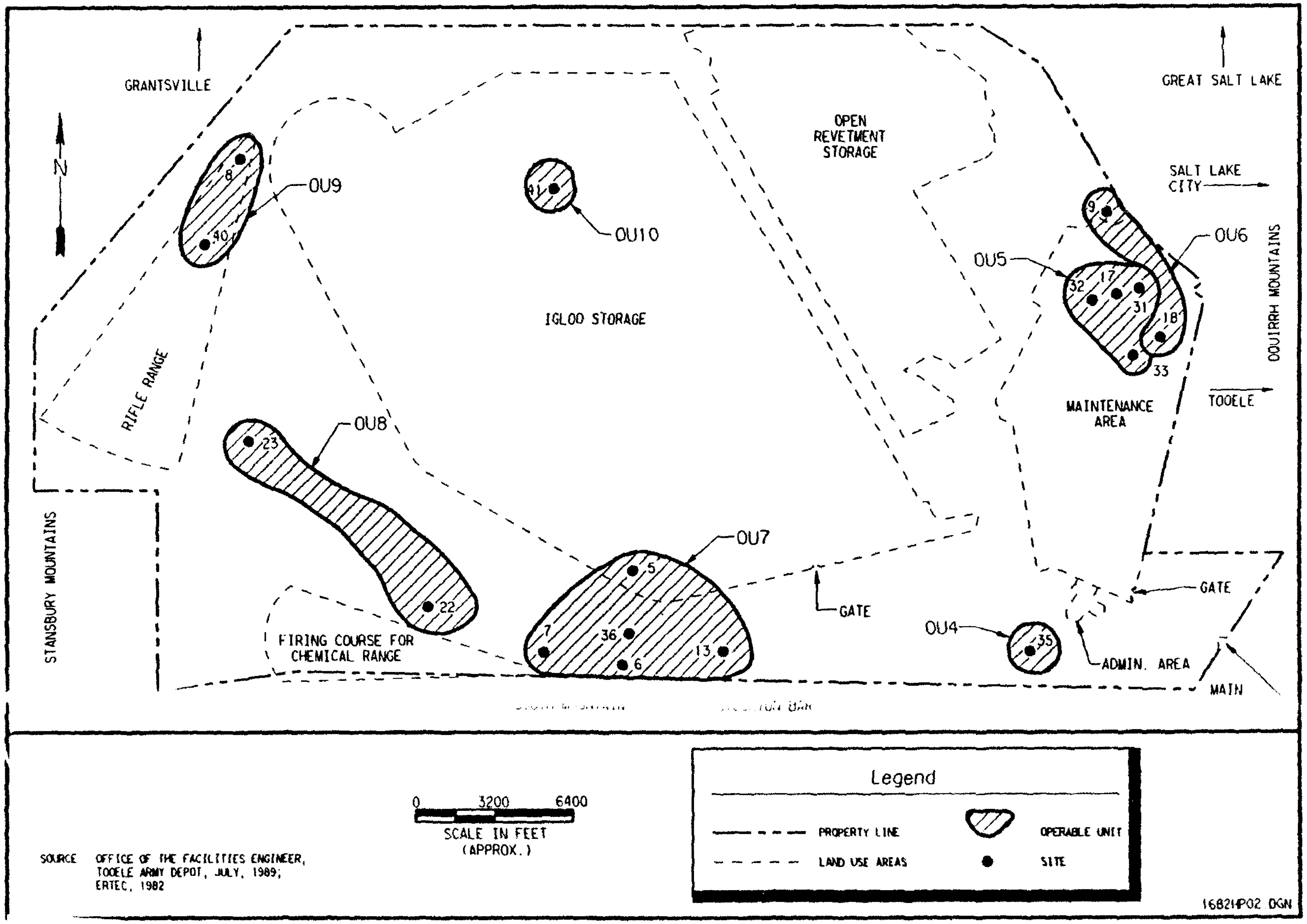

Figure 1. Location of Operable Units/Sites

FINAL MEMORANDUM ON REMEDIAL-ACTION OBJECTIVES

for

OPERABLE UNIT 4

TOOELE ARMY DEPOT—NORTH AREA, UTAH

December 1992

Contract No. DAAA15-90-D-0007

Prepared for
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland 21010-5401

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Grand Junction, Colorado 81506

EXECUTIVE SUMMARY

The Tooele Army Depot—North Area (TEAD-N) contains 46 sites, which were previously identified as having the potential for releasing or having released contaminants into the environment. These sites were originally considered Solid Waste Management Units (SWMUs) under a Resource Conservation and Recovery Act (RCRA) Corrective Action Permit. However, TEAD-N has been designated a National Priority List (NPL) site, which under the Comprehensive Environmental Response, Compensation, and Liability ACT of 1980 (CERCLA) as amended by SARA (1986), is required to perform a Remedial Investigation/Feasibility Study (RI/FS) to characterize the nature and extent of risks posed by hazardous-waste sites at TEAD-N. As a result of this requirement, 17 of the 46 RCRA SWMUs have been regrouped into seven Operable Units (OUs) under CERCLA (Superfund) by the Environmental Protection Agency (EPA) and the State of Utah.

The purpose of a Memorandum on Remedial-Action Objectives (MRAO) is to develop response objectives, remedial-action objectives, and general-response actions to aid in the development of remedial alternatives required to complete an FS for each OU at TEAD-N. This MRAO specifically addresses the remedial-action objectives for OU 4 at TEAD-N.

OU 4 is located in the southeast portion of TEAD-N in an area referred to as the Wastewater Spreading Area. This area consists of several unlined ditches leading to a ravine with channels cut through the ravine. In the past, wastewater from an on-site housing area was allowed to discharge to the ditches that empty to the ravine and subsequently discharge to a spreading area. This wastewater was allowed to percolate, infiltrate, and evaporate from the ditches, ravine, and spreading area. It is not known whether other sources of wastewater discharged to the Wastewater Spreading Area. Suspected contaminants from the wastewater include Volatile Organic Compounds (VOCs), semi-Volatile Organic Compounds (semi-VOCs), metals, and nitrates.

No previous data have been collected from the Wastewater Spreading Area. Current RI/FS Work Plans submitted by SEC Donohue, Inc., call for the sampling of soil/sediments from the ditches, ravine, and the ravine spreading area (i.e., outwash fan). These samples will be analyzed for VOCs, semi-VOCs, inorganics, and anions. Since contamination of the Wastewater Spreading Area has not been confirmed, the potential-response objectives contained in this document are based only on suspected contaminants that are typically present in domestic wastewater streams.

The potential-response objectives for possible contamination of the surface-soil, surface-water, and groundwater pathways in the Wastewater Spreading Area include the following:

- minimize potential for direct contact with contaminated soil by human and/or environmental receptors.
- reduce or eliminate potential for human and nonhuman exposure as a result of inhalation of vapors and/or airborne particulates in the air pathway.
- prevent further migration of contaminants through the surface-water environment to downstream environmental receptors.
- prevent contaminant migration to the groundwater pathway.
- comply with all chemical-specific, location-specific, and action-specific Applicable or Relevant and Appropriate Requirements (ARARs) that affect remedial actions at this OU.

Preliminary cleanup objectives for organic and inorganic contaminants (if present) will be to:

- meet or exceed all ARARs promulgated through state and federal agencies, that govern the contaminants of concern or established cleanup levels developed through the risk-assessment process.
- limit the total excess cancer risk to human receptors (both current and future) to levels within or below the EPA target-risk-reduction range of 10^{-4} to 10^{-6}.
- limit the hazard index for the total noncancer health risk to human receptors (both current and future) to a level below 1.
- minimize the risk to environmental receptors through source control and/or removal.

To meet the above response and cleanup objectives, several types of response actions were evaluated. These response actions included:

Soils:

- Excavation of contaminated soils using on-site treatment and disposal (treatment technologies included incineration, soil washing/leaching, and solvent extraction)
- Excavation of contaminated soils using off-site disposal at a licensed hazardous-waste facility
- In-situ treatment such as soil aeration, bioremediation, low-temperature air stripping, vitrification, aeration, and soil washing
- Capping of contaminated soils and rerouting surface water drainage
- Institutional controls
- No action

Surface Water:

- Control of surface-water flow around contaminated areas
- Containment of surface water (directed flow to lined pond)
- Institutional controls
- No action

Groundwater:

- On-site removal, treatment, and reinjection
- Institutional controls
- Long-term monitoring
- No action

This document will serve as the first phase of the overall FS. Results of the RI sampling and analysis activities to be performed at the Wastewater Spreading Area will be reviewed as they relate to the response and cleanup objectives and potential cleanup-response actions defined in this memorandum. If no contaminants are identified that exceed the ARARs or risk-based cleanup levels established for TEAD-N, no further FS activities will be required and a no-action recommendation will be made for the Wastewater Spreading Area. If contaminants other than those generally associated with domestic wastewater are found to be present, the objectives and response actions may have to be modified to fit the specific contaminants of concern.

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

SEC Donohue, Inc., is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) for seven Operable Units (OUs) at Tooele Army Depot —North Area, Tooele, Utah (TEAD-N). The RI is designed to provide information on the nature and extent of contamination associated with the site(s) within each OU and, on the basis of these data, evaluate and estimate the risks to human health and the environment as a result of the contaminants present. The FS is designed to assemble and evaluate a range of remedial-action alternatives that will meet the nine criteria established under CERCLA (EPA, 1988) for:

- Overall protection for human health and the environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
- Long-term effectiveness and performance
- Reduction of toxicity, mobility, and volume
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

The purpose of this Memorandum on Remedial-Action Objectives (MRAO) is to provide, as an initial step in the FS process, an assessment of the response objectives, remedial-action objectives, and general-response actions for OU 4 at TEAD-N. An MRAO has also been generated for each of the other six OUs at TEAD. This document is not designed to be a stand-alone document; it, along with the other six MRAOs, will be incorporated into the FS report for TEAD-N. The FS report will summarize the results of the FS process completed for each OU. Revisions to these documents will be made as new data and new information become available.

1.2 SETTING OF THIS TECHNICAL MEMORANDUM

1.2.1 Site Background

TEAD-N encompasses 24,732 acres of the Tooele Valley in Tooele County, Utah. The facility was established in 1942 and has been in continuous operation since that time for the storage, maintenance, and repair of vehicles; storage, issue, and disposal of munitions; and storage of other equipment. Developed features at TEAD-N include igloos, magazines, administrative buildings, an industrial maintenance area, military and civilian housing, roads, hardstands for vehicle storage, and other allied infrastructure.

The Wastewater Spreading Area is located in what is referred to as the industrial area of TEAD-N and is located adjacent to a former residential complex. The site was identified as a result of a review of Environmental Photographic Interpretation Center (EPIC) photographs, which showed liquids and ground staining associated with the former ditches.

1.2.2 Description of Operable Unit 4

OU 4 consists of the Wastewater Spreading Area (see Figure 1), where wastewater was apparently discharged from a former residential area and flowed westward through two culverts under railroad

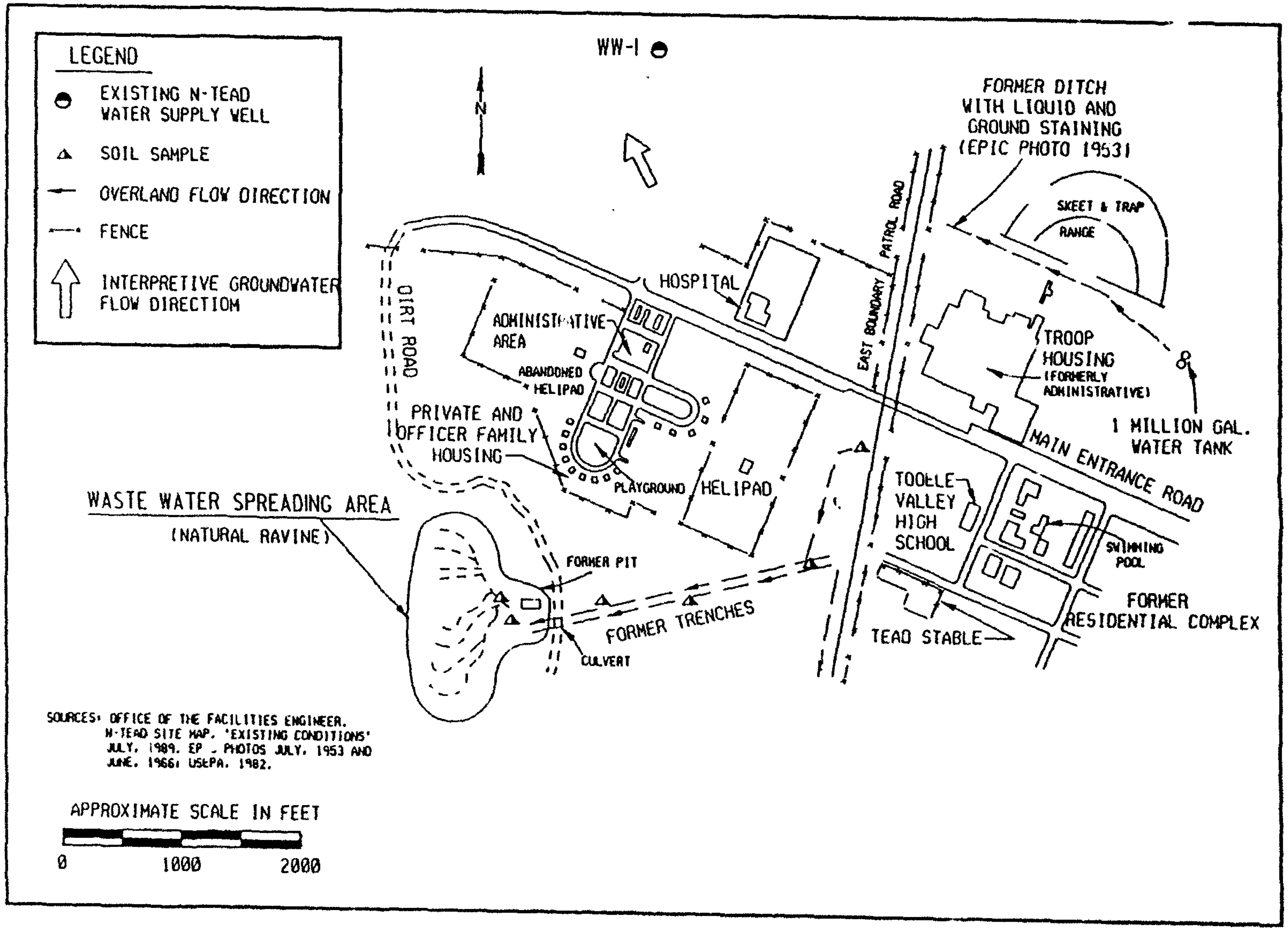

Figure 1. Wastewater Spreading Area (Site 35)

tracks into two unlined ditches, each 4 to 6 feet deep (EA, 1988). The ditches cross a field that slopes toward a ravine, which drops approximately 40 to 50 vertical feet from the surrounding ground surface. Domestic wastewater is thought to have been discharged to this area until the mid-1950s. A 1953 aerial photograph shows liquid in the ditches and in several channels cut at the base of the ravine. The nature of potential contaminants in the liquids is unknown. It is also uncertain whether there may have been other sources of wastewater in addition to the residential area. Liquids from the ditches and ravine discharged into an outwash fan, which spreads discharge water over a broad flat area.

Since the soils in the area are sandy and the ditches, ravine, and spreading area are all unlined, most of the discharged water would have entered the soils through infiltration prior to reaching the spreading area. Discharge and flow in the ditches and ravine would have been intermittent, and the existence of any off-site migration of contaminated water is unlikely. During a site visit to the Wastewater Spreading Area in October 1991 by SEC Donohue personnel, the ditches, ravine, and spreading area were dry, and there was no evidence of recent discharge to the drainage system.

1.2.3 Previous Investigations

Several environmental investigations have been conducted at TEAD-N. In 1982, the EPIC, through an interagency agreement with the EPA and USATHAMA, provided imagery-analysis support for an installation assessment for TEAD-N (EPA, 1982). Aerial photographs from 1953, 1959, 1966, and 1981 were analyzed to determine the potential environmental impact of past installation activities. The Wastewater Spreading Area was identified from the 1953 photographs as a potential waste site from the presence of liquids in the ditches, trenches, and ravine. No other environmental assessments have provided information that confirms the presence or absence of contaminants at this site. The current RI/FS will assess whether contaminants have been released to environmental pathways through surface and near-surface soil/sediment sampling.

1.2.4 Regulatory Background

Environmental studies have been conducted at TEAD-N since 1979. Early studies were performed under the Installation Restoration Program (IRP), which is a four-phase program administered by the Department of Defense (DOD) designed to identify and correct environmental contamination at DOD facilities. These studies included facility-wide assessments, as well as site-specific environmental assessments, Preliminary Assessment/Site Investigations (PA/SI), RI/FS, remedial design, remedial action, and their RCRA equivalents. From these studies and reports, 46 SWMUs were identified. Evaluations for each SWMU or former SWMU are in various stages of completion.

In October 1990, TEAD-N was added to the National Priorities List (NPL). As a result, EPA Region VIII and the State of Utah regrouped the original 46 sites into RCRA SWMUs and CERCLA (Superfund) sites. The CERCLA sites were placed into seven OUs. In 1991, Tooele Army Depot, EPA Region VIII, and the State of Utah entered into a Federal Facility Agreement (FFA) that specified the requirements, responsibilities, and schedule for the completion of all studies and remedial-action activities at TEAD.

SI and RI Work Plans were prepared by E.C. Jordan Company in December of 1990. These plans were submitted to EPA Region VIII and the State of Utah for review in 1991, and comments were received in November of 1991. As a result of the regrouping of the sites at TEAD-N, SEC Donohue was tasked with reformating the plans to meet CERCLA requirements, to include only those sites considered CERCLA sites, and to address concerns and comments received on the E.C. Jordan Plans. All of this work was conducted within the schedule set forth in the FFA. OU 4, the Wastewater Spreading Area, was one of the seven OUs to be characterized under the Superfund program. This MRAO fulfills one of the first requirements specified in the FFA.

1.2.5 Current Activities

Current proposed RI/FS sampling and analysis activities for OU 4 are outlined in the Final RI/FS Work Plan and Final RI/FS Sampling and Analysis Plan for TEAD-N prepared by SEC Donohue and submitted for review in March of 1992. These plans describe surface and near-surface soil/sediment sample collection for the former ditches, trenches, ravine, and spreading area. Results of this sampling effort are expected to be available the fall of 1992. Analytical results from the soil sampling will be used to refine the contaminants of concern (COCs) and to assess ARARs and human health and environmental risk for the COCs at OU 4. These activities will in turn allow revision of the remedial-action objectives for OU 4, which will be included in the Draft FS Report for OU 4. Although a Preliminary Baseline Risk Assessment has been completed for several of the SWMUs and Sites at TEAD-N (SECD, 1992), no risk assessment was completed for the Wastewater Spreading Area (OU 4) due to insufficient data. Similarly, although a general assessment of chemical-specific ARARs has been completed for TEAD-N (ORNL, 1992), existing data are insufficient to provide an ARARs assessment that is specific to OU 4. The general ARARs assessment used available data for TEAD-N to identify general COCs for the facility and to prepare tables of Maximum Contaminant Level (MCL) ARARs for groundwater COCs and To Be Considered (TBC) guidance for soil COCs. Pertinent information from the general ARARs assessment will be incorporated into the ARARs assessment for OU 4 following receipt of the RI data and refinement of the OU 4 COCs.

1.3 DEVELOPMENT OF REMEDIAL-ACTION OBJECTIVES FOR OPERABLE UNIT 4

The FS usually is made up of three phases: the development of alternatives, the screening of the alternatives, and the detailed analysis of the alternatives. This document specifically addresses the first of the three phases of the FS. The first phase of the FS includes the development of remedial-action objectives, which specify the contaminants and media of interest, exposure pathways, and preliminary remediation goals that permit a range of treatment and containment alternatives to be developed. This initial phase includes the development of response objectives, remedial-action objectives, and general-response actions. The response objectives are developed on the basis of the nature and extent of contamination, the resources that are currently and potentially threatened, and the potential for human or environmental exposure. The remedial-action objectives are site-specific goals that define the extent of cleanup required to achieve the response objectives. The response actions consist of remedial-action alternatives/technologies that can be used to meet or exceed the cleanup goals and satisfy the response objectives.

Since no data currently exist for the Wastewater Spreading Area of OU 4, the development of remedial-action objectives was completed on the basis of "suspected" contamination only. The established objectives should be considered preliminary and subject to change as new information is made available.

The development of remedial-action objectives for each medium includes a consideration of chemical-specific ARARs for the compounds of concern. Location- and action-specific ARARs will be identified during the development of remedial-action alternatives in the next step of the FS for this OU. A general location-specific ARARs assessment has been completed for TEAD-N (ORNL, 1992b); potential concerns for remedial actions include the presence of archaeological resources, historic sites, and endangered species on the facility. Examples of potential action-specific ARARs include regulations pursuant to the Occupational Safety and Health Act (for on-site workers during remediation) and regulations pursuant to the Resource Conservation and Recovery Act (e.g., land disposal restrictions, transport of hazardous waste, etc.).

2.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR SOILS

2.1 GENERAL

2.1.1 Site Conditions

Evidence of surface-soil staining was reportedly observed in the Wastewater Spreading Area by EPIC (EPA, 1982) during their review of aerial photography from 1953. No evidence of surface staining was observed by SEC Donohue during a site visit in October 1991. However, the possibility of surface-soil contamination in the areas of the former ditches, trenches, ravine, and spreading area does exist.

2.1.2 Potential Contaminants of Concern

Since the last discharge of wastewater from the former residential complex took place approximately 39 years ago, it is unlikely that significant concentrations of volatile organic compounds (VOCs) from these previous activities would still be present. Also, the possibility of significant nitrates in the soil is small since denitrification (i.e., conversion of NO_3 to inert N_2O and N_2) is likely to have occurred since the 1950s. Therefore, the contaminants of concern selected for the purpose of this MRAO are metals, which have the greatest resistance to leaching and degradation over time.

2.2 POTENTIAL EXPOSURE ROUTES

The potential exposure routes from contaminants of concern in surface and near-surface soils/sediments for both current and future use scenarios are as follows:

- Direct dermal contact with contaminants
- On-site ingestion of contaminants
- Ingestion by consuming bioaccumulated contaminants (i.e., crops, livestock, and wildlife)
- Inhalation of airborne contaminants (i.e., particulates)

Since the type and extent of contamination related to this OU are unknown, the following discussion on exposure routes should be considered preliminary.

It is unlikely that any contaminants are present in surface soils/sediments that would pose a significant risk through direct dermal contact. Since access to the area is restricted to TEAD-N personnel and there is currently no activity in the area, it is also unlikely that exposure through ingestion of contaminants is an exposure pathway of concern.

Since there are no food crops grown on the TEAD-N facility, and there is no evidence for off-site migration of contaminants to neighboring lands used for grazing of livestock, exposure through ingestion of bioaccumulated contaminants is also unlikely. However, limited grazing of livestock (i.e., cattle) is allowed in certain areas of TEAD-N. There is small potential of contaminant uptake by these animals.

The potential for exposure to contaminants through inhalation of airborne contaminants is possible for both on-site and off-site receptors. This potential, however, could be minimized by applying a clean soil cover, through the use of vegetation to reduce dust, or through dust control during any construction activities. The greatest potential for exposure would be to on-site workers during any construction activities in contaminated areas.

Possible future use of OU 4 without remediation for residential or agricultural purposes would potentially increase the risk to human health and the environment. The direct dermal contact and ingestion routes for humans could be of concern in this case because of the potentially greater exposure times for residential receptors than for on-site workers. Similarly, the potential for ingestion of bioaccumulated contaminants and/or inhalation of airborne contaminants may increase in the event of future unrestricted residential or agricultural use.

2.3 POTENTIAL-RESPONSE OBJECTIVES

2.3.1 Prevent Direct Human Exposure to Contaminated Soils

Since there is currently no evidence to suggest that off-site migration of contaminants has occurred, the primary-response objective would be to prevent on-site exposure to contaminated soils at levels that would present an excessive human health risk to TEAD-N personnel, to contractors conducting work in the Wastewater Spreading Area of TEAD-N, or to prospective future residents of the site area.

2.3.2 Reduce or Eliminate Migration of Contaminants to Other Environmental Pathways

Although there is no evidence for off-site migration of potentially contaminated surface water, a response objective for contaminated soils would be to reduce or eliminate the migration of contaminants from the source areas (i.e., ditches) to the surface-water or groundwater pathways. If no remedial action is conducted at the site, a potential exists for future migration of contaminants from soils to surface water or groundwater. Another response objective is to protect surface water and groundwater from this potential migration of contaminants.

2.3.3 Prevent Human Exposure to Airborne Contaminants

The potential for inhalation of contaminants in the air pathway exists at the site as a result of contaminants in surface soils. Another response objective is to reduce or eliminate the potential for airborne-contaminant exposure through the elimination or reduction of soil contaminants available to the air pathway.

2.4 PRELIMINARY REMEDIAL-ACTION OBJECTIVES

To ensure that the above response objectives are met or exceeded, the following remedial-action objectives have been established. This cleanup will be designed to meet or exceed ARARs or risk-based cleanup levels and minimize or eliminate risk to human health and the environment. According to the general ARARs document for TEAD, there are no maximum contaminant levels for soil under federal or state law (ORNL, 1992). Potential TBC guidance levels for soil, from the general ARARs document for TEAD-N, are presented in Table 1.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

2.4.1 Preliminary Cleanup Objectives

Prevention of Accidental Ingestion, Dermal Contact, or Inhalation. The proposed remedial actions will be designed to prevent accidental human ingestion, dermal contact, or inhalation of soil having a total excess cancer risk of greater than 10^{-4} to 10^{-6} or a noncancer hazard index of greater than 1. Following receipt of RI data, the baseline risk assessment for OU 4 will be used to establish specific cleanup levels for the soil COCs.

Prevention of Exposure to Nonhuman Environmental Receptors. The remedial actions will be designed to reduce or eliminate potential exposure to flora and fauna in order to prevent contamination of the food chain as a result of bioaccumulation of contaminants present in soils.

Protection of Other Environmental Pathways. The proposed remedial actions will be designed to prevent migration of soil contaminants from the Wastewater Spreading Area that would result in surface-water or groundwater contamination in excess of Maximum Contaminant Levels (MCLs) or health-based cleanup criteria. Potential MCL levels for water, from the general ARARs document for TEAD-N (ORNL, 1992), are presented in Table 2.

2.5 VOLUME OF SOIL REQUIRING REMEDIATION

An estimation of the volume of soil that may require remediation is dependent upon forthcoming RI data for OU 4. The areal and vertical extent of any soil contamination detected during the RI will be used to estimate the contaminated-soil volume.

2.6 GENERAL-RESPONSE ACTIONS

This section develops general-response actions that can satisfy the response and remedial-action objectives as stated above. A mixture or combination of general-response techniques may be necessary to be totally effective in meeting the remedial-action objectives.

2.6.1 Excavation and On-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding either health-based standards or remedial-action cleanup standards to remove the contaminant source and reduce or eliminate risk to human health or the environment. The soils removed would be treated

Table 1. Potential TBC Guidance Levels for Cleanup of Contaminated Soils at TEAD-N[a]

Chemical	RCRA CBEC mg/kg[b]	RCRA ECHO mg/L[c]	Site Background ug/g[d]
Metals			
Beryllium	0.3	0.1	ND[e]
Chromium	400	10	30
Lead	500	1.5	15
Nickel	1,000	10	7
Zinc	1,000	700	40
Nitroaromatics			
2,4-Dinitrotoluene	0.2 (0.7)	0.05	NA[f]
2,6-Dinitrotoluene	0.2 (0.7)	0.05	NA
HMX	NA	NA	NA
RDX	NA	NA	NA
1,3,5-Trinitrobenzene	4	0.2	NA
2,4,6-Trinitrotoluene	NA	NA	NA
PAHs (carcinogenic)			
Benzo(a)anthracene	0.05	0.01	NA
Benzo(a)pyrene	0.2	0.02	NA
Benzo(a)fluoranthene	0.1	0.02	NA
Chrysene	10	0.02	NA

[a]Except background, values were taken from *Assessment of Chemical-Specific ARARs for Tooele Army Depot, North and South Areas*, Oak Ridge National Laboratory, 1992.

[b]Values in this column are Tier 1 CBEC (concentration-based exemption criteria) for soils proposed in the RCRA hazardous waste identification rule (57 FR 21510, May 20, 1992; final rule expected April 1993). Values in parentheses in this column are Exemption Quantitation Criteria (EQC). When a CBEC is below the EQC, the exemption demonstration must achieve an actual detection limit that is at least as low as the specified EQC.

[c]Values in this column are the maximum contaminant concentrations for the Toxicity Characteristics (ECHO-Expanded Characteristics Option) for leachates proposed in the RCRA hazardous waste identification rule (57 FR 21510, May 20, 1992; final rule expected April 1993).

[d]Concentrations of inorganics in soils in Tooele County; from Boerngen, J.G. and Shacklette, H.T., 1981.

[e]ND=Not detectable.

[f]NA=Not available.

Table 2. Chemical-Specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Groundwater at TEAD-N (μg/L)[a][b]

Chemical	SDWA[c] MCL/MCLG[d]	Proposed SDWA MCL/MCLG	Utah MCLs[e]	TBC Value[f]
Metals				
Arsenic	50[g]	--	50	--
Chromium	100/100[h]	--	50	
Lead	--	--	50	15/0[i]
Nickel	100/100[j]	--	--	--
Thallium	2/0.5[j]	--	--	--
Zinc	5,000[k]	--	5,000[k]	2,100[l]
Organics				
Benzene	5/0[m]	--	5	--
Bis(2-ethylhexyl-phthalate)	6/0[j]	--	--	--
Trichloroethylene	5/0[m]	--	5	--
Anions				
Chloride	250,000[k]	--	250,000[k]	--
Nitrite/Nitrate	10,000/ 10,000[h]	--	--	--
Sulfate	250,000[k]	400,000/ 500,000[n]	500,000- 1,000,000	--
Nitroaromatics				
2,4-Dinitrotoluene	--	--	--	0.05[o]
HMX	--	--	--	400[l]
RDX	--	--	--	2[l]
1,3,5-Trinitrobenzene	--	--	--	2[p]
2,4,6-Trinitrotoluene	--	--	--	2[l]

Footnotes on next page

[a]Except background, values were taken from *Assessment of Chemical-Specific ARARs for Tooele Army Depot, North and South Areas*, Oak Ridge National Laboratory, 1992.

[b]The underlined values indicate the ARAR or TBC for each chemical.

[c]SDWA = Safe Drinking Water Act.

[d]MCL = Maximum Contaminant Level; MCLG = Maximum Contaminant Level Goal.

[e]Utah Administrative Code R309-103, effective July 1, 1991.

[f]TBC = to be considered guidance.

[g]40 FR 59570 (December 24, 1975).

[h]56 FR 3526 (January 30, 1991); effective July 30, 1992.

[i]Established as an action level/MCLG, 56 FR 26460 (June 7, 1991) effective December 7, 1992.

[j]57 FR 31776 (July 17, 1992), effective January 17, 1994.

[k]National secondary drinking water standard; designed to protect the aesthetic quality of water (44 FR 42198, July 19, 1979), also Utah Secondary Maximum Contaminant Levels.

[l]USEPA Office of Drinking Water lifetime health advisory.

[m]52 FR 25690 (July 8, 1987).

[n]55 FR 30370 (July 25, 1990).

[o]Estimated from carcinogen slope factor for a risk of 10^{-6}. The concentration in drinking water that will result in one excess cancer death in 1 x 10^6 people following a lifetime exposure to contaminated drinking water.

[p]Estimated from a reference dose. The concentration in drinking water that is assumed to result in no adverse health effects following daily ingestion for a lifetime.

on-site by soil washing or other treatment techniques suitable for removing the contaminants from the soil. Following treatment to acceptable levels, the soils would be returned to the site as fill.

2.6.2 E--cavation and Off-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding health-based standards or remedial-action cleanup standards in order to remove the contaminant source and reduce or eliminate risk to human health and the environment. The soils removed would be hauled to a licensed facility for treatment and disposal of contaminated soils. Uncontaminated soil would be hauled to the site for backfilling excavated areas. Disadvantages of this general response include the liability implications of off-site transport of contaminated soil and off-site disposal. Additionally, the long-term effectiveness of this method is dependent upon the treatment employed at the receiving treatment and disposal facility.

2.6.3 In-situ Treatment

Several types of in-situ response actions may be used depending on the nature of the contaminants. If organics were found to be present, in-situ soil aeration or biological degradation treatment may be effectively used. However, since the discharge of wastewater occurred approximately 40 years ago, it is unlikely that organic contaminants will be the contaminants of concern. If the contaminants present in soils are metals, in-situ stabilization is a possible treatment method.

2.6.4 Capping of Contaminated Soils and Rerouting of Surface-Water Drainage

This response action would involve the covering of contaminated soils with a plastic liner followed by a compacted clayey soil cap and a layer of top soil and then reseeding with shallow-rooted vegetation (i.e., grasses). Surface-water drainage would be rerouted around the contaminated area using lined ditches and/or pipes. This action would reduce or eliminate the risk of direct contact or ingestion of contaminated soils by human receptors and would reduce the risk due to migration of contaminants to other environmental pathways. This general response would not reduce toxicity or volume of the soil contamination. Long-term maintenance of the cap and enforcement of institutional controls, as described below, would be necessary to prevent intrusive damage to the cap.

2.6.5 Institutional Controls

This response would involve leaving the contaminated soils in place but placing controls on access to the site through deed restrictions, fencing, posting of signs, closure of roads, etc. This response action may be appropriate if the contaminants present have very low mobility, are in low concentrations, or have low toxicity. Long-term enforcement of institutional controls is necessary.

2.6.6 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any soil contamination that is present. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

3.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR SURFACE WATER

3.1 GENERAL

3.1.1 Site Conditions

The ditches and ravine of the Wastewater Spreading Area are no longer used for the discharge of wastewater. Surface-water flow at the site is now limited to periods of heavy precipitation where the drainage carries surface runoff. No water was present in the ditches or ravine at the time of the site visit held in October 1991. Surface water that intermittently flows through the ravine to the spreading area is lost through infiltration and evaporation. There is no evidence of off-site migration of potentially contaminated surface water from this area.

3.1.2 Potential Contaminants of Concern

Metal contaminants suspected to be present in the soils near the residential complex source area would generally have a low mobility and significant leaching and transport of metals to the spreading area is unlikely. No current activities at TEAD-N are likely to contribute additional contaminants to the surface-water pathway. The fact that the residential area has not been used since the 1950s indicates that organic-compound contaminants are not likely to be present in surface water in the Wastewater Spreading Area. Again, for the purpose of this MRAO, metals will be used as potential contaminants of concern.

3.2 POTENTIAL EXPOSURE ROUTES

The potential exposure routes for contaminants in surface water for both current and future use scenarios are:

- On-site direct dermal contact with contaminated water
- On-site ingestion of contaminated water
- Ecological exposure through consumption of contaminated surface water (i.e., from fauna) or through bioaccumulation by uptake of contaminated water (i.e., from flora) in the spreading area.

Direct dermal contact with contaminated surface water is unlikely under current use conditions since access is restricted to TEAD-N personnel and there are presently no work operations in the immediate area of the potentially contaminated water. Ingestion of surface water is also unlikely under current use conditions.

A future residential or agricultural use scenario increases the potential for human exposure through direct dermal contact or ingestion of surface water.

For both current and future use scenarios, however, the greatest potential for exposure to contaminants would be through consumption of wildlife- or livestock-contaminated water or consumption of bioaccumulated contaminants in plants present in the Wastewater Spreading Area. Based upon incidental visual observation, there is no evidence of any stressed vegetation in the area and no evidence of exposure to wildlife in the area.

3.3 POTENTIAL-RESPONSE OBJECTIVES FOR SURFACE WATER

3.3.1 Prevent Direct Human Exposure to Contaminated Surface Water

The main-response objective for potentially contaminated surface water related to the Wastewater Spreading Area would be to prevent accidental human exposure to contaminants by direct contact with or through ingestion of contaminated surface water. Since there currently is no evidence for the off-site migration of surface water originating from the ditches and ravine of the Wastewater Spreading Area, the emphasis of this response objective would be the protection of on-site TEAD-N personnel, their contractors, and potential future residents or users of the property from direct exposure to potentially contaminated surface water.

3.3.2 Reduce or Eliminate Migration of Contaminants to Other Environmental Pathways

The migration of contaminants through the surface-water pathway could result in contamination of other areas and other environmental pathways. A second response objective is to reduce or eliminate this migration potential in order to protect the site from future migration of contaminants to downstream soils/sediments, groundwater, and air via surface-water runoff.

3.3.3 Reduce or Eliminate Risk to Environmental Receptors

The flow of potentially contaminated surface water could result in risk to environmental receptors through consumption of contaminants by ingestion of water or plants that uptake contaminants from the water. Both plants and animals present in the spreading area could be affected by contaminated surface water.

3.4 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR SURFACE WATER

To ensure that the above response objectives are met or exceeded, the following remedial-action objectives have been established. These objectives provide quantitative goals for cleanup if warranted. This cleanup will be designed to meet or exceed ARARs and minimize or eliminate risk to human health and the environment. Table 2 presents potential ARARs for water, based on the general ARARs analysis for TEAD-N.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

3.4.1 Preliminary Cleanup Objectives

Prevention of Accidental Human Ingestion or Dermal Contact. The proposed remedial-action objectives for surface water are to prevent human ingestion or dermal contact with contaminated surface water that presents a total excess cancer risk of greater than 10^{-4} to 10^{-6} or noncancer hazard index of greater than 1.

Prevention or Reduction of Exposure to Nonhuman Environmental Receptors. The remedial actions for surface water will be designed to reduce or eliminate potential exposure of contaminants in surface water by flora and fauna. This will prevent environmental damage and reduce the risk of contaminants entering the food chain.

Protection of Other Environmental Pathways. The remedial actions will also be designed to ensure that risk to other environmental pathways is eliminated or reduced to acceptable levels through the control of surface-water flow and discharge and by control of contaminant sources to the surface-water pathway.

3.5 VOLUME OF SURFACE WATER REQUIRING REMEDIATION

If the surface-soil data from the RI at OU 4 indicate soil contamination in the Wastewater Spreading Area, and the baseline risk assessment indicates that the surface-water pathway presents an excessive human health or environmental risk, an estimate of surface-water volume will be made. The volume estimate will consider storm-water runoff and will be based on the drainage area of OU 4 and precipitation data for the TEAD-N region.

3.6 GENERAL-RESPONSE ACTIONS FOR SURFACE WATER

This section develops general-response actions that can satisfy the remedial-response and remedial-action objectives for surface water stated above. A mixture or combination of general-response techniques may be necessary to be totally effective in meeting the remedial-action objectives.

3.6.1 Control of Surface-Water Flow

Diversion of surface water around the area of potentially contaminated soils through the use of diversion ditches or pipelines would help reduce or eliminate surface-water contamination and subsequent transport to other environmental pathways or receptors. Long-term maintenance of the diversion mechanism is necessary. This approach used in conjunction with remediation of contaminated soils could significantly reduce the potential risk of human exposure and risk to environmental receptors.

3.6.2 Containment of Surface Water

Surface runoff from the ditches and ravine could be directed to and collected in a lined evaporation pond. This would prevent the risk of off-site migration of contaminated surface water, reduce the potential for contaminant migration to the groundwater pathway, and would reduce the potential for further surface- and subsurface-soil contamination in the former spreading area. This pond would be fenced to prevent use of the potentially contaminated water by wildlife and to prevent trespass onto the property by humans. Additional institutional controls, as described below, may be necessary to maintain the integrity of the pond. Containment without treatment does not reduce the toxicity or volume of contaminants.

3.6.3 Containment with Treatment

As above, the surface water would be directed to a lined evaporation pond where the water would then be pumped to a water-treatment unit and discharged to a drainage ditch following treatment. Depending on the type of contaminants, the treatment may consist of such methods as air stripping, carbon adsorption, ion exchange, vapor extraction, UV, or a combination of technologies.

3.6.4 Institutional Controls

This response action may be appropriate for this site if contaminants are found to be in low concentrations, have low mobility or low toxicity, and if institutional controls such as deed restrictions, fencing, and posting of the area and closing of roads are adequate to prevent direct contact with potentially contaminated surface water. Long-term enforcement of institutional controls is necessary.

3.6.5 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any surface-water contamination that is present. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

4.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

4.1 GENERAL

4.1.1 Site Conditions

The depth to groundwater at the site is estimated to be approximately 380 feet (JMM, 1987). Flow of groundwater is thought to be to the northwest. The nearest water supply well is WW-1, which is located less than a mile north of the Wastewater Spreading Area. A potential does exist for contamination of the groundwater pathway through leaching of contaminants from soils by infiltration of precipitation or surface water. However, the area is currently arid and appears to provide little recharge to the groundwater pathway, based upon observation during site visits.

4.1.2 Potential Contaminants of Concern

Because the discharge of wastewater was discontinued in the 1950s, many of the potential contaminants (i.e., organic compounds and nitrates) would no longer present a threat to human health or the environment due to natural degradation through volatilization, biodegradation, denitrification, etc. The most likely contaminants of concern would be metals. Because of their relative low mobility, it is unlikely that significant concentrations of metals would reach the groundwater pathway at the Wastewater Spreading Area.

4.2 POTENTIAL EXPOSURE ROUTES

The current potential exposure route for contaminated groundwater would be ingestion or direct contact by on-site TEAD-N personnel from water obtained from supply well WW-1, which is downgradient of the Wastewater Spreading Area. With the exception of the watering of lawns and shrubs, no agricultural or livestock activities are conducted at TEAD-N using potentially contaminated groundwater.

A future residential scenario includes ingestion or direct dermal contact by on-site residents if present or future wells contain contaminated groundwater and are utilized as a water supply. Present and future off-site receptors, including humans, livestock, and crops, could be exposed to contaminants through the use of potentially contaminated groundwater for residential or agricultural use

4.3 POTENTIAL RESPONSE OBJECTIVES FOR GROUNDWATER

4.3.1 Prevent Direct Human Exposure to Contaminated Groundwater

The main-response objective for groundwater would be to prevent accidental human exposure to contaminants by direct contact with or through ingestion of contaminated groundwater. The immediate concern would be to eliminate the use of contaminated on-site water-supply wells. Exposure to nonhuman receptors from contaminated water would be possible if the water from the supply wells was used for irrigation or livestock watering.

4.3.2 Prevent the Off-Site Migration of Contaminants to Human and Nonhuman Receptors

The second objective would be to control the source of contaminants by intercepting and removing contaminants prior to leaving TEAD-N to prevent the migration of contaminants to off-site receptors.

4.4 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

To ensure that the above response objectives are met or exceeded, the following remedial-action objectives have been established. These objectives provide quantitative goals for cleanup if warranted. This cleanup will be designed to meet or exceed ARARs and minimize or eliminate risk to human health and the environment. Table 2 presents potential ARARs for groundwater, based on the general ARARs assessment for TEAD-N.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

4.4.1 Preliminary Cleanup Objectives

Prevention of Accidental Human Ingestion or Dermal Contact. The proposed remedial actions for groundwater will be designed to prevent present and future ingestion or dermal contact with water having contaminants in excess of MCLs, presenting a total excess cancer risk of greater than 10^{-4} to 10^{-6}, or having a noncancer hazard index of greater than 1.

Prevention or Reduction of Exposure to Nonhuman Environmental Receptors. The remedial actions for groundwater will be designed to reduce or eliminate potential exposure of contaminants in groundwater by flora and fauna (e.g., agricultural use of groundwater to support livestock and crops). This will prevent environmental damage and reduce the risk of contaminants entering the food chain.

Protection of Other Environmental Pathways. The remedial actions will also be designed to protect local groundwater resources by preventing the migration of groundwater having contaminant concentrations in excess of MCLs.

4.5 VOLUME OF GROUNDWATER REQUIRING REMEDIATION

If the surface soil data from the RI at OU 4 indicate soil contamination in the Wastewater Spreading Area, a vadose zone model will be used to screen the potential for contaminant migration to groundwater and to evaluate the need for groundwater characterization.

4.6 GENERAL-RESPONSE ACTIONS FOR GROUNDWATER

This section develops general-response actions that can satisfy the remedial response and remedial-action objectives for groundwater stated above. A mixture or combination of general-response techniques may be necessary to be totally effective in meeting the remedial-action objectives.

4.6.1 On-Site Treatment of Contaminated Groundwater

This response action would involve the installation of pumping and reinjection wells for the surface treatment of groundwater and reinjection of treated water back to the aquifer. This response would be used in conjunction with source control (i.e., removal of contaminated soils) to prevent further contamination of the groundwater pathway. The effectiveness of this general response depends on successful capture of contaminated groundwater.

4.6.2 Institutional Controls

This response action could involve issuing permit restrictions for present and future wells, discontinuing the use of water supply wells, and providing an alternate source of water.

4.6.3 Long-Term Monitoring

This response action would involve the monitoring of downgradient wells to ensure that contaminant levels are and remain below acceptable levels (i.e., drinking water MCLs). Further response actions would not be required unless monitoring results indicate that the acceptable levels have been exceeded. Long-term monitoring does not involve a reduction of contaminant toxicity, mobility, or volume, except for natural attenuation such as dispersion and degradation.

4.6.4 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any groundwater contamination that is present. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

5.0 REFERENCES

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FINAL MEMORANDUM ON REMEDIAL-ACTION OBJECTIVES

for

OPERABLE UNIT 5

TOOELE ARMY DEPOT—NORTH AREA, UTAH

December 1992

Contract No. DAAA15-90-D-0007

Prepared for
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland 21010-5401

Prepared by
SEC Donohue, Inc.
Grand Junction, Colorado 81506

EXECUTIVE SUMMARY

The Tooele Army Depot—North Area (TEAD-N) contains 46 sites which were previously identified as having the potential for releasing or having released contaminants into the environment. These sites were originally considered Solid Waste Management Units (SWMUs) under a Resource Conservation and Recovery Act (RCRA) Corrective Action Permit. However, TEAD-N has been designated a National Priority List (NPL) site, which under the Comprehensive Environmental Response, Compensation, and Liability ACT of 1980 (CERCLA) as amended by SARA (1986), is required to perform a Remedial Investigation/Feasibility Study (RI/FS) to characterize the nature and extent of risks posed by hazardous waste sites at TEAD-N. As a result of this requirement, 17 of the 46 RCRA SWMUs have been regrouped into seven Operable Units (OUs) under CERCLA (Superfund) by the Environmental Protection Agency (EPA) and the State of Utah.

The purpose of a Memorandum on Remedial-Action Objectives (MRAO) is to develop remedial-action objectives, general-response actions, and potential volumes or areas requiring remediation to aid in the development of remedial alternatives required to complete an FS for each OU at TEAD-N. This MRAO specifically addresses the remedial-action objectives for OU 5 at TEAD-N.

OU 5 is located in what is referred to as the maintenance area of the facility. OU 5 consists of the Transformer Storage Area (Site 17), the Former Transformer Boxing Area (Site 31), the PCB Spill Site (Site 32), and the PCB Storage Building 659 (Site 33). Potential contaminants at these sites are PCBs.

Minimal data are available for the sites included in this OU. No further data collection is included in the current RI/FS work plans submitted by SEC Donohue, Inc., because of the low levels of contamination detected at the sites where data are available, low potential for migration of PCBs, and lack of evidence of spills or releases at sites where sampling data are not available.

The remedial-action objectives for soils and groundwater will be to:

- prevent present and future human exposure (through dermal contact, ingestion, or inhalation) to soils contaminated with PCBs at concentrations above 10 mg/kg PCBs or at concentrations above risk-based remediation levels.

- prevent present and future exposure of fauna to soils contaminated with PCBs at concentrations above 10 mg/kg PCBs.

- prevent migration of PCBs in soil that would result in groundwater contamination in excess of 0.0005 mg/l PCBs.

- prevent present and future human exposure (through dermal contact or ingestion) to PCBs in groundwater that are present at concentrations above 0.0005 mg/l PCBs.

- comply with all chemical-specific, location-specific, and action-specific Applicable or Relevant and Appropriate Requirements (ARARs) that affect remedial actions at this OU.

The objective of risk-based cleanup standards is to limit the total excess cancer risk to human receptors (current and future) to levels within or below the EPA target risk-reduction range of 1E-04 to 1E-06 and to limit the total noncancer hazard index to levels below 1. The Preliminary Baseline Risk Assessment for Site 17 and Site 32 estimates the excess cancer risk for current on-site industrial workers from dermal exposure to PCBs in soil and ingestion exposure to PCBs in soil at levels between 4.9E-08 and 6.5E-06. This risk estimate is within the EPA risk-reduction range. However, the Preliminary Baseline Risk Assessment did not consider PCBs in soil in a future on-site residential use scenario; this scenario will be considered during preparation of the Draft FS Report for OU 5 and will be used to establish risk-based cleanup standards for this OU. There are no reference doses available for PCBs, so a noncancer risk estimate was not computed.

Available soils analytical data indicate that none of the soils exceed the potential cleanup standard of 10 mg/kg PCBs. If the Baseline Risk Assessment for OU 5 indicates that PCBs in soils present an excess cancer risk to potential future on-site residents that exceeds the EPA target risk-reduction range, a risk-based cleanup standard will be calculated. This risk-based standard will then be compared against the existing data to estimate the volume of soil requiring remediation.

During the preparation of the FS for OU 5, a vadose zone model will be used to evaluate the potential for contaminant migration to groundwater and to evaluate the need for groundwater characterization. Modeling results will be incorporated into the Draft FS Report for OU 5.

This document will serve as the first phase of the overall FS for this OU. PCBs in soils do not exceed the ARAR cleanup level of 10 mg/kg PCBs. If PCBs do not exceed risk-based remediation levels established for TEAD-N, a no-action recommendation will be made for the subject site(s). The OU will continue to be evaluated throughout the RI/FS process.

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

SEC Donohue, Inc., is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) for seven Operable Units (OUs) at Tooele Army Depot—North Area, Tooele, Utah (TEAD-N). The RI is designed to provide information on the nature and extent of contamination associated with the site(s) within each OU and, on the basis of these data, evaluate and estimate the risks to human health and the environment as a result of the contaminants present. The FS is designed to develop, screen, and evaluate remedial-action alternatives for each OU.

The purpose of this Memorandum on Remedial-Action Objectives (MRAO) is to provide, as an initial step in the FS process, the development of remedial-action objectives and general-response actions for OU 5 at TEAD-N as well as identification of areas or volumes of media requiring remediation. An MRAO has also been generated for each of the other six OUs at TEAD. This document is not designed to be a stand-alone document; it, along with the other six MRAOs, will be incorporated into the FS report for TEAD-N. The FS report will summarize the results of the FS process completed for each OU. Revisions to these documents will be made as new data and new information become available.

1.2 SETTING OF THIS TECHNICAL MEMORANDUM

1.2.1 Site Background

TEAD-N encompasses 24,732 acres of the Tooele Valley in Tooele County, Utah. The facility was established in 1942 and has been in continuous operation since that time for the storage, maintenance, and repair of vehicles; storage, issue, and disposal of munitions; and storage of other equipment. Developed features at TEAD-N include igloos, magazines, administrative buildings, an industrial maintenance area, military and civilian housing, roads, hardstands for vehicle storage, and other allied infrastructure.

The Transformer Storage Area, Former Transformer Boxing Area, PCB Spill Site, and PCB Storage Area are all located in what is referred to as the maintenance area of the facility. All of these Sites were included in OU 5 for purposes of this study.

1.2.2 Description of Operable Unit 5

OU 5 consists of the Transformer Storage Area (Site 17), the Former Transformer Boxing Area (Site 31), the PCB Spill Site (Site 32), and the PCB Storage Building 659 (Site 33). Descriptions of each of these sites are given below.

The Transformer Storage Area (Site 17) is an unpaved gravel lot, approximately 5 acres in size, located on Open Lot 675B (see Figure 1). A drainage ditch parallels the northern edge of the lot. Until 1979, it was used for the storage of hundreds of PCB-containing transformers and capacitors. In 1979, all transformers were removed from the lot and were either disposed of or transferred to Building 659 (Site 33) for storage. The lot is currently being used for storage of vehicle equipment.

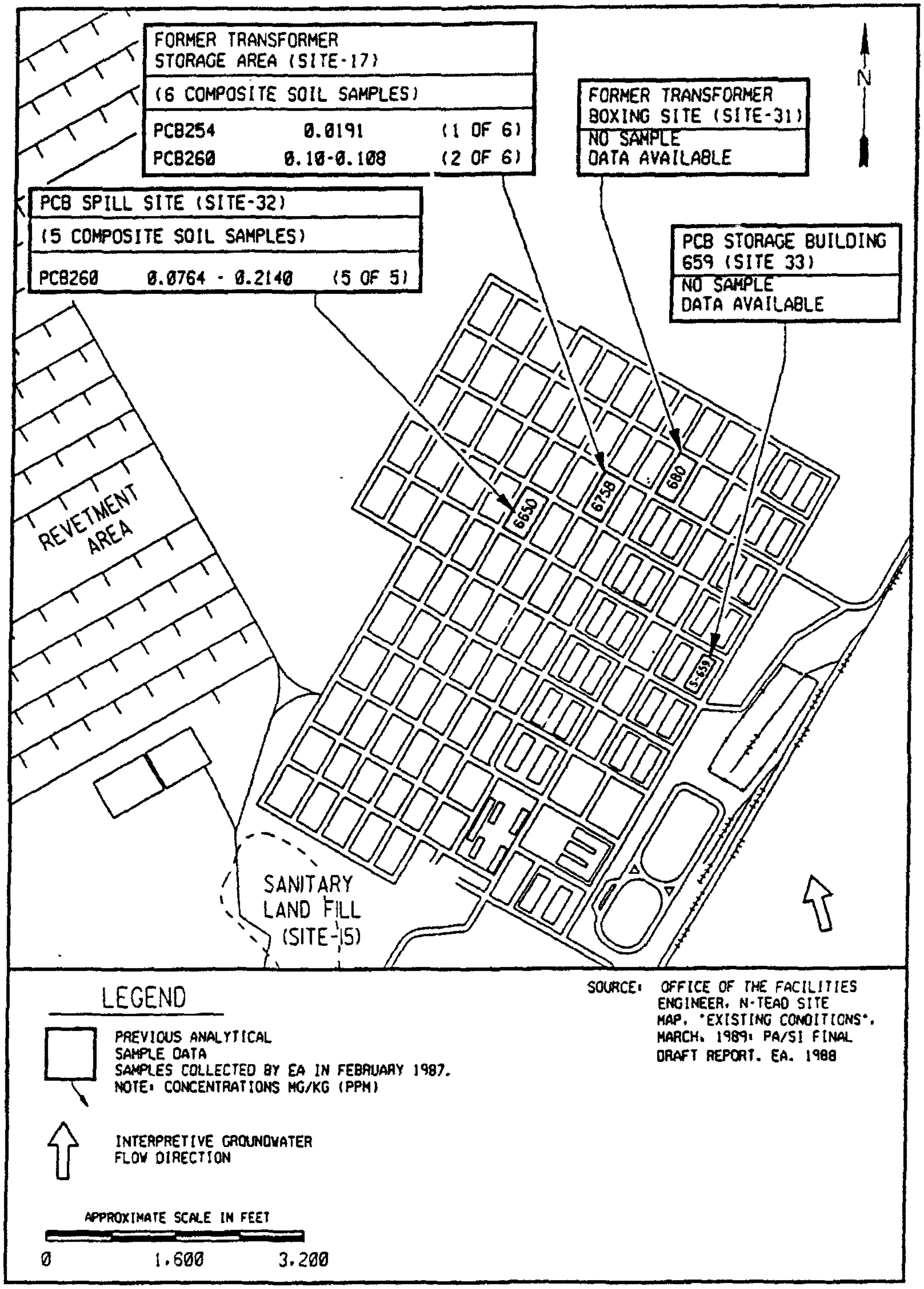

Figure 1. Former Transformer Storage Area (Site 17), Former Transformer Boxing Site (Site 31), PCB Spill Site (Site 32), and PCB Storage, Building 659 (Site 33)

The Former Transformer Boxing Area (Site 31) is also an unpaved lot located on Lot 680 (see Figure 1). It was used as a temporary storage area for the transformers originally stored in the former Transformer Storage Area. In 1979 or 1980, the transformers were disposed of or transferred to Building 659 (Site 33). This site was not used for long-term storage of transformers. This lot is currently used for vehicle storage.

The PCB Spill Site is located in the southern corner of Open Storage Lot 665D (Figure 1). In October 1980, a transformer oil spill occurred when two transformers containing a total of 1,000 gallons of PCB-contaminated oil were punctured with a forklift blade during removal operations. The impacted soil reportedly covered less than one-half acre of unpaved ground surface (EA, 1988). In 1980 or 1981, the soils saturated with oil were excavated, drummed, and disposed of properly. The depth of excavation was reported to be up to 8 feet in spots (EA, 1988), and the excavation area measured approximately 50 feet by 70 feet (TEAD personnel). About 440 55-gallon drums of contaminated soil and 18 drums of contaminated oil were removed. Fill material was subsequently imported and used to backfill the excavation (Fischer et. al., 1989).

The PCB Storage Building 659 (see Figure 2) is a TSCA-permitted facility used for storage of transformers and drums containing PCB-contaminated soil and protective clothing. This facility has a sealed cement floor, a perimeter berm, and diversion structures at each entrance for containment of oil spills (Shank, 1989). The ground surrounding the building is paved. Storage of transformers and drums containing PCBs began in 1979 after closure of the open-storage PCB areas (Sites 17 and 31).

1.2.3 Previous Investigations

Transformer Storage Area. There is no information to indicate that a release due to spills or leaks of PCB-contaminated oils occurred at this site. Soil staining was not noted on historical Environmental Photographic Interpretation Center (EPIC) aerial photographs (EPA,1982).

Following the removal of the transformers, the TEAD Facilities Engineering Division reportedly sampled surface soils at the site at depths of 0 to 3 inches. TEAD personnel verbally reported that the sampling results indicated that the soils contained less than 50 ppm total PCB Aroclors (EA, 1988). In February 1987, EA conducted follow-up sampling of the site to confirm the reported TEAD results. Samples were collected from 30 grid point locations at 0 to 6 inches in depth, and these samples were composited to form 6 composite samples. The composites were analyzed for the PCB Arochlors 1016, 1221, 1232, 1242, 1248, 1254, and 1260 (EA, 1988). Analytical results from the EA sampling event showed that only 2 PCB Arochlors were detected in the samples. PCB 1254 was detected in one soil sample at 0.019 mg/kg, and PCB 1260 was detected in a second sample at 0.10 mg/kg.

Former Transformer Boxing Area. There are no available data to suggest that a release of PCBs occurred at this site. A review of historical aerial photographs also indicates that no surface-soil staining has occurred as a result of transformer storage (SEC Donohue, 1992). This area was used only for short-term storage of transformers.

PCB Spill Site. EA conducted a site investigation at the PCB Spill Site to confirm that the soils remaining after excavation were not contaminated. A total of 17 discrete surface-soil samples were collected from an area measuring 45 feet by 50 feet The samples were composited into five samples, which were analyzed for all PCB Aroclors. Only PCB 1260 was detected, however, it was found in all five samples ranging from 0.0764 to 0.2140 mg/kg.

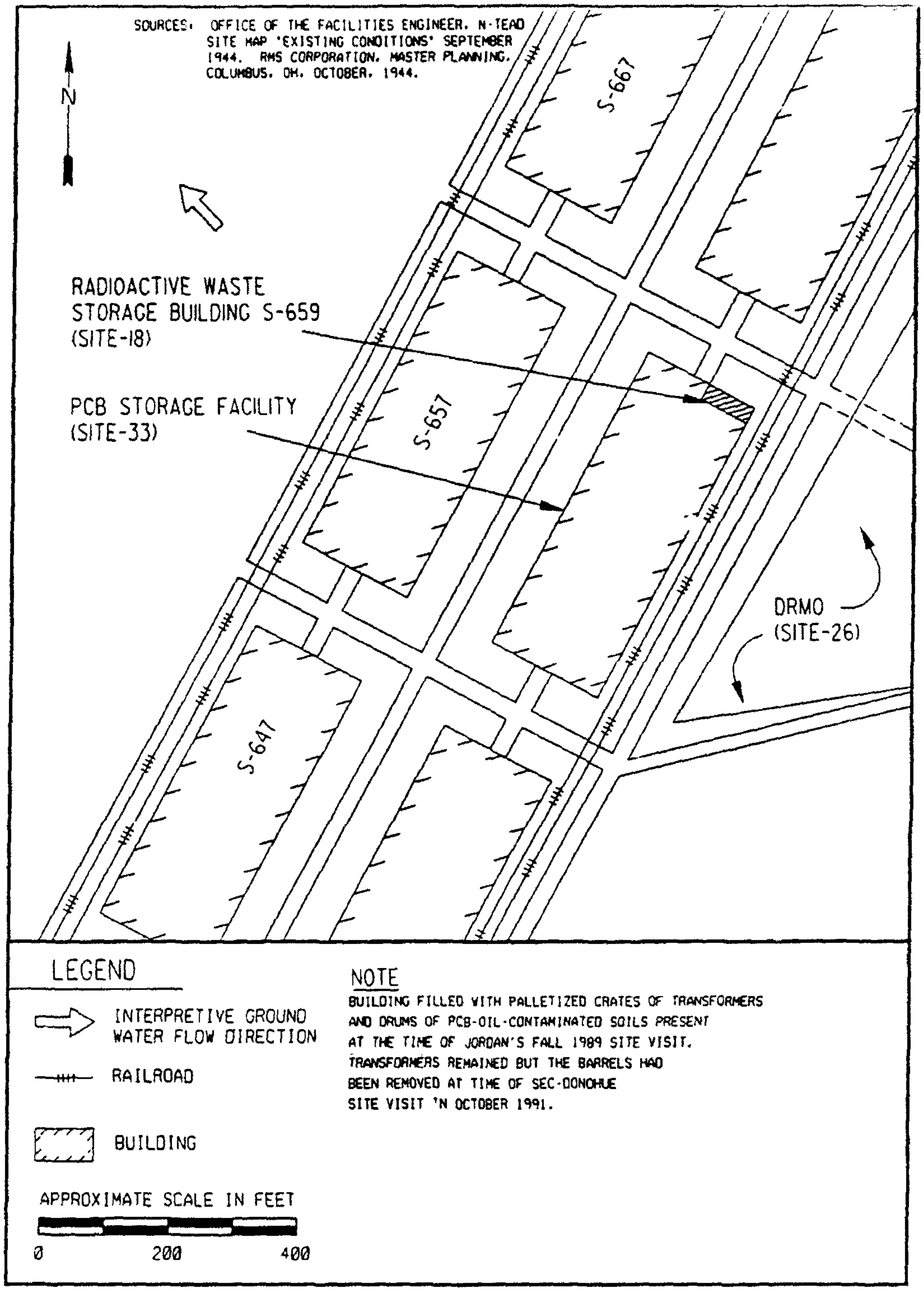

Figure 2. Radioactive Waste Storage Building (Site 18) and PCB Storage Building Facility (Site 33)

PCB Storage Building 659. Spills of PCB oils have reportedly occurred in the facility. The contaminated cleanup materials such as oil absorbent and protective clothing are drummed, appropriately marked, and stored for disposal (EA, 1988). PCB disposal is managed by DRMO and conducted by U.S. Pollution Control, Inc., of West Murray, Utah. The PCB waste is disposed of at the Grassy Mountain Hazardous Waste Landfill in Utah (EA, 1988).

Soil and dust are collected during periodic sweep downs of the building and are properly drummed and disposed of. Since the facility is TSCA-permitted, and apparently well maintained and operated, releases from the facility are unlikely. There is no evidence or data to indicate that PCB-contaminated wastes have been released to the environmental pathways surrounding the building.

1.2.4 Regulatory Background

Environmental studies have been conducted at TEAD-N since 1979. Early studies were performed under the Installation Restoration Program (IRP) which is a four-phase program administered by the Department of Defense (DOD) designed to identify and correct environmental contamination at DOD facilities. These studies included facility-wide assessments, as well as site-specific environmental assessments, Preliminary Assessment/Site Investigations (PA/SI), RI/FS, remedial design, remedial action, and their RCRA equivalents. From these studies and reports, 46 SWMUs were identified. Evaluations for each SWMU or former SWMU are in various stages of completion.

In October 1990, TEAD-N was added to the National Priorities List (NPL). As a result, EPA Region VIII and the State of Utah regrouped the original 46 sites into RCRA SWMUs and CERCLA (Superfund) sites. The CERCLA sites were placed into seven OUs. In 1991, TEAD, EPA Region VIII, and the State of Utah entered into a Federal Facility Agreement (FFA) which specified the requirements, responsibilities, and schedule for the completion of all studies and remedial-action activities at TEAD.

SI and RI Work Plans were prepared by E.C. Jordan Company in December of 1990. These plans were submitted to EPA Region VIII and the State of Utah for review in 1991, and comments were received in November 1991. As a result of the regrouping of the sites at TEAD-N, SEC Donohue was tasked with reformating the plans to meet CERCLA requirements, to include only those sites considered CERCLA sites, and to address concerns and comments received on the E.C. Jordan Company Plans. All of this work was conducted within the schedule set forth in the FFA.

OU 5 was one of the seven OUs to be characterized under the Superfund program. This MRAO fulfills one of the first requirements specified in the FFA.

1.2.5 Current Activities

Current proposed RI/FS sampling and analysis activities for several of the OUs are outlined in the Final RI/FS Work Plan and Final RI/FS Sampling and Analysis Plan for TEAD-N prepared by SEC Donohue and submitted for review in March 1992. No additional data are being collected for any of the sites included in OU 5.

1.3 DEVELOPMENT OF REMEDIAL-ACTION OBJECTIVES FOR OU 5

The FS is usually made up of three phases: the development of remedial alternatives, the screening of the alternatives, and the detailed analysis of the alternatives (EPA, 1988). The first phase of the FS begins with the development of remedial-action objectives. The remedial-action objectives are based on the nature and extent of contamination, exposure pathways, ARARs, and the risk potential for human health and the environment. These remedial-action objectives include site-specific cleanup goals that will allow protection of human health and the environment. The first phase of the FS continues with the identification of a range of general-response actions that can satisfy the remedial-action objectives and with an estimation of volumes or areas to which the general-response actions would apply. Examples of general-response actions include treatment, disposal, containment, institutional control, and no action. The next step in the development of remedial alternatives involves the identification of technologies and process options for each general-response action (e.g., identification of biological, chemical, or physical-treatment technologies for the general response of treatment) and the screening of these technologies/process options on the basis of technical implementability. Finally, the screened technologies/process options are assembled into a range of remedial alternatives.

The second phase in the FS process is the screening of the alternatives. This involves a more detailed definition of the alternatives followed by a screening of the alternatives based on effectiveness, implementability, and preliminary costs. Alternatives retained after this initial screening are then subject to the next phase, the detailed analysis of alternatives. This third phase involves assessing each retained alternative against each of the following evaluation criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Implementability
- Cost
- State acceptance
- Community acceptance

This MRAO includes only the initial steps of the first FS phase, the development of remedial-action objectives, and general-response actions. The remedial-action objectives for OU 5 are completed based on PCBs since these are the only potential contaminants known for each of the sites. The media for which remedial actions are developed include soils and groundwater. Since there are no permanent surface waters affected by any of the sites included in this OU, surface water is not addressed as a separate media. Runoff via the ditch in the Transformer Staging Area is addressed as part of the soils remediation since the ditch serves as a potential pathway by which soils could migrate off of the site. Potential exposure to PCB contaminants via the air pathway will be reduced or eliminated as part of the response actions for soil contamination.

The development of remedial-action objectives for each medium includes a consideration of chemical-specific ARARs for the compounds of concern. Location- and action-specific ARARs will be identified during the development of remedial-action alternatives in the next step of the FS for this OU. A general location-specific ARARs assessment has been completed for TEAD-N (ORNL, 1992); potential concerns for remedial actions include the presence of archaeological resources, historic sites, and endangered species on the facility. Examples of potential action-specific ARARs include regulations pursuant to the Occupational Safety and Health Act (for on-site workers during remediation) and regulations pursuant to the Resource Conservation and Recovery Act (e.g., land-disposal restrictions, transport of hazardous waste, etc.).

2.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR SOILS

2.1 GENERAL

2.1.1 Site Conditions

No evidence of any surface-soil staining has been observed in the Transformer Storage Area or the Former Transformer Boxing Area. The soils on which the PCB spill occurred in Site 32 have been removed, and backfill has been added where the soils were removed. Some spills have reportedly occurred in the PCB Storage Building 659, but the floors of the building are sealed concrete; there is a berm around the perimeter; and containment for oil spills is provided at each entrance.

2.1.2 Contaminants of Potential Concern

The only potential contaminants of concern identified for the sites in OU 5 are PCBs.

2.2 POTENTIAL EXPOSURE ROUTES

The potential current and future exposure routes from PCBs in surface and near-surface soils/sediments are as follows:

- Direct dermal contact with contaminated soils by TEAD personnel or future on-site residents
- Ingestion of contaminants in soils by TEAD personnel or future on-site residents
- Inhalation of airborne contaminants (particulates) by TEAD personnel or future on-site residents
- Ingestion of bioaccumulated contaminants (i.e., crops, livestock, and wildlife) by TEAD personnel or future on-site residents
- Ingestion of soil contaminants by present and future on-site fauna
- Migration off-site via a drainage ditch (Transformer Storage Area)
- Migration of soil contaminants to groundwater

Transformer Storage Area, Former Transformer Boxing Area, and PCB Spill Site. Under current use conditions, exposure to human receptors by ingestion of or direct dermal contact with potentially contaminated surface soils or inhalation of dust is considered unlikely due to the restricted access to the sites (i.e., TEAD-N personnel only), the limited usage of the sites (e.g., vehicle storage), and the low concentrations of contaminants present at the surface. However, under a future residential or agricultural use scenario, the potential for human exposure to soil contaminants via dermal contact, ingestion, inhalation, and bioaccumulation increases due to unlimited access to soils and longer exposure durations.

There is a potential for transport of contaminated soils via the drainage ditch adjacent to the Transformer Storage Area during periods of heavy rainfall; however, the low concentrations of contaminants detected at this site make the risks associated with this potential route minimal. There is a potential for soil contaminants to migrate to groundwater; however, PCBs tend to adsorb to soils and are resistant to leaching. Current and future ingestion by fauna is also a potential exposure pathway.

PCB Storage, Building 659. The only realistic pathway for the migration of PCBs from Building 659 would be by transport of PCB-contaminated dust via personnel or equipment. Surface soils outside the building could then be contaminated with low concentrations of PCBs, which could subsequently be mobilized by wind or surface-water runoff. However, periodic sweepdowns, which are a component of building maintenance, should effectively mitigate the potential for release of PCB-contaminated dust that might accumulate in Building 659.

The effectiveness of routine maintenance and spill-cleanup procedures are speculative, based on TSCA regulation of the facility, site observations, and discussions. It is recommended that TEAD-N add appropriate verification-of-effectiveness sampling to the cleanup procedures. Verification of cleanup would minimize the chances of human and environmental exposure under both current and future use scenarios.

2.3 POTENTIAL REMEDIATION LEVELS

The only contaminant of concern identified for all of the sites in OU 5 were PCBs. According to 40 CFR 761.125, all spills of PCBs at concentrations of 50 ppm or greater which occur after May 4, 1987 are subject to decontamination requirements under TSCA. This regulation requires soil contaminated by the spill to be decontaminated to 10 ppm PCBs by weight provided that soil is excavated to a depth of 10 inches. The excavated soil must be replaced with clean soil and the spill site be restored. Although this regulation may not be applicable on the basis of the dates of the potential or actual spills (pre-1987) for the various sites in OU 5, it would be considered relevant and appropriate due to the type of contamination present.

A Preliminary Baseline Risk Assessment has been completed for the Transformer Storage Area (Site 17) and the PCB Spill Site (Site 32) (SECD, 1992). Tables 1 and 2 present the results of the surface soil risk characterization for carcinogenic effects under the current on-site industrial use scenario; Table 1 provides results for the reasonable maximum exposure; and Table 2 provides results for the average exposure. The only contaminant risk contribution from Sites 17 and 32 is from PCB 1262. For exposure to PCB only, the preliminary baseline risk assessment estimates total values for the excess cancer risk due to dermal exposure and ingestion at values of 2.6E-06 to 6.6E-06. This risk estimate is within the EPA target risk reduction range of 1E-04 to 1E-06. An estimate of the noncancer health risk was not computed because reference dose values are not available for PCBs. Additionally, the preliminary baseline risk assessment did not consider a future on-site residential use scenario for PCBs in soil; this scenario will be considered during preparation of the Draft FS Report for OU 5 and will be used to establish risk-based cleanup standards for this OU.

2.4 REMEDIAL-ACTION OBJECTIVES FOR SOILS

The only contaminants of concern in OU 5 are PCBs, and the only potential routes of exposure are to environmental fauna through the food chain or human exposure via direct contact, inhalation, or ingestion in the PCB Storage Area, the Former PCB Boxing Area, and the PCB Spill Site. Remediation of all soils to 10 ppm or less PCBs, as suggested by 40 CFR 761, would leave contaminant levels that meet ARARs for contaminant. Health-based risk levels for PCB contamination will be based on the baseline risk assessment for future on-site residential exposure to surface soils via dermal contact and ingestion; exposure due to inhalation will not be considered because an inhalation slope factor is not available for computing carcinogenic risk.

Table 1. Surface Soil Risk Characterization: Carcinogenic Effects—Reasonable Maximum Exposure Level Current Use On-Site Industrial Sites/SWMUs 17, 29 and 32

Chemical	CDI (mg/kg/day)	Advised Oral Slope Factor $(mg/kg/day)^{-1}$	Chemical-Specific Risk
Pathway: Dermal Exposure			
Benzo(a)anthracene	1.7E-06	1.2E+01	2.0E-05
Benzo(k)fluoranthene	2.2E-06	1.2E+01	2.6E-05
Benzo(a)pyrene	2.3E-06	1.3E+01	1.7E-05
Chrysene	8.7E-06	1.2E+01	1.0E-04
PCB 1262	7.6E-07	8.5E+00	6.5E-06
Pyrene	1.8E-05	1.2E+01	2.2E-04
Trichloroethylene	2.0E-07	2.2E-01	4.4E-08
		Total Pathway Risk	3.9E-04
Pathway: Ingestion			
Benzo(a)anthracene	3.5E-08	1.2E+01	4.2E-07
Benzo(k)fluoranthene	4.2E-08	1.2E+01	5.0E-07
Benzo(a)pyrene	4.6E-08	1.2E+01	5.5E-07
Chrysene	1.2E-07	1.2E+01	1.4E-06
PCB 1262	1.5E-08	7.7E+00	1.2E-07
Pyrene	3.8E-07	1.2E+01	4.6E-06
Trichloroethylene	3.9E-07	1.1E-02	4.3E-09
		Total Pathway Risk	7.6E-06
		Total Site Risk	4.0E-04

Table 2. Surface Soil Risk Characterization: Carcinogenic Effects—Average Exposure Level Current Use On-Site Industrial Sites/SWMUs 17, 29, and 32

Chemical	CDI (mg/kg/day)	Advised Oral Slope Factor $(mg/kg/day)^{-1}$	Chemical-Specific Risk
Pathway: Dermal Exposure			
Benzo(a)anthracene	1.5E-06	1.2E+01	1.8E-05
Benzo(k)fluoranthene	2.2E-06	1.2E+01	2.6E-05
Benzo(a)pyrene	2.0E-06	1.3E+01	2.0E-06
Chrysene	3.3E-06	1.2E+01	4.0E-06
PCB 1262	3.0E-07	8.5E+00	2.6E-06
Pyrene	1.3E-05	1.2E+01	1.6E-04
Trichloroethylene	2.0E-07	2.2E-01	4.4E-08
		Total Pathway Risk	2.1E-04
Pathway: Ingestion			
Benzo(a)anthracene	2.9E-08	1.2E+01	3.5E-07
Benzo(k)fluoranthene	4.2E-08	1.2E+01	5.0E-07
Benzo(a)pyrene	3.9E-08	1.2E+01	4.7E-07
Chrysene	6.3E-08	1.2E+01	7.6E-07
PCB 1262	6.4E-09	7.7E+00	4.9E-08
Pyrene	2.0E-07	1.2E+01	2.4E-06
Trichloroethylene	3.9E-07	1.1E-02	4.3E-09
		Total Pathway Risk	4.5E-06
		Total Site Risk	2.1E-04

The main objective for remedial action of the soils in OU 5 is to limit the total excess cancer risk to human receptors (both current and future) to levels within or below the EPA target risk reduction range of 1E-04 to 1E-06. Additional remedial-action objectives are to prevent fauna ingestion of soil with PCBs in excess of the ARAR or health-based cleanup level, prevent off-site migration of soil that is contaminated in excess of the ARAR or health-based cleanup level, and to prevent the migration of PCBs to groundwater that would result in groundwater contamination in excess of the drinking water maximum contaminant level (MCL) of 0.0005 mg/l.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

2.5 VOLUME OF SOIL REQUIRING REMEDIATION

As discussed earlier in Section 1.2.3, previous investigations of the sites included in OU 5 did not reveal any soils-contamination levels at or above 10 ppm. The highest level of PCBs detected in a composite sample collected from the Transformer Storage Area was 0.108 ppm, which, based on the analytical results, would yield a maximum concentration of 0.50 ppm in any one discrete sample. Similarly for the PCB Spill Area, the highest PCB concentration in a composite sample was 0.2140 ppm, which would yield a maximum discrete concentration of 0.64 ppm. Because of the short-term use of the PCB Transformer Boxing Area and since there is no record of any spills, no samples were collected at that site. Because the PCB Storage Building is a TSCA-permitted facility with proper containment and specific procedures to follow in the event of a spill, it is also assumed that no soil contamination exists at that site (EA, 1988).

Available soils analytical data indicate that none of the soils exceed the potential cleanup standard of 10 ppm PCBs. If the Baseline Risk Assessment for OU 5 indicates that the soils present an excess cancer risk to potential future on-site residents that exceeds the EPA target risk reduction range of 1E-04 to 1E-06, a risk-based cleanup level will be calculated. This risk-based level will then be compared against the existing data to estimate the volume of soil requiring remediation.

2.6 GENERAL-RESPONSE ACTIONS

This section develops general-response actions that can satisfy the remedial-action objectives stated above. The general-response actions include containment, excavation followed by on-site or off-site treatment and disposal, in-situ treatment, institutional controls, and no action. A combination of general-response actions may be necessary to be completely effective in meeting the remedial-action objectives.

2.6.1 Asphalt or Concrete Capping

This containment-response action may be effective in reducing or eliminating the potential for direct contact with and inhalation or ingestion of PCB contaminants by providing a barrier between the PCB-contaminated soil and potential receptors. This response action would also protect other environmental pathways by reducing the potential for contaminant leaching as a result of infiltration of precipitation and surface runoff. This response action could have added economic benefit since the paved or concrete areas could be utilized for storage of vehicles or equipment with minimal maintenance costs. This general response does not reduce the toxicity or volume of soil contaminants. Long-term maintenance of the cap and enforcement of institutional controls, described below, are necessary to protect the integrity of the cap.

2.6.2 Excavation Followed by On-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding regulatory or risk-based remediation levels. The soils removed would be treated on-site using a treatment method, such as soil washing or dehalogenation, that is suitable for removing PCBs from the soil. Following treatment to acceptable levels, the soils would be returned to the site as fill material.

2.6.3 Excavation Followed by Off-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding remediation levels. The soils would be hauled to a licensed facility for treatment and disposal of contaminated soils. This response would also involve hauling clean backfill to the site to replace the removed soils. Disadvantages of this general response include the liability implications of off-site transport of contaminated soils and off-site disposal. Additionally, the long-term effectiveness of this method is dependent upon the treatment employed at the receiving treatment and disposal facility.

2.6.4 In-Situ Treatment

This general response would involve the in-situ treatment of contaminated soils exceeding remediation cleanup levels. Example treatment methods include biological treatment and vitrification.

2.6.5 Institutional Controls

This general response would involve leaving the contaminated or potentially contaminated soils in place, but placing controls on access to the site through deed restrictions, fencing, placing of signs, closure of roads, etc. This response action may be appropriate considering the low mobility of PCBs in soils, the low concentrations (i.e., <10 ppm), and the potentially low risk to potential receptors.

2.6.6 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any soil contamination that is present. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

3.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

3.1 GENERAL

3.1.1 Site Conditions

The depth to groundwater is estimated to be 300 feet below ground surface (bgs) in the Transformer Storage Area, 400 feet bgs in the Former Transformer Boxing Areas, 290 feet bgs in the PCB Spill Area, and 230 feet bgs in the area of the PCB Storage Building 659. Groundwater-flow direction at TEAD-N is from the southeast to the northwest. The nearest on-site water-supply well is WW-2, which is approximately 3,000 feet from the Former Transformer Boxing Area and the PCB Spill Site, and 4,000 feet from the Transformer Storage Area and the PCB Storage Building. However, WW-2 is not located directly downgradient of these sites. A potential does exist for contamination of the groundwater through leaching of contaminants from soils by infiltration of precipitation. However, PCBs, which are the contaminants of concern in this OU, tend to adsorb strongly to the soils. This tendency, coupled with the depth to groundwater below these sites, makes it unlikely that groundwater contamination would occur.

3.1.2 Contaminants of Concern

The only contaminants of concern in this OU are PCBs. Because of their strong tendency to adsorb to soils and the extensive depth to the groundwater table below these sites, it is unlikely that significant concentrations of these contaminants would reach the groundwater.

3.2 POTENTIAL EXPOSURE ROUTES

The potential exposure route for contaminated groundwater would be ingestion or dermal contact by on-site TEAD-N personnel, by future on-site residents, and by fauna from water obtained from supply well WW-2 or possible future on-site wells. Well WW-2 is located approximately 3,000 to 4,000 feet from the sites. This well is not currently used for drinking water, but is used for process water at the facility.

3.3 POTENTIAL REMEDIATION LEVELS

The only contaminants of concern identified for all of the sites in OU 5 are PCBs. The MCL for PCBs (i.e., 56 FR 3526, effective July 30, 1992) is 0.0005 mg/l. This contamination level will be used to set remediation levels for this OU.

3.4 REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

The only contaminants of concern in OU 5 are PCBs, and the only potential route of exposure from contaminated groundwater is via well WW-2 or future on-site or downgradient wells. Reducing or maintaining PCB concentrations below the MCL of 0.0005 mg/l is the recommended remedial-action objective for OU 5. This objective could be met through source control and remediation as necessary. Meeting this objective would reduce risk to human health by reducing

PCBs to acceptable regulatory concentration levels and health-based criteria and would restore the quality of groundwater for future use.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

3.5 VOLUME OF GROUNDWATER REQUIRING REMEDIATION

No groundwater analytical data currently exist; however, the likelihood of PCBs from any of the sites included in OU 5 reaching the groundwater is minimal because of the strong tendency for PCBs to adsorb to soils and the extensive depth to groundwater. During the FS for OU 5, a vadose-zone model will be used to evaluate the potential for contaminant migration to groundwater and to evaluate the need for groundwater characterization.

3.6 GENERAL-RESPONSE ACTIONS

This section develops general-response actions that can satisfy the remedial-action objectives stated above. The general-response actions include containment, extraction followed by treatment, institutional controls, long-term monitoring, and no action. A combination of general-response actions may be necessary to be completely effective in meeting the remedial objectives.

3.6.1 Containment

This response action includes capping and/or vertical barriers, such as slurry walls. The extensive depth to the groundwater at this site eliminates vertical barriers as a feasible option. Capping areas of soil contamination limits the infiltration of water and reduces the potential for contaminant migration to groundwater. Capping does not reduce the toxicity or volume of contaminants. Long-term maintenance of the cap and enforcement of institutional controls, described below, are necessary to protect the integrity of the cap.

3.6.2 Extraction Followed by Treatment

This response action includes the installation of pumping and reinjection wells for the surface treatment of groundwater and reinjection of treated water back to the aquifer. Examples of treatment methods for PCBs include solvent extraction and dehalogenation.

This response would be used in conjunction with source control (i.e., removal of contaminated soils) to prevent further contamination of the groundwater pathway. The effectiveness of this response depends on the successful capture of contaminated groundwater by extraction wells.

3.6.3 Institutional Controls

This general response could prevent human and fauna exposure by issuing deed restrictions, discontinuing the use of water-supply wells, and providing alternate sources of water. Contaminant toxicity, mobility, and volume are not reduced by institutional controls, except that which may occur through natural degradation and dispersion.

3.6.4 Monitoring

This general response would involve the monitoring of downgradient wells to ensure that contaminant levels remain below acceptable levels (i.e., drinking water MCLs and risk-based levels). Further response actions would not be required unless monitoring results indicate that remediation levels have been exceeded.

3.6.5 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any groundwater contamination that is present, except that which may occur through natural degradation and dispersion. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

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FINAL MEMORANDUM ON REMEDIAL-ACTION OBJECTIVES

for

OPERABLE UNIT 6

TOOELE ARMY DEPOT—NORTH AREA, UTAH

December 1992

Contract No. DAAA15-90-D-0007

Prepared for
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland 21010-5401

Prepared by
SEC Donohue, Inc.
Grand Junction, Colorado 81506

EXECUTIVE SUMMARY

The Tooele Army Depot—North Area (TEAD-N) contains 46 sites which were previously identified as having the potential for releasing or having released contaminants into the environment. These sites were originally considered Solid Waste Management Units (SWMUs) under a Resource Conservation and Recovery Act (RCRA) Corrective Action Permit. However, TEAD-N has been designated a National Priority List (NPL) sit, which under the Comprehensive Environmental Response, Compensation, and Liability ACT of 1980 (CERCLA) as amended by SARA (1986), is required to perform a Remedial Investigation/Feasibility Study (RI/FS) to characterize the nature and extent of risks posed by hazardous-waste sites at TEAD-N. As a result of this requirement, 17 of the 46 RCRA SWMUs have been regrouped into seven Operable Units (OUs) under CERCLA (Superfund) by the Environmental Protection Agency (EPA) and the State of Utah.

The purpose of a Memorandum on Remedial-Action Objectives (MRAO) is to develop remedial-action objectives, general-response actions, and potential volumes or areas requiring remediation to aid in the development of remedial alternatives required to complete an FS for each OU at TEAD-N. This MRAO specifically addresses the remedial-action objectives for OU 6 at TEAD-N.

OU 6 is located in the eastern portion of TEAD-N in an area referred to as the Industrial Area. This Operable Unit consists of two sites: the Drummed Radioactive Waste Area (Site 9) and the Radioactive Waste Storage Area (Site 18). The Drummed Radioactive Waste Area consisted of one 55-gallon drum of radioactive waste that was stored at the site from approximately 1960 to 1978. The waste reportedly included radioactive transmitting tubes that were used to generate microwaves for radar systems used with the NIKE-Hercules missile systems. Other low-level radioactive wastes may have included speedometers, luminous watch dials, contaminated tools, and decontamination materials. The Radioactive Waste Storage Area (Site 18) is a dedicated controlled room located in the northeast corner of Building 659. The building has a concrete floor and bermed containment and is a Nuclear Regulatory Commission (NRC)-licensed facility for the storage of radioactive materials. Wastes are stored in containers, and the entrance to the Radioactive Waste Storage Area is kept locked.

No environmental assessments have been conducted at either site included in OU 6. Radiation surveys are conducted periodically at the Building 659 Radioactive Waste Storage Area; a review of safety survey reports indicates that any radioactive contamination found at the site is monitored, controlled, and disposed of properly. The current RI/FS activities include surface-radiation surveys at the Drummed Radioactive Waste Area (Site 9) to assess possible presence of a radiation source. No sampling is planned at the Radioactive Waste Storage Area (Site 18). Since the presence of contaminants in environmental pathways at OU 6 has not been confirmed, the potential remedial-action objectives and general-response actions contained in this document are based only on suspected potential contamination.

The preliminary remedial-action objectives for contaminants (if present) in the soil pathway at OU 6 will be to:

- prevent inhalation of airborne radioparticulate contaminants.

- prevent exposure of human or environmental receptors through direct contact with or ingestion of contaminated soils, or ingestion of bioaccumulated contaminants in fauna.

- prevent long-term human or environmental receptor exposure to gamma radiation.

- comply with all chemical-specific, location-specific, and action-specific Applicable or Relevant and Appropriate Requirements (ARARs) that affect remedial actions at this OU.

The preliminary remedial-action objectives for contaminants (if present) in the groundwater pathway at OU 6 will be to prevent human exposure to contaminants by direct contact with or ingestion of contaminated groundwater.

Preliminary cleanup objectives for contaminants present in soils or groundwater at OU 6 will be to:

- meet or exceed all ARARs promulgated through state and federal agencies that govern the contaminants of concern or risk-based contaminant levels.

- limit the total excess cancer risk to human receptors (both current and future) to levels within or below the EPA target risk reduction range of 10^{-4} to 10^{-6}.

- limit the hazard index for the total noncancer health risk to human receptors (both current and future) to a level below 1.

- minimize the risk to environmental receptors through source control and/or removal.

To meet the above objectives, several types of response actions were evaluated. These response actions included:

<u>Soils:</u>

- Containment of contaminated soils with a barrier and cap

- Excavation followed by on-site treatment and disposal in a lined cell and cap

- Excavation followed by off-site treatment and disposal in a licensed low-level radioactive waste disposal facility

- Institutional controls

- No action

<u>Groundwater:</u>

- Containment of contaminated groundwater with vertical barriers

- Extraction and disposal of contaminated groundwater

- Institutional controls

- Monitoring

- No action

This document will serve as the first phase of the overall FS. Results of the RI sampling and analysis activities to be performed at the Drummed Radioactive Waste Area (Site 9) will be reviewed as they relate to the response and cleanup objectives and general-response actions defined in this memorandum. If no contaminants are identified that exceed the ARARs established for TEAD-N, no further FS activities will be required and a no-action recommendation will be made for OU 6. If contaminants other than those generally associated with radioactive waste storage are found to be present, the objectives and response actions may need to be modified to fit the specific contaminants of concern.

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

SEC Donohue, Inc., is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) for seven Operable Units (OUs) at Tooele Army Depot —North Area, Tooele, Utah (TEAD-N). The RI is designed to provide information on the nature and extent of contamination associated with the site(s) within each OU and, on the basis of these data, evaluate and estimate the risks to human health and the environment as a result of the contaminants present. The FS is designed to develop, screen, and evaluate remedial-action alternatives for each OU.

The purpose of this Memorandum on Remedial-Action Objectives (MRAO) is to provide, as an initial step in the FS process, the development of remedial-action objectives and general-response actions for OU 6 at TEAD-N as well as identification of areas or volumes of media requiring remediation. An MRAO has also been generated for each of the other six OUs at TEAD-N. This document is not designed to be a stand-alone document; it, along with the other six MRAOs, will be incorporated into the FS report for TEAD-N. The FS report will summarize the results of the FS process completed for each OU. Revisions to these documents will be made as new data and new information become available.

1.2 SETTING OF THIS TECHNICAL MEMORANDUM

1.2.1 Site Background

TEAD-N encompasses 24,732 acres of the Tooele Valley in Tooele County, Utah. The facility was established in 1942 and has been in continuous operation since that time for the storage, maintenance, and repair of vehicles; storage, issue, and disposal of munitions; and storage of other equipment. Developed features at TEAD-N include igloos, magazines, administrative buildings, an industrial maintenance area, military and civilian housing, roads, hardstands for vehicle storage, and other allied infrastructure.

The Drummed Radioactive Waste Area (Site 9) is located in the northeast corner of the TEAD-N industrial area. The Radioactive Waste Storage Area (Site 18) is located in the northeast corner of Building 659, which is also used for storage of PCB-contaminated materials.

1.2.2 Description of Operable Unit 6

OU 6 consists of two sites: the Drummed Radioactive Waste Area (Site 9) and the Radioactive Waste Storage Area (Site 18).

The Drummed Radioactive Waste Area (see Figure 1) is located in the northeast corner of the Industrial Area, and consisted of one 55-gallon drum of radioactive waste that was stored at the site from approximately 1960 to 1978. Originally, the drum was stored in an area approximately 50 to 75 feet south of Building S-753 (radar-test facility) and then later was moved to an open unfenced field approximately 200 to 300 feet northwest of Building S-753. The drum of waste was reportedly removed from the site for off-site disposal in 1978 (EA, 1988). NUS (1987) reported that waste was disposed of at this site, but according to Pitts (1989) only waste storage occurred. The waste reportedly included radioactive transmitting tubes that were used to generate microwaves

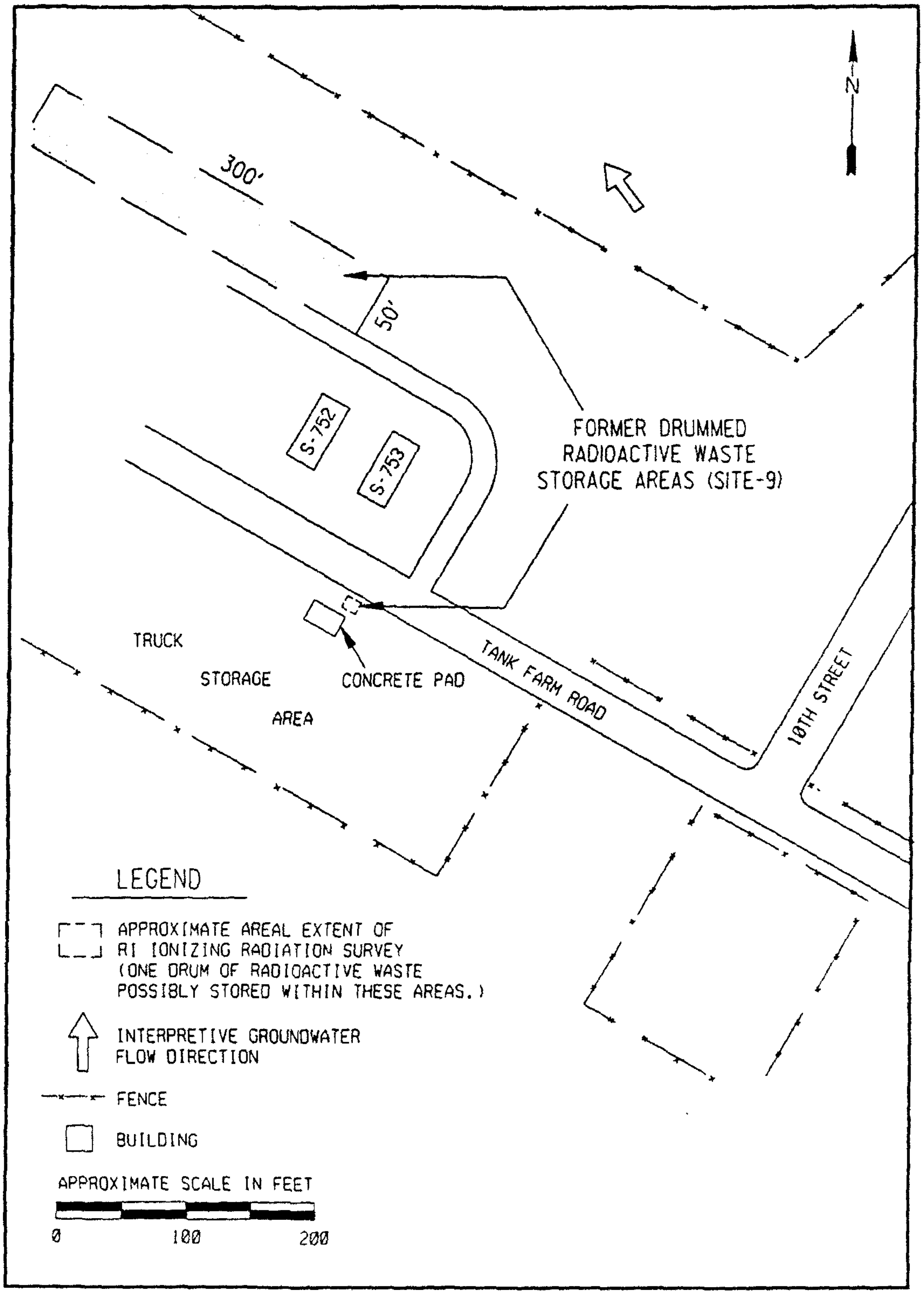

Figure 1. Drummed Radioactive Waste Area (Site 9)

for radar systems used with the NIKE-Hercules missile systems. Other low-level radioactive wastes may have included speedometers, luminous watch dials, contaminated tools, decontamination materials, cabinets, drawers, and shelves (EA, 1988). The standard method of containment for the types of radioactive materials stored at this location was containment in a plastic bag inside a drum, and placement into an overpacked drum.

The Radioactive Waste Storage Area (see Figure 2) is located in the northeast corner of Building 659 (Site 33). The building has a concrete floor and bermed containment, and is a Nuclear Regulatory Commission (NRC)-licensed facility for the storage of radioactive materials. The Radioactive Waste Storage Area is enclosed and contains low-level radioactive materials such as radiation detection meters, compasses, sights, rangefinders, and radioactive luminous compounds (NUS, 1987). All wastes are stored in USEPA/DOT-approved containers, and the entrance to the radioactive waste storage area is kept locked. Due to the small amount of materials generated and stored, waste removal is reportedly conducted only once every 5 years. It is unlikely that uncontrolled radioactive releases have occurred at the site, and according to TEAD personnel, no radioactive releases, other than minor monitored and controlled contamination within the confines of the dedicated storage enclosure, are known to have occurred (EA, 1988).

1.2.3 Previous Investigations

Several environmental investigations have been conducted at TEAD-N. In 1982, the Environmental Photographic Interpretation Center (EPIC), through an interagency agreement with the EPA and USATHAMA, provided imagery analysis support for an installation assessment for TEAD-N (EPA, 1982). Aerial photographs from 1953, 1959, 1966, and 1981 were analyzed to determine the potential environmental impact of past installation activities. No environmental assessments have been conducted at the Drummed Radioactive Waste Area to confirm the presence or absence of contaminants at this site. Radiation surveys conducted periodically at the Building 659 Radioactive Waste Storage Area (i.e., an NRC-licensed facility) indicate that no uncontrolled releases have occurred and that the storage area is being properly controlled and maintained. The current RI/FS includes surface-radiation surveys to assess the potential presence of a radiation source at the Drummed Radioactive Waste Area (Site 9).

1.2.4 Regulatory Background

Environmental studies have been conducted at TEAD-N since 1979. Early studies were performed under the Installation Restoration Program (IRP) which is a four-phase program administered by the Department of Defense (DOD) designed to identify and correct environmental contamination at DOD facilities. These studies included facility-wide assessments, as well as site-specific environmental assessments, Preliminary Assessment/Site Investigations (PA/SI), RI/FS, remedial design, remedial action, and their RCRA equivalents. From these studies and reports, 46 SWMUs were identified. Evaluations for each SWMU or former SWMU are in various stages of completion.

In October 1990, TEAD-N was added to the National Priorities List (NPL). As a result, EPA Region VIII and the State of Utah regrouped the original 46 sites into RCRA SWMUs and CERCLA (Superfund) sites. The CERCLA sites were placed into seven OUs. In 1991, the TEAD, EPA Region VIII, and the State of Utah entered into a Federal Facility Agreement (FFA) that specified the requirements, responsibilities, and schedule for the completion of all studies and remedial-action activities at TEAD.

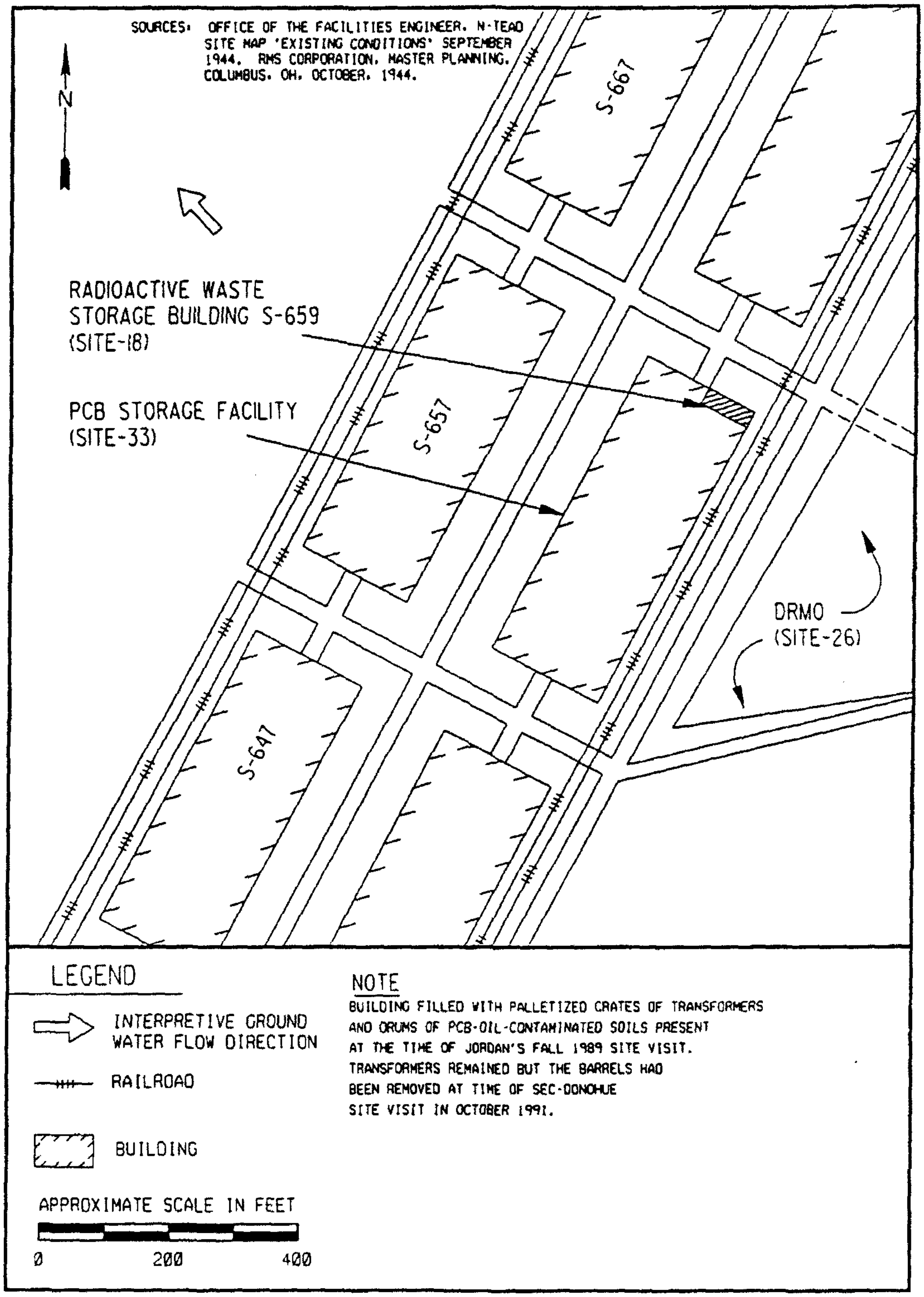

Figure 2. Radioactive Waste Storage Building (Site 18) and PCB Storage Building Facility (Site 33)

SI and RI Work Plans were prepared by E.C. Jordan Company in December of 1990. These plans were submitted to EPA Region VIII and the State of Utah for review in 1991, and comments were received in November of 1991. As a result of the regrouping of the sites at TEAD-N, SEC Donohue was tasked with reformating the plans to meet CERCLA requirements, to include only those sites considered CERCLA sites, and to address concerns and comments received on the E.C. Jordan Company plans. All of this work was conducted within the schedule set forth in the FFA.

OU 6, consisting of the Radioactive Waste Storage Area (Site 18) and the Drummed Radioactive Waste Area (Site 9), was one of the seven OUs to be characterized under the Superfund program. This MRAO fulfills one of the first requirements specified in the FFA.

1.2.5 Current Activities

Current proposed RI/FS sampling and analysis activities for OU 6 are outlined in the Final RI/FS Work Plan and Final RI/FS Sampling and Analysis Plan for TEAD-N prepared by SEC Donohue and submitted for review in March 1992. The plans describe ground-surface surveys conducted using portable radiation detectors capable of detecting alpha, beta, and gamma radiation at or above background at the Drummed Radioactive Waste Storage Area (Site 9). Swipe samples are proposed to be collected from areas found to contain elevated levels of radioactivity. Results from the RI sampling effort will be used to assess the nature and extent of radioactive contamination, if present, and to assess ARARs and the risk to human health and the environment. These activities will, in turn, allow revision of the remedial-action objectives for OU 6, which will be included in the Draft FS report for OU 6. No RI/FS investigation or sampling is planned at the Radioactive Waste Storage Area (Site 18 in Building 659).

1.3 DEVELOPMENT OF REMEDIAL-ACTION OBJECTIVES FOR OPERABLE UNIT 6

The FS is usually made up of three phases: the development of remedial alternatives, the screening of the alternatives, and the detailed analysis of the alternatives (EPA, 1988). The first phase of the FS begins with the development of remedial-action objectives. The remedial-action objectives are based on the nature and extent of contamination, exposure pathways, ARARs, and the risk potential for human health and the environment. These remedial-action objectives include site-specific cleanup goals that will allow protection of human health and the environment. The first phase of the FS continues with the identification of a range of general-response actions that can satisfy the remedial-action objectives and estimation of volumes or areas to which the general-response actions would apply. Examples of general-response actions include treatment, disposal, containment, institutional control, and no action. The next step in the development of remedial alternatives involves the identification of technologies and process options for each general-response action (e.g., identification of biological, chemical, or physical treatment technologies for the general response of treatment) and the screening of these technologies/process options on the basis of technical implementability. Finally, the screened technologies/process options are assembled into a range of remedial alternatives.

The second phase in the FS process is the screening of the alternatives. This involves a more detailed definition of the alternatives followed by a screening of the alternatives based on effectiveness, implementability, and preliminary costs. Alternatives retained after this initial screening are then subject to the next phase, the detailed analysis of alternatives. This third phase involves assessing each retained alternative against each of the following evaluation criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

This MRAO includes only the initial steps of the first FS phase, the development of remedial-action objectives and general-response actions. The media for which remedial-action objectives will be developed include soils and groundwater. No permanent surface waters are affected by the sites included in OU 6. Containment is provided at the Radioactive Waste Storage Area (Site 18) such that releases to surface waters are extremely unlikely. Runoff from the Drummed Radioactive Waste Area (Site 9) would infiltrate into the subsurface prior to reaching any surface water body; thus, no impacts to surface waters are likely. Therefore, surface water is excluded as a potential pathway.

Since no data exist for OU 6, the development of remedial-action objectives was completed on the basis of potential contamination by radionuclides. The established objectives should be considered preliminary and subject to change as new information is made available as a result of the RI/FS sampling activities.

The development of remedial-action objectives for each medium includes a consideration of chemical-specific ARARs for the compounds of concern. Location- and action-specific ARARs will be identified during the development of remedial-action alternatives in the next step of the FS for this OU. A general location-specific ARARs assessment has been completed for TEAD-N (ORNL, 1992); potential concerns for remedial actions include the presence of archaeological resources, historic sites, and endangered species on the facility. Examples of potential action-specific ARARs include regulations pursuant to the Occupational Safety and Health Act (for on-site workers during remediation) and regulations pursuant to the Resource Conservation and Recovery Act (e.g., land disposal restrictions, transport of hazardous waste, etc.).

2.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR SOILS

2.1 GENERAL

2.1.1 Site Conditions

No data currently exist to indicate that spills or disposal of radioactive wastes has occurred at the Drummed Radioactive Waste Area (Site 9). There is no historical or current evidence that radioactive materials have been released into the environment as a result of storage of radioactive materials at the Radioactive Waste Storage Area (in Building 659). Radiation surveys conducted periodically at the Building 659 Radioactive Waste Storage Area (Site 18) indicate that no uncontrolled releases have occurred and that the storage area is being properly controlled and maintained.

2.1.2 Contaminants of Potential Concern

Radioactive isotopes are of the only contaminants of potential concern at this OU. Low-level radioactive wastes were reportedly stored at the Drummed Radioactive Waste Area (EA, 1988). Many of the isotopes stored at the Radioactive Waste Storage Building (Site 18) have relatively short half-lives, low detection ranges of alpha particle emissions, or low beta and gamma energy levels. According to EA (1988), the contaminants of concern included tritium, radium, and uranium-238.

2.2 POTENTIAL EXPOSURE ROUTES

The potential exposure routes for current on-site workers and potential future residents from contaminants of concern in surface and near-surface soil/sediments at OU 6 are as follows:

- Direct dermal contact with contaminated surface soils
- Inhalation of airborne contaminants (i.e., particulates)
- On-site ingestion of contaminants
- Ingestion by consuming bioaccumulated contaminants (i.e., crops, livestock, and wildlife)
- Long-term exposure to gamma radiation

Since the extent of contamination related to this OU is unknown, the following discussion on exposure routes should be considered preliminary and subject to amendment pending results of the RI/FS sampling.

Drummed Radioactive Waste Area (Site 9). It is unknown if any radioactive isotopes are present in surface soils/sediments that would pose a significant risk. Exposure to human receptors by ingestion of potentially contaminated surface soils or by direct dermal contact is considered unlikely since access to the area is restricted to TEAD-N personnel, and the site is no longer used. A low potential exists for exposure through inhalation of airborne radioparticulate contaminants, given that the site is no longer used. No food crops are grown on the TEAD-N facility; thus, exposure through ingestion of bioaccumulated contaminants in agricultural products is unlikely. However, the potential does exist for environmental exposure of fauna through direct contact and human exposure through bioaccumulated contaminants in fauna.

Radioactive Waste Storage Area (Site 18). The Radioactive Waste Storage Area is located in Building 659, which has a concrete floor and bermed containment. The ground surface surrounding the building is paved. Therefore, contaminant releases into the soil pathway are essentially blocked. However, if the waste media contains particulates, then inhalation of airborne radioparticulate contaminants could potentially be a pathway of concern.

Radioactive isotopes could be released to the soil pathway by a dry spill of radioactive material from containers. Contamination could be spread to outside surface soils by personnel or equipment. Additionally, on-site workers could be exposed to radioactive material spilled on surfaces within the storage building. However, continued maintenance of the facility and control of the radioactive materials in containers at TEAD-N should effectively mitigate potential exposure through both pathways.

If, in the future, Building 659 was released for unrestricted residential or agricultural use, proper decommissioning of the facility would be necessary to assure protection of human health and the environment (e.g., decommissioning in compliance with NRC procedures).

2.3 REMEDIAL-ACTION OBJECTIVES FOR SOILS

Radioactive isotopes are contaminants of potential concern at this OU. Preliminary remedial-action objectives for surface soils and sediments at this OU will be to:

- prevent exposure of human receptors to contaminated soils through direct contact, ingestion, or inhalation of airborne particulates or ingestion of bioaccumulated contaminants in area fauna at levels in excess of ARARs or at levels that would pose and excessive health risk (i.e., excess cancer risk of greater than 10^{-4} to 10^{-6} or total noncancer hazard index of greater than 1); and

- prevent long-term exposure to gamma radiation.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

2.4 POTENTIAL REMEDIATION LEVELS

Radioactive isotopes, including tritium, radium, and uranium-238, are potential contaminants of concern at this OU. The U.S. Department of Energy has published guidelines for residual radioactive material at formerly utilized sites (U.S. DOE, 1987). Guidelines for residual concentrations of Ra-226 and Ra-228 are 5 pCi/g, averaged over the first 15 cm of soil below the surface and 15 pCi/g averaged over 15-cm-thick layers of soil more than 15 cm below the surface.

Guidelines are also provided for airborne radon decay products, applicable to existing occupied or habitable structures on private property intended for unrestricted use. The guideline does not apply to structures that will be demolished. The guideline provides for an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 working level.

The guidelines include provisions that the average level of gamma radiation inside a building or habitable structure on a site to be released for unrestricted use shall not exceed the background level by more the 20 uR/h and shall comply with the basic dose limit when an appropriate-use scenario is considered.

2.5 VOLUME OF SOIL REQUIRING REMEDIATION

Radioactive Waste Storage Area (Site 18). The Radioactive Waste Storage Area in Building 659 is a permitted storage area with proper containment and monitoring procedures. It is assumed that no soil contamination exists at this site; thus, the volume currently requiring remediation on the basis of cleanup standards would be zero.

Future residential or agricultural use of the Site 18 property would require proper decommissioning of the facility.

Drummed Radioactive Waste Area (Site 9). No evidence of releases or waste disposal are known at the Drummed Radioactive Waste Area. If radioactivity in soils does not exceed the values outlined in the DOE guidance (U.S. DOE, 1987), the no-action alternative would be recommended for this site. Surface-radiation surveys are to be conducted at this site during the RI field surveys. If radiation levels above background are detected during these surveys, soil requiring remediation may be identified. Presently, the estimated volume of soils to be remediated is zero for either current or future-use scenarios.

2.6 GENERAL-RESPONSE ACTIONS FOR SOILS

General-response actions include containment and excavation followed by on-site or off-site treatment and disposal, or no action (which may include institutional controls). Each of these actions is intended to prevent direct contact with the contaminants and to prevent soil from becoming a source of groundwater contamination.

2.6.1 Containment

This response action would involve covering the contaminated soils with a barrier sufficiently thick and impermeable to minimize the diffusion of radon gas and attenuate the gamma radiation associated with the radionuclides (EPA, 1990). This action would reduce or eliminate exposure to receptors. An impermeable cap would also prevent windblown radioparticulate contamination and protect the groundwater and surface-water pathways through reduction of water infiltration and runoff. The cap may include a synthetic liner followed by a clayey soil layer and clean topsoil or may include asphalt or concrete caps.

Containment does not reduce contaminant toxicity or volume. Institutional controls, described below, would be necessary to protect the integrity of the cap. Long-term maintenance of the cap and enforcement of institutional controls is necessary.

2.6.2 Excavation Followed by On-Site or Off-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding remediation levels. The soils removed would be hauled to an on-site NRC-licensed disposal cell or an off-site NRC-licensed facility for disposal of low-level radioactively-contaminated soils. The excavated soil may require treatment prior to disposal to meet NRC disposal requirements (e.g., encapsulation or solidification). This response would also involve hauling clean backfill to the site to replace the removed soils.

2.6.3 Institutional Controls

This action would involve leaving the contaminated or potentially contaminated soils in place, but placing controls on access to the site through deed restrictions, fencing, placing of signs, closure of roads, or other physical barriers. This response action may be appropriate if the contaminants present have very low mobility, are in low concentrations, or have low toxicity. Long-term enforcement of institutional controls is necessary.

2.6.4 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any soil contamination that is present. Generally, the no-action response is effective in meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

3.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

3.1 GENERAL

3.1.1 Site Conditions

No data exist to indicate that contaminants of concern have been released to groundwater from OU 6. Depth to groundwater in the vicinity of this OU is approximately 230 feet Although the depth to groundwater is great, a potential does exist for soluble radioactive isotopes to reach groundwater.

3.1.2 Contaminants of Potential Concern

Radioactive isotopes are the only contaminants of potential concern at this OU. No specific isotopes have been identified of potential concern at the Drummed Radioactive Waste Area (Site 9). Contaminants of potential concern identified at the Radioactive Waste Storage Building (Site 18) include tritium, radium, and uranium-238 (EA, 1988).

3.2 POTENTIAL EXPOSURE PATHWAYS

The potential exposure route for contaminated groundwater would be ingestion or direct contact to water obtained from an on-site water supply well by TEAD-N personnel or potential future residents/livestock. Water supply well WW-2 is located in the general vicinity of OU 6, approximately 3,000 feet southeast of the Drummed Radioactive Waste Area (Site 9).

3.3 REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

Radionuclides are contaminants of potential concern at this OU. The primary remedial-action objective for groundwater would be to prevent human exposure to contaminants by direct contact with or ingestion of contaminated groundwater at levels in excess of ARARs or at levels that pose an excessive human health risk (i.e., total excess cancer risk greater than 10^{-4} to 10^{-6} or total noncancer hazard index greater than 1).

Potential remediation levels based on ARARs are Maximum Contaminant Levles (MCLs) for drinking water. MCLs would apply to groundwater determined to be contaminated at this OU.

The following MCLs would potentially apply:

- Combined radium-226 and radium-228 - 5 pCi/l
- Gross alpha particle activity (including radium-226 but excluding radon and uranium) - 15 pCi/l

MCLs are also provided for beta particle and photon radioactivity for man-made radionuclides (40 CFR 141.16). The average annual concentration of beta particle and photon radioactivity from manmade radionuclides in drinking water must produce an annual dose equivalent to the total body or any internal organ of no greater than 4 millirem per year. The regulations assume that an average annual concentration of 20,000 pCi/l of tritium or 8 pCi/l of strontium-90 will produce a total body or organ dose of 4 millirem per year.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

3.4 VOLUME OF GROUNDWATER REQUIRING REMEDIATION

Radioactive Waste Storage Area (Site 18). The Radioactive Waste Storage Area in Building 659 is a permitted storage area with proper containment and monitoring procedures. It is unlikely that groundwater has been impacted by radionuclides at this site; thus, the no-action alternative may be appropriate for groundwater at this site.

Drummed Radioactive Waste Area (Site 9). No evidence of releases or waste disposal are known at the Drummed Radioactive Waste Area. Surface-radiation surveys are to be conducted at this site during the RI. If radiation levels above background are detected in soil, the potential for impacts to groundwater will be evaluated through computer modeling.

3.5 GENERAL-RESPONSE ACTIONS

General-response actions for groundwater potentially contaminated with radionuclides include containment, extraction followed by treatment, institutional controls, and no action.

3.5.1 Containment

This response action includes capping and/or vertical barriers such as slurry walls. The extensive depth to the groundwater at this site eliminates vertical barriers as a feasible option. Containment does not reduce contaminant toxicity or volume, but can reduce contaminant migration to groundwater by reducing water infiltration. Long-term maintenance of the cap and enforcement of institutional controls, described below, are necessary to protect the integrity of the cap.

3.5.2 Extraction Followed by Treatment

This response action includes the installation of pumping and reinjection wells for the surface treatment of groundwater and reinjection of treated water back to the aquifer. Treatment would consist of chemical treatment (e.g., precipitation, flocculation), or membrane separation. This response would be used in conjunction with source control (i.e., removal of contaminated soils) to prevent further contamination of the groundwater pathway. The effectiveness of this general response depends upon successful capture of contaminated groundwater.

3.5.3 Institutional Controls

This general response may involve issuing deed restrictions, discontinuing the use of water supply wells, providing alternate sources of water and allowing the natural reduction of contaminants through dispersion to concentrations below remediation levels. Long-term enforcement of institutional controls is necessary.

3.5.4 Monitoring

This general response would involve the monitoring of downgradient wells to ensure that contaminant levels remain below acceptable levels (i.e., drinking water MCLs). Further response actions would not be required unless monitoring results indicate that remediation levels have been exceeded. Monitoring does not reduce contaminant toxicity, mobility, or volume.

3.5.5 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any groundwater contamination that is present. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

4.0 REFERENCES

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FINAL MEMORANDUM ON REMEDIAL-ACTION OBJECTIVES

for

OPERABLE UNIT 7

TOOELE ARMY DEPOT—NORTH AREA, UTAH

December 1992

Contract No. DAAA15-90-D-0007

Prepared for
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland 21010-5401

Prepared by
SEC Donohue, Inc.
Grand Junction, Colorado 81506

EXECUTIVE SUMMARY

The Tooele Army Depot—North area (TEAD-N) contains 46 sites which were previously identified as having the potential for releasing or having released contaminants into the environment. These sites were originally considered Solid Waste Management Units (SWMUs) under a Resource Conservation and Recovery Act (RCRA) Corrective Action Permit. However, TEAD-N has been designated a National Priority List (NPL) site, which under the Comprehensive Environmental Response, Compensation, and Liability ACT of 1980 (CERCLA) as amended by SARA (1986), is required to perform a Remedial Investigation/Feasibility Study (RI/FS) to characterize the nature and extent of risks posed by hazardous-waste sites at TEAD-N. As a result of this requirement, 17 of the 46 RCRA SWMUs have been regrouped into seven Operable Units (OUs) under CERCLA (Superfund) by the Environmental Protection Agency (EPA) and the State of Utah.

The purpose of a Memorandum on Remedial Action Objectives (MRAO) is to develop remedial-action objectives, general-response actions, and potential volumes or areas requiring remediation to aid in the development of remedial alternatives required to complete an FS for each OU at TEAD-N. This MRAO specifically addresses the remedial-action objectives for OU 7 at TEAD-N.

OU 7 is located in the south central portion of TEAD-N. OU 7 consists of the Pole Transformer PCB Spill Site (Site 5), the Old Burn Area (Site 6), the Chemical Range (Site 7), the Tire Disposal Area (Site 13), and the Old Burn Staging Area (Site 36). Suspected contaminants include:

Site 5 - PCBs, dioxins/furans
Site 6 - VOCs, semi-VOCs, inorganics, anions, explosives
Site 7 - VOCs, semi-VOCs, inorganics, anions, explosives
Site 13 - tires
Site 36 - VOCs, semi-VOCs, inorganics, anions, explosives

Little previous data have been collected from the sites included in this OU. Current RI/FS work plans submitted by SEC Donohue, Inc. call for sampling of surface and near-surface soils/sediments in the area around utility pole No. 184, from 4 test pits and the gullies in the Old Burn Area, from each former trench location in the Chemical Range, and from the perimeter of the pit bottom in the Old Burn Staging Area. A site walkover, but no sampling, is planned for the Tire Disposal Area. Geophysical surveys will also be conducted in the Old Burn, Old Burn Staging, and Chemical Range Areas. The results from these investigations will be used to refine the preliminary contaminants of concern identified in this MRAO. An assessment of Applicable or Relevant and Appropriate Requirements (ARARs) and human health and environmental risk will then be completed for the refined list of contaminants of concern. These activities will in turn allow refinement of the preliminary remedial action objectives identified in this MRAO. All new information and revisions will be incorporated into the RI and FS reports for OU 7.

Remedial-action objectives for this OU will be to:

- reduce the potential for human and environmental exposure to contaminants by remediating all soils containing above 10 ppm PCBs (in Pole Transformer PCB Spill Site) or contaminants above risk-based remediation levels (all sites).

- reduce the potential for human exposure by ingestion or direct contact with contaminated groundwater by remediating all groundwater containing levels of contaminants above MCLs or risk-based levels if MCLs do not exist for contaminants present.

- comply with all chemical-specific, location-specific, and action-specific Applicable or Relevant and Appropriate Requirements that affect remedial actions at this OU.

Risk-based cleanup levels for soil and groundwater will be established to limit the total excess cancer risk to human receptors (both current and future) to levels within or below the EPA target risk reduction range of 10^{-4} to 10^{-6} and to limit the total noncancer hazard index to levels below 1.

The volume of soils and groundwater requiring remediation could not be quantified pending the results of the sampling being conducted as part of the RI. The areal and vertical extent of any soil contamination detected during the RI will be used to estimate volumes of contaminated soil. If the RI data indicate the presence of soil contamination, a vadose zone model will be used to evaluate the potential for contaminant migration to groundwater and to evaluate the need for additional groundwater characterization. Volume estimates and modeling results will be incorporated into the FS report for OU 7.

Potential general-response actions were identified and include the following:

Soils:

- Capping of contaminated soils and rerouting surface water drainage
- Excavation of contaminated soils with on-site treatment and disposal
- Excavation of contaminated soils with off-site treatment and/or disposal
- In-situ treatment such as soil vitrification or bioremediation
- Institutional controls
- No action

Groundwater:

- Containment
- On-site removal, treatment, and reinjection
- Institutional controls
- Long-term monitoring
- No action

This document will serve as the first phase of the overall FS. Results of the RI sampling and analysis activities to be performed at the various sites will be reviewed as they relate to the response and cleanup objectives and potential cleanup response actions defined in this memorandum. If no contaminants are identified that exceed the ARARs or risk-based remediation levels established for TEAD-N, no further FS activities will be required and a no-action recommendation will be made for that particular site.

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

SEC Donohue, Inc., is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) for seven Operable Units (OUs) at Tooele Army Depot—North Area, Tooele, Utah (TEAD-N). The RI is designed to provide information on the nature and extent of contamination associated with the sites within each OU and, on the basis of these data, evaluate and estimate the risks to human health and the environment as a result of the contaminants present. The FS is designed to develop, screen, and evaluate remedial-action alternatives for each OU.

The purpose of this Memorandum on Remedial-Action Objectives (MRAO) is to provide an assessment of the remedial action objectives and general-response actions for OU 7 at TEAD-N as an initial step in the FS process as well as to identify areas or volumes of media requiring remediation. An MRAO has also been generated for each of the other six OUs at TEAD. This document is not designed to be a stand-alone document; it, along with the other six MRAOs, will be incorporated into the FS report for TEAD-N. The FS report will summarize the results of the FS process completed for each OU. Revisions to these documents will be made as new data and new information become available.

1.2 SETTING OF THE TECHNICAL MEMORANDUM

1.2.1 Site Background

TEAD-N encompasses 24,732 acres of the Tooele Valley in Tooele County, Utah. The facility was established in 1942 and has been in continuous operation since that time for the storage, maintenance, and repair of vehicles; storage, issue, and disposal of munitions; and storage of other equipment. Developed features at TEAD-N include igloos, magazines, administrative buildings, an industrial maintenance area, military and civilian housing, roads, hardstands for vehicle storage, and other allied infrastructure.

The Pole PCB Transformer Spill Area, Old Burn Area, Chemical Range, Tire Disposal Area, and Old Burn Staging Area are all located in the south central portion of the facility. All of these sites were included in OU 7 for purposes of this study.

1.2.2 Description of Operable Unit 7

OU 7 consists of the Pole Transformer PCB Spill Site (Site 5), the Old Burn Area (Site 6), the Chemical Range (Site 7), the Tire Disposal Area (Site 13), and the Old Burn Staging Area (Site 36). Descriptions of these sites are given below.

The Pole Transformer PCB Spill Site (Site 5) resulted from a utility-pole (No. 184) fire in 1976. The pole is located west of Igloo Rows B4 and B5 on the west side of the railroad tracks (see Figure 1). During the fire, a pole-mounted transformer was damaged and PCB- contaminated oil was released to the surrounding soils. Shortly after the spill occurred, the contaminated soils were excavated and placed into 55-gallon drums.

The Old Burn Area (Site 6) is located in the north-central portion of the Ordnance area (see Figure 2). Another name for this area is the Surveillance Test Area. It was used for the testing of

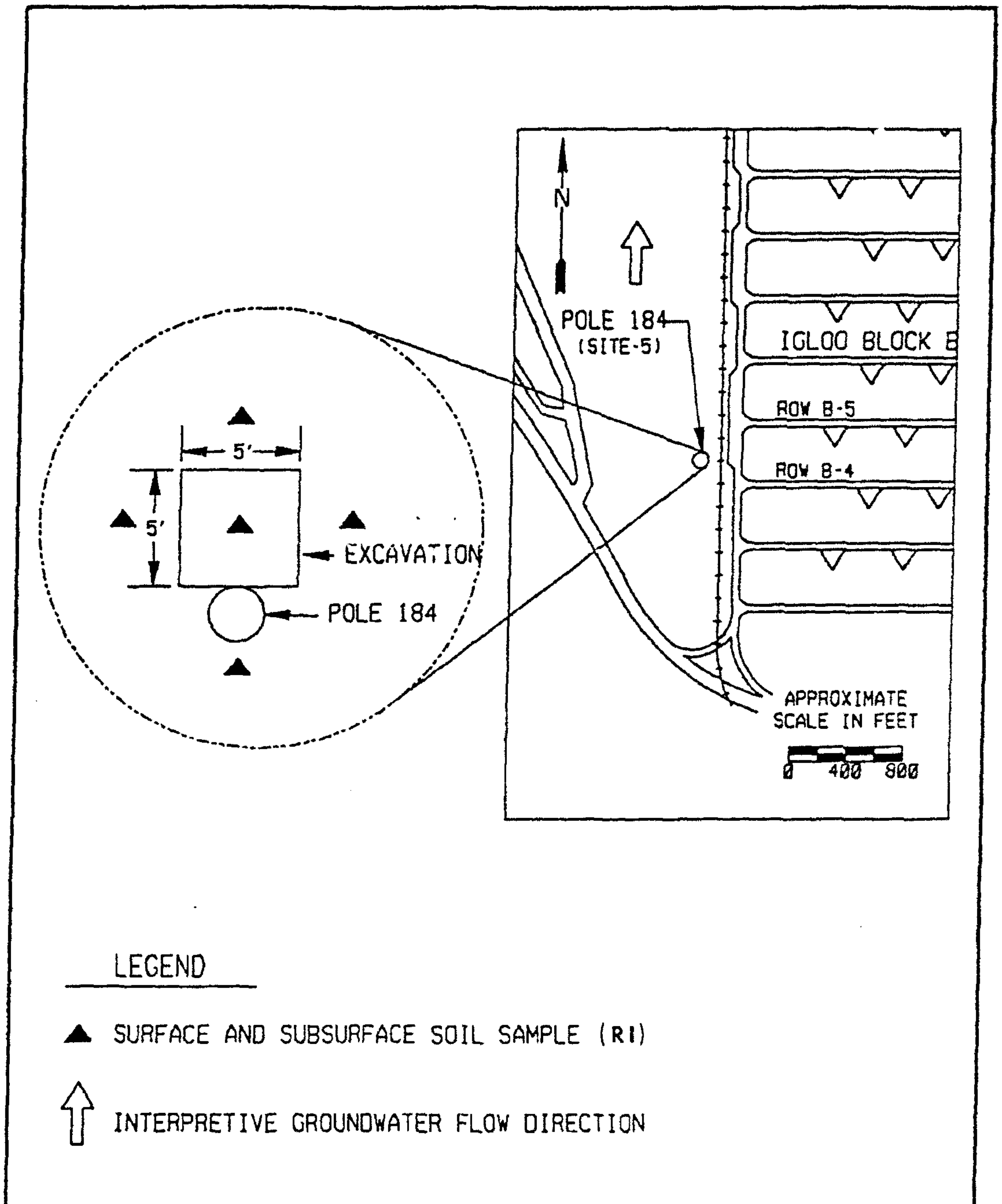
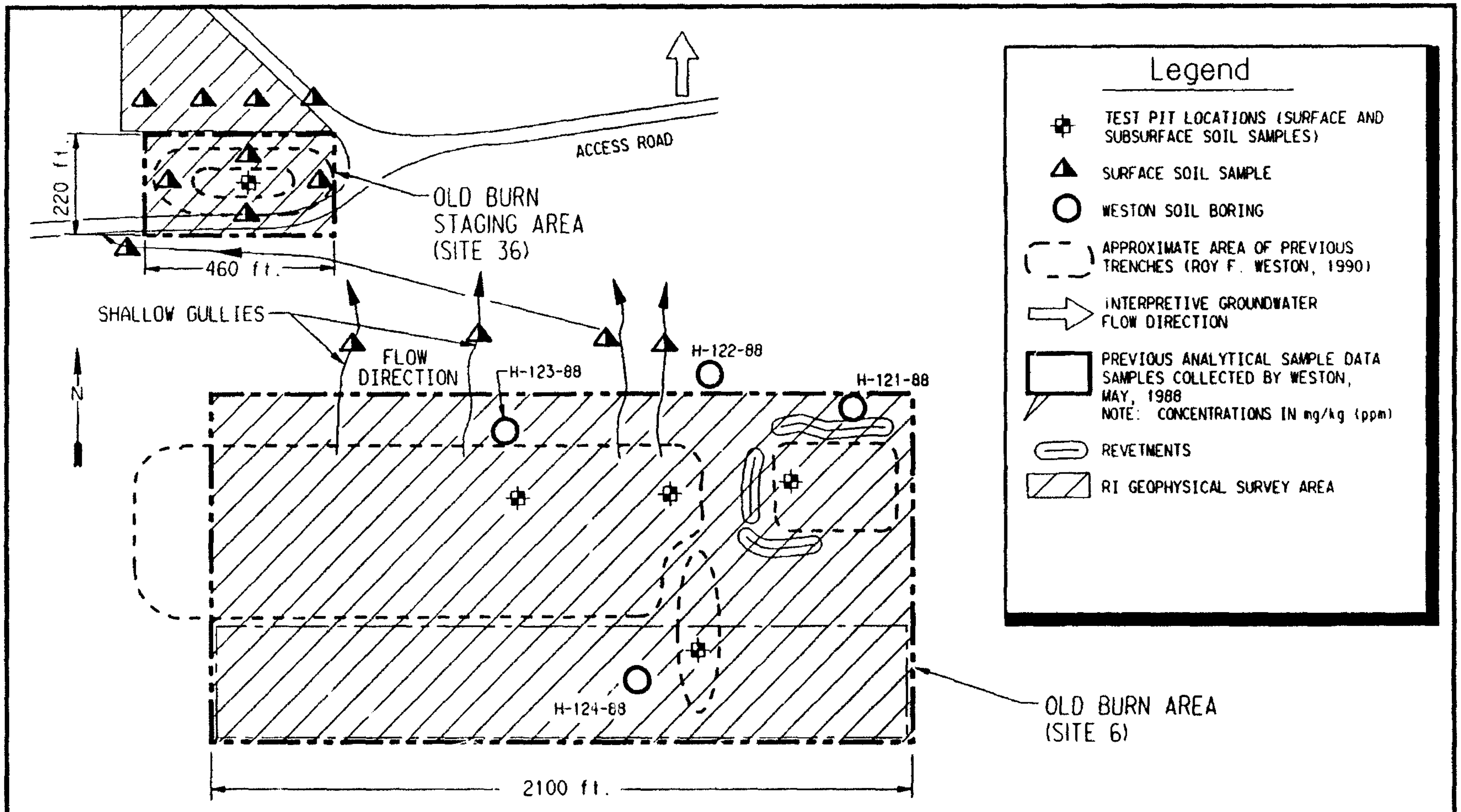


Figure 1. Pole Transfer PCB Spill Site (Site 5)



Notes

1. GEOPHYSICAL GRID SYSTEM FOR THE ENTIRE AREA WILL BE 50 FT. BY 50 FT. ANOMALIES MAY BE RE-SURVEYED AT A CLOSER SPACING.
2. USE GROUND-PENETRATING RADAR TO ASSIST IN LOCATING BURIED WASTE. AFTER UXO CLEARING OF THE TRENCH CONTENTS AT EACH LOCATION, COLLECT A SURFACE AND SUBSURFACE SOIL SAMPLE AT 4 DISCRETE LOCATIONS.

SOURCE: EPIC PHOTOS USEPA, 1982. DRAFT R.I. ROY F. WESTON INC. 1990

1682HP08 DGN

Figure 2. Old Burn Area (Site 6) and Old Burn Staging Area (Site 36)

HC-filled smoke munitions, fuses, and propellants until the early 1970s (EA, 1988). The area was also used for large-scale burning of wooden boxes. The site still contains pieces of grenades, projectiles, detonators, various metals,and melted glass scattered throughout the area. A revetment area is still discernable in the eastern portion of the site. A large field (approximately 1/4-mile by 1/2-mile in size) is located just west of the revetment area. Historical Environmental Photographic Interpretation Center (EPIC) photographs show that as many as 13 trenches were located where the field now exists (the trenches were filled and the area was graded).

The Chemical Range (Site 40) is located in the southwestern portion of the Ordnance Area (see Figure 3). It was used from 1942 to the early 1970s. It consists of three trenches west of the Old Burn Area. In 1990, these trenches included one suspected covered trench on the basis of a geophysical anomaly and two uncovered trenches. Presently, all three trenches are covered. The two trenches that were previously open contained drums and scrap from the testing and disposal of munitions, including CS-grenades and canisters, flare casings, and smoke pots (E.C. Jordan Company, 1989). Other munitions reportedly tested and possibly disposed of in the trench area include projectiles, incendiary items such as bombs, pouch and document destroyers, and flame thrower igniters (Roy F. Weston, Inc.).

The Tire Disposal Area (Site 13) is located near the southern boundary of TEAD-N in the Ordnance Area (see Figure 4). It is an area formerly used for mining gravel. Since 1981, however, the site has been used for the disposal of unreclaimable tire carcasses from TEAD-N vehicles. Tires have been dumped in a pit, and the accumulated pile has been periodically covered with gravel. The former gravel pit covers an area of approximately 18 acres. SEC Donohue, Inc., during a site visit in October 1991, estimated that approximately 11 of the 18 acres contain tires.

The Old Burn Staging Area (Site 36) is located adjacent to and north of the Old Burn Area (Site 6) in the south-central portion of the Ordnance Area (see Figure 2). The site consists of an 8-to-13-foot deep gravel-lined pit, which was used to stage materials for the Old Burn Area during the same period that the Old Burn Area was in operation (until the early 1970s). There are two cuts in the north bank of the pit with dirt roads leading into and away from the site. A small amount of scrap wood and steel are scattered throughout the site (EA, 1988). During the site visit by SEC Donohue in October 1991, several burn areas appeared to be present north of the pit. These small areas also contained charred wood, metal, and glass.

1.2.3 Previous Investigations

PCB Pole Spill Site. No data appear to have been collected during excavation activities. During a site visit by SEC Donohue in 1991, the excavation was found to be open and it measured approximately 5 feet by 5 feet by 2.5 feet (deep). No surface oil-contaminated soil was observed. A single composite sample was collected from the excavated and drummed soils that contained 3.45 ppm of PCB 1260. Confirmation sampling in and around the excavated area is being conducted as part of the RI. Results from the RI sampling will be used to determine the extent of PCB soil contamination, to assess human health and environmental risk, and to evaluate the potential for groundwater contamination through modeling. The results of these activities will allow revision of the remedial action objectives, which will be incorporated into the FS Report for OU 7.

Old Burn Area. Previous investigations at the Old Burn Area included geophysical surveys and soil borings and samples. The geophysical surveys consisted of magnetometer, electromagnetic terrain conductivity (EM), and ground-penetrating radar (GPR) used to detect areas containing

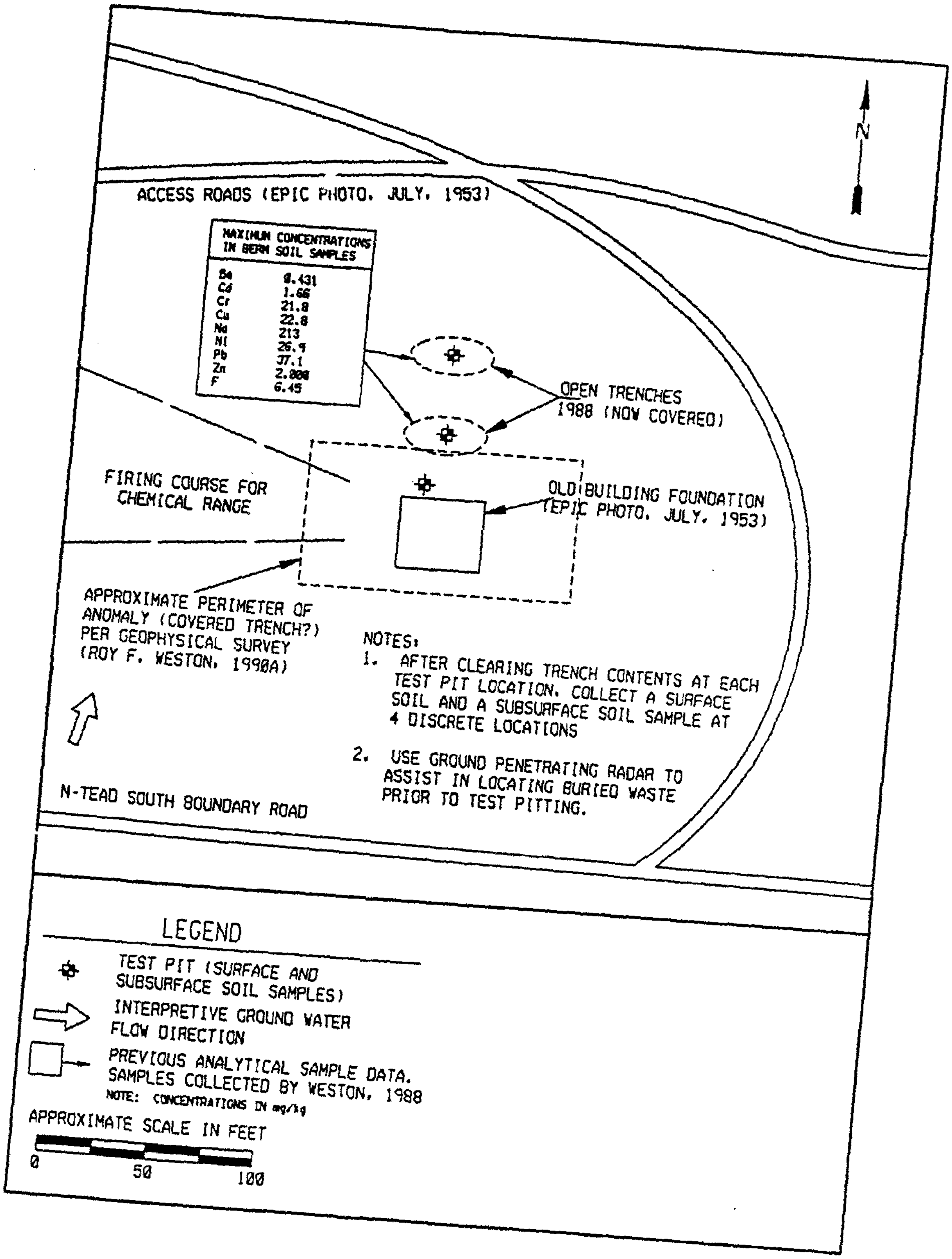


Figure 3. Chemical Range (Site 7)

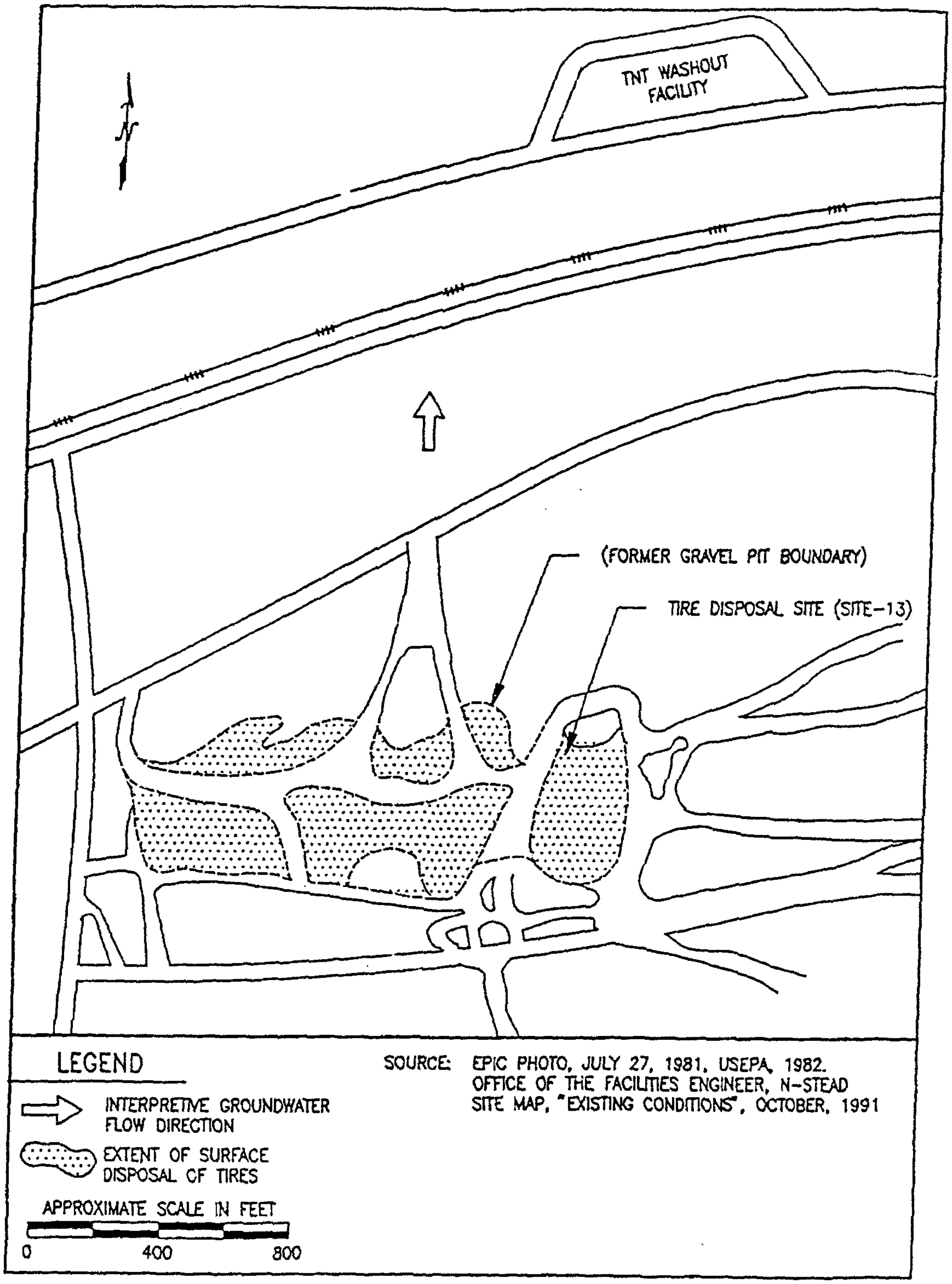


Figure 4. Tire Disposal Site (Site 13)

buried metal wastes. All three techniques detected several buried metal wastes within the test area and at another location just west of the test area. Magnetometer and EM surveys detected still another burial location in the approximate center of the field west of the test area. The areas detected by geophysical methods were consistent with past site activities as depicted in EPIC photographs. However, the boundaries of the anomalies from previous surveys were not defined in some cases. Further definition concerning the location and extent of former trenches and other burial locations will be developed through geophysical surveys and soil sampling during the RI.

Due to the potential for unexploded ordnance (UXO) in previously trenched areas, previous soil-boring activities were conducted immediately north and south of the trenched areas, but not in them. Chemical analysis of soils from these borings, which were drilled up to 50 feet in depth, consisted of explosives, metals, and anions. Results of the sampling and analysis indicated possible metals contamination of site soils. No explosives were detected in the boring samples. The only anion present above the reporting limit was fluorine. No data have been collected within the areas containing buried waste due to safety concerns.

Chemical Range. Previous environmental investigations included a geophysical survey and surface-soil sampling (Roy F. Weston). A geophysical survey using magnetometry resulted in the location of an area of buried metal wastes to the south of the open trenches. The dimensions of the area of magnetic anomaly associated with the buried metal wastes are approximately 100 feet east-west by 70 feet north-south. This was interpreted as being a covered trench.

Surface-soil samples were also collected at 12 locations in the immediate vicinity of the two previously uncovered trenches. All of the samples were collected from the berm materials adjacent to the trenches. The soil samples were analyzed for explosives, metals, and anions. Nickel and zinc were present at levels exceeding background. It should be noted that the soils most likely to be contaminated are those below and downgradient of the trenches, and those soils have not been tested yet.

Tire Disposal Area. No data currently exist for the Tire Disposal Area. A thorough walkover will be conducted at this site during the RI field program. Results from the walkover will allow estimation of the area of the site and will provide visual data on the nature of materials disposed of at the site.

Old Burn Staging Area. There have been no environmental investigations that have generated field data for this site with the exception of review of EPIC photographs and field visits by E.C. Jordan Company (1989), JMM (Shank, 1990), and SEC Donohue in October 1991.

1.2.4 Regulatory Background

Environmental studies have been conducted at TEAD-N since 1979. Early studies were performed under the Installation Restoration Program (IRP), which is a four-phase program administered by the Department of Defense (DOD) designed to identify and correct environmental contamination at DOD facilities. These studies included facility-wide assessments, as well as site-specific environmental assessments, Preliminary Assessment/Site Investigations (PA/SI), RI/FS, remedial design, remedial action, and their RCRA equivalents. From these studies and reports, 46 SWMUs were identified. Evaluations for each SWMU or former SWMU are in various stages of completion.

In October of 1990, TEAD-N was added to the National Priorities List (NPL). As a result, EPA Region VIII and the State of Utah regrouped the original 46 sites into RCRA SWMUs and CERCLA (Superfund) sites. The CERCLA sites were placed into seven OUs. In 1991, TEAD, EPA Region VIII, and the State of Utah entered into a Federal Facility Agreement (FFA) which specified the requirements, responsibilities, and schedule for the completion of all studies and remedial-action activities at TEAD.

SI and RI Work Plans were prepared by E.C. Jordan Company in December of 1990. These plans were submitted to EPA Region VIII and the State of Utah for review in 1991 and comments were received in November of 1991. As a result of the regrouping of the sites at TEAD-N, SEC Donohue was tasked with reformatting the plans to meet CERCLA requirements, to include only those sites considered CERCLA sites, and to address concerns and comments received on the E.C. Jordan Company Plans. All of this work was conducted within the schedule set forth in the FFA.

1.2.5 Current Activities

Current proposed RI/FS sampling and analysis activities for OU 7 are outlined in the Final RI/FS Work Plan and Final RI/FS Sampling and Analysis Plan for TEAD-N prepared by SEC Donohue and submitted for review in March of 1992. These plans describe surface and near-surface soil/sediment sample collection for the area around utility pole No. 184, from four test pits and the gullies in the Old Burn Area, from each former trench location in the Chemical Range, and from the perimeter of the pit bottom in the Old Burn Staging Area. (No additional sampling is planned for the Tire Disposal Area.) Results of these sampling and survey efforts are expected to be available the summer of 1992. Analytical results from the soil sampling will be used to refine the contaminants of concern (COCs) and to assess ARARs and human health and environmental risk for the COCs at OU 7. These activities will in turn allow revision of the remedial-action objectives for OU 7 and will allow the quantification of contaminant-specific cleanup goals; results will be included in the Draft FS Report for OU 7.

Although a Preliminary Baseline Risk Assessment has been completed for several of the SWMUs and Sites at TEAD-N (SECD, 1992), only Site 7 was included in the baseline risk assessment. No risk assessment was completed for Sites 5, 6, 13, and 36 due to insufficient data. Similarly, although a general assessment of chemical-specific ARARs has been completed for TEAD-N (ORNL, 1992), existing data are insufficient to provide an ARARs assessment (except for PCBs in soil) that is specific to the Sites at OU 7. The general ARARs assessment used available data for TEAD-N to identify general COCs for the facility and to prepare a table of Maximum Contaminant Level (MCL) ARARs for groundwater COCs and To Be Considered (TBC) guidance for soil COCs. Pertinent information from the general ARARs assessment will be incorporated into the ARARs assessment for OU 7 following receipt of the RI data and refinement of the OU 7 COCs.

1.3 DEVELOPMENT OF REMEDIAL-ACTION OBJECTIVES FOR OU 7

The FS is usually made up of three phases: the development of remedial alternatives, the screening of the alternatives, and the detailed analysis of the alternatives (EPA, 1988). The first phase of the FS begins with the development of remedial-action objectives. The remedial-action objectives are based on the nature and extent of contamination, exposure pathways, ARARs, and the risk potential for human health and the environment. These remedial-action objectives include site-specific cleanup goals that will allow protection of human health and the environment. The first phase of the FS continues with the identification of a range of general-response actions, which can satisfy the remedial action objectives and estimation of volumes or areas to which the general-response actions would apply. Examples of general-response actions include treatment, disposal, containment, institutional control, and no action. The next step in the development of remedial alternatives involves the identification of technologies and process options for each general-response action (e.g., for example, identification of biological, chemical, or physical treatment technologies for the general response of treatment) and the screening of these technologies/process options on the basis of technical implementability. Finally, the screened technologies/process options are assembled into a range of remedial alternatives.

The second phase in the FS process is the screening of the alternatives, which involves a more detailed definition of the alternatives followed by a screening of the alternatives based on effectiveness, implementability, and preliminary costs. Alternatives retained after this initial screening are then subject to the next phase, the detailed analysis of alternatives. This third phase involves assessing each retained alternative against each of the following evaluation criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

This MRAO includes only the initial steps of the first FS phase, the development of remedial-action objectives and general-response actions. The remedial-action objectives for OU 7 are completed based on suspected potential contaminants identified for each of the sites. The established objectives should be considered preliminary and subject to change as new information is made available. The media for which remedial actions are developed include soils and groundwater. Since there are no permanent surface waters affected by any of the sites included in this OU, surface water is not addressed as a separate medium.

The development of remedial-action objectives for each medium includes a consideration of chemical-specific ARARs for the compounds of concern. Location- and action-specific ARARs will be identified during the development of remedial-action alternatives in the next step of the FS for this OU. A general location-specific ARARs assessment has been completed for TEAD-N (ORNL, 1992b); potential concerns for remedial actions include the presence of archaeological resources, historic sites, and endangered species on the facility. Examples of potential action-specific ARARs include regulations pursuant to the Occupational Safety and Health Act (for on-site workers during remediation) and regulations pursuant to the Resource Conservation and Recovery Act (e.g., land disposal restrictions, transport of hazardous waste, etc.).

2.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR SOILS

2.1 GENERAL

2.1.1 Site Conditions

Pole Transformer PCB Spill Site. No surface-oil contaminated soil has been observed since the cleanup of the spill area. During a site visit in 1989, E.C. Jordan Company reported the 11 drums from the cleanup were staged near the utility pole and were unlabeled and rusted, but not deteriorated. Since then, the drums have been hauled off and properly disposed of.

Old Burn Area. The revetment area and the burning trenches within the revetment area along the east side of the Old Burn Area are the only evidence of activity visible at the ground surface. Any other disturbed areas have been leveled to ground surface. Buried metal wastes and potential UXO could be a source of metals, explosives, nitrogen compounds, and anions contamination. There is little information concerning the types and quantities of materials that may have been buried in the trenches adjacent the Old Burn Area. Due to the variety and quantity of materials tested and potentially disposed of at the site, a variety of contaminants may be present. Chemical weathering of the various metals known to be present at the site could release a significant amount of metals contamination to environmental pathways.

Chemical Range. Three trenches were observed during the initial RI site visit in the northeast area near the surveillance buildings. Two of the three trenches were open and contained various unburned munitions canisters, scrap metal, and metal containers labeled "smoke pot-floating-HC-M4A2" (Weston, 1990). Since then, all trenches have been covered.

Tire Disposal Area. The tires in this area have been dumped in a pit, and the accumulated pile has been periodically covered with gravel. The tires are assumed to be primarily rubber with nylon, steel, cloth, polyester, or other fabrics used in tire construction.

Old Burn Staging Area. The Old Burn Staging Area appears to have been used primarily as a staging area for materials used at the Old Burn Area and not as a disposal area. Small amounts of scrap wood and steel bands have been observed scattered throughout the site. Dark material covering the floor of the pit was apparent in the 1959 EPIC photograph. In the 1953 photograph, three small trenches were located in the center of the pit and photographs from 1966 show dark material, possibly standing liquid, ringing the perimeter of the pit (USEPA, 1982). Aside from the photographs, no records are available that detail what materials were staged or disposed of in the pit. SEC Donohue, during a site visit in October 1991, observed what appear to be several burn areas (former burn pits) north of the pit. The dark areas observed in previous photographs within the pit may also have been burn areas.

2.1.2 Contaminants of Potential Concern

Pole Transformer PCB Spill Site. The only contaminants of concern in the soils at the Pole Transformer PCB Spill Site are PCBs and possible dioxin/furans as a result of the fire.

Old Burn Area. The potential contaminants of concern in the soils at the Old Burn Area include metals, explosives, nitrogen compounds, VOCs, semi-VOCs, and anions.

Chemical Range. Potential contaminants of concern in the soils for the Chemical Range include semi-VOCs, explosives, metals, and anions. The Preliminary Baseline Risk Assessment for TEAD-N identified beryllium, cadmium, nickel, zinc, and fluoride as contaminants of concern in soil at the Chemical Range (SECD, 1992).

Tire Disposal Area. Typically, tires are very chemically stable in the environment. It has been estimated that a whole tire requires at least 100 years to fully decompose (Cadle and Williams, 1980). Although unlikely, potential releases from the Tire Disposal Site could result from natural degradation or combustion of tires during a fire. Natural degradation results when microorganisms break the sulfur linkages in the vulcanized portion of the polymers in tires. Although biodegradation does not reduce the total carbon content, experiments suggest that it may detoxify some of the polynuclear aromatic hydrocarbons (PAHs) in the oils. The final degradation products through biodegradation would be butadiene, isoprene, vinylcyclohexene, and styrene (Cadle and Williams, 1980). Possible chemical contaminants which could be released due to combustion during a fire include ash, sulfur compounds, polynuclear aromatic hydrocarbons, oil, carbon and nitrogen oxides, and particulates (Goodyear, 1990).

Old Burn Staging Area. Potential contaminants of concern in the soils at the Old Burn Staging Area are the same as those for the Old Burn Area: metals, explosives, nitrogen compounds, VOCs, semi-VOCs, and anions.

2.2 EXPOSURE ROUTES

The potential current and future exposure routes from contaminants in surface and near-surface soils/sediments are as follows:

- Direct dermal contact with contaminants in soil by TEAD personnel or future on-site residents
- Ingestion of contaminants in soil by TEAD personnel or future on-site residents
- Detonation of UXOs in the vicinity of TEAD personnel or future on-site residents
- Inhalation of airborne contaminants (i.e., vapors or particulates) by TEAD personnel or future on-site residents
- Ingestion of bioaccumulated contaminants (i.e., crops, livestock, and wildlife) by TEAD personnel or future on-site residents
- Ingestion of soil contaminants by present and future on-site fauna
- Migration of soil contaminants to groundwater

Since the extent of contamination related to the OU is unknown, the following discussion on exposure routes should be considered preliminary and subject to amendment pending results of the RI sampling.

Pole Transformer PCB Spill Site. If PCB-contaminated soils remain at this site, there is a potential for exposure to public health or the environment since this site is not fenced. Exposure to human receptors by dermal contact or ingestion of potentially contaminated surface soils or inhalation of dust is currently considered unlikely due to the excavation and removal of the contamination followed by covering with clean fill material. A future scenario that includes residential use may involve more risk from direct contact due to the increased time of exposure that an on-site resident would experience. A potential also exists for human exposure through the food chain under a future on-site agricultural use scenario.

The typically low amounts of precipitation and low mobility of PCBs in soil limits the potential for PCBs to migrate to groundwater.

Old Burn Site. Because this site is not presently in use by TEAD-N, there is little current opportunity for human exposure related to direct dermal contact with, ingestion of, or inhalation of contaminated soils. Again, future residential or agricultural use increases the potential human exposure to soil contamination through dermal contact, ingestion, inhalation, and bioaccumulation in the food chain. There may also be physical risk under both present and future use associated with potential UXO or reactive soils.

Chemical Range. Contaminated dust and/or sand from surface contamination could be transported off-site, thereby increasing the likelihood of human exposure through inhalation of contaminated particulates. Since there are currently no activities at the Chemical Range, chances for direct dermal contact and ingestion are small at present. The potential for human exposure through dermal contact, ingestion, and inhalation increases with a future on-site residential use scenario. Risk to fauna would be restricted to burrowing animals who would be at risk from direct contact/ingestion exposure to surface and near-surface contamination. There may also be physical risk to present and future on-site workers conducting subsurface activities due to the potential of UXO and reactive soils.

A Preliminary Baseline Risk Assessment has been completed for the Chemical Range, using beryllium, cadmium, nickel, zinc, and fluoride as contaminants of concern (SEC Donohue, Inc., 1992). Tables 1 and 2 present the results of the surface soil risk characterization for a future on-site residential use scenario; Table 1 provides results for carcinogenic health effects; and Table 2 presents results for noncarcinogenic health effects. The on-site residential scenario provides the most conservative estimate of the human health risk potential posed by the contaminants present at the site. The preliminary baseline risk assessment estimates a total risk for carcinogenic effects from dermal exposure and ingestion is 7.5E - 06; this level of risk is within the EPA target risk reduction range of 1E -04 to 1E -06. For Site 7, the total pathway (i.e., dermal and ingestion) hazard index estimate is 0.14; this level of risk is less than 1, which indicates a level of risk which is unlikely to cause adverse noncarcinogenic health effects to humans, including sensitive populations. This preliminary risk assessment indicates that the risk to human health from exposure to the soil at the Chemical Range is not excessive. Following receipt of additional soil data from the RI at Site 7, an updated baseline risk assessment will be completed for the site.

Tire Disposal Area. Since access to the site is restricted at present, the potential for contact with any soil contaminants is low. The greatest potential for exposure would be in the unlikely event of a fire at the site. This would release contaminants primarily into the air. If the tires were to decompose, potential exposure to human health and the environment could exist in the present or future via direct contact and/or inhalation of contaminated soils/gravels.

Old Burn Staging Area. Because this site is not presently used by TEAD-N, there is little current risk of direct contact with contaminated materials. Any contamination is expected to be limited to the pit area, which is not frequented by TEAD-N personnel. A potential risk does exist for fauna as a result of potential direct contact with contaminated materials within and just north of the pit.

Under a future residential use scenario, the potential for human exposure to contaminated soil through direct contact, ingestion, and inhalation increases.

Table 1. Surface Soil Risk Characterization: Carcinogenic Effects Future On-Site Residential Site/SWMU 7

Chemical	CDI (mg/kg/day)	Oral Slope Factor $(mg/kg/day)^{-1}$	Chemical-Specific Risk
Pathway: Dermal Exposure			
Beryllium	4.8E-08	8.6E+01	4.1E-06
		Total Pathway Risk	4.1E-06
Pathway: Ingestion			
Beryllium	8.0E-07	4.3E+00	3.4E-06
		Total Pathway Risk	3.4E-06
		Total Site Risk	7.5E-06

Table 2. Surface Soil Risk Characterization: Non-Carcinogenic Effects—Future On-Site Residential Site/SWMU 7

Chemical	CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	Hazard Quotient
<u>Pathway: Dermal Exposure</u>			
Beryllium	1.1E-07	2.5E-04	4.4E-04
Cadmium	6.7E-07	4.0E-05	1.7E-02
Nickel	5.6E-06	1.0E-03	5.6E-03
Zinc	4.4E-04	1.0E-02	4.4E-02
Fluoride	1.4E-06	3.0E-03	4.7E-04
		Total Pathway Hazard	6.8E-02
<u>Pathway: Ingestion</u>			
Beryllium	1.9E-06	5.0E-03	3.7E-04
Cadmium	1.2E-05	5.0E-04	2.4E-02
Nickel	9.8E-05	2.0E-02	5.2E-03
Zinc	7.3E-03	2.0E-01	3.9E-02
Fluoride	2.4E-05	6.0E-02	4.2E-04
		Total Pathway Hazard	6.9E-02
		Total Pathway Hazard Index	1.4E-01

2.3 POTENTIAL REMEDIATION LEVELS

With the exception of PCBs, there are no federal regulations which set limits on contamination levels of the various contaminants suspected in soils of OU 7. Therefore, risk-based remediation levels should be used for cleaning up soils. Once data from the RI become available and the actual contaminants present at each site have been identified, these risk-based remediation levels will be established for each of the contaminants present.

2.3.1 Pole Transformer PCB Spill Site

The only contaminant of concern identified at this site is PCBs; 40 CFR 761.125 regulates all spills of PCBs at concentrations of 50 ppm or greater which occur after May 4, 1987, and are subject to *decontamination requirements* under TSCA. This regulation requires soil contaminated by the spill to be decontaminated to 10 ppm PCBs by weight provided that soil is excavated to a depth of 10 inches. The excavated soil must be replaced with clean soil and the spill site restored. Although this regulation is not applicable because of the date of the spill, it is relevant and appropriate due to the type of contamination. When the RI data become available, a baseline risk assessment will be performed to determine a cleanup level for PCBs that will be protective of human health and the environment; a more stringent cleanup level than 10 ppm PCBs in soil may be necessary to be sufficiently protective.

Because of the transformer fire, a possibility of dioxin/furan as a byproduct exists. Additional sampling and analysis for these possible contaminants are scheduled as part of the RI. Remediation levels for these contaminants will be established if they are found to be present.

2.3.2 Old Burn Site, Chemical Area, and Old Burn Staging Area

Table 3 lists the potential contaminants for these areas by type (i.e., Inorganics, Anions, Pesticides/PCBs, VOCs, semi-VOCs, and Explosives). Once the actual compounds present at each of the sites have been identified, risk-based remediation levels will be set for all contaminants detected.

2.3.3 Tire Disposal Area

The only compounds of concern which may currently exist in the soils at this site are the biodegradation products from tires: butadiene, isoprene, vinylcyclohexene, and styrene. There are no regulations that limit the allowable amount of any of these compounds in soil. Given the stability of tires in the environment, the remedial-action objective for the Tire Disposal Area is to ensure that the site is in compliance with the State of Utah procedures for tire disposal.

2.4 REMEDIAL-ACTION OBJECTIVES FOR SOILS

The contaminants of concern vary from site to site in this OU. Under present use, the primary route of exposure from each of the sites would be ingestion of soil contaminants by on-site fauna, although there is some potential for human exposure. A future residential use scenario, however, provides a greater potential for human exposure to soil contaminants through dermal contact, ingestion, inhalation, and bioaccumulation. Since no remediation levels exist for soils except for

Table 3. Potential Contaminants in Soil: Volatiles and Pesticides/PCBs

VOLATILES
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1-Dichloroethene
1,1-Dichloroethane
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichloropropene
2-Chloroethylvinyl ether
Acetone
Bromodichloromethane
Cis-1,3-dichloropropene
Acetic acid
Vinyl Chloride (Chloroethene)
Chloroethane
Benzene
Carbon Tetrachloride
Methylene Chloride
Bromomethane
Chloromethane
Bromoform
Chloroform
Chlorobenzene
Carbon disulfide
Dibromochloromethane
Ethylbenzene
Toluene
Methylethyl ketone

VOLATILES
Methyl isobutyl carbinol
Methyl isobutyl ketone
Methyl-n-butyl ketone
Styrene
Trans-1,3-dichloropropene
1,1,2,2-tetrachloroethane
Tetrachloroethene
Trichloroethene
Total Xylenes

PESTICIDES/PCBs
Alpha BHC
Alpha Chlordane
Alpha Endosulfan/Endosulfan I
Aldrin
Beta BHC
Beta-endosulfan/Endosulfan II
Decachlorobiphenyl
Tetrachlorometaxylene
Delta BHC
Dieldrin
Endrin
Endrin ketone
Endosulfan sulfate
Gamma chlordane
Heptachlor
Heptachlor epoxide
Lindane/Gamma BHC
Methoxychlor
PCB 1016
PCB 1221
PCB 1232
PCB 1242
PCB 1248
PCB 1254
PCB 1260
2,2-Bis(para-chlorophenyl)-1,1-DCA
2,2-Bis(para-chlorophenyl)-1,1-DCE
2,2-Bis(para-chlorophenyl)-1,1,1-TCA
Toxaphene

Table 3. Potential Contaminants in Soil: Semi-Volatiles (continued)

SEMI-VOLATILES
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol/2-cresol
2-Nitroaniline
2-Nitrophenol
3,3-Dichlorobenzidine
3,4-Dinitrotoluene
3-Nitroaniline
3-Nitrotoluene
4,6-Dinitro-2-cresol
4-Bromophenylphenyl ether
4-Chloro-3-cresol
4-Chloroaniline
4-Chlorophenylphenyl ether
4-Methylphenol/4-cresol
4-Nitroaniline
4-Nitrophenol
Acenaphthene
Acenaphthylene
Anthracene
Bis(2-chloroethoxy)methane
Bis(2-chloroisopropyl)ether

SEMI-VOLATILES
Bis(2-chloroethyl)ether
Bis(2-ethylhexyl)phthalate
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Butylbenzy phthalate
Benzoic acid
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Benzyl alcohol
Chrysene
Hexachlorobenzene
Hexachlorocyclopentadiene
Hexachloroethane
Dibenz(a,h)anthracene
Dibenzofuran
Diethyl phthalate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Fluoranthene
Fluorene
Hexachlorobutadiene
Ideno(1,2,3-c,d)pyrene
Isopropylamine
Isophorone
Naphthalene
Nitroso di-n-propylamine
N-nitroso di-n-propylamine
N-nitroso diphenylamine
Pentachlorophenol
Phenanthrene
Phenol
Pyrene

Table 3. Potential Contaminants in Soil: Inorganics, Anions, and Explosives (continued)

INORGANICS
Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Cyanide
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

ANIONS
Bromide
Chloride
Fluoride
Phosphate
Sulfate
Nitrogen Compounds
Nitrate (as N)
Nitrite (as N)
Total NO3+NO2 (as N)

EXPLOSIVES – No MCLs promulgated
1,3,5–Trinitrobenzene
1,3–Dinitrobenzene
2,4,6–Trinitrotoluene
2,4–Dinitrotoluene
2,6–Dinitrotoluene
Cyclotetramethylenetetranitramine
Nitrobenzene
Cyclotrimethlyenetrinitramine/Cyclonite
N–Methyl–n,2,4,6–tetranitroaniline/Nitramine

PCBs, risk-based remediation levels will need to be established for any other contaminants found to be present in soil during the RI. The soil remediation level of 10 ppm set by 40 CFR 761 and risk-based remediation levels that will be determined after the RI will be used for the PCB Pole Spill Site.

A final remedial-action objective is that any remedial action conducted at this OU comply with all chemical-specific, location-specific, and action-specific ARARs.

2.5 VOLUMES OF SOIL REQUIRED FOR SOIL REMEDIATION

The limited data available for the sites included in OU 7 make estimations of volumes potentially requiring remediation infeasible. When the RI data become available, contaminated-soil-volume estimations will be based on the areal and vertical extent of any soil contamination detected.

2.6 GENERAL-RESPONSE ACTIONS

This section develops general response actions that can satisfy the remedial-action objectives stated above. General-response actions include containment, excavation followed by on-site or off-site treatment and disposal, institutional controls, and no action. A combination of general-response techniques may be necessary to be completely effective in meeting the remedial-action objectives.

2.6.1 Containment

This response action would involve covering the contaminated soils with a plastic liner followed by a compacted clayey soil cap. Surface-water drainage would be rerouted around the contaminated area through the use of lined ditches and/or pipes. This action would reduce or eliminate the risk of direct contact, ingestion, or inhalation of contaminated soils by human receptors. A cap would also reduce water infiltration, which would reduce the potential for contaminant migration to groundwater. Containment does not reduce contaminant toxicity or volume. Long-term maintenance of the cap and enforcement of institutional controls, described below, would be necessary to protect the integrity of the cap.

2.6.2 Excavation Followed by On-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding remediation levels. The soils removed would be treated on-site. Examples of possible treatment methods include the following:

- treatment for PCB
  stabilization/solidification, vitrification, soil washing, chemical extraction (using mineral acids, complexing agents, or inorganic salts), physical separation (screening, classification, gravity concentration, or flotation)

- treatment for metals
  stabilization/solidification, vitrification, soil washing

- treatment for nitrogen compounds
  vitrification(molten glass process), biological treatment, solvent extraction

- treatment for explosives
  open burning

- treatment for anions
  vitrification, solidification/stabilization

- treatment for VOCs/semi-VOCs
  dehalogenation, evaporation, thermal systems, chemical oxidation, wet oxidation, biological treatment, stabilization/solidification, encapsulation

- treatment for old tires
  shred and use for fuel in cement kiln, pulp and paper mills, or utility boilers, use as fuel in tire-to-energy facility, reuse in asphalt paving

Following treatment to acceptable levels, the soils would be returned to the site as fill material.

2.6.3 Excavation Followed by Off-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding remediation levels. The soils removed would be hauled to a licensed facility for treatment and disposal. This general response involves the liability concerns of off-site transport and off-site disposal. The long-term effectiveness of this response depends upon the treatment employed at the treatment-and-disposal facility. This response would also involve hauling clean backfill to the site to replace the removed soils.

2.6.4 In-Situ Treatment

Several types of in-situ response actions may be used depending on the nature of the contaminants. If organics were found to be present, in-situ biological degradation treatment or soil aeration may be effectively used. If PCBs, metals, nitrogen compounds, and/or anions are present, vitrification may be an effective treatment method.

2.6.5 Institutional Controls

This action would involve leaving the contaminated or potentially contaminated soils in place, but placing controls on access to the site through deed restrictions, fencing, placing of signs, closure of roads, etc. This response action may be appropriate if the contaminants present have very low mobility, are in low concentrations, or have low toxicity. Long-term enforcement of institutional controls is necessary.

2.6.6 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any soil contamination that is present. Generally, the no action response is effective in meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

3.0 PRELIMINARY REMEDIAL ACTION OBJECTIVES FOR GROUNDWATER

3.1 GENERAL

3.1.1 Site Conditions

The depth to groundwater is estimated to be approximately 260 feet bgs at the Pole Transformer PCB Spill Site, 300 feet bgs at the Old Burn Site, 400 feet bgs in the Chemical Range, 3/0 feet bgs at the Tire Disposal Area, and 300 feet at the Old Burn Staging Area. The groundwater flow direction at the Tooele site is from the southeast to the northwest. The nearest water-supply well is WW-1. A potential does exist for contamination of the groundwater through leaching of contaminants from soils by infiltration of precipitation. The depth to groundwater makes this route of exposure unlikely, especially in the Pole Transformer PCB Spill Site since PCBs have a strong tendency to adsorb to the soils. However, the length of time that these sites were in operation and the type of materials that were staged, disposed of, and possibly burned there leaves the potential for eventual migration to the water table.

3.1.2 Potential Contaminants of Concern

Pole Transformer PCB Spill Site. The only contaminants of concern in the groundwater at the Pole Transformer PCB Spill Site are PCBs and possible dioxins/furans.

Old Burn Area. The potential contaminants of concern in the groundwater at the Old Burn Area include metals, explosives, nitrogen compounds, VOCs, semi-VOCs, and anions.

Chemical Range. Potential contaminants of concern in the groundwater for the Chemical Range include explosives, metals, and anions.

Tire Disposal Area. Typically, tires are very chemically stable in the environment. It has been estimated that a whole tire requires at least 100 years to fully decompose (Cadle and Williams, 1980). However, potential releases from the Tire Disposal Site could result from natural degradation or combustion of tires during a fire. Natural degradation results when microorganisms break the sulfur linkages in the vulcanized portion of the polymers in tires. Although biodegradation does not reduce the total carbon content, experiments suggest that it may detoxify some of the polynuclear aromatic hydrocarbons in the oils. The final degradation products through biodegradation would be butadiene, isoprene, vinylcyclohexene, and styrene (Cadle and Williams, 1980). Possible chemical contaminants that could be released due to combustion during a fire include ash, sulfur compounds, polynuclear aromatic hydrocarbons, oil, carbon and nitrogen oxides, and particulates (Goodyear, 1990).

Old Burn Staging Area. Potential contaminants of concern in the groundwater at the Old Burn Staging Area are the same as those for the Old Burn Area: metals, explosives, nitrogen compounds, VOCs, semi-VOCs, and anions.

3.2 POTENTIAL EXPOSURE ROUTES

The current potential exposure route for contaminated groundwater would be ingestion or direct contact by on-site TEAD-N personnel from water obtained from supply well WW-1. The well is not currently used for drinking water, but is used for process water on the site. In the future, on-site water wells may be used for residential or agricultural purposes, which could expose humans, livestock, and crops to contaminated groundwater.

3.3 POTENTIAL REMEDIATION LEVELS

The only identified contaminants of concern for the Pole Transformer PCB Spill Site were PCBs. The MCL for PCBs (56 FR 3526, effective July 30, 1992) is 0.0005 mg/l. This contamination level will be used to set remediation levels at this site.

The Old Burn Area, Chemical Range, and Old Burn Staging Area's contaminants of concern are metals, anions, nitrogen compounds, explosives, VOCs, and semi-VOCs. Lists of potential contaminants in each of these categories together with their current and proposed (where applicable) MCLs are included in Table 4. Where no MCLs or proposed MCLs exist, risk-based remediation levels will be developed for contaminants found during the RI data collection.

The only compounds of concern for the Tire Disposal Area that may currently exist in the groundwater are the biodegradation products from tires: butadiene, isoprene, vinylcyclohexene, and styrene. No MCLs exist for these compounds. Given the stability of tires in the environment, the remedial objective for the Tire Disposal Area will be to ensure that the site is in compliance with the State of Utah tire disposal practices.

3.4 REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

The contaminants of concern vary from site to site in this OU. At present, the only route of exposure to potentially contaminated groundwater is ingestion or dermal contact by on-site workers via supply well WW-1. In the future, under a residential or agricultural use scenario, human exposure to potentially contaminated groundwater could occur through ingestion or dermal contact via on-site water supply wells; additionally, livestock or crops could receive on-site well water, which could result in bioaccumulation. The primary remedial action objective for groundwater is to prevent human exposure to groundwater contaminants at levels in excess of ARARs or at levels noncancer hazard index greater than 1. An additional remedial objective is to protect local groundwater resources by preventing the migration of groundwater having contaminant concentrations in excess of MCLs or risk-based criteria.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

Table 4. Potential Contaminants by Category: Volatiles and Pesticides/PCBs (All values are mg/L)

VOLATILES	Primary MCLs	
	FINAL	PROPOSED
1,1,1-Trichloroethane	0.20	
1,1,2-Trichloroethane	0.005	
1,1-Dichloroethene	0.007	
1,1-Dichloroethane		
cis-1,2-Dichloroethene	0.07	
trans-1,2-Dichloroethene	0.1	
1,2-Dichloroethane	0.005	
1,2-Dichloropropane	0.005	
1,3-Dichloropropene		
2-Chloroethylvinyl ether		
Acetone		
Bromodichloromethane	0.10 *	
Cis-1,3-dichloropropene		
Acetic acid		
Vinyl Chloride (Chloroethene)	0.002	
Chloroethane		
Benzene	0.005	
Carbon Tetrachloride	0.005	
Methylene Chloride	0.005	
Bromomethane		
Chloromethane		
Bromoform		
Chloroform		
Chlorobenzene		
Carbon disulfide		
Dibromochloromethane	0.10 *	
Ethylbenzene	0.7	
Toluene	1.0	
Methylethyl ketone		

VOLATILES (cont.)	Primary MCLs	
	FINAL	PROPOSED
Methyl isobutyl carbinol		
Methyl isobutyl ketone		
Methyl-n-butyl ketone		
Styrene		
Trans-1,3-dichloropropene		
1,1,2,2-tetrachloroethane		
Tetrachloroethene	0.005	
Trichloroethene	0.005	
Total Xylenes	10	

PESTICIDES/PCBs	Primary MCLs	
	FINAL	PROPOSED
Alpha BHC		
Alpha Chlordane	0.002 *	
Alpha Endosulfan/Endosulfan I		
Aldrin		
Beta BHC		
Beta-endosulfan/Endosulfan II		
Decachlorobiphenyl		
Tetrachlorometaxylene		
Delta BHC		
Dieldrin		
Endrin	0.002	
Endrin ketone		
Endosulfan sulfate		
Gamma chlordane	0.002 **	
Heptachlor	0.0004	
Heptachlor epoxide	0.0002	
Lindane/Gamma BHC	0.0002	
Methoxychlor	0.04	
PCB 1016		
PCB 1221		
PCB 1232		
PCB 1242		
PCB 1248		
PCB 1254		
PCB 1260		
2,2-Bis(para-chlorophenyl)-1,1-DCA		
2,2-Bis(para-chlorophenyl)-1,1-DCE		
2,2-Bis(para-chlorophenyl)-1,1,1-TCA		
Toxaphene	0.003	

*MCL for total trihalomethanes

**MCL for chlordane

Note: Blanks indicate no MCL promulgated or proposed.

Table 4. Potential Contaminants by Category: Semi-volatiles (mg/L) (continued)

SEMI-VOLATILES	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
1,2,4-Trichlorobenzene	0.07			
1,2-Dichlorobenzene				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene				
2,4,5-Trichlorophenol				
2,4,6-Trichlorophenol				
2,4-Dichlorophenol				
2,4-Dimethylphenol				
2,4-Dinitrophenol				
2,4-Dinitrotoluene				
2,6-Dinitrotoluene				
2-Chloronaphthalene				
2-Chlorophenol				
2-Methylnaphthalene				
2-Methylphenol/2-cresol				
2-Nitroaniline				
2-Nitrophenol				
3,3-Dichlorobenzidine				
3,4-Dinitrotoluene				
3-Nitroaniline				
3-Nitrotoluene				
4,6-Dinitro-2-cresol				
4-Bromophenylphenyl ether				
4-Chloro-3-cresol				
4-Chloroaniline				
4-Chlorophenylphenyl ether				
4-Methylphenol/4-cresol				
4-Nitroaniline				
4-Nitrophenol				
Acenaphthene				
Acenaphthylene				
Anthracene				
Bis(2-chloroethoxy)methane				
Bis(2-chloroisopropyl)ether				

Note: Blanks indicate no MCL promulgated or proposed.

SEMI-VOLATILES (cont.)	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Bis(2-chloroethyl)ether				
Bis(2-ethylhexyl)phthalate				
Benzo(a)anthracene		0.0001		
Benzo(a)pyrene	0.0002			
Benzo(b)fluoranthene		0.0002		
Butylbenzy phthalate				
Benzoic acid				
Benzo(g,h,i)perylene				
Benzo(k)fluoranthene		0.0002		
Benzyl alcohol				
Chrysene		0.0002		
Hexachlorobenzene	0.001			
Hexachlorocyclopentadiene	0.05			0.008
Hexachloroethane				
Dibenz(a,h)anthracene		0.0003		
Dibenzofuran				
Diethyl phthalate				
Dimethyl phthalate				
Di-n-butyl phthalate				
Di-n-octyl phthalate				
Fluoranthene				
Fluorene				
Hexachlorobutadiene				
Ideno(1,2,3-c,d)pyrene				
Isopropylamine				
Isophorone				
Naphthalene				
Nitroso di-n-propylamine				
N-nitroso di-n-propylamine				
N-nitroso diphenylamine				
Pentachlorophenol	0.001			
Phenanthrene				
Phenol				
Pyrene				

Table 4. Potential Contaminants by Category: Inorganics, Anions, and Explosives (mg/L) (continued)

INORGANICS	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Aluminum			0.05–0.2(**)	
Antimony	0.006			
Arsenic	0.05			
Barium	2			
Beryllium	0.004			
Cadmium	0.005			
Calcium				
Chromium	0.1			
Cobalt				
Copper			1	
Cyanide	0.2			
Iron			0.3	
Lead	0.05			
Magnesium				
Manganese			0.05	
Mercury	0.002			
Nickel	0.1			
Potassium				
Selenium	0.05			
Silver			0.1	
Sodium				
Thallium		.001/.002(*)		
Vanadium				
Zinc			5	

* Alternate MCL options proposed.

** MCL determined based on water quality and treatment situation.

ANIONS	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Bromide				
Chloride			250	
Fluoride	4.0		2.0	
Phosphate				
Sulfate			400/500(*)	250
Nitrogen Compounds				
Nitrate (as N)	10			
Nitrite (as N)	1			
Total NO3+NO2 (as N)	10			

EXPLOSIVES – No MCLs promulgated
1,3,5–Trinitrobenzene
1,3–Dinitrobenzene
2,4,6–Trinitrotoluene
2,4–Dinitrotoluene
2,6–Dinitrotoluene
Cyclotetramethylenetetranitramine
Nitrobenzene
Cyclotrimethylenetrinitramine/Cyclonite
N–Methyl–n,2,4,6–tetranitroaniline/Nitramine

3.5 VOLUMES OF GROUNDWATER REQUIRING REMEDIATION

Since no data exist for groundwater in any of the sites included in this OU, no estimations can be made of the volumes requiring remediation at this time. If data from the RI indicate the presence of soil contamination at OU 7, a vadose-zone model will be used to evaluate the potential for contaminant migration to groundwater and to evaluate the need for groundwater characterization.

3.6 GENERAL-RESPONSE ACTIONS

General-response actions for groundwater potentially contaminated with metals, explosives, nitrogen compounds, VOCs, semi-VOCs, and anions include containment, extraction followed by treatment, monitoring, institutional controls, and no action.

3.6.1 Containment

This response action includes capping and/or vertical barriers such as slurry walls. The extensive depth to the groundwater at this site eliminates vertical barriers as a feasible option. Capping areas of soil-contamination limits the infiltration of water and reduces the potential for contaminant migration to groundwater. Containment does not reduce contaminant toxicity or volume. Long-term maintenance of the cap and enforcement of institutional controls, described below, are necessary to protect the integrity of the cap.

3.6.2 Extraction Followed by Treatment

This response action includes the installation of pumping and reinjection wells for the surface treatment of groundwater and reinjection of treated water back to the aquifer. Examples of treatment methods include the following:

- treatment for PCBs
  aeration, filtration, carbon adsorption, ion exchange, chemical treatment (precipitation, flocculation), membrane separation

- treatment for metals
  separation/filtration, chemical precipitation, carbon adsorption, electrolytic recovery, ion exchange, membrane separation, freeze crystallization

- treatment for explosives
  carbon adsorption, hydrolysis, ozonation, chemical precipitation

- treatment for nitrogen compounds
  solvent extraction, biological treatment

- treatment for inorganic anions
  filtration, ion exchange

- treatment for VOCs/semi-VOCs
  distillation, solvent extraction, air/steam stripping, thin-film evaporation, freeze crystallization, separation/filtration, dehalogenation, ozonation, evaporation, chemical oxidation, wet oxidation, biological treatment

This response would be used in conjunction with source control (i.e., removal of contaminated soils) to prevent further contamination of the groundwater pathway. The effectiveness of this general response depends upon successful capture of contaminated groundwater.

3.6.3 Institutional Controls

This general response could involve issuing deed restrictions, discontinuing the use of water supply wells, and providing alternate sources of water. Contaminant toxicity, mobility, and volume are not reduced by institutional controls, except that which may occur through natural degradation and dispersion.

3.6.4 Monitoring

This general response involves the monitoring of downgradient wells to ensure that contaminant levels remain below acceptable levels (i.e., drinking water MCL sand risk-based levels). Further response actions would not be required unless monitoring results indicate that remediation levels have been exceeded.

3.6.5 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any groundwater contamination that is present, except that which may occur through natural degradation and dispersion. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

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FINAL MEMORANDUM ON REMEDIAL-ACTION OBJECTIVES

for

OPERABLE UNIT 8

TOOELE A :MY DEPOT—NORTH AREA, UTAH

December 1992

Cc tract No. DAAA15-90-D-0007

Prepared for
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen roving Ground, Maryland 21010-5401

Prepared by
SEC Donohue, Inc.
C and Junction, Colorado 81506

EXECUTIVE SUMMARY

The Tooele Army Depot—North Area (TEAD-N) contains 46 sites which were previously identified as having the potential for releasing or having released contaminants into the environment. These sites were originally considered Solid Waste Management Units (SWMUs) under a Resource Conservation and Recovery Act (RCRA) Corrective Action Permit. However, TEAD-N has been designated a National Priority List (NPL) site, which under the Comprehensive Environmental Response, Compensation, and Liability ACT of 1980 (CERCLA) as amended by SARA (1986), is required to perform a Remedial Investigation/Feasibility Study (RI/FS) to characterize the nature and extent of risks posed by hazardous-waste sites at TEAD-N. As a result of this requirement, 17 of the 46 RCRA SWMUs have been regrouped into seven Operable Units (OUs) under CERCLA (Superfund) by the Environmental Protection Agency (EPA) and the State of Utah.

The purpose of a Memorandum on Remedial-action objectives (MRAO) is to develop remedial-action objectives, general-response actions, and potential volumes or areas requiring remediation to aid in the development of remedial alternatives required to complete an FS for each OU at TEAD-N. This MRAO specifically addresses the remedial-action objectives for OU 8 at TEAD-N.

OU 8 consists of the Building 1303 Washout Pond (Site 22) and the Bomb and Shell Reconditioning Building (Site 23), located in the southwest portion of TEAD-N. Building 1303 was used to saw apart highly explosive bombs and projectiles, and a pond reportedly received washdown water during weekly cleaning of the building's interior. The Bomb and Shell Reconditioning Building (Site 23) was used to perform work on large munitions, and floor drains in the building are thought to discharge to two ditches in the front of a building. The ditches drain into culverts, which lead to small spreading areas.

No previous environmental investigations have been conducted at either of the sites included in OU 8. Surface and near-surface soil/sediment sampling will be conducted during the RI for OU 8 to assess whether contaminants have been released to environmental pathways in the vicinity of these two sites. The results from the RI will be used to refine the preliminary contaminants of concern identified in this MRAO. An assessment of Applicable or Relevant and Appropriate Requirements (ARARs) and human health and environmental risk will then be completed and will allow the quantification of cleanup goals for the contaminants of concern. These activities will in turn allow refinement of the preliminary remedial-action objectives identified in this MRAO. All new information and revisions will be incorporated into the RI and FS reports for OU 8.

Remedial-action objectives for OU 8 will be to:

- prevent present and future human exposure (through dermal contact, ingestion, or inhalation) and environmental exposure (through ingestion by fauna) to soil contamination that is present at concentrations above risk-based remediation levels.
- prevent migration of soil contaminants that would result in groundwater contamination in excess of federal or state ARARs or health-based criteria.
- prevent present and future human exposure (dermal contact, ingestion, bioaccumulation) and environmental exposure (ingestion by livestock/fauna) to groundwater contaminants that are present in concentrations above ARARs or health-based criteria.

- comply with all chemical-specific, location-specific, and action-specific ARARs that affect remedial actions at this OU.

The objective of risk-based cleanup standards is to limit the total excess cancer risk to human receptors (both current and future) to levels within or below the EPA target risk reduction range of 10^{-4} to 10^{-6} and to limit the total noncancer hazard index to levels below 1.

The volume of soils and groundwater requiring remediation cannot be quantified pending the results of the soil sampling being conducted as part of the RI. The areal and vertical extent of any soil contamination detected during the RI will be used to estimate volumes of contaminated soil. If the RI data indicate the presence of soil contamination, a vadose zone model will be used to evaluate the potential for contaminant migration to groundwater and to evaluate the need for additional groundwater characterization. Volume estimates and modeling results will be incorporated into the FS report for OU 8.

Potential general-response actions include the following:

Soils:

- Containment of contaminated soils by capping and rerouting surface-water drainage
- Excavation followed by on-site treatment and disposal
- Excavation followed by off-site treatment and disposal
- In-situ treatment such as soil vitrification and bioremediation
- Institutional controls
- No action

Groundwater:

- Containment
- Extraction followed by treatment
- Institutional controls
- Long-term monitoring
- No action

This document will serve as the first phase of the overall FS. Results of the RI sampling and analysis activities to be performed at the various sites will be reviewed as they relate to the response and cleanup objectives and potential-response actions defined in the MRAO. If no contaminants are identified that exceed ARARs or risk-based remediation levels established for TEAD-N, no further FS activities will be required and a no-action recommendation will be made for the subject site.

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

SEC Donohue, Inc., is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) for seven Operable Units (OUs) at Tooele Army Depot—North Area, Tooele, Utah (TEAD-N). The RI is designed to provide information on the nature and extent of contamination associated with the site(s) within each OU and, on the basis of these data, evaluate and estimate the risks to human health and the environment as a result of the contaminants present. The FS is designed to develop, screen, and evaluate remedial-action alternatives for each OU.

The purpose of this Memorandum on Remedial-Action Objectives (MRAO) is to provide the development of remedial-action objectives and general-response actions for OU 8 at TEAD-N as an initial step in the FS process, as well as to identify areas or volumes of media requiring remediation. An MRAO has also been generated for each of the other six OUs at TEAD. This document is not designed to be a stand-alone document; it, along with the other six MRAOs, will be incorporated into the FS report for TEAD-N. The FS report will summarize the results of the FS process completed for each OU. Revisions to these documents will be made as new data and new information become available.

1.2 SETTING OF THIS TECHNICAL MEMORANDUM

1.2.1 Site Background

TEAD-N encompasses 24,732 acres of the Tooele Valley in Tooele County, Utah. The facility was established in 1942 and has been in continuous operation since that time for the storage, maintenance, and repair of vehicles; storage, issue, and disposal of munitions; and storage of other equipment. Developed features at TEAD-N include igloos, magazines, administrative buildings, an industrial maintenance area, military and civilian housing, roads, hardstands for vehicle storage, and other allied infrastructure.

The Building 1303 Washout Pond and the Bomb and Shell Reconditioning Area are located in the western portion of TEAD-N in an area referred to as the Ordnance Area.

1.2.2 Description of Operable Unit 8

OU 8 consists of the Building 1303 Washout Pond (Site 22) and the Bomb and Shell Reconditioning Building (Site 23).

The Building 1303 Washout Pond (Site 22) is located in the southwestern portion of the Ordnance Area (see Figure 1). Building 1303 was used to saw apart highly explosive bombs and projectiles to determine their loading characteristics. The pond reportedly received washdown water from Building 1303 during weekly cleaning of the building's interior (E.C. Jordan Company, 1989). The building has not been washed down for more than 20 years, but it is assumed that there was a period when washdown water was directed out the building doors and drained downgradient to the pond. The pond is now essentially dry and its location is not readily discernable (E.C. Jordan Company, 1989).

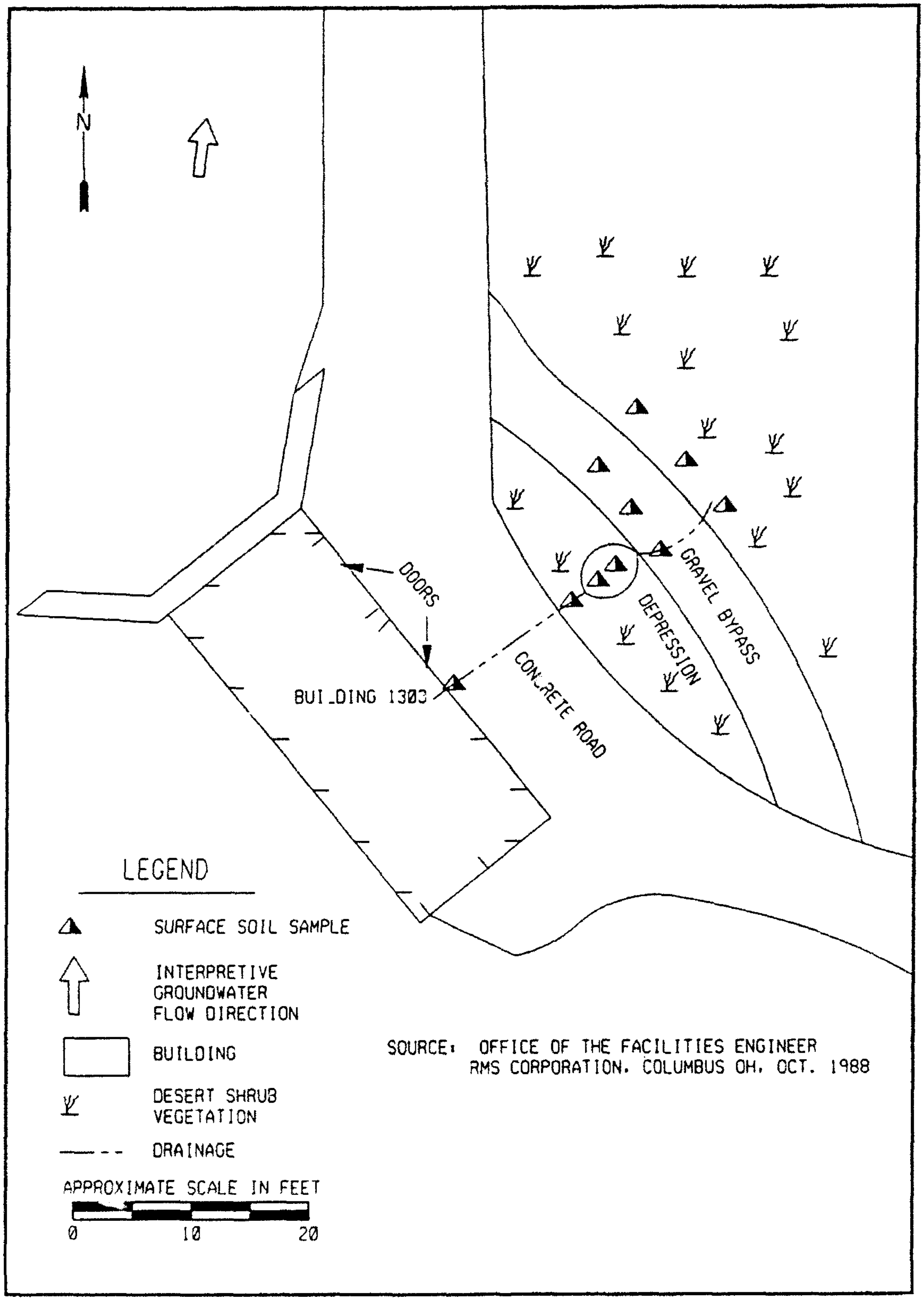

Figure 1. Building 1303 Washout Pond (Site 22) Location

The Bomb and Shell Reconditioning Building (Site 23) is located in the Ordnance Area and was actively used from the late 1950s to 1977 to perform external work on large munitions (see Figure 2). The building consists of two rooms and concrete loading/unloading facilities located on opposite sides of the building. Floor drains are located near the paint booths and are thought to discharge to two ditches paralleling the road in front of the building. The ditches drain into culverts, which empty into small spreading areas where liquid effluent infiltrates into the subsurface. Paint sludge and spent sand-blast material were among the wastes generated during active use of the building. An underground storage tank for diesel fuel is also located at this site. The Bomb and Shell Reconditioning Building is also identified as Building 1345. Limited painting operations are still on-going at the site.

1.2.3 Previous Investigations

Several environmental investigations have been conducted at TEAD-N. However, no environmental investigations have been conducted at either of the sites included in OU 8. No records are available that provide information on the composition of the washdown effluent at Building 1303. No records are available for the Bomb and Shell Reconditioning Area to indicate whether spills may have occurred inside or outside the building, with the exception of staining noted by E.C. Jordan Company on and near the concrete pad on the southeast side of the building (E.C. Jordan Company, 1989). Surface and near-surface soil/sediment sampling will be utilized during the current RI/FS to assess whether contaminants have been released to environmental pathways in the vicinity of these two sites.

1.2.4 Regulatory Background

Environmental studies have been conducted at TEAD-N since 1979. Early studies were performed under the Installation Restoration Program (IRP) which is a four-phase program administered by the Department of Defense (DOD) designed to identify and correct environmental contamination at DOD facilities. These studies included facility-wide assessments, as well as site-specific environmental assessments, Preliminary Assessment/Site Investigations (PA/SI), RI/FS, remedial design, remedial action, and their RCRA equivalents. From these studies and reports, 46 SWMUs were identified. Evaluations for each SWMU or former SWMU are in various stages of completion.

In October 1990, TEAD-N was added to the National Priorities List (NPL). As a result, EPA Region VIII and the State of Utah regrouped the original 46 sites into RCRA SWMUs and CERCLA (Superfund) sites. The CERCLA sites were placed into seven OUs. In 1991, TEAD, EPA Region VIII, and the State of Utah entered into a Federal Facility Agreement (FFA) that specified the requirements, responsibilities, and schedule for the completion of all studies and remedial-action activities at TEAD-N.

SI and RI Work Plans were prepared by E.C. Jordan Company in December of 1990. These plans were submitted to EPA Region VIII and the State of Utah for review in 1991, and comments were received in November 1991. As a result of the regrouping of the sites at TEAD-N, SEC Donohue was tasked with reformating the plans to meet CERCLA requirements, to include only those sites considered CERCLA sites, and to address concerns and comments received on the E.C. Jordan Company Plans. All of this work was conducted within the schedule set forth in the FFA.

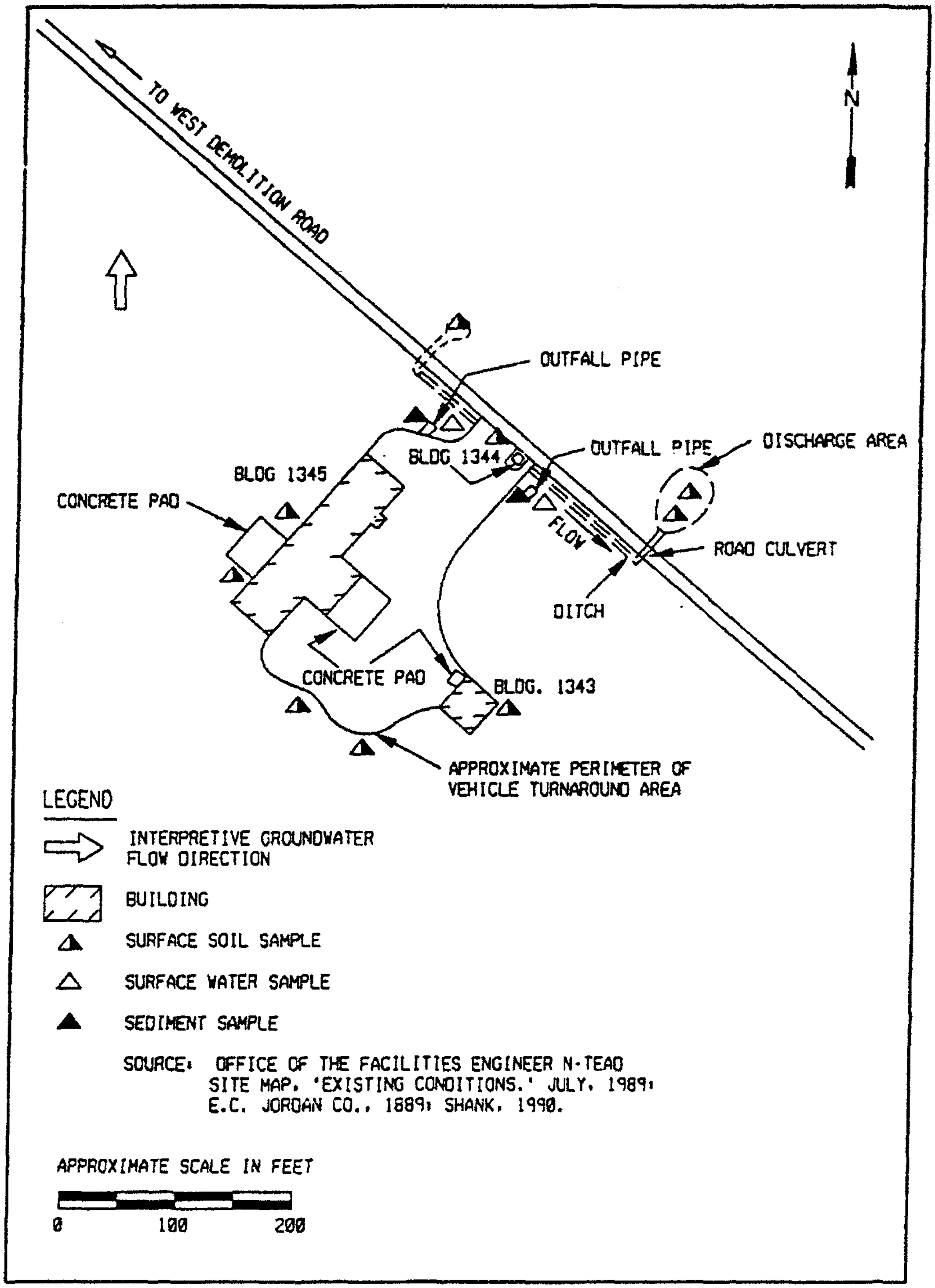

Figure 2. Bomb and Shell Reconditioning Building (Site 23) Location

OU 8, consisting of the Building 1303 Washout Pond (Site 22) and the Bomb and Shell Reconditioning Area (Site 23), was one of the seven OUs to be characterized under the Superfund program. This MRAO fulfills one of the first requirements specified in the FFA.

1.2.5 Current Activities

Current proposed RI/FS sampling and analysis activities for OU 8 are outlined in the Final RI/FS Work Plan and Final RI/FS Sampling and Analysis Plan for TEAD-N prepared by SEC Donohue and submitted for review in March 1992. These plans describe surface and near-surface soil/sediment sample collection from ditches and areas where discharged water would have spread out over the land surface. Results of this sampling effort are expected to be available in the summer of 1992. Analytical results from the soil sampling will be used to refine the contaminants of concern (COCs) and to assess ARARs and human health and environmental risk for the COCs at OU 8. These activities will, in turn, allow the quantification of contaminant-specific cleanup goals and revision of the remedial-action objectives for OU 8; results will be included in the Draft FS Report for OU 8.

Although a Preliminary Baseline Risk Assessment has been completed for several of the SWMUs and Sites at TEAD-N (SECD, 1992), no risk assessment was completed for Site 22 or Site 23 due to insufficient data. Similarly, although a general assessment of chemical-specific ARARs has been completed for TEAD-N (ORNL, 1992), existing data are insufficient to provide an ARARs assessment that is specific to the Sites at OU 8. The general ARARs assessment used available data for TEAD-N to identify general COCs for the facility and to prepare table of Maximum Contaminant Level (MCL) ARARs for groundwater COCs and To Be Considered (TBC) guidance for soil COCs. Pertinent information from the general ARARs assessment will be incorporated into the ARARs assessment for OU 8 following receipt of the RI data and refinement of the OU 8 COCs.

1.3 DEVELOPMENT OF REMEDIAL-ACTION OBJECTIVES FOR OPERABLE UNIT 8

The FS is usually made up of three phases: the development of remedial alternatives, the screening of the alternatives, and the detailed analysis of the alternatives (EPA, 1988). The first phase of the FS begins with the development of remedial-action objectives. The remedial-action objectives are based on the nature and extent of contamination, exposure pathways, ARARs, and the risk potential for human health and the environment. These remedial-action objectives include site-specific cleanup goals that will allow protection of human health and the environment. The first phase of the FS continues with the identification of a range of general-response actions that can satisfy the remedial-action objectives and estimation of volumes or areas to which the general-response actions would apply. Examples of general-response actions include treatment, disposal, containment, institutional control, and no action. The next step in the development of remedial alternatives involves the identification of technologies and process options for each general-response action (e.g., identification of biological, chemical, or physical treatment technologies for the general response of treatment) and the screening of these technologies/process options on the basis of technical implementability. Finally, the screened technologies/process options are assembled into a range of remedial alternatives.

The second phase in the FS process is the screening of the alternatives. This involves a more detailed definition of the alternatives followed by a screening of the alternatives based on effectiveness, implementability, and preliminary costs. Alternatives retained after this initial screening are then subject to the next phase, the detailed analysis of alternatives. This third phase involves assessing each retained alternative against each of the following evaluation criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility or volume
- Implementability
- Cost
- State acceptance
- Community acceptance

This MRAO includes only the initial steps of the first FS phase, the development of remedial-action objectives and general-response actions. The remedial-action objectives for OU 8 are completed based on the suspected potential contaminants identified for each of the sites. The remedial-action objectives are developed for soils and groundwater. Since there are no permanent surface waters affected by any of the sites included in this OU, surface water is not addressed as a separate medium.

Since no data currently exist for the Building 1303 Washout Pond (Site 22) and the Bomb and Shell Reconditioning Building (Site 23), the development of remedial-action objectives was completed on the basis of suspected contamination only. The established objectives should be considered preliminary and subject to change as new information is made available.

The development of remedial-action objectives for each medium includes a consideration of chemical-specific ARARs for the compounds of concern. Location- and action-specific ARARs will be identified during the development of remedial-action alternatives in the next step of the FS for this OU. A general location-specific ARARs assessment has been completed for TEAD-N (ORNL, 1992b); potential concerns for remedial actions include the presence of archaeological resources, historic sites, and endangered species on the facility. Examples of potential action-specific ARARs include regulations pursuant to the Occupational Safety and Health Act (for on-site workers during remediation) and regulations pursuant to the Resource Conservation and Recovery Act (e.g., land disposal restrictions, transport of hazardous waste, etc.).

2.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR SOIL

2.1 GENERAL

2.1.1 Site Conditions

During a site visit by E.C. Jordan Company in January of 1990, a drum of paint sludge was observed outside of the Bomb and Shell Reconditioning Building. A rust-colored liquid was also observed discharging from the outfalls into the ditch. Standing liquid was observed at the base of one outfall, and soils appeared to be damp from outfall discharge for a short distance downgradient. Erosion in the bottom of the ditch was observed, possibly indicative of past significant discharges potentially associated with blowdown of the boiler in nearby Building 1343 (see Figure 2).

Indications of liquid spills were also observed on and near the concrete pad located on the southeast side of the Bomb and Shell Reconditioning Building. A pile of material containing oil and grease on surface soils southwest of Building 1343 was observed by SEC Donohue during a site visit in October 1991. It is assumed that liquid spills at this site would be uncontrolled due to a lack of containment. An underground storage tank containing diesel fuel is also present at the site. The condition of this tank has not been assessed.

No environmental investigations involving collection of field data at the Building 1303 Washout Pond (Site 22) have been conducted. No operating records that define the composition of the washdown effluent are available. The pond is now essentially dry and its location is not readily discernable (E.C. Jordan Company, 1990).

2.1.2 Potential Contaminants of Concern

Explosives are contaminants of potential concern at both sites due to the use of buildings at each site for munitions work. Inorganics (metals) and anions are also of potential concern at both sites. VOCs and semi-VOCs are of potential concern at the Bomb and Shell Reconditioning Area (Site 23), but no evidence suggests that VOC or semi-VOC contamination would be present as a result of previous operations at the Building 1303 Washout Pond (Site 22). Incendiaries and white phosphorus may also be of potential concern at the Bomb and Shell Reconditioning Area.

2.2 POTENTIAL EXPOSURE PATHWAYS

The potential current and future exposure routes for contaminants of concern in surface and near-surface soil/sediments at OU 8 are as follows:

- Direct dermal contact with contaminated surface soils by TEAD personnel or future on-site residents
- Inhalation of airborne contaminants (i.e., particulates) by TEAD personnel or future on-site residents
- Ingestion of contaminants in soils or discharge water (Site 23) by TEAD personnel or future on-site residents
- Ingestion of bioaccumulated contaminants (i.e.,crops, livestock, and wildlife) by TEAD personnel or future on-site residents
- Explosion of contaminants in soil in the vicinity of TEAD personnel or future on-site residents
- Ingestion of soil contaminants by present and future on-site fauna
- Migration of soil contaminants to groundwater

Since the extent of contamination related to the OU is unknown, the following discussion on exposure routes should be considered preliminary and subject to amendment pending results of the RI sampling.

Current exposure to human receptors by ingestion of potentially contaminated surface soils is considered unlikely since access to the area is restricted to TEAD-N personnel. No food crops are grown on the TEAD-N facility, but exposure through ingestion of bioaccumulated contaminants in area fauna is a possible pathway. Ingestion of discharge water by fauna at the Bomb and Shell Reconditioning Building is also a potential exposure pathway.

Activities at the Bomb and Shell Reconditioning Building (Site 23) continue and, though activities at Building 1303 have ceased, some activity does continue at neighboring buildings. Therefore, human exposure through direct dermal contact or inhalation of airborne contaminants are the most likely current exposure pathways for soil/sediments at OU 8.

Under a future residential or agricultural use scenario, the potential for human exposure to soil contaminants via dermal contact, ingestion, inhalation, and bioaccumulation increases due to unlimited access to soils and longer exposure durations.

Additionally, a current and future potential exists for explosion at the Building 1303 Washout Pond if explosive compounds are present in sufficient concentrations to detonate under shock.

2.3 POTENTIAL REMEDIATION LEVELS

No federal or state regulations exist which establish allowable concentration limits for the potential soil contaminants at OU 8. Therefore, risk-based remediation levels will be used for cleanup of soils at this OU. Once the RI soil data are available, and the actual contaminants present at each site have been identified, risk-based remediation levels will be established for each of the contaminants present. Table 1 lists potential contaminants by group for which risk-based remediation levels may need to be established.

2.4 REMEDIAL-ACTION OBJECTIVES FOR SOILS

The contaminants of potential concern at OU 8 include inorganics (metals), anions (nitrogen compounds), VOCs. and semi-VOCs. Incendiaries and white phosphorus may also be of potential concern at the Bomb and Shell Reconditioning Area (Site 23). Exposure through direct dermal contact, inhalation of airborne contaminants, and ingestion of bioaccumulated contaminants in fauna are the primary potential exposure pathways. No soil-remediation levels exist for the contaminants of potential concern. The remedial-action objective for contaminated soils at of OU 8 is to limit the total excess cancer risk to human receptors (current and future) to levels within or below the EPA target risk reduction range of 10^{-4} to 10^{-6} and to limit the total noncancer hazard index to levels below 1. An additional remedial-action objective is to prevent migration of soil contaminants to groundwater that would result in groundwater contamination in excess of MCLs or health-based criteria.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

2.5 VOLUMES OF SOIL REQUIRING REMEDIATION

Estimates of volumes of soil requiring remediation are infeasible at this time because of limited data. When the RI data become available, contaminated-soil-volume estimations will be based on the areal and vertical extent of any soil contamination detected.

2.6 GENERAL-RESPONSE ACTIONS

This section develops general-response actions that can satisfy the remedial-action objectives stated above. General-response actions include containment, excavation followed by on-site or off-site treatment and disposal, institutional controls, and no action. A combination of general-response actions may be necessary to be completely effective in meeting the remedial-action objectives.

Table 1. Potential Contaminants in Soil: Volatiles and Pesticides/PCBs

VOLATILES
1,1,1–Trichloroethane
1,1,2–Trichloroethane
1,1–Dichloroethene
1,1–Dichloroethane
cis–1,2–Dichloroethene
trans–1,2–Dichloroethene
1,2–Dichloroethane
1,2–Dichloropropane
1,3–Dichloropropene
2–Chloroethylvinyl ether
Acetone
Bromodichloromethane
Cis–1,3–dichloropropene
Acetic acid
Vinyl Chloride (Chloroethene)
Chloroethane
Benzene
Carbon Tetrachloride
Methylene Chloride
Bromomethane
Chloromethane
Bromoform
Chloroform
Chlorobenzene
Carbon disulfide
Dibromochloromethane
Ethylbenzene
Toluene
Methylethyl ketone

VOLATILES
Methyl isobutyl carbinol
Methyl isobutyl ketone
Methyl–n–butyl ketone
Styrene
Trans–1,3–dichloropropene
1,1,2,2–tetrachloroethane
Tetrachloroethene
Trichloroethene
Total Xylenes

PESTICIDES/PCBs
Alpha BHC
Alpha Chlordane
Alpha Endosulfan/Endosulfan I
Aldrin
Beta BHC
Beta–endosulfan/Endosulfan II
Decachlorobiphenyl
Tetrachlorometaxylene
Delta BHC
Dieldrin
Endrin
Endrin ketone
Endosulfan sulfate
Gamma chlordane
Heptachlor
Heptachlor epoxide
Lindane/Gamma BHC
Methoxychlor
PCB 1016
PCB 1221
PCB 1232
PCB 1242
PCB 1248
PCB 1254
PCB 1260
2,2–Bis(para–chlorophenyl)–1,1–DCA
2,2–Bis(para–chlorophenyl)–1,1–DCE
2,2–Bis(para–chlorophenyl)–1,1,1–TCA
Toxaphene

Table 1. Potential Contaminants in Soil: Semi-Volatiles (continued)

SEMI-VOLATILES
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol/2-cresol
2-Nitroaniline
2-Nitrophenol
3,3-Dichlorobenzidine
3,4-Dinitrotoluene
3-Nitroaniline
3-Nitrotoluene
4,6-Dinitro-2-cresol
4-Bromophenylphenyl ether
4-Chloro-3-cresol
4-Chloroaniline
4-Chlorophenylphenyl ether
4-Methylphenol/4-cresol
4-Nitroaniline
4-Nitrophenol
Acenaphthene
Acenaphthylene
Anthracene
Bis(2-chloroethoxy)methane
Bis(2-chloroisopropyl)ether

SEMI-VOLATILES
Bis(2-chloroethyl)ether
Bis(2-ethylhexyl)phthalate
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Butylbenzy phthalate
Benzoic acid
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Benzyl alcohol
Chrysene
Hexachlorobenzene
Hexachlorocyclopentadiene
Hexachloroethane
Dibenz(a,h)anthracene
Dibenzofuran
Diethyl phthalate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Fluoranthene
Fluorene
Hexachlorobutadiene
Ideno(1,2,3-c,d)pyrene
Isopropylamine
Isophorone
Naphthalene
Nitroso di-n-propylamine
N-nitroso di-n-propylamine
N-nitroso diphenylamine
Pentachlorophenol
Phenanthrene
Phenol
Pyrene

Table 1. Potential Contaminants in Soil: Inorganics, Anions, and Explosives (continued)

INORGANICS
Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Cyanide
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

ANIONS
Bromide
Chloride
Fluoride
Phosphate
Sulfate
Nitrogen Compounds
Nitrate (as N)
Nitrite (as N)
Total NO3+NO2 (as N)

EXPLOSIVES – No MCLs promulgated
1,3,5–Trinitrobenzene
1,3–Dinitrobenzene
2,4,6–Trinitrotoluene
2,4–Dinitrotoluene
2,6–Dinitrotoluene
Cyclotetramethylenetetranitramine
Nitrobenzene
Cyclotrimethlyenetrinitramine/Cyclonite
N–Methyl–n,2,4,6–tetranitroaniline/Nitramine

2.6.1 Containment

This response action would involve covering the contaminated soils with a plastic liner followed by a compacted clayey soil cap. Surface-water drainage would be rerouted around the contaminated area through the use of lined ditches and/or pipes. This action would reduce or eliminate the risk of direct contact or ingestion of contaminated soils by human receptors. This response would also reduce water infiltration, which would reduce the potential for contaminant migration to groundwater. Containment does not reduce the toxicity or volume of soil contaminants. Long-term maintenance of the cap and enforcement of institutional controls, described below, are necessary to protect the integrity of the cap.

2.6.2 Excavation Followed by On-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding regulatory or risk-based remediation levels. The soils removed would be treated on-site using a treatment method suitable for removing the contaminants from the soil. Examples of treatment technologies for various types of contaminants include the following:

- treatment for metals
  stabilization/solidification, vitrification, soil washing
- treatment for nitrogen compounds
  vitrification (molten glass process), biological treatment, solvent extraction
- treatment for explosives
  open burning
- treatment for anions
  vitrification, solidification/stabilization
- treatment for VOCs/semi-VOCs
  dehalogenation, evaporation, thermal systems, chemical oxidation, wet oxidation, biological treatment, stabilization/solidification, encapsulation

Following treatment to acceptable levels, the soils would be returned to the site as fill material.

2.6.3 Excavation Followed by Off-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding remediation levels. The soils would be hauled to a licensed facility for treatment and disposal of contaminated soils. This response would also involve hauling clean backfill to the site to replace the removed soils. Disadvantages of this general response include the liability implications of off-site transport of contaminated soils and off-site disposal. Additionally, the long-term effectiveness of this method is dependent upon the treatment employed at the receiving treatment-and-disposal facility.

2.6.4 In-Situ Treatment

Several types of in-situ response actions may be used depending on the nature of the contaminants. For example, if organics were found to be present, in-situ biological treatment or soil aeration may be effectively used. For metals, in-situ stabilization and in-situ vitrification are possible treatment methods.

2.6.5 Institutional Controls

This general response would involve leaving the contaminated or potentially contaminated soils in place, but placing controls on access to the site through deed restrictions, fencing, placing of signs, closure of roads, etc. This response action may be appropriate if the contaminants present have very low mobility, are in low concentrations, or have low toxicity. Long-term enforcement of institutional controls is necessary.

2.6.6 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any soil contamination that is present. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

3.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

3.1 GENERAL

3.1.1 Site Conditions

Depth to groundwater is estimated to be 450 feet bgs at the Building 1303 Washout Pond (Site 22) and approximately 550 feet bgs at the Bomb and Shell Reconditioning Building (Site 23). No field data have been collected to evaluate releases of hazardous constituents to groundwater from these sites.

3.1.2 Contaminants of Potential Concern

Explosives, semi-VOCs, inorganics, and anions are of potential concern at both sites. VOCs are of potential concern at the Bomb and Shell Reconditioning Building. These constituents exhibit variable characteristics for downward migration through unsaturated soils toward the water table, depending on specific site conditions.

3.2 POTENTIAL EXPOSURE PATHWAYS

The current potential exposure route for contaminated groundwater would be ingestion or direct contact by TEAD-N personnel to water obtained from an on-site water-supply well. No water-supply wells are present in the immediate vicinity of the Building 1303 Washout Pond. Water-supply well WW-4 is located approximately 0.3 miles downgradient of the Bomb and Shell Reconditioning Building (Site 23).

In the future, on-site water wells may be used for residential or agricultural purposes, which could expose humans, livestock, other fauna, and crops to contaminated groundwater. Human exposure through ingestion, dermal contact, and bioaccumulation could occur. Exposure to livestock or other fauna could occur from ingestion.

3.3 POTENTIAL REMEDIATION LEVELS

MCLs have been promulgated or proposed for some of the potential contaminants of concern at this OU (Table 2). Where no current or proposed MCLs exist, risk-based remediation levels are necessary.

3.4 REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

Explosives, semi-VOCs, VOCs, inorganics, and anions are of potential concern at sites included in this OU. At present, the primary potential groundwater-exposure route would be ingestion of contaminated groundwater from supply well WW-4, if the well is impacted by contaminants from this OU. In the future, under a residential or agricultural use scenario, human exposure to potentially contaminated groundwater could occur through ingestion or dermal contact via on-site or downgradient water-supply wells; additionally, livestock or crops could receive well water that could result in bioaccumulation. The primary remedial-action objective for groundwater is to limit human exposure to groundwater contaminants to levels that are below ARARs. present a total excess cancer risk that is within or below the EPA target risk reduction range of 10^{-4} to 10^{-6}, and have a total noncancer hazard index of less than 1. An additional remedial objective is to protect local groundwater resources by preventing the migration of groundwater having contaminant concentrations in excess of MCLs or risk-based criteria.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

3.5 VOLUMES OF GROUNDWATER REQUIRING REMEDIATION

No groundwater data exists for OU 8; therefore, no estimate can be made of the volume of groundwater requiring remediation. If analytical data from the RI soil sampling effort indicate the presence of soil contamination at OU 8, a vadose-zone model will be used to evaluate the potential for contaminant migration to groundwater and to evaluate the need for groundwater characterization.

3.6 GENERAL-RESPONSE ACTIONS

General-response actions for groundwater potentially contaminated with metals, explosives, nitrogen compounds, VOCs, semi-VOCs, and anions include containment, extraction followed by treatment, institutional controls, monitoring, and no action.

3.6.1 Containment

This response action includes capping and/or vertical barriers such as slurry walls. The extensive depth to the groundwater at this site eliminates vertical barriers as a feasible option. Capping areas

Table 2. Potential Contaminants by Category: Volatiles and Pesticides/PCBs (All values are mg/L)

VOLATILES	Primary MCLs	
	FINAL	PROPOSED
1,1,1-Trichloroethane	0.20	
1,1,2-Trichloroethane	0.005	
1,1-Dichloroethene	0.007	
1,1-Dichloroethane		
cis-1,2-Dichloroethene	0.07	
trans-1,2-Dichloroethene	0.1	
1,2-Dichloroethane	0.005	
1,2-Dichloropropane	0.005	
1,3-Dichloropropene		
2-Chloroethylvinyl ether		
Acetone		
Bromodichloromethane	0.10 *	
Cis-1,3-dichloropropene		
Acetic acid		
Vinyl Chloride (Chloroethene)	0.002	
Chloroethane		
Benzene	0.005	
Carbon Tetrachloride	0.005	
Methylene Chloride	0.005	
Bromomethane		
Chloromethane		
Bromoform		
Chloroform		
Chlorobenzene		
Carbon disulfide		
Dibromochloromethane	0.10 *	
Ethylbenzene	0.7	
Toluene	1.0	
Methylethyl ketone		

VOLATILES (cont.)	Primary MCLs	
	FINAL	PROPOSED
Methyl isobutyl carbinol		
Methyl isobutyl ketone		
Methyl-n-butyl ketone		
Styrene		
Trans-1,3-dichloropropene		
1,1,2,2-tetrachloroethane		
Tetrachloroethene	0.005	
Trichloroethene	0.005	
Total Xylenes	10	

PESTICIDES/PCBs	Primary MCLs	
	FINAL	PROPOSED
Alpha BHC		
Alpha Chlordane	0.002 *	
Alpha Endosulfan/Endosulfan I		
Aldrin		
Beta BHC		
Beta-endosulfan/Endosulfan II		
Decachlorobiphenyl		
Tetrachlorometaxylene		
Delta BHC		
Dieldrin		
Endrin	0.002	
Endrin ketone		
Endosulfan sulfate		
Gamma chlordane	0.002 **	
Heptachlor	0.0004	
Heptachlor epoxide	0.0002	
Lindane/Gamma BHC	0.0002	
Methoxychlor	0.04	
PCB 1016		
PCB 1221		
PCB 1232		
PCB 1242		
PCB 1248		
PCB 1254		
PCB 1260		
2,2-Bis(para-chloropheryl)-1,1-DCA		
2,2-Bis(para-chloropheryl)-1,1-DCE		
2,2-Bis(para-chloropheryl)-1,1,1-TCA		
Toxaphene	0.003	

*MCL for total trihalomethanes

**MCL for chlordane

Note: Blanks indicate no MCL promulgated or proposed.

Table 2. Potential Contaminants by Category: Semi-Volatiles (mg/L) (continued)

SEMI-VOLATILES	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
1,2,4-Trichlorobenzene	0.07			
1,2-Dichlorobenzene				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene				
2,4,5-Trichlorophenol				
2,4,6-Trichlorophenol				
2,4-Dichlorophenol				
2,4-Dimethylphenol				
2,4-Dinitrophenol				
2,4-Dinitrotoluene				
2,6-Dinitrotoluene				
2-Chloronaphthalene				
2-Chlorophenol				
2-Methylnaphthalene				
2-Methylphenol/2-cresol				
2-Nitroaniline				
2-Nitrophenol				
3,3-Dichlorobenzidine				
3,4-Dinitrotoluene				
3-Nitroaniline				
3-Nitrotoluene				
4,6-Dinitro-2-cresol				
4-Bromophenylphenyl ether				
4-Chloro-3-cresol				
4-Chloroaniline				
4-Chlorophenylphenyl ether				
4-Methylphenol/4-cresol				
4-Nitroaniline				
4-Nitrophenol				
Acenaphthene				
Acenaphthylene				
Anthracene				
Bis(2-chloroethoxy)methane				
Bis(2-chloroisopropyl)ether				

Note: Blanks indicate no MCL promulgated or proposed.

SEMI-VOLATILES (cont.)	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Bis(2-chloroethyl)ether				
Bis(2-ethylhexyl)phthalate				
Benzo(a)anthracene		0.0001		
Benzo(a)pyrene	0.0002			
Benzo(b)fluoranthene		0.0002		
Butylbenzy phthalate				
Benzoic acid				
Benzo(g,h,i)perylene				
Benzo(k)fluoranthene		0.0002		
Benzyl alcohol				
Chrysene		0.0002		
Hexachlorobenzene	0.001			
Hexachlorocyclopentadiene	0.05			0.008
Hexachloroethane				
Dibenz(a,h)anthracene		0.0003		
Dibenzofuran				
Diethyl phthalate				
Dimethyl phthalate				
Di-n-butyl phthalate				
Di-n-octyl phthalate				
Fluoranthene				
Fluorene				
Hexachlorobutadiene				
Ideno(1,2,3-c,d)pyrene				
Isopropylamine				
Isophorone				
Naphthalene				
Nitroso di-n-propylamine				
N-nitroso di-n-propylamine				
N-nitroso diphenylamine				
Pentachlorophenol	0.001			
Phenanthrene				
Phenol				
Pyrene				

Table 2. Potential Contaminants by Category: Inorganics Anions, and Explosives (mg/L) (continued)

INORGANICS	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Aluminum			0.05–0.2(**)	
Antimony	0.006			
Arsenic	0.05			
Barium	2			
Beryllium	0.004			
Cadmium	0.005			
Calcium				
Chromium	0.1			
Cobalt				
Copper			1	
Cyanide	0.2			
Iron			0.3	
Lead	0.05			
Magnesium				
Manganese			0.05	
Mercury	0.002			
Nickel	0.1			
Potassium				
Selenium	0.05			
Silver			0.1	
Sodium				
Thallium		.001/.002(*)		
Vanadium				
Zinc			5	

* Alternate MCL options proposed.

** MCL determined based on water quality and treatment situation.

ANIONS	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Bromide				
Chloride			250	
Fluoride	4.0		2.0	
Phosphate				
Sulfate			400/500(*)	250
Nitrogen Compounds				
Nitrate (as N)	10			
Nitrite (as N)	1			
Total NO3+NO2 (as N)	10			

EXPLOSIVES – No MCLs promulgated
1,3,5–Trinitrobenzene
1,3–Dinitrobenzene
2,4,6–Trinitrotoluene
2,4–Dinitrotoluene
2,6–Dinitrotoluene
Cyclotetramethylenetetranitramine
Nitrobenzene
Cyclotrimethlyenetrinitramine/Cyclonite
N–Methyl–n,2,4,6–tetranitroaniline/Nitramine

of soil contamination limits the infiltration of water and reduces the potential for contaminant migration to groundwater. Capping does not reduce the toxicity or volume of contaminants. Long-term maintenance of the cap and enforcement of institutional controls, described below, are necessary to protect the integrity of the cap.

3.6.2 Extraction Followed by Treatment

This response action includes the installation of pumping and reinjection wells for the surface treatment of groundwater and reinjection of treated water back to the aquifer. Examples of treatment methods for various types of groundwater contaminants include the following:

- treatment for metals
  separation/filtration, chemical precipitation, carbon adsorption, electrolytic recovery, ion exchange, membrane separation, freeze crystallization

- treatment for explosives
  carbon adsorption, hydrolysis, ozonation, chemical precipitation

- treatment for nitrogen compounds
  solvent extraction, biological treatment

- treatment for inorganic anions
  filtration, ion exchange

- treatment for VOCs/semi-VOCs
  distillation, solvent extraction, air/steam stripping, thin-film evaporation, freeze crystallization, separation/filtration, dehalogenation, ozonation, evaporation, chemical oxidation, wet oxidation, biological treatment

This response would be used in conjunction with source control (i.e., removal of contaminated soils) to prevent further contamination of the groundwater pathway. The effectiveness of this response depends on the successful capture of contaminated groundwater by extraction wells.

3.6.3 Institutional Controls

This general response could prevent human and fauna exposure by issuing deed restrictions, discontinuing the use of water-supply wells, and providing alternate sources of water. Contaminant toxicity, mobility, and volume are not reduced by institutional controls, except that which may occur through natural degradation and dispersion.

3.6.4 Monitoring

This general response would involve the monitoring of downgradient wells to ensure that contaminant levels remain below acceptable levels (i.e., drinking water MCLs and risk-based levels). Further response actions would not be required unless monitoring results indicate that remediation levels have been exceeded.

3.6.5 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any groundwater contamination that is present, except that which may occur through natural degradation and dispersion. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

4.0 REFERENCES

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SEC Donohue, Inc. (SECD), 1992. Final Draft Preliminary Baseline Risk Assessment, Tooele Army Depot - North Area, Tooele, Utah.

U.S. Environmental Protection Agency (EPA), 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

FINAL MEMORANDUM ON REMEDIAL-ACTION OBJECTIVES

for

OPERABLE UNIT 9

TOOELE ARMY DEPOT—NORTH AREA, UTAH

December 1992

Contract No. DAAA15-90-D-0007

Prepared for
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland 21010-5401

Prepared by
SEC Donohue, Inc.
Grand Junction, Colorado 81506

EXECUTIVE SUMMARY

The Tooele Army Depot—North Area (TEAD-N) contains 46 sites which were previously identified as having the potential for releasing or having released contaminants into the environment. These sites were originally considered Solid Waste Management Units (SWMUs) under a Resource Conservation and Recovery Act (RCRA) Corrective Action Permit. However, TEAD-N has been designated a National Priority List (NPL) site, which under the Comprehensive Environmental Response, Compensation, and Liability ACT of 1980 (CERCLA) as amended by SARA (1986), is required to perform a Remedial Investigation/Feasibility Study (RI/FS) to characterize the nature and extent of risks posed by hazardous-waste sites at TEAD-N. As a result of this requirement, 17 of the 46 RCRA SWMUs have been regrouped into seven Operable Units (OUs) under CERCLA (Superfund) by the Environmental Protection Agency (EPA) and the State of Utah.

The purpose of a Memorandum on Remedial-Action Objectives (MRAO) is to develop remedial-action objectives, general-response actions, and potential volumes or areas of media requiring remediation to aid in the development of remedial alternatives required to complete an FS for each OU at TEAD-N. This MRAO specifically addresses the remedial-action objectives for OU 9 at TEAD-N.

OU 9 includes both the Small Arms Firing Range and the AED Test Range. Suspected contaminants in each of these sites include metals, explosives, and nitrogen compounds; the AED Test Site also potentially includes white phosphorus, unexploded ordnance, semi-volatile organics, and anions.

Little previous data have been collected from the sites included in this OU. Current RI/FS work plans submitted by SEC Donohue, Inc., call for sampling of surface and near-surface soils in the impact area in the Small Arms Firing Range as well as surface and subsurface soil in the revetments, test pits, and the area around the building in the AED Test Range. A geophysical survey will also be conducted in the northwest portion of the AED Test range as well as magnetometer surveys of the revetments at that site. Results of these sampling and survey efforts are expected to be available in the fall of 1992. The results from the RI will be used to refine the preliminary contaminants of concern identified in this MRAO. An assessment of Applicable or Relevant and Appropriate Requirements (ARARs) and human health and environmental risk will then be completed and will allow the quantification of cleanup goals for the contaminants of concern. These activities will, in turn, allow refinement of the preliminary remedial-action objectives identified in this MRAO. All new information and revisions will be incorporated into the RI and FS reports for OU 9.

The remedial-action objectives for possible contamination of the soils and the groundwater in these sites will be to:

- prevent present and future human exposure (i.e., dermal contact, ingestion, and inhalation) and environmental exposure (i.e., ingestion by fauna) to soil contamination that is present at concentrations above risk-based remediation levels;
- prevent migration of soil contaminants that would result in groundwater contamination in excess of federal or state ARARs or health-based criteria;

- prevent present and future human exposure (i.e., dermal contact, ingestion, and bioaccumulation) and environmental exposure (i.e., ingestion by livestock/fauna) to groundwater contaminants that are present in concentrations above ARARs or health-based criteria;

- comply with all chemical-specific, location-specific, and action-specific ARARs that affect remedial actions at this OU.

The objective of risk-based cleanup standards is to limit the total excess cancer risk to human receptors (both current and future) to levels within or below the EPA target risk reduction range of 10^{-4} to 10^{-6} and to limit the total noncancer hazard index to levels below 1.

The volume of soils and groundwater requiring remediation cannot be quantified pending the results of the soil sampling being conducted as part of the RI. The areal and vertical extent of any soil contamination detected during the RI will be used to estimate volumes of contaminated soil. If the RI data indicate the presence of soil contamination, a vadose zone model will be used to evaluate the potential for contaminant migration to groundwater and to evaluate the need for additional groundwater characterization. Volume estimates and modeling results will be incorporated into the FS report for OU 9.

Potential general-response actions were identified and include the following:

Soils:

- Capping of contaminated soils and rerouting surface water drainage

- Excavation of contaminated soils with on-site treatment and disposal

- Excavation of contaminated soils with off-site treatment and disposal at a licensed hazardous-waste facility

- In-situ treatment

- Institutional controls

- No Action

Groundwater:

- Containment

- On-site removal, treatment, and reinjection

- Institutional controls

- Long-term monitoring

- No action

This document will serve as the first phase of the overall FS. Results of the RI sampling and analysis activities to be performed at the various sites will be reviewed as they relate to the response and cleanup objectives and potential cleanup response actions defined in this memorandum. If no contaminants are identified that exceed the ARARs or risk-based remediation levels established for TEAD-N, no further FS activities will be required and a no-action recommendation will be made for that particular site.

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

SEC Donohue, Inc., is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) for seven Operable Units (OUs) at Tooele Army Depot—North Area, Tooele, Utah (TEAD-N). The RI is designed to provide information on the nature and extent of contamination associated with the sites within each OU and, on the basis of these data, evaluate and estimate the risks to human health and the environment as a result of the contaminants present. The FS is designed to develop, screen, and evaluate remedial-action alternatives for each OU.

The purpose of this Memorandum on Remedial-Action Objectives (MRAO) is to provide the development of remedial-action objectives and general-response actions for OU 9 at TEAD-N as an initial step in the FS process, as well as to identify areas or volumes of media requiring remediation. An MRAO has also been generated for each of the other six OUs at TEAD. This document is not designed to be a stand-alone document; it, along with the other six MRAOs, will be incorporated into the FS report for TEAD-N. The FS report will summarize the results of the FS process completed for each OU. Revisions to these documents will be made as new data and new information become available.

1.2 SETTING OF THIS TECHNICAL MEMORANDUM

1.2.1 Site Background

TEAD-N encompasses 24,732 acres of the Tooele Valley in Tooele County, Utah. The facility was established in 1942 and has been in continuous operation since that time for the storage, maintenance, and repair of vehicles; storage, issue, and disposal of munitions; and storage of other equipment. Developed features at TEAD-N include igloos, magazines, administrative buildings, an industrial maintenance area, military and civilian housing, roads, hardstands for vehicle storage, and other allied infrastructure.

The Small Arms Firing Range and the AED Test Range are both located in the Rifle Range portion of TEAD-N. Both of these sites were included in OU 9 for purposes of this study.

1.2.2 Description of Operable Unit 9

OU 9 consists of the Small Arms Firing Range (Site 8) and the AED Test Range (Site 40). Descriptions of these sites are given below.

The Small Arms Firing Range (Site 8) is located along the extreme western boundary of TEAD-N (see Figure 1) and was used by the National Guard, Army Reserve, Navy, and TEAD military personnel for training in the use of small arms (e.g., M-16s, M-60 machine guns, and pistols). There were 20 firing stations with targets located at 25-, 50-, 100-, and 200-meter ranges. Although the range was available for use 365 days per year, its use amounted to only 3 to 10 days per year (EA,1988). The range was well maintained and was in use from 1942 to about 1989. A bermed area behind the targets was used to stop the fired rounds of ammunition.

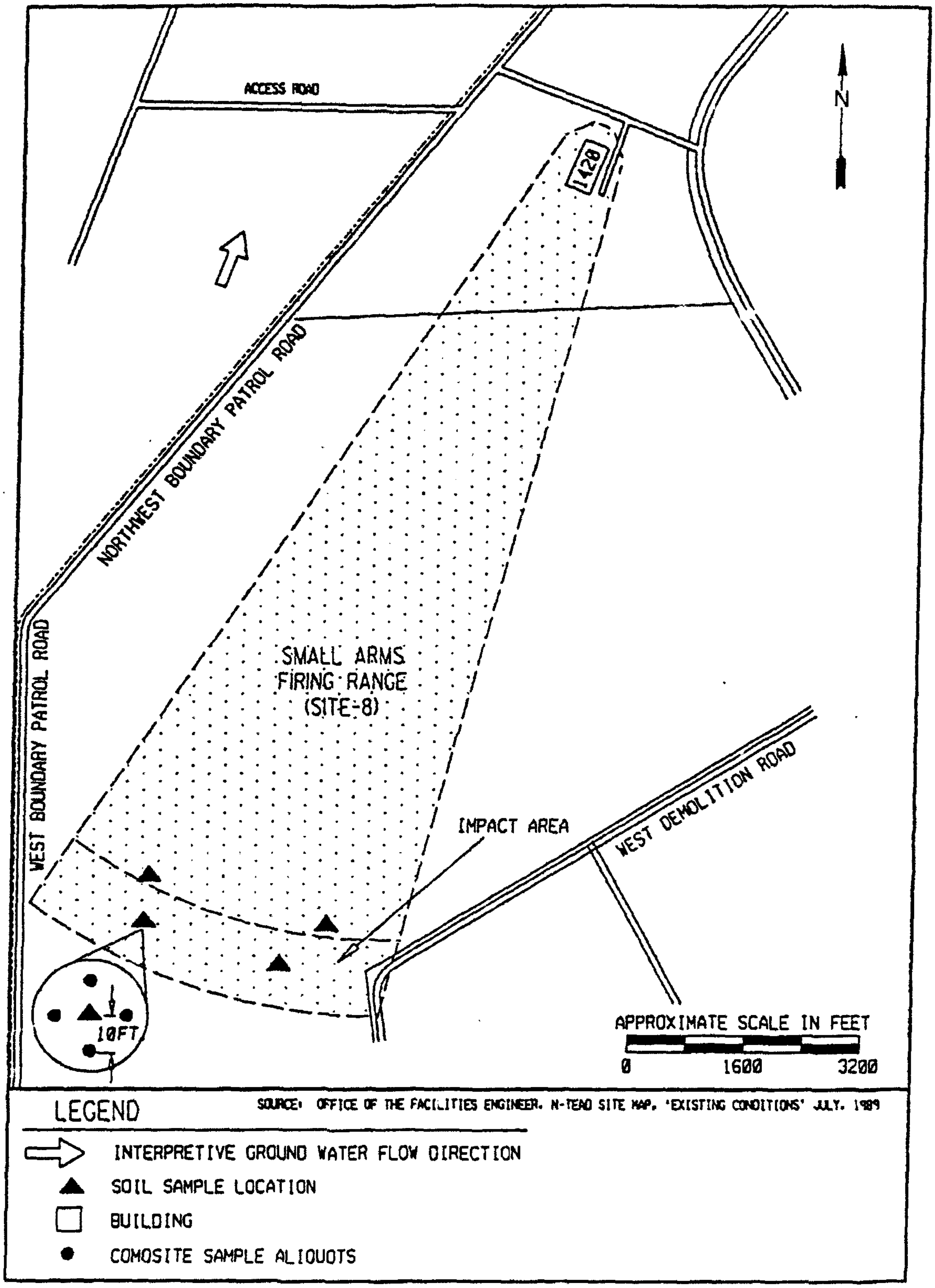

Figure 1. Small Arms Firing Range (Site 8)

The AED Test Range (Site 40), located in the northwest area of TEAD-N (see Figure 2), was used for testing munitions including open detonation of white phosphorus (WP) and smoke munitions, bomb-drop (i.e., shock-sensitivity) testing, propagation, and conveyor-spacing testing, as well as possible testing of the 1236 deactivation furnace (used for burning of small munitions in pits with metal covers). The testing of rocket engines was also conducted at this location. Detonation of large bombs in the area resulted in the creation of 20 or more craters in the northern portion of the site. No testing of chemical agent rounds was conducted at this site (E.C.Jordan Company, 1989). The AED Test Range is not currently in use and is remotely located from active TEAD-N operations.

The AED Test Range contains several revetments, four located on the east side of the access road and four on the west side of the road. The revetments on the east side of the road appear to have had limited use. Contents of these revetments include sand-filled ammunition boxes, concrete blocks, steel plate and piping, and shell casings. The revetments on the west side of the road appear to have had considerable activity. A large revetment contains a tall wooden hoisting apparatus (i.e., drop tower). Another revetment in the northwest area of the range borders an area used for open detonation (Environmental Photographic Interpretation Center (EPIC) photographs show 20 shallow, closely-spaced craters). A 1981 photograph shows a deep trench located immediately south of the craters. The purpose and contents of the trench are unknown. There is also a foundation and three walls of a building located on the west side of the road. The contents of the building indicate that the building may have housed fluid systems at one time. To the south of the building is an observation tower containing a periscope, chairs, and an electrical-control panel.

1.2.3 Previous Investigations

Several environmental investigations have been conducted at TEAD-N. In 1982, the EPIC, through an interagency agreement with the EPA and USATHAMA, provided imagery-analysis support for an installation assessment for TEAD-N (EPA, 1982). Aerial photographs from 1953, 1959, 1966, and 1981 were analyzed to determine the potential environmental impact of past installation activities. No other environmental assessments have provided information that confirms the presence or absence of contaminants at these sites. The current RI/FS will assess, through surface- and subsurface-soil sampling, whether contaminants have been released to environmental pathways.

Small Arms Firing Range. No previous data exist for the Small Arms Firing Range.

AED Test Range. There have been no previous environmental investigations at the AED Test Range and, therefore, no data are available for the site. Observations made in October of 1991 by SEC Donohue and their subcontractor, EOD Technologies, Inc., indicate that unexploded ordnance (UXO) is still present in several areas of the AED Test Range. Fragments of propellant were also observed to be scattered throughout the area. TEAD-N personnel indicated that craters and pits within the revetments have been covered and the floors of the revetments were graded in the past. A potential exists for buried UXO in the revetments.

1.2.4 Regulatory Background

Environmental studies have been conducted at TEAD-N since 1979. Early studies were performed under the Installation Restoration Program (IRP), which is a four-phase program administered by

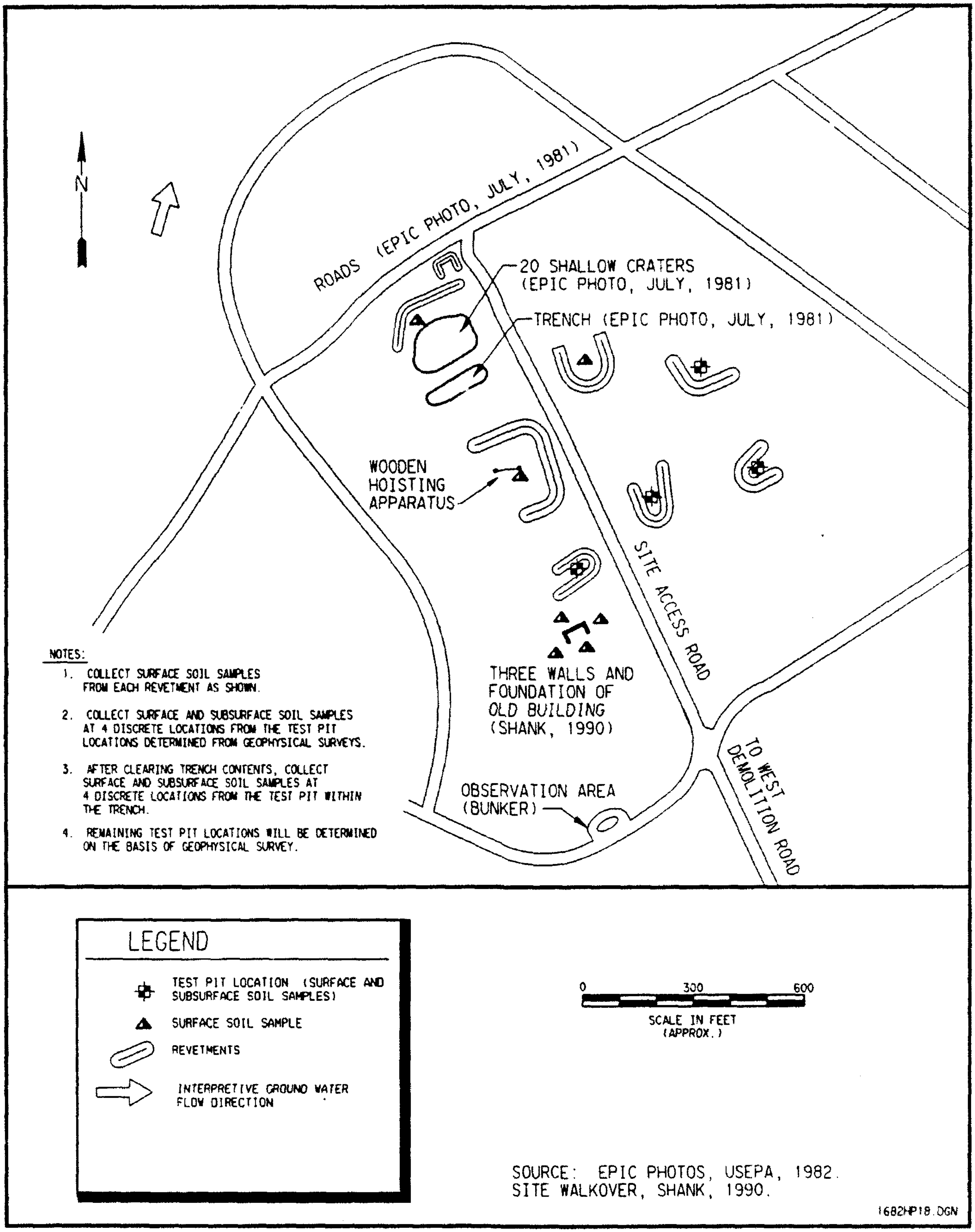

Figure 2. AED Test Range (Site 40)

the Department of Defense (DOD) designed to identify and correct environmental contamination at DOD facilities. These studies included facility-wide assessments, as well as site-specific environmental assessments, Preliminary Assessment/Site Investigations (PA/SI), RI/FS, remedial design, remedial action, and their RCRA equivalents. From these studies and reports, 46 SWMUs were identified. Evaluations for each SWMU or former SWMU are in various stages of completion.

In October 1990, TEAD-N was added to the National Priorities List (NPL). As a result, EPA Region VIII and the State of Utah regrouped the original 46 sites into RCRA SWMUs and CERCLA (Superfund) sites. The CERCLA sites were placed into seven OUs. In 1991, TEAD, EPA Region VIII, and the State of Utah entered into a Federal Facility Agreement (FFA) that specified the requirements, responsibilities, and schedule for the completion of all studies and remedial-action activities at TEAD.

SI and RI Work Plans were prepared by E.C. Jordan Company in December of 1990. These plans were submitted to EPA Region VIII and the State of Utah for review in 1991, and comments were received in November of 1991. As a result of the regrouping of the sites at TEAD-N, SEC Donohue was tasked with reformatting the plans to meet CERCLA requirements, to include only those sites considered CERCLA sites, and to address concerns and comments received on the E.C. Jordan Company plans. All of this work was conducted within the schedule set forth in the FFA.

1.2.5 Current Activities

Current proposed RI/FS sampling and analysis activities for OU 9 are outlined in the Final RI/FS Work Plan and Final RI/FS Sampling and Analysis Plan for TEAD-N prepared by SEC Donohue and submitted for review in March of 1992. These plans describe surface-soil sample collection for the impact area in the Small Arms Firing Range as well as surface and subsurface-soil sample collection for the revetments, test pits, and the area around the building in the AED Test Range. A geophysical survey will also be conducted in the northwest portion of the AED Test Range as well as magnetometer surveys of the revetments at that site. Results of these sampling and survey efforts are expected to be available in the summer of 1992. Analytical results from the soil sampling will be used to refine the contaminants of concern (COCs) and to assess ARARs and human health and environmental risk for the COCs at OU 9. These activities will, in turn, allow the quantification of contaminant-specific cleanup goals and revision of the remedial-action objectives for OU 8; results will be included in the Draft FS Report for OU 9.

Although a Preliminary Baseline Risk Assessment has been completed for several of the SWMUs and Sites at TEAD-N (SECD, 1992), no risk assessment was completed for Site 8 or Site 40 due to insufficient data. Similarly, although a general assessment of chemical-specific ARARs has been completed for TEAD-N (ORNL, 1992), existing data are insufficient to provide an ARARs assessment that is specific to the Sites at OU 9. The general ARARs assessment used available data for TEAD-N to identify general COCs for the facility and to prepare a table of Maximum Contaminant Level (MCL) ARARs for groundwater COCs and To Be Considered (TBC) guidance for soil COCs. Pertinent information from the general ARARs assessment will be incorporated into the ARARs assessment for OU 9 following receipt of the RI data and refinement of the OU 9 COCs.

1.3 DEVELOPMENT OF REMEDIAL-ACTION OBJECTIVES FOR OU 9

The FS is usually made up of three phases: the development of remedial alternatives, the screening of the alternatives, and the detailed analysis of the alternatives (EPA, 1988). The first phase of the FS begins with the development of remedial-action objectives. The remedial-action objectives are based on the nature and extent of contamination, exposure pathways, ARARs, and the risk potential for human health and the environment. These remedial-action objectives include site-specific cleanup goals that will allow protection of human health and the environment. The first phase of the FS continues with the identification of a range of general-response actions which can satisfy the remedial-action objectives and estimation of volumes or areas to which the general-response actions would apply. Examples of general-response actions include treatment, disposal, containment, institutional control, and no action. The next step in the development of remedial alternatives involves the identification of technologies and process options for each general-response action (e.g., identification of biological, chemical, or physical treatment technologies for the general response of treatment) and the screening of these technologies/process options on the basis of technical implementability. Finally, the screened technologies/process options are assembled into a range of remedial alternatives.

The second phase in the FS process is the screening of the alternatives, which involves a more detailed definition of the alternatives followed by a screening of the alternatives based on effectiveness, implementability, and preliminary costs. Alternatives retained after this initial screening are then subject to the next phase, the detailed analysis of alternatives. This third phase involves assessing each retained alternative against each of the following evaluation criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility or volume
- Implementability
- Cost
- State acceptance
- Community acceptance

This MRAO includes only the initial steps of the first FS phase, the development of remedial-action objectives and general-response actions. The remedial-action objectives for OU 8 are completed based on the suspected potential contaminants identified for each of the sites. The remedial-action objectives are developed for soils and groundwater. Since there are no permanent surface waters affected by any of the sites included in this OU, surface water is not addressed as a separate medium.

The development of remedial-action objectives for each medium includes a consideration of chemical-specific ARARs for the compounds of concern. Location- and action-specific ARARs will be identified during the development of remedial-action alternatives in the next step of the FS for this OU. A general location-specific ARARs assessment has been completed for TEAD-N (ORNL, 1992b); potential concerns for remedial actions include the presence of archaeological resources, historic sites, and endangered species on the facility. Examples of potential action-specific ARARs include regulations pursuant to the Occupational Safety and Health Act (for on-site workers during remediation) and regulations pursuant to the Resource Conservation and Recovery Act (e.g., land disposal restrictions, transport of hazardous waste, etc.).

2.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR SOILS

2.1 GENERAL

2.1.1 Site Conditions

No sampling has been done on the soils in either of the sites included in OU 9. It is possible that the constituents of products from spent small-caliber ammunition (i.e., lead) are present in the surface soils of the Small Arms Firing Range. The area of particular interest is the bermed area used to stop the fired rounds, which is likely to contain residual metals.

There are no records documenting any significant release of chemicals to the AED Test Range. However, open detonation of munitions and potential disposal of wastes in trenches may have resulted in significant releases of contaminants to environmental pathways at the site. Open detonation could have resulted in a release of explosive compounds, metals, and possibly residue from smoke agents and/or white phosphorous to site soils. Operations at the building site may have also led to a release of the above-mentioned chemicals with the possible addition of industrial chemicals. The trench observed in Environmental Photographic Interpretation Center (EPIC) photographs could contain residuals from munitions testing, packing materials, and/or residue from burning operations (e.g., propellants, munitions, or packing materials). Incomplete burning upon detonation or misfires may have resulted in the presence of UXO at the site.

2.1.2 Contaminants of Potential Concern

Contaminants of potential concern in the soils at the Small Arms Firing Range are metals and explosives. The potential contaminants of concern in the soils at the AED Test Range include metals, explosives, nitrates, white phosphorous, UXO, and potentially semi-volatile organics and anions.

2.2 POTENTIAL EXPOSURE PATHWAYS

The current and future potential exposure routes for contaminants of concern in surface and near-surface soil/sediments at OU 9 are as follows:

- Direct dermal contact with contaminated surface soils by TEAD personnel or future on-site residents
- Inhalation of airborne contaminants (i.e., particulates) by TEAD personnel or future on-site residents
- Ingestion of contaminants in soils TEAD personnel or future on-site residents
- Ingestion of bioaccumulated contaminants (i.e., crops, livestock, and wildlife) by TEAD personnel or future on-site residents
- Explosion of contaminants in soil in the vicinity of TEAD personnel or future on-site residents
- Ingestion of soil contaminants by present and future on-site fauna
- Migration of soil contaminants to groundwater

Since the extent of contamination related to the OU is unknown, the following discussion on exposure routes should be considered preliminary and subject to amendment pending results of the RI sampling.

Small Arms Firing Range. Due to the infrequent use of the firing range, significant releases of contaminants are not anticipated. If contaminants are present, they are likely dispersed over a wide area at very low concentrations. Because this site is in a remote location and is used infrequently, current exposure to human receptors is expected to be negligible. A future residential use scenario would involve longer exposure durations and a subsequently greater potential for human exposure to soil contaminants through ingestion, dermal contact, and inhalation. Contaminants located in the soil could also affect current and future animal receptors through ingestion of the potentially contaminated soils; bioaccumulation could also result in human exposure.

AED Test Range. Contaminated soils may be present in several areas within the AED Test Range including the bomb craters, the trench, the building area, and other potential areas containing buried waste. Because activities at the AED Test Range have ceased, there is presently little opportunity for human exposure by dermal contact with, ingestion of, or inhalation of contaminated soils. However, a future residential use scenario would involve longer exposure durations and a subsequently greater potential for human exposure to soil contaminants through ingestion, dermal contact, and inhalation. Also, both current and future environmental receptors (i.e., fauna, crops, and groundwater) could be at risk due to the persistence of certain chemicals in the soil. The current and future potential for human injury associated with UXO is also of concern at the AED Test Range.

2.3 POTENTIAL REMEDIATION LEVELS

No federal or state regulations exist which establish allowable concentration limits for the potential soil contaminants at OU 9. Therefore, risk-based remediation levels will be used for cleanup of soils at this OU. Once the RI soil data are available and the actual contaminants present at each site have been identified, risk-based remediation levels will be established for each of the contaminants present. Table 1 lists potential contaminants by group for which risk-based remediation levels may need to be established.

2.4 REMEDIAL-ACTION OBJECTIVES FOR SOILS

The potential contaminants of concern for this OU include metals, explosives, white phosphorus, nitrogen compounds, anions, and semi-VOCs. No soil-remediation levels exist for the contaminants of potential concern. The remedial-action objective for the soils of OU 9 is to limit the total excess cancer risk to human receptors (both current and future) to levels within or below the EPA target risk reduction range of 10^{-4} to 10^{-6} and to limit the total noncancer hazard index to levels below 1. An additional remedial-action objective is to prevent migration of soil contaminants that would result in groundwater contamination in excess of MCLs or health-based criteria.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

2.5 VOLUMES OF SOIL REQUIRING REMEDIATION

Estimates of volumes of soil requiring remediation are infeasible at this time because of limited data. When the RI data become available, contaminated soil-volume estimations will be based on the areal and vertical extent of any soil contamination detected.

Table 1. Potential Contaminants in Soil: Volatiles and Pesticides/PCBs

VOLATILES
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1-Dichloroethene
1,1-Dichloroethane
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichloropropene
2-Chloroethylvinyl ether
Acetone
Bromodichloromethane
Cis-1,3-dichloropropene
Acetic acid
Vinyl Chloride (Chloroethene)
Chloroethane
Benzene
Carbon Tetrachloride
Methylene Chloride
Bromomethane
Chloromethane
Bromoform
Chloroform
Chlorobenzene
Carbon disulfide
Dibromochloromethane
Ethylbenzene
Toluene
Methylethyl ketone

VOLATILES
Methyl isobutyl carbinol
Methyl isobutyl ketone
Methyl-n-butyl ketone
Styrene
Trans-1,3-dichloropropene
1,1,2,2-tetrachloroethane
Tetrachloroethene
Trichloroethene
Total Xylenes

PESTICIDES/PCBs
Alpha BHC
Alpha Chlordane
Alpha Endosulfan/Endosulfan I
Aldrin
Beta BHC
Beta-endosulfan/Endosulfan II
Decachlorobiphenyl
Tetrachlorometaxylene
Delta BHC
Dieldrin
Endrin
Endrin ketone
Endosulfan sulfate
Gamma chlordane
Heptachlor
Heptachlor epoxide
Lindane/Gamma BHC
Methoxychlor
PCB 1016
PCB 1221
PCB 1232
PCB 1242
PCB 1248
PCB 1254
PCB 1260
2,2-Bis(para-chlorophenyl)-1,1-DCA
2,2-Bis(para-chlorophenyl)-1,1-DCE
2,2-Bis(para-chlorophenyl)-1,1,1-TCA
Toxaphene

Table 1. Potential Contaminants in Soil: Semi-Volatiles (continued)

SEMI-VOLATILES
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol/2-cresol
2-Nitroaniline
2-Nitrophenol
3,3-Dichlorobenzidine
3,4-Dinitrotoluene
3-Nitroaniline
3-Nitrotoluene
4,6-Dinitro-2-cresol
4-Bromophenylphenyl ether
4-Chloro-3-cresol
4-Chloroaniline
4-Chlorophenylphenyl ether
4-Methylphenol/4-cresol
4-Nitroaniline
4-Nitrophenol
Acenaphthene
Acenaphthylene
Anthracene
Bis(2-chloroethoxy)methane
Bis(2-chloroisopropyl)ether

SEMI-VOLATILES
Bis(2-chloroethyl)ether
Bis(2-ethylhexyl)phthalate
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Butylbenzy phthalate
Benzoic acid
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Benzyl alcohol
Chrysene
Hexachlorobenzene
Hexachlorocyclopentadiene
Hexachloroethane
Dibenz(a,h)anthracene
Dibenzofuran
Diethyl phthalate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Fluoranthene
Fluorene
Hexachlorobutadiene
Ideno(1,2,3-c,d)pyrene
Isopropylamine
Isophorone
Naphthalene
Nitroso di-n-propylamine
N-nitroso di-n-propylamine
N-nitroso diphenylamine
Pentachlorophenol
Phenanthrene
Phenol
Pyrene

Table 1. Potential Contaminants in Soil: Inorganics, Anions, and Explosives (continued)

INORGANICS
Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Cyanide
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

ANIONS
Bromide
Chloride
Fluoride
Phosphate
Sulfate
Nitrogen Compounds
Nitrate (as N)
Nitrite (as N)
Total NO3+NO2 (as N)

EXPLOSIVES – No MCLs promulgated
1,3,5–Trinitrobenzene
1,3–Dinitrobenzene
2,4,6–Trinitrotoluene
2,4–Dinitrotoluene
2,6–Dinitrotoluene
Cyclotetramethylenetetranitramine
Nitrobenzene
Cyclotrimethlyenetrinitramine/Cyclonite
N–Methyl–n,2,4,6–tetranitroaniline/Nitramine

2.6 GENERAL-RESPONSE ACTIONS

This section develops general-response actions that can satisfy the remedial-action objectives stated above. General-response actions include containment, excavation followed by on-site or off-site treatment and disposal, institutional controls, and no action. A combination of general-response actions may be necessary to be completely effective in meeting the remedial-action objectives.

2.6.1 Containment

This response action would involve covering the contaminated soils with a plastic liner followed by a compacted clayey soil cap. Surface-water drainage would be rerouted around the contaminated area through the use of lined ditches and/or pipes. This action would reduce or eliminate the risk of direct contact or ingestion of contaminated soils by human receptors. This response would also reduce water infiltration which would reduce the potential for contaminant migration to groundwater. Containment does not reduce the toxicity or volume of soil contaminants. Long-term maintenance of the cap and enforcement of institutional controls, described below, are necessary to protect the integrity of the cap.

2.6.2 Excavation Followed by On-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding regulatory or risk-based remediation levels. The soils removed would be treated on-site using a treatment method suitable for removing the contaminants from the soil. Examples of treatment technologies for various types of contaminants include the following:

- treatment for metals
  stabilization/solidification, vitrification, soil washing

- treatment for nitrogen compounds
  vitrification (molten glass process), biological treatment, solvent extraction

- treatment for explosives
  open burning

- treatment for phosphorus
  detonation

- treatment for anions
  vitrification, solidification/stabilization

- treatment for semi-VOCs
  dehalogenation, evaporation, thermal systems, chemical oxidation, wet oxidation, biological treatment, stabilization/solidification, encapsulation

Following treatment to acceptable levels, the soils would be returned to the site as fill material.

2.6.3 Excavation Followed by Off-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding remediation levels. The soils would be hauled to a licensed facility for treatment and disposal of contaminated soils. This response would also involve hauling clean backfill to the site to replace the removed soils. Disadvantages of this general response include the liability implications of off-site transport of contaminated soils and off-site disposal. Additionally, the long-term effectiveness of this method is dependent upon the treatment employed at the receiving treatment and disposal facility.

2.6.4 In-Situ Treatment

Several types of in-situ response actions may be used depending on the nature of the contaminants. For example, if organics were found to be present, in-situ biological treatment or soil aeration may be effectively used. For metals, in-situ stabilization and in-situ vitrification are possible treatment methods.

2.6.5 Institutional Controls

This general response would involve leaving the contaminated or potentially contaminated soils in place, but placing controls on access to the site through deed restrictions, fencing, placing of signs, closure of roads, etc. This response action may be appropriate if the contaminants present have very low mobility, are in low concentrations, or have low toxicity. Long-term enforcement of institutional controls is necessary.

2.6.6 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any soil contamination that is present. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

3.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

3.1 GENERAL

3.1.1 Site Conditions

The depth to groundwater is estimated to be 320 feet bgs (below ground surface) in the Small Arms Firing Range and 440 feet bgs in the AED Test Range. Groundwater flow direction at the Tooele site is from the southeast to the northwest. The nearest water supply well is WW-5, which is approximately 4,000 feet from the Small Arms Firing Range and 6,500 feet from the AED Test Range. If a release of chemicals to the soils has occurred, chemicals may continue to migrate vertically through the site soils and eventually reach the groundwater table.

3.1.2 Potential Contaminants of Concern

Contaminants of potential concern in the groundwater at the Small Arms Firing Range are metals and explosives. The potential contaminants of concern at the AED Test Range include metals, explosives, nitrates, WP, UXO, and potentially semi-volatile organics and anions.

3.2 POTENTIAL EXPOSURE ROUTES

The current potential exposure route for contaminated groundwater would be ingestion or dermal contact by on-site TEAD-N personnel from water obtained from supply well WW-5, located approximately 4,000 to 6,500 feet from the sites. This well is not currently used for drinking water, but is used for process water.

In the future, on-site water wells may be used for residential or agricultural purposes, which could expose humans, livestock, other fauna, and crops to contaminated groundwater. Human exposure through ingestion, dermal contact, and bioaccumulation could occur. Exposure to livestock or other fauna could occur from ingestion.

3.3 POTENTIAL REMEDIATION LEVELS

MCLs have been promulgated or proposed for some of the potential contaminants of concern at this OU (see Table 2). Where no current or proposed MCLs exist, risk-based remediation levels are necessary.

3.4 REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

For the Small Arms Firing Range the potential contaminants of concern are metals and explosives. For the AED Test Area, the potential contaminants of concern are inorganics (metals), anions, nitrogen compounds, explosives, and semi-VOCs. At present, the primary potential groundwater exposure route would be ingestion of contaminated groundwater from supply well WW-5, if the well is impacted by contaminants from this OU. In the future, under a residential or agricultural use scenario, human exposure to potentially contaminated groundwater could occur through ingestion or dermal contact via on-site or downgradient water supply wells; additionally, livestock or crops could receive well water that could result in bioaccumulation. The primary remedial-action objective for groundwater is to limit human exposure to groundwater contaminants to levels that are below ARARs, present a total excess cancer risk that is within or below the EPA target risk reduction range of 10^{-4} to 10^{-6}, and have a total noncancer hazard index of less than 1. An additional remedial objective is to protect local groundwater resources by preventing the migration of groundwater having contaminant concentrations in excess of MCLs or risk-based criteria.

A final remedial-action objective is that any remedial action conducted at this OU will comply with all chemical-specific, location-specific, and action-specific ARARs.

3.5 VOLUMES OF GROUNDWATER REQUIRING REMEDIATION

No groundwater data exists for OU 9; therefore, no estimate can be made of the volume of groundwater requiring remediation. If analytical data from the RI soil sampling effort indicate the

Table 2. Potential Contaminants by Category: Volatiles and Pesticides/PCBs
(All values are mg/L)

VOLATILES	Primary MCLs	
	FINAL	PROPOSED
1,1,1-Trichloroethane	0.20	
1,1,2-Trichloroethane	0.005	
1,1-Dichloroethene	0.007	
1,1-Dichloroethane		
cis-1,2-Dichloroethene	0.07	
trans-1,2-Dichloroethene	0.1	
1,2-Dichloroethane	0.005	
1,2-Dichloropropane	0.005	
1,3-Dichloropropene		
2-Chloroethylvinyl ether		
Acetone		
Bromodichloromethane	0.10 *	
Cis-1,3-dichloropropene		
Acetic acid		
Vinyl Chloride (Chloroethene)	0.002	
Chloroethane		
Benzene	0.005	
Carbon Tetrachloride	0.005	
Methylene Chloride	0.005	
Bromomethane		
Chloromethane		
Bromoform		
Chloroform		
Chlorobenzene		
Carbon disulfide		
Dibromochloromethane	0.10 *	
Ethylbenzene	0.7	
Toluene	1.0	
Methylethyl ketone		

*MCL for total trihalomethanes

**MCL for chlordane

VOLATILES (cont.)	Primary MCLs	
	FINAL	PROPOSED
Methyl isobutyl carbinol		
Methyl isobutyl ketone		
Methyl-n-butyl ketone		
Styrene		
Trans-1,3-dichloropropene		
1,1,2,2-tetrachloroethane		
Tetrachloroethene	0.005	
Trichloroethene	0.005	
Total Xylenes	10	

Note: Blanks indicate no MCL promulgated or proposed.

PESTICIDES/PCBs	Primary MCLs	
	FINAL	PROPOSED
Alpha BHC		
Alpha Chlordane	0.002 *	
Alpha Endosulfan/Endosulfan I		
Aldrin		
Beta BHC		
Beta-endosulfan/Endosulfan II		
Decachlorobiphenyl		
Tetrachlorometaxylene		
Delta BHC		
Dieldrin		
Endrin	0.002	
Endrin ketone		
Endosulfan sulfate		
Gamma chlordane	0.002 **	
Heptachlor	0.0004	
Heptachlor epoxide	0.0002	
Lindane/Gamma BHC	0.0002	
Methoxychlor	0.04	
PCB 1016		
PCB 1221		
PCB 1232		
PCB 1242		
PCB 1248		
PCB 1254		
PCB 1260		
2,2-Bi(para-chloropheryl)-1,1-DCA		
2,2-Bi(para-chloropheryl)-1,1-DCB		
2,2-Bi(para-chloropheryl)-1,1,1-TCA		
Toxaphene	0.003	

Table 2. Potential Contaminants by Category: Semi-Volatiles (mg/L) (continued)

SEMI-VOLATILES	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
1,2,4-Trichlorobenzene	0.07			
1,2-Dichlorobenzene				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene				
2,4,5-Trichlorophenol				
2,4,6-Trichlorophenol				
2,4-Dichlorophenol				
2,4-Dimethylphenol				
2,4-Dinitrophenol				
2,4-Dinitrotoluene				
2,6-Dinitrotoluene				
2-Chloronaphthalene				
2-Chlorophenol				
2-Methylnaphthalene				
2-Methylphenol/2-cresol				
2-Nitroaniline				
2-Nitrophenol				
3,3-Dichlorobenzidine				
3,4-Dinitrotoluene				
3-Nitroaniline				
3-Nitrotoluene				
4,6-Dinitro- 2-cresol				
4-Bromophenylphenyl ether				
4-Chloro-3-cresol				
4-Chloroaniline				
4-Chlorophenylphenyl ether				
4-Methylphenol/4-cresol				
4-Nitroaniline				
4- Nitrophenol				
Acenaphthene				
Acenaphthylene				
Anthracene				
Bis(2-chloroethoxy)methane				
Bis(2-chloroisopropyl)ether				

Note: Blanks indicate no MCL promulgated or proposed.

SEMI-VOLATILES (cont.)	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Bis(2-chloroethyl)ether				
Bis(2-ethylhexyl)phthalate				
Benzo(a)anthracene		0.0001		
Benzo(a)pyrene	0.0002			
Benzo(b)fluoranthene		0.0002		
Butylbenzy phthalate				
Benzoic acid				
Benzo(g,h,i)perylene				
Benzo(k)fluoranthene		0.0002		
Benzyl alcohol				
Chrysene		0.0002		
Hexachlorobenzene	0.001			
Hexachlorocyclopentadiene	0.05			0.008
Hexachloroethane				
Dibenz(a,h)anthracene		0.0003		
Dibenzofuran				
Diethyl phthalate				
Dimethyl phthalate				
Di-n-butyl phthalate				
Di-n-octyl phthalate				
Fluoranthene				
Fluorene				
Hexachlorobutadiene				
Ideno(1,2,3-c,d)pyrene				
Isopropylamine				
Isophorone				
Naphthalene				
Nitroso di-n-propylamine				
N-nitroso di-n-propylamine				
N-nitroso diphenylamine				
Pentachlorophenol	0.001			
Phenanthrene				
Phenol				
Pyrene				

Table 2. Potential Contaminants by Category: Inorganics, Anions, and Explosives (mg/L) (continued)

INORGANICS	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Aluminum			0.05–0.2(**)	
Antimony	0.006			
Arsenic	0.05			
Barium	2			
Beryllium	0.004			
Cadmium	0.005			
Calcium				
Chromium	0.1			
Cobalt				
Copper			1	
Cyanide	0.2			
Iron			0.3	
Lead	0.05			
Magnesium				
Manganese			0.05	
Mercury	0.002			
Nickel	0.1			
Potassium				
Selenium	0.05			
Silver			0.1	
Sodium				
Thallium		.001/.002(*)		
Vanadium				
Zinc			5	

* Alternate MCL options proposed.

** MCL determined based on water quality and treatment situation.

ANIONS	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Bromide				
Chloride			250	
Fluoride	4.0		2.0	
Phosphate				
Sulfate			400/500(*)	250
Nitrogen Compounds				
Nitrate (as N)	10			
Nitrite (as N)	1			
Total NO3+NO2 (as N)	10			

EXPLOSIVES – No MCLs promulgated
1,3,5–Trinitrobenzene
1,3–Dinitrobenzene
2,4,6–Trinitrotoluene
2,4–Dinitrotoluene
2,6–Dinitrotoluene
Cyclotetramethylenetetranitramine
Nitrobenzene
Cyclotrimethlyenetrinitramine/Cyclonite
N–Methyl–n,2,4,6–tetranitroaniline/Nitramine

presence of soil contamination at OU 9, a vadose-zone model will be used to evaluate the potential for contaminant migration to groundwater and to evaluate the need for groundwater characterization.

3.6 GENERAL-RESPONSE ACTIONS

General-response actions for groundwater potentially contaminated with metals, explosives, nitrogen compounds, VOCs, semi-VOCs, and anions include containment, extraction followed by treatment, institutional controls, monitoring, and no action.

3.6.1 Containment

This response action includes capping and/or vertical barriers such as slurry walls. The extensive depth to the groundwater at this site eliminates vertical barriers as a feasible option. Capping areas of soil-contamination limits the infiltration of water and reduces the potential for contaminant migration to groundwater. Capping does not reduce the toxicity or volume of contaminants. Long-term maintenance of the cap and enforcement of institutional controls, described below, are necessary to protect the integrity of the cap.

3.6.2 Extraction Followed by Treatment

This response action includes the installation of pumping and reinjection wells for the surface treatment of groundwater and reinjection of treated water back to the aquifer. Examples of treatment methods for various types of groundwater contaminants include the following:

- treatment for metals
  separation/filtration, chemical precipitation, carbon adsorption, electrolytic recovery, ion exchange, membrane separation, freeze crystallization

- treatment for explosives
  carbon adsorption, hydrolysis, ozonation, chemical precipitation

- treatment for nitrogen compounds
  solvent extraction, biological treatment

- treatment for inorganic anions
  filtration, ion exchange

- treatment for semi-VOCs
  distillation, solvent extraction,air/steam stripping, thin-film evaporation, freeze crystallization, separation/filtration, dehalogenation, ozonation, evaporation, chemical oxidation, wet oxidation, biological treatment

- treatment for phosphorus
  chemical precipitation, sorption, ion exchange

This response would be used in conjunction with source control (i.e., removal of contaminated soils) to prevent further contamination of the groundwater pathway. The effectiveness of this response depends on the successful capture of contaminated groundwater by extraction wells.

3.6.3 Institutional Controls

This general response could prevent human and fauna exposure by issuing deed restrictions, discontinuing the use of water-supply wells, and providing alternate sources of water. Contaminant toxicity, mobility, and volume are not reduced by institutional controls, except that which may occur through natural degradation and dispersion.

3.6.4 Monitoring

This general response would involve the monitoring of downgradient wells to ensure that contaminant levels remain below acceptable levels (i.e., drinking water MCLs and risk-based levels). Further response actions would not be required unless monitoring results indicate that remediation levels have been exceeded.

3.6.5 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any groundwater contamination that is present, except that which may occur through natural degradation and dispersion. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

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FINAL MEMORANDUM ON REMEDIAL-ACTION OBJECTIVES

for

OPERABLE UNIT 10

TOOELE ARMY DEPOT—NORTH AREA, UTAH

December 1992

Contract No. DAAA15-90-D-0007

Prepared for
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland 21010-5401

Prepared by
SEC Donohue, Inc.
Grand Junction, Colorado 81506

EXECUTIVE SUMMARY

The Tooele Army Depot—North Area (TEAD-N) contains 46 sites which were previously identified as having the potential for releasing or having released contaminants into the environment. These sites were originally considered Solid Waste Management Units (SWMUs) under a Resource Conservation and Recovery Act (RCRA) Corrective Action Permit. However, TEAD-N has been designated a National Priority List (NPL) site, which under the Comprehensive Environmental Response, Compensation, and Liability ACT of 1980 (CERCLA) as amended by SARA (1986), is required to perform a Remedial Investigation/Feasibility Study (RI/FS) to characterize the nature and extent of risks posed by hazardous-waste sites at TEAD-N. As a result of this requirement, 17 of the 46 RCRA SWMUs have been regrouped into seven Operable Units (OUs) under CERCLA (Superfund) by the Environmental Protection Agency (EPA) and the State of Utah.

The purpose of a Memorandum on Remedial Action Objectives (MRAO) is to develop remedial-action objectives, general-response actions, and potential volumes or areas requiring remediation to aid in the development of remedial alternatives required to complete an FS for each OU at TEAD-N. This MRAO specifically addresses the remedial-action objectives for OU 10 at TEAD-N.

OU 10 is located in the north-central portion of TEAD-N. This OU consists of the Box Elder Wash Drum Site (Site 41), located southeast of row J of the Igloo Storage Area. Samples of the contents from the drums were collected and analyzed for a limited range of analytes in April 1989, and detectable levels of inorganics and organic compounds were reported. No environmental assessments have been conducted to confirm the presence or absence of contaminants in soils/sediments at this site. Current RI/FS work plans include surface and near-surface soil sampling to assess the potential release of contaminants to environmental pathways at this site. The results from the RI will be used to refine the preliminary contaminants of concern identified in this MRAO. An assessment of Applicable or Relevant and Appropriate Requirements (ARARs) and human health and environmental risk will then be completed and will allow the quantification of cleanup goals for the contaminants of concern. These activities will in turn allow refinement of the preliminary remedial-action objectives identified in this MRAO. All new information and revisions will be incorporated into the RI and FS reports for OU 10.

Remedial action objectives for this OU will be to:

- prevent present and future human exposure (i.e., dermal contact, ingestion, inhalation) and environmental exposure (i.e., ingestion by fauna) to soil contamination that is present at concentrations above risk-based remediation levels;
- prevent migration of soil contaminants that would result in groundwater or surface water contamination in excess of federal or state ARARs or health-based criteria;
- prevent present and future human exposure (i.e., dermal contact, ingestion, and bioaccumulation) and environmental exposure (i.e., ingestion by livestock/fauna) to groundwater contaminants that are present in concentrations above ARARs or health-based criteria;
- prevent present and future human exposure (i.e., dermal contact, ingestion, and bioaccumulation) and environmental exposure (i.e., ingestion by livestock/fauna) to surface water contaminants that are present in concentrations above ARARs or health-based criteria;

- remove the source of contamination to environmental pathways by proper removal and disposal of the improperly disposed 55-gallon drums.

- comply with all chemical-specific, location-specific, and action-specific ARARs that affect remedial actions at this OU.

The objective of risk-based cleanup standards is to limit the total excess cancer risk to human receptors (both current and future) to levels within or below the EPA target risk reduction range of 10^{-4} to 10^{-6} and to limit the total noncancer hazard index to levels below 1.

The volume of soils, groundwater, and surface water requiring remediation cannot be quantified pending the results of the soil sampling being conducted as part of the RI. The areal and vertical extent of any soil contamination detected during the RI will be used to estimate volumes of contaminated soil. If the RI data indicate the presence of soil contamination, a vadose zone model will be used to evaluate the potential for contaminant migration to groundwater and to evaluate the need for additional groundwater characterization. A volume estimate for surface water will consider stormwater runoff and will be based on the drainage area of OU 10 and precipitation data for the TEAD-N region. Volume estimates and modeling results will be incorporated into the FS report for OU 10.

Potential general-response actions include:

Soils:

- Removal of drums from the wash
- Containment of contaminated soils by capping and rerouting surface water drainage
- Excavation followed by on-site treatment and disposal
- Excavation followed by off-site treatment and disposal
- In-situ treatment such as vitrification and bioremediation
- Institutional controls
- No action

Groundwater:

- Containment
- Extraction followed by treatment
- Institutional controls
- Long-term monitoring
- No action

Surface water:

- Control of surface-water flow
- Containment and treatment of surface water
- Institutional controls
- No action

This document will serve as the first phase of the overall FS. Results of the RI sampling and analysis activities to be performed at the various sites will be reviewed as they relate to the response and cleanup objectives and potential response actions defined in the MRAO. If no contaminants are identified that exceed ARARs or risk-based remediation levels established for TEAD-N, no further FS activities will be required and a no-action recommendation will be made for the subject site.

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

SEC Donohue, Inc., is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) for seven Operable Units (OUs) at Tooele Army Depot - North Area, Tooele, Utah (TEAD-N). The RI is designed to provide information on the nature and extent of contamination associated with the sites within each OU and, on the basis of these data, evaluate and estimate the risks to human health and the environment as a result of the contaminants present. The FS is designed to develop, screen, and evaluate remedial-action alternatives for each OU.

The purpose of this Memorandum on Remedial-Action Objectives (MRAO) is to provide the development of remedial-action objectives and general-response actions for OU 10 at TEAD-N as an initial step in the FS process as well as to identify areas or volumes of media requiring remediation. An MRAO has also been generated for each of the other six OUs at TEAD. This document is not designed to be a stand-alone document; it, along with the other six MRAOs, will be incorporated into the FS report for TEAD-N. The FS report will summarize the results of the FS process completed for each OU. Revisions to these documents will be made as new data and new information become available.

1.2 SETTING OF THIS TECHNICAL MEMORANDUM

1.2.1 Site Background

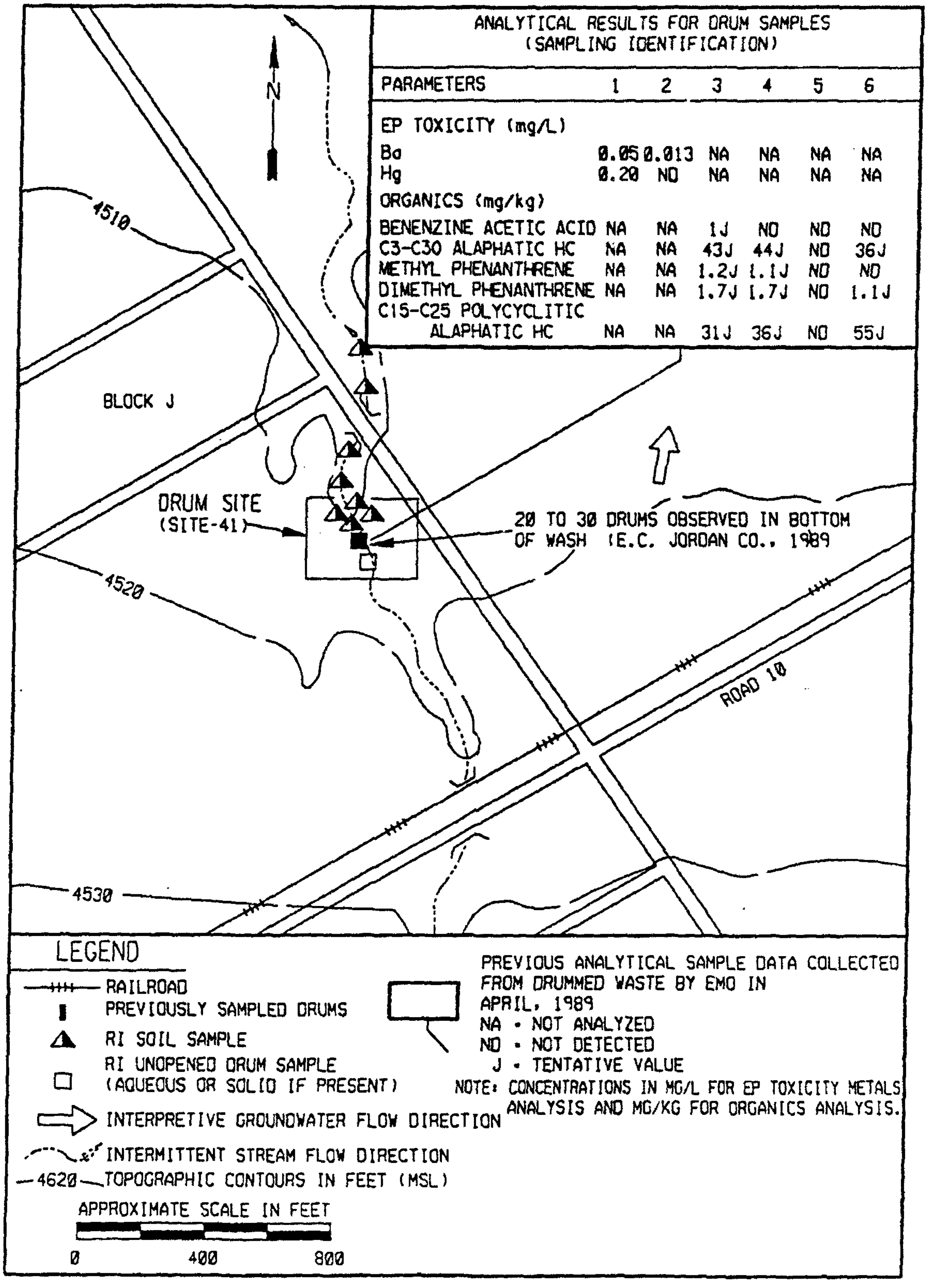
TEAD-N encompasses 24,732 acres of the Tooele Valley in Tooele County, Utah. The facility was established in 1942 and has been in continuous operation since that time for the storage, maintenance, and repair of vehicles; storage, issue, and disposal of munitions; and storage of other equipment. Developed features at TEAD-N include igloos, magazines, administrative buildings, an industrial maintenance area, military and civilian housing, roads, hardstands for vehicle storage, and other allied infrastructure.

The Box Elder Wash Drum Site is located in the Igloo Storage Area of TEAD-N, in a streambed which carries intermittent runoff from the southwest corner of the Depot north to the TEAD-N boundary.

1.2.2 Description of Operable Unit 10

OU 10 consists of the Box Elder Wash Drum Site, located southeast of row J of the Igloo Storage Area (see Figure 1). The site was estimated to contain 20 to 30 drums in the Box Elder Wash streambed, which carries intermittent runoff from the southwest corner of TEAD-N, north through the Igloo Storage Area, and across the north-central TEAD-N boundary. The wash terminates in an area approximately 1.3 miles north of the TEAD-N northern boundary.

The drums in the streambed were apparently dumped off the eastern edge and lie in the lower bank and bottom of the wash. The drums were observed in a 100-to-200-foot long stretch of the wash, and most of the drums are at least partially obscured by soil and/or vegetation (E.C. Jordan Company, 1990). The soil covering the drums appears to be the result of sedimentation occurring during periods of surface-water flow and by caving of the steep stream bank. It is possible that some drums are completely buried by soil. Drums that are visible are in various stages of deterioration and have no obvious markings. SEC Donohue, as part of the RI, will characterize the number, location, and contents of the drums in the wash. Preliminary results of geophysical surveying indicate that the total number of drums is less than the 20 to 30 previously estimated.



ANALYTICAL RESULTS FOR DRUM SAMPLES
(SAMPLING IDENTIFICATION)

PARAMETERS	1	2	3	4	5	6
EP TOXICITY (mg/L)						
Ba	0.05	0.013	NA	NA	NA	NA
Hg	0.20	ND	NA	NA	NA	NA
ORGANICS (mg/kg)						
BENENZINE ACETIC ACID	NA	NA	1J	ND	ND	ND
C3-C30 ALAPHATIC HC	NA	NA	43J	44J	ND	36J
METHYL PHENANTHRENE	NA	NA	1.2J	1.1J	ND	ND
DIMETHYL PHENANTHRENE	NA	NA	1.7J	1.7J	ND	1.1J
C15-C25 POLYCYCLITIC ALAPHATIC HC	NA	NA	31J	36J	ND	55J

Figure 1 . Box Elder Wash Drum Site (Site 41)

1.2.3 Previous Investigations

Several environmental investigations have been conducted at TEAD-N. In 1982, the Environmental Photographic Interpretation Center (EPIC), through an interagency agreement with the EPA and USATHAMA, provided imagery-analysis support for an installation assessment for TEAD-N (EPA, 1982). Aerial photographs from 1953, 1959, 1966, and 1981 were analyzed to determine the potential environmental impact of past installation activities.

Samples of the contents of drums in Box Elder Wash were collected and analyzed for a limited range of analytes in April 1989 by the Environmental Management Office at TEAD-N. Detectable levels of inorganics and organic compounds were reported. Of the metal analytes, mercury was reported at a concentration equal to the concentration specified in 40 CFR 261.24 for characterization of a waste as hazardous. Low levels of pyrene and phenanthrene were reported as well as several tentatively identified compounds, including benzene, acetic acid, and unidentified aliphatic and polycyclic aliphatic hydrocarbons. No environmental assessments have been conducted to confirm the presence or absence of contaminants in environmental pathways at this site. The current RI/FS will assess whether contaminants have been released to environmental pathways through surface and near-surface soil/sediment sampling.

1.2.4 Regulatory Background

Environmental studies have been conducted at TEAD-N since 1979. Early studies were performed under the Installation Restoration Program (IRP), which is a four-phase program administered by the Department of Defense (DOD) designed to identify and correct environmental contamination at DOD facilities. These studies included facility-wide assessments, as well as site-specific environmental assessments, Preliminary Assessment/Site Investigations (PA/SI), RI/FS, remedial design, remedial action, and their RCRA equivalents. From these studies and reports, 46 SWMUs were identified. Evaluations for each SWMU or former SWMU are in various stages of completion.

In October 1990, TEAD-N was added to the National Priorities List (NPL). As a result, EPA Region VIII and the State of Utah regrouped the original 46 sites into RCRA SWMUs and CERCLA (Superfund) sites. The CERCLA sites were placed into seven OUs. In 1991, the TEAD, EPA Region VIII, and the State of Utah entered into a Federal Facility Agreement (FFA) that specified the requirements, responsibilities, and schedule for the completion of all studies and remedial-action activities at TEAD.

SI and RI Work Plans were prepared by E.C. Jordan Company in December of 1990. These plans were submitted to EPA Region VIII and the State of Utah for review in 1991 and comments were received in November of 1991. As a result of the regrouping of the sites at TEAD-N, SEC Donohue was tasked with reformatting the plans to meet CERCLA requirements, to include only those sites considered CERCLA sites, and to address concerns and comments received on the E.C. Jordan Company plans. All of this work was conducted within the schedule set forth in the FFA.

OU 10, the Box Elder Wash Drum Site, was one of the seven OUs to be characterized under the Superfund program. This MRAO fulfills one of the first requirements specified in the FFA.

1.2.5 Current Activities

Current proposed RI/FS sampling and analysis activities for OU 10 are outlined in the Final RI/FS Work plan and Final RI/FS Sampling and Analysis Plan for TEAD-N prepared by SEC Donohue and submitted for review in March of 1992. These plans describe collection of surface-soil and shallow subsurface-soil samples from areas adjacent to the drums and from areas within the wash where eddies would be expected to form during wash flooding. A magnetometer survey of the area will be taken to determine if additional buried drums are present. Samples will be taken from both open and unopened drums. Results of this sampling effort are expected to be available in the fall of 1992.

Analytical results from the RI sampling effort will be used to refine the contaminants of concern (COCs) and to assess ARARs and human health and environmental risk for the COCs at OU 10. These activities will, in turn, allow revision of the remedial action objectives for OU 10, which will be included in the Draft FS Report for OU 10. Although a Preliminary Baseline Risk Assessment has been completed for several of the SWMUs and Sites at TEAD-N (SECD, 1992), no risk assessment was completed for the Box Elder Drum Wash Site (OU 10) because of insufficient data. Similarly, although a general assessment of chemical-specific ARARs has been completed for TEAD-N (ORNL, 1992), existing data are insufficient to provide a complete ARARs assessment that is specific to OU 10. The general ARARs assessment used available data for TEAD-N to identify general soil and groundwater COCs for the facility and to prepare tables of ARARs and To Be Considered (TBC) guidance for remediation. Pertinent information from the general ARARs assessment will be incorporated into the ARARs assessment for OU 10 following receipt of the RI data and refinement of the OU 10 COCs.

1.3 DEVELOPMENT OF REMEDIAL-ACTION OBJECTIVES FOR OU 10

The FS is usually made up of 3 phases: the development of remedial alternatives, the screening of the alternatives, and the detailed analysis of the alternatives (EPA, 1988). The first phase of the FS begins with the development of remedial-action objectives. The remedial-action objectives are based on the nature and extent of contamination, exposure pathways, ARARs, and the risk potential for human health and the environment. These remedial-action objectives include site-specific cleanup goals that will allow protection of human health and the environment. The first phase of the FS continues with the identification of a range of general-response actions that can satisfy the remedial-action objectives and estimation of volumes or areas to which the general-response actions would apply. Examples of general-response actions include treatment, disposal, containment, institutional control, and no action. The next step in the development of remedial alternatives involves the identification of technologies and process options for each general-response action (e.g., identification of biological, chemical, or physical treatment technologies for the general response of treatment) and the screening of these technologies/process options on the basis of technical implementability. Finally, the screened technologies/process options are assembled into a range of remedial alternatives.

The second phase in the FS process is the screening of the alternatives. This involves a more detailed definition of the alternatives followed by a screening of the alternatives based on effectiveness, implementability, and preliminary costs. Alternatives retained after this initial screening are then subject to the next phase, the detailed analysis of alternatives. This third phase involves assessing each retained alternative against each of the following evaluation criterion:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility or volume
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

This MRAO includes only the initial steps of the first FS phase, the development of remedial-action objectives, estimation of affected volumes or areas, and identification of general-response actions. Since no data currently exist for surface or shallow surface soils at the Box Elder Wash Drum Site, the development of remedial-action objectives was completed on the basis of suspected contamination only. The established objectives should be considered preliminary and subject to change as new information is made available. The media for which remedial actions are developed include soils, groundwater, and surface water.

The development of remedial-action objectives for each medium includes a consideration of chemical-specific ARARs for the compounds of concern. Location- and action-specific ARARs will be identified during the development of remedial-action alternatives in the next step of the FS for this OU. A general location-specific ARARs assessment has been completed for TEAD-N (ORNL, 1992b); potential concerns for remedial actions include the presence of archaeological resources, historic sites, and endangered species on the facility. Examples of potential action-specific ARARs include regulations pursuant to the Occupational Safety and Health Act (for on-site workers during remediation) and regulations pursuant to the Resource Conservation and Recovery Act (e.g., land disposal restrictions, transport of hazardous waste, etc.).

2.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR SOILS

2.1 GENERAL

2.1.1 Site Conditions

No environmental data exist to indicate whether a release of hazardous constituents has occurred at the Box Elder Wash Drum Site (Site 41). Drums located in the wash contain a black tarry substance, which has been sampled and analyzed. Mercury was detected in the tarry substance, along with low concentrations of phenanthrene and pyrene. Additionally, benzene, acetic acid, and aliphatic and polycyclic aliphatic hydrocarbons were reported as tentatively identified compounds. Because some of the drums are open to the environment and the integrity of buried or partially buried drums is unknown, releases of contaminants may have occurred to the surrounding soils and sediments.

The drum site is located approximately 6,400 feet south of the northern TEAD-N boundary, in a wash (or streambed) that carries intermittent runoff from the southwest corner of TEAD-N through the Igloo Storage Area and across the central portion of the northern TEAD-N boundary. The wash terminates in an area 1.3 miles north of the TEAD-N boundary.

2.1.2 Contaminants of Potential Concern

Contaminants of potential concern at this OU include explosives, VOCs, semi-VOCs, inorganics, metals, and anions. Mercury, phenanthrene, and pyrene are specific constituents which may be of potential concern at this site.

2.2 POTENTIAL EXPOSURE PATHWAYS

The potential current and future exposure routes for contaminants of concern in surface and near-surface soil/sediments at OU 10 are as follows:

- Direct dermal contact with contaminated surface soils by TEAD personnel, off-site residents, or future on-site residents
- Inhalation of airborne contaminants (i.e., particulates) by TEAD personnel, off-site residents, or future on-site residents
- Ingestion of contaminants in soils by TEAD personnel, off-site residents, or future on-site residents
- Ingestion of bioaccumulated contaminants (i.e., crops, livestock, and wildlife) by TEAD personnel, off-site residents, or future on-site residents
- Physical injury to on-site workers while characterizing and removing buried drums
- Ingestion of soil contaminants by present and future on-site and off-site fauna
- Migration of soil contaminants to groundwater or surface water

Since the extent of contamination related to this OU is unknown, the exposure routes described in this section should be considered preliminary and subject to amendment pending results of the RI sampling.

No activities presently occur at the site; thus, current exposure through ingestion, direct dermal contact, or inhalation of airborne contaminants by on-site receptors is not likely. Because the wash terminates at a location off-site, however, the potential exists for exposure of off-site receptors to contaminated soil/sediments through the pathways identified above. Additionally, if use of the site becomes unrestricted in the future, on-site residents may be exposed to contaminated soil/sediments through the pathways identified above.

2.3 POTENTIAL REMEDIATION LEVELS

No federal or state regulations exist which establish allowable concentration limits for the potential soil contaminants at OU 10. Therefore, risk-based remediation levels will be used for cleanup of soils at this OU. Once the RI soil data are available, and the actual contaminants present at each site have been identified, risk-based remediation levels will be established for each of the contaminants present. Table 1 lists potential contaminants by group for which risk-based remediation levels may need to be established. Mercury, phenanthrene, and pyrene are specific constituents for which risk-based cleanup levels may need to be established.

Table 1. Potential Contaminants in Soil: Volatiles and Pesticides/PCBs

VOLATILES
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1-Dichloroethene
1,1-Dichloroethane
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichloropropene
2-Chloroethylvinyl ether
Acetone
Bromodichloromethane
Cis-1,3-dichloropropene
Acetic acid
Vinyl Chloride (Chloroethene)
Chloroethane
Benzene
Carbon Tetrachloride
Methylene Chloride
Bromomethane
Chloromethane
Bromoform
Chloroform
Chlorobenzene
Carbon disulfide
Dibromochloromethane
Ethylbenzene
Toluene
Methylethyl ketone

VOLATILES
Methyl isobutyl carbinol
Methyl isobutyl ketone
Methyl-n-butyl ketone
Styrene
Trans-1,3-dichloropropene
1,1,2,2-tetrachloroethane
Tetrachloroethene
Trichloroethene
Total Xylenes

PESTICIDES/PCBs
Alpha BHC
Alpha Chlordane
Alpha Endosulfan/Endosulfan I
Aldrin
Beta BHC
Beta-endosulfan/Endosulfan II
Decachlorobiphenyl
Tetrachlorometaxylene
Delta BHC
Dieldrin
Endrin
Endrin ketone
Endosulfan sulfate
Gamma chlordane
Heptachlor
Heptachlor epoxide
Lindane/Gamma BHC
Methoxychlor
PCB 1016
PCB 1221
PCB 1232
PCB 1242
PCB 1248
PCB 1254
PCB 1260
2,2-Bis(para-chlorophenyl)-1,1-DCA
2,2-Bis(para-chlorophenyl)-1,1-DCE
2,2-Bis(para-chlorophenyl)-1,1,1-TCA
Toxaphene

Table 1. Potential Contaminants in Soil: Semi-Volatiles (continued)

SEMI-VOLATILES
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol/2-cresol
2-Nitroaniline
2-Nitrophenol
3,3-Dichlorobenzidine
3,4-Dinitrotoluene
3-Nitroaniline
3-Nitrotoluene
4,6-Dinitro-2-cresol
4-Bromophenylphenyl ether
4-Chloro-3-cresol
4-Chloroaniline
4-Chlorophenylphenyl ether
4-Methylphenol/4-cresol
4-Nitroaniline
4-Nitrophenol
Acenaphthene
Acenaphthylene
Anthracene
Bis(2-chloroethoxy)methane
Bis(2-chloroisopropyl)ether

SEMI-VOLATILES
Bis(2-chloroethyl)ether
Bis(2-ethylhexyl)phthalate
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Butylbenzy phthalate
Benzoic acid
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Benzyl alcohol
Chrysene
Hexachlorobenzene
Hexachlorocyclopentadiene
Hexachloroethane
Dibenz(a,h)anthracene
Dibenzofuran
Diethyl phthalate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Fluoranthene
Fluorene
Hexachlorobutadiene
Ideno(1,2,3-c,d)pyrene
Isopropylamine
Isophorone
Naphthalene
Nitroso di-n-propylamine
N-*nitroso* di-n-propylamine
N-nitroso diphenylamine
Pentachlorophenol
Phenanthrene
Phenol
Pyrene

Table 1. Potential Contaminants in Soil: Inorganics, Anions, and Explosives (continued)

INORGANICS
Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Cyanide
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

ANIONS
Bromide
Chloride
Fluoride
Phosphate
Sulfate
Nitrogen Compounds
Nitrate (as N)
Nitrite (as N)
Total NO3+NO2 (as N)

EXPLOSIVES – No MCLs promulgated
1,3,5–Trinitrobenzene
1,3–Dinitrobenzene
2,4,6–Trinitrotoluene
2,4–Dinitrotoluene
2,6–Dinitrotoluene
Cyclotetramethylenetetranitramine
Nitrobenzene
Cyclotrimethlyenetrinitramine/Cyclonite
N–Methyl–n,2,4,6–tetranitroaniline/Nitramine

2.4 REMEDIAL ACTION OBJECTIVES FOR SOILS

Potential contaminants of concern include explosives, VOCs, semi-VOCs, inorganics, metals, and anions. Potential exposure pathways include direct dermal contact or ingestion of contaminated soil, inhalation of particulates, or ingestion of bioaccumulated contaminant from area fauna. Preliminary remedial-action objectives for surface soils/sediments at the Box Elder Wash Drum Site (Site 41) will be to limit the total excess cancer risk to human receptors (current and future) to levels within or below the EPA target risk reduction range of 10^{-4} to 10^{-6} and to limit the total noncancer hazard index to levels below 1. Additional remedial-action objectives are to prevent migration of soil contaminants to groundwater and surface water at levels that would result in groundwater or surface-water contamination in excess of MCLs or health-based criteria.

2.5 VOLUMES OF SOIL REQUIRING REMEDIATION

Estimates of volumes of soil requiring remediation are infeasible at this time because of limited data. When the RI data become available, contaminated-soil-volume estimations will be based on the areal and vertical extent of any soil contamination detected.

2.6 GENERAL RESPONSE ACTIONS

This section develops general-response actions that can satisfy the remedial-action objectives stated above. General-response actions include containment, excavation followed by on-site or off-site treatment and disposal, institutional controls, and no action. A combination of general-response actions may be necessary to be completely effective in meeting the remedial-action objectives.

2.6.1 Removal of Drums from Wash Area

Drums of waste have been observed to be present in the wash. Because some drums are open to the environment and others are of questionable integrity, contaminants could be released from the drums directly to soils/sediments in the wash. Removal of the drums would eliminate the potential for continued releases to the soil/sediments. Each of the following actions would first require removal of the drums to meet the remedial-action objectives for OU 10.

2.6.2 Containment

This response action would involve covering the contaminated soils with a plastic liner followed by a compacted clay/soil cap. Surface-water drainage would be rerouted around the contaminated area through the use of lined ditches and/or pipes. This action would reduce or eliminate the risk of direct contact or ingestion of contaminated soils by human receptors. This response would also reduce water infiltration, which would reduce the potential for contaminant migration to groundwater. Containment does not reduce the toxicity or volume of soil contaminants. Long-term maintenance of the cap and enforcement of institutional controls, described below, are necessary to protect the integrity of the cap.

2.6.3 Excavation Followed by On-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding regulatory or risk-based remediation levels. The soils removed would be treated on-site using a treatment method suitable for removing the contaminants from the soil. Examples of treatment technologies for various types of contaminants include the following:

- treatment for metals
  stabilization/solidification, vitrification, soil washing

- treatment for explosives
  open burning

- treatment for anions
  vitrification, solidification/stabilization

- treatment for VOCs/semi-VOCs
  dehalogenation, evaporation, thermal systems, chemical oxidation, wet oxidation, biological treatment, stabilization/solidification, encapsulation

Following treatment to acceptable levels, the soils would be returned to the site as fill material.

2.6.4 Excavation Followed by Off-Site Treatment and Disposal

This response action would involve the removal of contaminated soils exceeding remediation levels. The soils would be hauled to a licensed facility for treatment and disposal of contaminated soils. This response would also involve hauling clean backfill to the site to replace the removed soils. Disadvantages of this general response include the liability implications of off-site transport of contaminated soils and off-site disposal. Additionally, the long-term effectiveness of this method is dependent upon the treatment employed at the receiving treatment and disposal facility.

2.6.5 In-Situ Treatment

Several types of in-situ response actions may be used depending on the nature of the contaminants. For example, if organics were found to be present, in-situ biological treatment or soil aeration may be effectively used. For metals, in-situ stabilization and in-situ vitrification are possible treatment methods.

2.6.6 Institutional Controls

This general response would involve leaving the contaminated or potentially contaminated soils in place but placing controls on access to the site through deed restrictions, fencing, placing of signs, closure of roads, etc. This response action may be appropriate if the contaminants present have very low mobility, are in low concentrations, or have low toxicity. Long-term enforcement of institutional controls is necessary.

2.6.7 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any soil contamination that is present. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

3.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

3.1 GENERAL

3.1.1 Site Conditions

Depth to groundwater in the vicinity of the Box Elder Wash Drum Site (Site 41) is approximately 220 feet, with the depth decreasing along the northern stretch of the wash (Ertec, 1982). The City of Grantsville is located approximately 19,000 feet downgradient from the site. No environmental data exist to indicate whether a release of contaminants has occurred to groundwater from this site.

3.1.2 Contaminants of Potential Concern

VOCs,semi-VOCs, and metals are contaminants of potential concern at this site. Mercury, pyrene, and phenanthrene were detected in samples collected from waste present in the drums at this site.

3.2 POTENTIAL EXPOSURE PATHWAYS

No TEAD-N water supply wells are located in the vicinity of this site; therefore, no current exposure to on-site personnel is likely. However, current and future off-site groundwater users and future on-site groundwater users could potentially be exposed through use of contaminated groundwater from water-supply wells. Human exposure could occur through ingestion, dermal contact, and bioaccumulation (from livestock, fauna, or crops that receive groundwater). Exposure to livestock or other fauna could occur from ingestion.

3.3 POTENTIAL REMEDIATION LEVELS

MCLs are relevant and appropriate cleanup criteria for contaminants detected in groundwater at this OU (see Table 2). The MCL for mercury is 0.002 mg/l. Where no current or proposed MCLs exist, risk-based remediation levels are necessary. For example, no MCLs exist for pyrene or phenanthrene.

3.4 REMEDIAL-ACTION OBJECTIVES FOR GROUNDWATER

The primary remedial-action objective for groundwater is to limit human exposure to groundwater contaminants to levels that are below ARARs, present a total excess cancer risk that is within or below the EPA target risk reduction range of 10^{-4} to 10^{-6}, and have a total noncancer hazard index

Table 2. Potential Contaminants by Category: Volatiles and Pesticides/PCBs (All values are mg/L)

VOLATILES	Primary MCLs	
	FINAL	PROPOSED
1,1,1-Trichloroethane	0.20	
1,1,2-Trichloroethane	0.005	
1,1-Dichloroethene	0.007	
1,1-Dichloroethane		
cis-1,2-Dichloroethene	0.07	
trans-1,2-Dichloroethene	0.1	
1,2-Dichloroethane	0.005	
1,2-Dichloropropane	0.005	
1,3-Dichloropropene		
2-Chloroethylvinyl ether		
Acetone		
Bromodichloromethane	0.10 *	
Cis-1,3-dichloropropene		
Acetic acid		
Vinyl Chloride (Chloroethene)	0.002	
Chloroethane		
Benzene	0.005	
Carbon Tetrachloride	0.005	
Methylene Chloride	0.005	
Bromomethane		
Chloromethane		
Bromoform		
Chloroform		
Chlorobenzene		
Carbon disulfide		
Dibromochloromethane	0.10 *	
Ethylbenzene	0.7	
Toluene	1.0	
Methylethyl ketone		

VOLATILES (cont.)	Primary MCLs	
	FINAL	PROPOSED
Methyl isobutyl carbinol		
Methyl isobutyl ketone		
Methyl-n-butyl ketone		
Styrene		
Trans-1,3-dichloropropene		
1,1,2,2-tetrachloroethane		
Tetrachloroethene	0.005	
Trichloroethene	0.005	
Total Xylenes	10	

PESTICIDES/PCBs	Primary MCLs	
	FINAL	PROPOSED
Alpha BHC		
Alpha Chlordane	0.002 *	
Alpha Endosulfan/Endosulfan I		
Aldrin		
Beta BHC		
Beta-endosulfan/Endosulfan II		
Decachlorobiphenyl		
Tetrachlorometaxylene		
Delta BHC		
Dieldrin		
Endrin	0.002	
Endrin ketone		
Endosulfan sulfate		
Gamma chlordane	0.002 **	
Heptachlor	0.0004	
Heptachlor epoxide	0.0002	
Lindane/Gamma BHC	*0.0002*	
Methoxychlor	0.04	
PCB 1016		
PCB 1221		
PCB 1232		
PCB 1242		
PCB 1248		
PCB 1254		
PCB 1260		
2,2-Bi(para-chlorophenyl)-1,1-DCA		
2,2-Bi(para-chlorophenyl)-1,1-DCB		
2,2-Bi(para-chlorophenyl)-1,1,1-TCA		
Toxaphene	0.003	

*MCL for total trihalomethanes

**MCL for chlordane

Note: Blanks indicate no MCL promulgated or proposed.

Table 2. Potential Contaminants by Category: Semi-Volatiles (mg/L) (continued)

SEMI-VOLATILES	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
1,2,4-Trichlorobenzene	0.07			
1,2-Dichlorobenzene				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene				
2,4,5-Trichlorophenol				
2,4,6-Trichlorophenol				
2,4-Dichlorophenol				
2,4-Dimethylphenol				
2,4-Dinitrophenol				
2,4-Dinitrotoluene				
2,6-Dinitrotoluene				
2-Chloronaphthalene				
2-Chlorophenol				
2-Methylnaphthalene				
2-Methylphenol/2-cresol				
2-Nitroaniline				
2-Nitrophenol				
3,3-Dichlorobenzidine				
3,4-Dinitrotoluene				
3-Nitroaniline				
3-Nitrotoluene				
4,6-Dinitro-2-cresol				
4-Bromophenylphenyl ether				
4-Chloro-3-cresol				
4-Chloroaniline				
4-Chlorophenylphenyl ether				
4-Methylphenol/4-cresol				
4-Nitroaniline				
4-Nitrophenol				
Acenaphthene				
Acenaphthylene				
Anthracene				
Bis(2-chloroethoxy)methane				
Bis(2-chloroisopropyl)ether				

Note: Blanks indicate no MCL promulgated or proposed.

SEMI-VOLATILES (cont.)	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Bis(2-chloroethyl)ether				
Bis(2-ethylhexyl)phthalate				
Benzo(a)anthracene		0.0001		
Benzo(a)pyrene	0.0002			
Benzo(b)fluoranthene		0.0002		
Butylbenzy phthalate				
Benzoic acid				
Benzo(g,h,i)perylene				
Benzo(k)fluoranthene		0.0002		
Benzyl alcohol				
Chrysene		0.0002		
Hexachlorobenzene	0.001			
Hexachlorocyclopentadiene	0.05			0.008
Hexachloroethane				
Dibenz(a,h)anthracene		0.0003		
Dibenzofuran				
Diethyl phthalate				
Dimethyl phthalate				
Di-n-butyl phthalate				
Di-n-octyl phthalate				
Fluoranthene				
Fluorene				
Hexachlorobutadiene				
Ideno(1,2,3-c,d)pyrene				
Isopropylamine				
Isophorone				
Naphthalene				
Nitroso di-n-propylamine				
N-nitroso di-n-propylamine				
N-nitroso diphenylamine				
Pentachlorophenol	0.001			
Phenanthrene				
Phenol				
Pyrene				

Table 2. Potential Contaminants by Category: Inorganics, Anions, and Explosives (mg/L) (continued)

INORGANICS	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Aluminum			0.05–0.2(**)	
Antimony	0.006			
Arsenic	0.05			
Barium	2			
Beryllium	0.004			
Cadmium	0.005			
Calcium				
Chromium	0.1			
Cobalt				
Copper			1	
Cyanide	0.2			
Iron			0.3	
Lead	0.05			
Magnesium				
Manganese			0.05	
Mercury	0.002			
Nickel	0.1			
Potassium				
Selenium	0.05			
Silver			0.1	
Sodium				
Thallium		.001/.002(*)		
Vanadium				
Zinc			5	

* Alternate MCL options proposed.

** MCL determined based on water quality and treatment situation.

ANIONS	Primary MCLs		Secondary MCLs	
	FINAL	PROPOSED	FINAL	PROPOSED
Bromide				
Chloride			250	
Fluoride	4.0		2.0	
Phosphate				
Sulfate			400/500(*)	250
Nitrogen Compounds				
Nitrate (as N)	10			
Nitrite (as N)	1			
Total NO3+NO2 (as N)	10			

EXPLOSIVES – No MCLs promulgated
1,3,5–Trinitrobenzene
1,3–Dinitrobenzene
2,4,6–Trinitrotoluene
2,4–Dinitrotoluene
2,6–Dinitrotoluene
Cyclotetramethylenetetranitramine
Nitrobenzene
Cyclotrimethlyenetrinitramine/Cyclonite
N–Methyl–n,2,4,6–tetranitroaniline/Nitramine

of less than 1. An additional remedial objective is to protect local groundwater resources by preventing the migration of groundwater having contaminant concentrations in excess of MCLs or risk-based criteria.

A final remedial-action objective is that any remedial action conducted at this OU comply with all chemical-specific, location-specific, and action-specific ARARs.

3.5 VOLUMES OF GROUNDWATER REQUIRING REMEDIATION

No groundwater data exist for OU 8; therefore, no estimate can be made of the volume of groundwater requiring remediation. If analytical data from the RI soil sampling effort indicate the presence of soil contamination at OU 8, a vadose-zone model will be used to evaluate the potential for contaminant migration to groundwater and to evaluate the need for groundwater characterization.

3.6 GENERAL RESPONSE ACTIONS

This section develops general-response actions that can satisfy the remedial-action objectives for groundwater stated above. The general-response actions for groundwater include containment, extraction followed by treatment, institutional controls, monitoring, and no action. A combination of general-response actions may be necessary to be totally effective in meeting the remedial-action objectives.

3.6.1 Containment

This response action includes capping and/or vertical barriers such as slurry walls. The extensive depth to the groundwater at this site eliminates vertical barriers as a feasible option. Capping areas of soil contamination limits the infiltration of water and reduces the potential for contaminant migration to groundwater. Capping does not reduce the toxicity or volume of contaminants. Long-term maintenance of the cap and enforcement of institutional controls, described below, are necessary to protect the integrity of the cap.

3.6.2 Extraction Followed by Treatment

This response action includes the installation of pumping and reinjection wells for the surface treatment of groundwater and reinjection of treated water back to the aquifer. Examples of treatment methods for various types of groundwater contaminants include the following:

- treatment for metals
  separation/filtration, chemical precipitation, carbon adsorption, electrolytic recovery, ion exchange, membrane separation, freeze crystallization

- treatment for explosives
  carbon adsorption, hydrolysis, ozonation, chemical precipitation

- treatment for inorganic anions
  filtration, ion exchange

- reatment for VOCs/semi-VOCs
  distillation, solvent extraction,air/steam stripping, thin-film evaporation, freeze crystallization, separation/filtration, dehalogenation, ozonation, evaporation, chemical oxidation, wet oxidation, biological treatment

This response would be used in conjunction with source control (i.e., removal of contaminated soils) to prevent further contamination of the groundwater pathway. The effectiveness of this response depends on the successful capture of contaminated groundwater by extraction wells.

3.6.3 Institutional Controls

This general response could prevent human and fauna exposure by issuing deed restrictions, discontinuing the use of water-supply wells, and providing alternate sources of water. Contaminant toxicity, mobility, and volume are not reduced by institutional controls, except that which may occur through natural degradation and dispersion.

3.6.4 *Monitoring*

This general response would involve the monitoring of downgradient wells to ensure that contaminant levels remain below acceptable levels (i.e., drinking water MCLs and risk-based levels). Further-response actions would not be required unless monitoring results indicate that remediation levels have been exceeded.

3.6.5 No Action

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any groundwater contamination that is present, except that which may occur through natural degradation and dispersion. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose an excessive human health or environmental risk.

4.0 PRELIMINARY REMEDIAL-ACTION OBJECTIVES FOR SURFACE WATER

4.1 GENERAL

4.1.1 Site Conditions

The Box Elder Wash Drum Site (Site 41) is located in a wash that carries intermittent runoff from the southwest corner of TEAD-N through the Igloo Storage Area and across the north-central TEAD-N boundary. The source of flow in this wash is snow melt from the Stansbury Mountains or runoff occurring during periods of heavy precipitation. The wash terminates in an area 1.3 miles north of the TEAD-N boundary and does not appear to discharge into any other surface water body. Instead, discharge eventually infiltrates into the subsurface and may serve as a recharge source to groundwater. No environmental data are available to indicate whether contaminants have been released from the drums into surface water intermittently present in the wash.

4.1.2 Contaminants of Potential Concern

Contaminants of potential concern at this OU include explosives, VOCs, semi-VOCs, inorganics, metals, and anions. Mercury, phenanthrene, and pyrene were detected in waste samples collected from the drums present in the wash.

4.2 POTENTIAL EXPOSURE PATHWAYS

Potential receptors of exposure to surface-water contamination include humans, flora, fauna, and groundwater, both on-site and off-site, in the present and in the future. Human exposure to potentially contaminated surface water could occur through ingestion and dermal contact, primarily through recreational use of surface water. Human exposure to surface-water contamination could also occur through bioaccumulation from crops, livestock, and other fauna that receive surface water. Fauna may be exposed to contaminated surface water through ingestion. Groundwater may be exposed to contaminated surface water through infiltration.

4.3 POTENTIAL REMEDIATION LEVELS

MCLs are relevant and appropriate cleanup criteria for contaminants detected in surface water at this OU (see Table 2). The MCL for mercury is 0.002 mg/l. Where no current or proposed MCLs exist, risk-based remediation levels are necessary. For example, no MCLs exist for pyrene or phenanthrene.

4.4 REMEDIAL-ACTION OBJECTIVES FOR SURFACE WATER

The contaminants of potential concern at this OU include explosives, VOCs, semi VOCs, inorganics, metals, and anions. The primary remedial-action objective for surface water is to limit human exposure to surface-water contaminants to levels that are below ARARs, present a total excess cancer risk that is within or below the EPA target risk reduction range of 10^{-4} to 10^{-6}, and have a total noncancer hazard index of less than 1. An additional remedial objective is to protect local groundwater resources by preventing the infiltration of surface-water contaminants at levels that would result in groundwater contamination in excess of MCLs or risk-based criteria.

4.5 VOLUMES OF SURFACE WATER REQUIRING REMEDIATION

If the RI data from soil sampling indicate the presence of soil contamination at OU 10, and the baseline risk assessment indicates that the surface-water pathway presents an excessive human health or environmental risk, an estimate of surface-water volume will be made. The volume estimate will consider storm-water runoff and will be based on the drainage area of OU 10 and precipitation data for the TEAD-N region.

4.6 GENERAL-RESPONSE ACTIONS

This section develops general-response actions that can satisfy the remedial-action objectives for surface water stated above. The general-response actions for surface water include control of the surface-water flow, containment of surface water, institutional controls, and no action. A combination of general-response actions may be necessary to be completely effective in meeting the remedial-action objectives.

4.6.1 Control of Surface-Water Flow

Diversion of surface water around the area of potentially contaminated soils through the use of diversion ditches or pipelines would reduce or eliminate surface-water contamination and subsequent transport of these contaminants to other environmental pathways or receptors via the surface-water pathway. Long-term maintenance of the diversion mechanism is necessary. This response action, used in conjunction with remediation of contaminated soils, could significantly reduce the potential risk of human exposure and risk to environmental receptors.

4.6.2 Containment of Surface Water

Surface-water runoff in the wash could be directed to and collected in a lined evaporation pond. This would prevent the risk of off-site migration of contaminated surface water, reduce the potential for contaminant migration to the groundwater pathway and further surface and subsurface soil contamination in the wash bed. Containment without treatment does not reduce contaminant toxicity or volume. Depending on the types of contamination present, a treatment option could be added to the ponded water with subsequent discharge of treated water back to the Box Elder Wash drainage.

4.6.3 Institutional Controls

This response action may be appropriate for this site if contaminants are found to be in low concentrations, have low mobility or low toxicity, and if institutional controls such as deed restrictions, fencing and posting of the area, and closing of roads are adequate to prevent direct contact with contaminated surface water.

4.6.4 No Action with Institutional Controls

The no-action general response involves no remedial action. The no-action response does not reduce the toxicity, mobility, or volume of any surface-water contamination that is present. Generally, the no-action response is effective at meeting the remedial-action objectives only if contamination levels are in compliance with ARARs and do not pose and excessive human health or environmental risk.

5.0 REFERENCES

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