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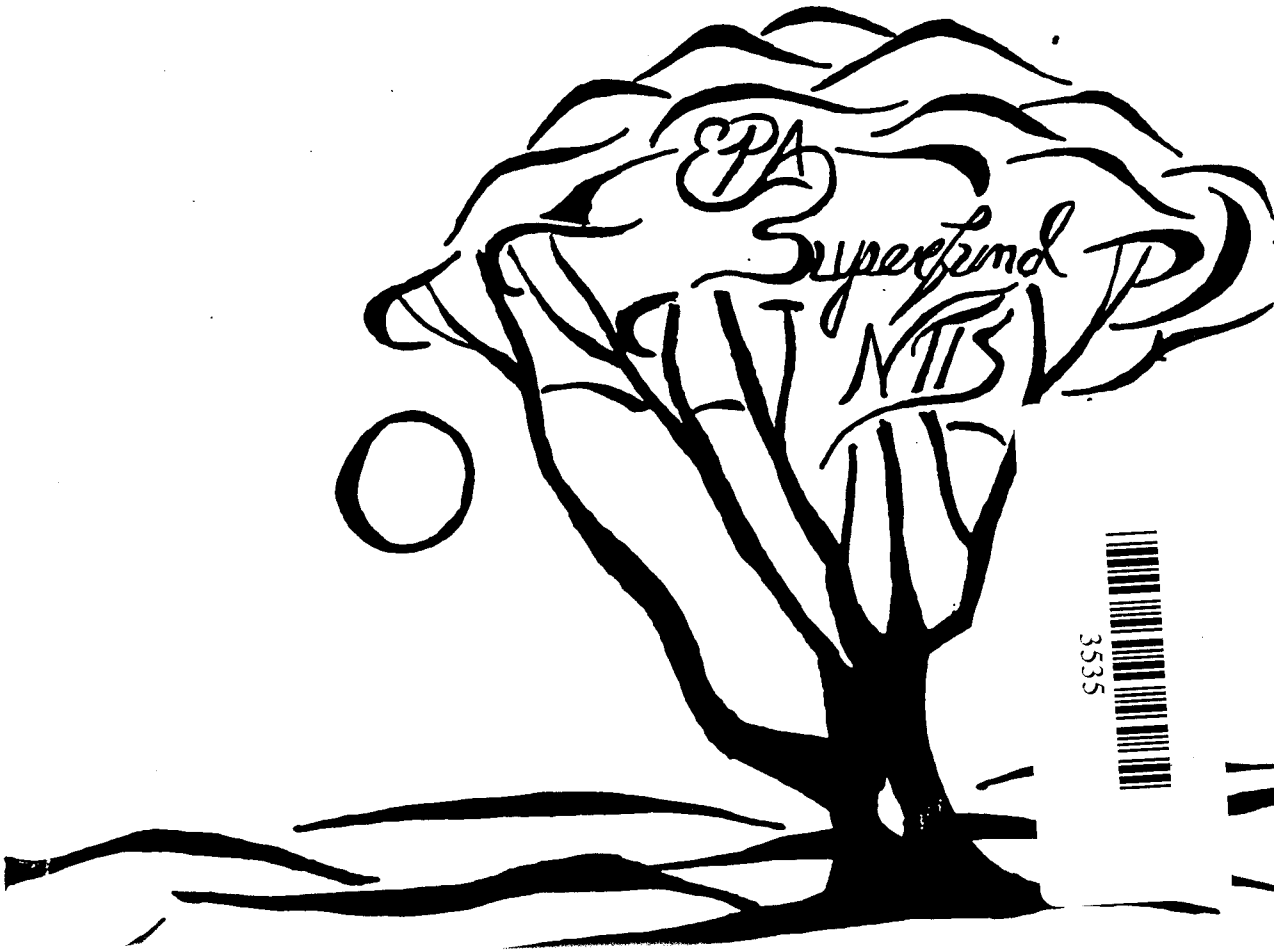
February 1995

EPA Superfund Record of Decision:

Umatilla Army Depot (Lagoons), Operable Unit 4, Hermiston, OR 7/19/1994



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DEFENSE ENVIRONMENTAL RESTORATION PROGRAM

FINAL RECORD OF DECISION

UMATILLA DEPOT ACTIVITY
AMMUNITION DEMOLITION ACTIVITY AREA
OPERABLE UNIT

June 10, 1994

In accordance with Army Regulation 200-2, this document is intended by the Army to comply with the National Environmental Policy Act of 1969 (NEPA).

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Acronyms and Abbreviations

ADA	Ammunition Demolition Activity Area
ARARs	Applicable or Relevant and Appropriate Requirements
BB	Below Background
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
cy	Cubic Yards
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenylethane
DDT	Dichlorodiphenyltrichloroethane
2,4-DNT	2,4-Dinitrotoluene
2,6-DNT	2,6-Dinitrotoluene
DoD	Department of Defense
EA	Ecological Assessment
EPA	U.S. Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
FFA	Federal Facility Agreement
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (High Melting Explosive)
HRS	Hazard Ranking System
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
lb	Pound
LDR	Land Disposal Restrictions
MCL	Maximum Contaminant Level

Acronyms and Abbreviations *(continued)*

TSDF	Treatment, Storage, and Disposal Facility
UCL	Upper Confidence Limit
UMDA	U.S. Army Depot Activity at Umatilla
USAEC	U.S. Army Environmental Center (formerly USATHAMA)
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
UXO	Unexploded Ordnance

1.0 Declaration of the Record of Decision

Site Name and Location

U.S. Army Depot Activity, Umatilla
Ammunition Demolition Activity Area Operable Unit
Hermiston, Oregon 97838-9544

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Ammunition Demolition Activity Area (ADA) Operable Unit at the U.S. Army Depot Activity, Umatilla (UMDA), at Hermiston, Oregon, which has been selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision is based on the administrative record for this site. Documents supporting the selection of the remedy are identified in Attachment A to this Record of Decision (ROD).

The remedy was selected by the U.S. Army and the U.S. Environmental Protection Agency (EPA). The State of Oregon concurs with the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from the site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The selected remedy for the contamination at the ADA includes the implementation of actions to (1) clean up chemically contaminated soils; (2) remove unexploded ordnance (UXO) items from the ground surface; (3) detect and quantify UXO below the ground surface; and (4) conduct retrieval and treatment of buried UXO to a depth that will allow for the selected land use under Base Realignment and Closure.

The specific steps involved in the cleanup of contaminated soils at the ADA will include:

- Excavation of approximately 14,000 cubic yards of contaminated soil at five separate sites at the ADA (Site Numbers 15, 17, 19, 31, and 32). UXO items would be removed from these sites during excavation as necessary to permit safe excavation and access.
- Treatment of contaminated soils by a mobile solidification/stabilization system.
- Disposal of the treated soil from the solidification/stabilization system into the on-site UMDA landfill.
- Restoration of excavated areas with clean backfill and vegetation.

Lead and Support Agency Acceptance of the Record of Decision
U.S. Army Depot Activity Umatilla
Ammunition Demolition Activity Area Operable Unit

Signature sheet for the foregoing Record of Decision for the Ammunition Demolition Activity Area Operable Unit final action at the U.S. Army Depot Activity at Umatilla between the U.S. Army and the United States Environmental Protection Agency, with concurrence by the State of Oregon Department of Environmental Quality.

Lewis D. Walker

Lewis D. Walker
Deputy Assistant Secretary of the Army
(Environment, Safety, and Occupational Health)

9/30/94
Date

Lead and Support Agency Acceptance of the Record of Decision
U.S. Army Depot Activity Umatilla
Ammunition Demolition Activity Area Operable Unit (Cont'd)

Signature sheet for the foregoing Record of Decision for the Ammunition Demolition Activity Area Operable Unit final action at the U.S. Army Depot Activity at Umatilla between the U.S. Army and the United States Environmental Protection Agency, with concurrence by the State of Oregon Department of Environmental Quality.

Mark Daugherty
BRAC Environmental Coordinator
U.S. Army Depot Activity, Umatilla

28 July 94
Date

jm.d/rod.67062-62.8/94

Lead and Support Agency Acceptance of the Record of Decision
U.S. Army Depot Activity Umatilla
Ammunition Demolition Activity Area Operable Unit (Cont'd)

Signature sheet for the foregoing Record of Decision for the Ammunition Demolition Activity Area Operable Unit final action at the U.S. Army Depot Activity at Umatilla between the U.S. Army and the United States Environmental Protection Agency, with concurrence by the State of Oregon Department of Environmental Quality.

Chuck Clarke

Chuck Clarke
Regional Administrator, Region X
U.S. Environmental Protection Agency

7/16/94
Date

2.0 Decision Summary

This Decision Summary provides an overview of the problems posed by the conditions at the UMDA ADA, the remedial alternatives, and the analysis of those options. It explains the rationale for the remedy selection and describes how the selected remedy satisfies statutory requirements.

2.1 Site Name, Location, and Description

UMDA is located in northeastern Oregon in Morrow and Umatilla Counties, approximately 5 miles west of Hermiston, Oregon, as shown in Figure 1. The installation covers about 19,700 acres of land. The ADA is located in the northwestern portion of UMDA. This approximately 1,750-acre area contains 20 individual sites that have been identified as areas of historical or current Army activities. The locations of these sites are presented in Figure 2.

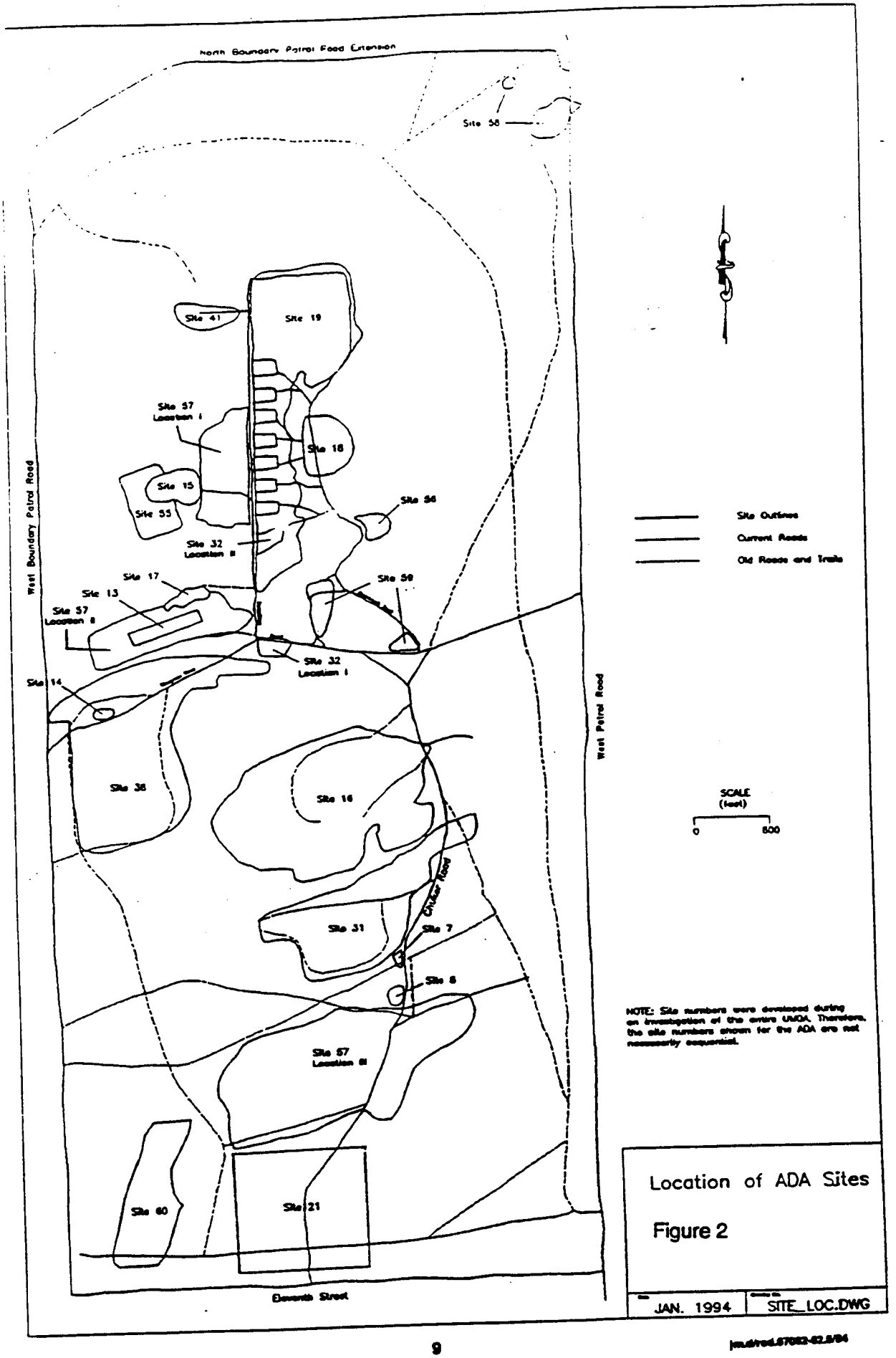
The region surrounding UMDA is primarily used for irrigated agriculture. The population centers closest to UMDA are Hermiston (population 10,075), approximately 5 miles east; Umatilla (population 3,032), approximately 3 miles northeast; and Irrigon (population 820), 2 miles northwest. The total populations of Umatilla and Morrow Countries are approximately 59,000 and 7,650, respectively.

Northeastern Oregon, the setting for UMDA (and the ADA), is characterized by a semi-arid, cold desert climate, an average annual precipitation of 8 to 9 inches, and a potential evapo-transpiration rate of 32 inches. The installation is located on a regional plateau of low relief that consists of relatively permeable glaciofluvial sand and gravel overlying Columbia River Basalt.

Ground water at UMDA occurs primarily in two settings: in an unconfined aquifer within the overlying deposits and weathered basalts, and in a vertical sequence of semi-confined and confined aquifers within the basalt. Regional flow gradients in the uppermost unconfined aquifer are influenced by irrigation, pumping, and leakage from irrigation canals. Ground water flow directions in this aquifer reverse seasonally in response to off-post pumping and recharge activities. During the summer and early fall, flow is toward the east and south as irrigation activities peak. During the winter and early spring, when irrigation activities are at a minimum, ground water flow is to the north and west. Approximately 1,470 wells have been identified within a 4-mile radius of UMDA, the majority of which are used for domestic and irrigation water. Three municipal water systems (Hermiston, Umatilla, and Irrigon) draw from ground water within a 4-mile radius of UMDA.

The Columbia River flows from east to west approximately 3 miles to the north of the UMDA boundary, and the Umatilla River flows from south to north approximately 1 to 2 miles to the east. The Columbia River is a major source of potable and irrigation water, and is also used for recreation, fishing, and the generation of hydroelectric power. The principal use of the Umatilla River is irrigation. No natural streams occur within UMDA; the facility is characterized by areas of closed drainage.

The topography of the ADA is relatively flat with occasional gently rolling hills or ridges. Elevations are in the range of approximately 460 to 580 feet above mean sea level. Soils at the ADA sites typically consist of fine- to medium-grained sand. Vegetation is relatively sparse, consistent with the UMDA installation in general. Depths to ground water at the ADA sites are in the range of approximately 60 to 100 feet below the ground surface.



NOTE: Site numbers were developed during an investigation of the entire UXOA. Therefore, the site numbers shown for the ADA are not necessarily sequential.

Location of ADA Sites

Figure 2

JAN. 1994 | SITE_LOC.DWG

Table 1: ADA Site Names and General Descriptions

Site Number/Name		Description
7	Aniline Pit	Small fenced area reportedly used to dispose of aniline (a missile fuel component)
8	Acid Pit	Small pit reportedly used to dispose of red fuming nitric acid
13	Smoke Canister Disposal Area	Long, narrow mound in which debris from smoke canister burning operations was found
14	Flare and Fuse Disposal Area	Mound of soil containing debris from flare and fuse burning operations
15	TNT Sludge Burial and Burn Area	Sludges from Explosives Washout Plant and/or other wastes reportedly dumped at this site
16	Open Detonation Pits	Rows of pits in which conventional munitions have been, and are currently being detonated
17	Aboveground Open Detonation Area	Area used for the detonation of decontaminated rockets and land mines
18	Dunnage Pits	Several historical pits reportedly used to dispose of and burn dunnage, liquid wastes, and sludges
19	Open Burning Trenches/Pads	Row of trenches and a burn field area reportedly used to burn explosives sludges and other wastes
21	Missile Fuel Storage Areas	Sheds used to store missile fuel components
31	Pesticide Pits	Several pits reportedly used to burn or dispose of pesticide solutions
32	Open Burning Trays	Two areas currently in use to conduct permitted open burning operations
38	Pit Field Area	Several rows of pits that were reportedly used to explode and dispose of old or faulty ordnance
41	Chemical Agent Decontamination Solution Burial Area	Trench and pit suspected to have been used as a burial area for chemical agent decontamination solutions
55	Trench/Burn Field	Several rows of apparent burn trenches – specific operations that occurred there are unknown
56	Munitions Crate Burn Area	Circular area reportedly used to burn empty wooden crates
57	Former Pit Area Locations	Three areas containing pits – specific operations that occurred there are unknown
58	Borrow/Burn/Disposal Area	Area showing signs that burning operations may have been conducted there
59	Chemical Agent Decontamination Solution Disposal Areas	Pits suspected to have been used as a disposal area for chemical agent decontamination solutions
60	Active Firing Range	18-acre site currently in use by the National Guard as a rifle, machine gun, and grenade firing range

- Explosives Washout Lagoon Plant
- Deactivation Furnace (and surrounding soils)
- Ammunition Demolition Activity Area (ADA)
- Miscellaneous Sites

The ADA Operable Unit, a 1,750-acre area located in the northwest corner of UMDA, contains 20 sites with varying degrees of possible contamination. In addition, UXO are potentially present across the entire ADA (UXO are not limited to the 20 defined sites). The threats described in this ROD are those associated with contaminated soil at these sites and the presence of unknown quantities of UXO at unknown locations throughout the ADA. The cleanup strategy presented in this ROD includes an action for soil in addition to a specified degree of removal of UXO from the ADA.

2.5 Site Characteristics

The sources of contamination at the ADA are activities associated with the disposal of ordnance and other solid wastes by burning, detonation, dumping, or burial. (Refer to Table 1 for a general description of each of the 20 ADA sites.) The types of contamination include:

- Explosives (contained in ordnance or other wastes disposed of)
- Metals (contained in ordnance and munition casings being burned, detonated, or disposed of)
- Pesticides (through application or disposal)
- UXO and related metallic debris

2.5.1 Results of Soil Investigations

Several soil investigations have been conducted at the ADA since 1981. Samples collected from surface soils and from soil borings have been used to determine the vertical and horizontal extent of soil contamination. Investigation results are presented in Table 2. In identifying these contaminants, it was assumed that soil at depths greater than 10 feet would not be available for exposure; therefore, only soils collected from 10 feet or shallower were included in the analysis of investigation results. The contaminants presented in Table 2 are those that were positively detected in at least one sample and were found to be present in concentrations greater than naturally occurring background concentrations. For reference, Table 2 includes measures of the average contaminant concentration (to depths of 2 feet and 10 feet) and the frequency at which the contaminant was detected at those depths.The total volume of soil affected by the contaminants as presented in Table 2 is roughly estimated at more than 33,000 cy. As can be seen in Table 2, no contamination was detected in soils at Sites 7, 58, and 59.

In the course of conducting the soil investigations, clearance of UXO was performed to ensure safe access by people collecting chemical samples. Approximately 80 UXO were found, as well as an extensive amount of inert metal debris. The total area cleared was small (less than 100 acres) compared to the entire ADA, but involved the areas most likely to have UXO. Because this clearance included only a small area, the total quantities, locations, and depths of UXO in the ADA are not well defined.

In general, the chemical contaminants in soil at the ADA can be characterized as having relatively low aqueous solubilities and low volatilities. Potential routes for their migration include the following:

Table 2: Summary of Contaminants of Concern in Soil at the ADA (continued)

Site	Contaminant of Concern	Background Concentration ppm (a)	To a Depth of 2 Feet		To a Depth of 10 Feet	
			95% UCL Concentration ppm	Frequency of Detection	95% UCL Concentration ppm	Frequency of Detection
16	Arsenic	5.24	NDB		8.59	45 of 45
	Barium	233	427	5 of 5	257	44 of 45
	Cadmium	3.05	3.31	1 of 5	1.69	1 of 45
	Cobalt	15	19	1 of 5	8.58	1 of 45
	Copper	58.6	118	2 of 5	102	45 of 45
	Silver	0.038	1.49	4 of 5	0.274	26 of 45
	Zinc	94	NDB		542	45 of 45
	Cyanide	0.92	1.14	1 of 5	0.612	4 of 45
	1,3,5-TNB	NSA	NA		0.935	1 of 45
	2,4,6-TNT	NSA	1.07	3 of 5	6.81	6 of 45
	2,4-DNT	NSA	NA		0.232	1 of 45
	HMX	NSA	NA		0.365	1 of 45
	Nitrobenzene	NSA	NA		1.58	1 of 45
	RDX	NSA	1.32	2 of 5	0.949	8 of 45
	Nitrite/nitrate	9.9	15.6	5 of 5	4.31	37 of 45
17	Antimony	3.8	85	2 of 4	NA	
	Beryllium	1.86	3	1 of 4	NA	
	Cadmium	3.05	5.25	1 of 4	NA	
	Cobalt	15	23.7	1 of 4	NA	
	Copper	58.6	299	1 of 4	NA	
	Iron	26233	69158	4 of 4	NA	
	Lead	8.37	1460	4 of 4	NA	
	Nickel	12.6	27	1 of 4	NA	
	Silver	0.038	0.138	3 of 4	NA	
	Sodium	978	948	4 of 4	NA	
	Zinc	94	118	4 of 4	NA	
	2,4,6-TNT	NSA	3.01	1 of 4	NA	
	HMX	NSA	1.69	2 of 4	NA	
	RDX	NSA	12	3 of 4	NA	
18	Aluminum	8604	29945	4 of 4	14059	28 of 28
	Arsenic	5.24	6.19	4 of 4	10.5	28 of 28
	Barium	233	462	4 of 4	1526	28 of 28
	Beryllium	1.86	NA		2.34	3 of 28
	Cadmium	3.05	NA		3.95	4 of 28
	Chromium (b)	32.7	80.6	1 of 4	22.7	6 of 28
	Copper	58.6	100	1 of 4	741	7 of 28
	Iron	26233	NDB		33861	28 of 28
	Lead	8.37	273	4 of 4	266	28 of 30
	Manganese	874	1620	4 of 4	782	28 of 28
	Nickel	12.6	389	1 of 4	63.5	7 of 28
	Silver	0.038	1.68	2 of 4	0.637	17 of 28
	Sodium	978	3073	4 of 4	1544	28 of 28
	Dieldrin	NSA	NA		0.005	1 of 28
	DDE	NSA	NA		0.006	3 of 28
	DDT	NSA	NA		0.01	5 of 28

Table 2: Summary of Contaminants of Concern in Soil at the ADA (continued)

Site	Contaminant of Concern	Background Concentration ppm (a)	To a Depth of 2 Feet		To a Depth of 10 Feet	
			95% UCL Concentration ppm	Frequency of Detection	95% UCL Concentration ppm	Frequency of Detection
32 (Area I)	Copper	58.6	304	1 of 4	NA	
	Lead	8.37	177	4 of 4	NA	
	Potassium	2179	4045	4 of 4	NA	
	Silver	0.038	0.104	4 of 4	NA	
	Zinc	94	1030	4 of 4	NA	
	2,4-DNT	NSA	1.33	3 of 4	NA	
	Nitrate/nitrite	9.9	28	4 of 4	NA	
32 (Area II)	Aluminum	8604	9967	4 of 4	NA	
	Antimony	3.8	30.6	2 of 4	NA	
	Barium	233	23274	4 of 4	NA	
	Copper	58.6	5133	3 of 4	NA	
	Lead	8.37	1263	4 of 4	NA	
	Magnesium	8585	16820	4 of 4	NA	
	Potassium	2179	2487	4 of 4	NA	
	Silver	0.038	631	3 of 4	NA	
	Zinc	94	741	4 of 4	NA	
	2,4-DNT	NSA	1.61	1 of 4	NA	
	Nitrate/nitrite	9.9	26	4 of 4	NA	
38	Copper	58.6	4270	1 of 10	831	3 of 50
	Iron	26233	28363	10 of 10	24518	50 of 60
	Mercury	0.056	0.237	1 of 10	0.065	1 of 50
	Nickel	12.6	20.4	2 of 10	9.64	3 of 50
	Potassium	2179	2207	10 of 10	1818	50 of 50
	Silver	0.038	0.056	5 of 10	0.032	25 of 50
	Zinc	94	2752	10 of 10	965	50 of 50
	Nitrobenzene	NSA	NA		1.31	1 of 50
	2,4,6-TNT	NSA	0.381	1 of 10	2.71	6 of 50
	Tetryl	NSA	NA		0.452	2 of 50
41	Antimony	3.8	8.41	2 of 2	7.31	6 of 10
	Lead	8.37	16.3	2 of 2	11.2	10 of 10
	Zinc	94	99.5	2 of 2	132	10 of 10
55	HMX	NSA	NA		1.03	2 of 12
	RDX	NSA	NA		1.42	4 of 12
56	Beryllium	1.86	2.76	1 of 3	1.85	1 of 6
	Lead	8.37	10.3	3 of 3	7.86	6 of 6
	Magnesium	8585	NDB		8936	6 of 6
57 (Area I)	Lead	8.37	45.6	1 of 1	11.8	17 of 17
	Mercury	0.056	0.137	1 of 1	0.043	1 of 17
	Potassium	2179	2240	1 of 1	1543	17 of 17
	Zinc	94	163	1 of 1	74.5	14 of 17

Air

Airborne transport of soil contaminants is the most likely route of contaminant migration at the ADA. This might occur via the dispersion of soil particles by wind or soil disturbances caused by human activity at the contaminated ADA sites. Passive transport of soil contaminants is unlikely given their low volatility.

Surface Water

There is little potential for surface water transport of the contaminants at the ADA. The ADA is not located within a floodplain nor is there run-on or run-off from the ADA. The low precipitation rate and high soil permeability allow for ready percolation of any rain falling directly onto the ADA soil.

Subsurface

Infiltration of precipitation provides a potential subsurface pathway for migration of contaminants in soil at the ADA. However, the rate of transport is expected to be low due to the low precipitation and high evaporation rates in the region. The depth to ground water at the ADA (typically in excess of 60 feet), combined with the low rate of transport of contaminants through the subsurface soils, makes ground water contamination due to the migration of contaminants at the ADA unlikely.

2.5.2 Results of Ground Water Investigation

During the RI, sampling and analysis of ground water was performed at selected sites (or groups of sites) to identify potential ground water contamination beneath the ADA. Investigation results are presented in Table 3. The contaminants presented in Table 3 are those that were positively detected in at least one sample and were found to be present in concentrations greater than naturally occurring background concentrations. For reference, this table includes measures of the average concentration and the frequency at which the contaminants were detected.

Despite the presence of inorganic elements or compounds in the ground water beneath the ADA, there is no evidence that migration of contaminants in soil was, or in the future would be, responsible for ground water contamination. This finding is supported by the general absence of any specific correlation between the contaminants of concern in soil and ground water as well as the lack of evidence that contaminants of concern in ground water have any relation to activities performed at the ADA.

For the most part, contaminants of concern in ground water at the ADA are those that were identified in background ground water characterizations. These inorganics were consistently identified across the entire installation and were not restricted to the ADA.

2.6 Summary of Site Risks

This section summarizes the human health risks and environmental impacts associated with exposure to ADA contaminants, and presents potential remedial action criteria.

2.6.1 Human Health Risks

A human health baseline risk assessment was conducted by the Army to estimate the risk posed to human health by the ADA should it remain in its current state with no remediation. The risk assessment consisted of an exposure assessment, toxicity assessment, and human health risk characterization. The exposure assessment detailed the

Table 3: Summary of Contaminants of Concern in Groundwater at the ADA (continued)

Site	Contaminant of Concern	Background Concentration ug/l (a)	95% UCL Concentration ug/l	Frequency of Detection
19	Antimony	1	18.4	2 of 7
	Arsenic	1	18.2	7 of 7
	Beryllium	NSA	0.5	1 of 7
	Copper	1	3.32	1 of 7
	Lead	5	9.53	1 of 7
	Nickel	NSA	17.7	1 of 7
	Selenium	1	29.8	2 of 7
	Vanadium	NSA	89.5	6 of 6
	1,3- DNB	NSA	0.484	1 of 6
41	Antimony	1	2.34	1 of 7
	Arsenic	1	26.5	7 of 7
	Barium	59	74.2	6 of 6
	Beryllium	NSA	0.5	1 of 7
	Chromium	1	6.09	1 of 7
	Copper	1	6.36	2 of 7
	Lead	5	9.88	3 of 7
	Nickel	NSA	17.7	1 of 7
	Vanadium	NSA	63	6 of 6
	Zinc	40	30	2 of 7
57I	Antimony	1	5.07	2 of 4
	Arsenic	1	30.8	4 of 4
	Barium	59	104	4 of 4
	Chromium	1	13.2	2 of 4
	Copper	1	8.78	1 of 4
	Manganese	140	189	4 of 4
	Vanadium	NSA	37.1	2 of 4
	Zinc	40	40.7	1 of 4
57III	Antimony	1	3.21	3 of 6
	Arsenic	1	27.4	6 of 6
	Barium	59	87.6	6 of 6
	Mercury	0.4	0.449	1 of 6
	Vanadium	NSA	56.8	6 of 6
59	None			

Notes:
UCL - Upper Confidence Limit
NSA - No Standard Available
(a) - Background concentration as established in RI

Ground water was not characterized at Sites 7, 17, 21, 32, 56, 58, and 60 because of the proximity of these sites to others where ground water was characterized

- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Potassium
- Selenium
- Silver
- Thallium
- Zinc
- Cyanide
- Nitrate/nitrite
- Trichloroethylene
- Xylenes
- 1,3,5-TNB
- 2,4,6-TNT
- 2,4-DNT
- 2,6-DNT
- RDX
- Tetryl
- HMX
- Nitrobenzene
- DDD
- DDE
- DDT
- Dieldrin
- Endrin

The populations at risk of exposure to the contaminants of concern at the ADA were identified by considering both current and future use scenarios. Public access to the ADA is currently restricted, and there is little incentive or opportunity for trespassers to approach the contaminated ADA sites, so public exposure is unlikely. Currently, only installation personnel conducting operations are being exposed to the contaminated ADA sites. Current contaminant exposure routes are correspondingly limited to the inhalation of contaminated soil as airborne dust by these installation personnel (incidental ingestion of contaminated soil is also considered for Site 60 only).

The probability of future human exposures may be high, since reuse of the ADA may be possible. The most likely routes of exposure to contaminants in soil are dermal absorption of chemicals in soil, incidental ingestion of soil, and dust inhalation.

Soil concentrations used in the calculation of risks were Reasonable Maximum Exposure (RME) concentrations. These concentrations are assumed to be the 95 percent upper confidence limit (UCL) on the arithmetic mean of sampling data (values presented in Table 2) unless the UCL is above the maximum detected value in which case the maximum detected value is used. Using these concentrations and exposure factors obtained from EPA's Risk Assessment Guidance for Superfund, chronic daily intake factors for each chemical within each exposure pathway for a given population at risk were calculated.

Using the toxicity and health effects data available and the calculated chronic daily intake factors, excess cancer risks and noncancer HIs were calculated for current and future use scenarios with the assumption that remediation of soils takes place.

Results of the calculations for current land use scenarios are presented in Table 4. As shown, of the current receptors, the highest risks and hazards apply to the open detonation pit and open burning tray workers, whose multiple pathway risk is 8×10^{-7} with a corresponding hazard index of less than one.

A summary of risks and hazards posed by exposures to contaminated soil associated with the future use of the ADA is presented in Table 5. These risks and hazards were calculated for each of the ADA sites where contamination was present in soil and represent future residential use, the most conservative future use scenario. The exposure pathways used to calculate the values presented in Table 5 are dermal absorption of chemicals in soil (Pathway 1), incidental ingestion of soil (Pathway 2), and dust inhalation (Pathway 3).

As shown, if no soil remediation occurs, the excess cancer risks associated with direct soil contact by future residents assuming a reasonable maximum exposure scenario are greater than 1×10^{-6} for Sites 13, 15, 17, 18, 19, 31, 32, 56, and 57 (Area III). These values are greater than 1×10^{-5} for Sites 13, 15, 17, 18, 19, 31, 32, and 56. Risks for Sites 15, 19, and 31 exceed a level of 1×10^{-4}.

The noncancer hazard indices associated with direct soil contact by future residents assuming a reasonable maximum exposure scenario are greater than one for Sites 15, 16, 17, 19, and 32 (Area II).

The NCP states that the acceptable risk range for carcinogens is 1×10^{-4} to 1×10^{-6} [40 CFR 300.430(e)(2)(i)(A)(2)]. For systemic toxicants (i.e., constituents having a noncancer health effect), the NCP states the following:

> For systemic toxicants, acceptable exposure levels shall represent concentration levels to which human populations, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety. [40 CFR 300.430(e)(2)(i)(A)(1)]

As discussed earlier, acceptable exposure levels are usually evaluated in terms of the HI; an HI of less than or equal to one generally represents an acceptable exposure.

In addition to the cancer and noncancer risk calculation results presented in Table 5, an analysis of risks posed by lead was performed. To determine the potential exposure to lead, an uptake/biokinetic model was used in the Risk Assessment. The level of lead that is determined to present an unacceptable risk to human health is established as a site-specific value based on applicable regulatory guidance including:

- Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites, EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-02, September 1, 1989
- Supplement to above guidance, OSWER Directive 9355.4-02A, January 26, 1990
- Update on OSWER Soil Lead Cleanup Guidance, August 29, 1991

As a result of the risk assessment and consideration of regulatory guidance, a lead cleanup level of 500 ppm was established at the ADA. This means that sites with lead concentrations in soil of 500 ppm or greater would present an unacceptable threat to human health.

- Site 15 (Cancer Risk = 4×10^{-4}, HI = 200, 95% UCL lead = 695 ppm)
- Site 16 (HI = 7)
- Site 17 (HI = 10, 95% UCL lead = 1,460 ppm)
- Site 19 (Cancer Risk = 2×10^{-2}, HI = 3000, 95% UCL lead = 3,908 ppm)
- Site 31 (Cancer Risk = 1×10^{-3}, HI = 220)
- Site 32 (Area II) (HI = 2, 95% UCL lead = 1,263 ppm)

The potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, non-carcinogenic hazard level, and action level for lead at sites 7, 8, 13, 14, 18, 21, 32 (Area I), 38, 41, 55, 56, 57, 58, 69, and 60.

As stated above, the future residential scenario represents the most conservative of the possible future use scenarios. However, future residential use of the ADA is highly unlikely due to the presence of UXO in unknown quantities at unknown depths and locations throughout the ADA. Future industrial use is a far more realistic (and still conservative) future use scenario for the ADA. For this reason, cancer risk and noncancer hazard calculations were performed assuming a future use of light industrial for the sites that exceeded the acceptable residential cancer risk ranges and/or noncancer hazard levels (Sites 15, 16, 17, 19, 31, 32 [Area II]). The results of these calculations are presented in Table 6.

The risks and hazard indices presented in Table 6 indicate that, based on these values, Sites 16, 17, and 32 (Area II) are within or below the acceptable cancer risk range or noncancer level for future light industrial users. However, it should be noted that soils at Sites 17 and 32 (Area II) still exceed the 500 ppm action level for lead.

In summary, in the event of likely future land use changes at the ADA brought about by UMDA's inclusion in the BRAC program, actual or threatened releases of hazardous chemical substances in soil from the site, if not addressed by implementing the response action selected in this ROD, may present a threat to human health associated with future light industrial use at the following sites:

- Site 15
- Site 17
- Site 19
- Site 31
- Site 32 (Area II)

Based on the discussion provided above, if no response action is implemented at the following sites, unacceptable human exposures to hazardous chemical substances in soil will not occur for future light industrial workers:

- Site 7
- Site 8
- Site 13
- Site 14
- Site 16
- Site 21
- Site 32 (Area I)
- Site 38
- Site 41
- Site 55
- Site 57
- Site 58
- Site 59
- Site 60

In addition to the health risks caused by the chemical contaminants in soil, risks are posed by UXOs. UXOs present a human safety hazard if they are encountered and detonate

accidentally. Accidental detonation could also result in the spread of explosive contamination in the environment.

Risks of Contaminants of Concern in Ground Water

As stated in Section 2.5.2, for the most part, contaminants of concern in ground water are those that were identified in background ground water characterizations. These contaminants were consistently identified across the entire installation and were not restricted to the ADA. The most ubiquitous contaminant of concern in the ground water at the ADA is arsenic, which was detected in levels above the value established in the RI as background (1µg/l) at all sites at which ground water was characterized (with the exception of Site 59).

A summary of risks and hazards posed by exposures to ground water associated with the future use of the ADA is presented in Table 7. These risks and hazards represent future residential use, the most conservative future use scenario. The exposure pathways used to calculate the values presented in Table 7 include one or more of the following:

- Ingestion of Ground Water (Pathway 5)
- Inhalation of Volatile Contaminants Emitted from Ground Water During Showering (Pathway 6)
- Dermal Absorption of Ground Water During Showering (Pathway 7)

As shown in Table 7, ground water-related risks and hazards exceed the future residential use criteria (risk of 1×10^{-6} and HI of 1) at Sites 8, 13, 14, 15, 16, 18, 19, 31, 38, 41, 55, 57I, 57II, and 57III. There are two important points to note about this observation:

- First, all of the exceedences in risk-based values are due to the presence of arsenic in the ground water. However, it is likely that the levels of arsenic measured in ground water at the ADA represent background levels because: the values consistently fall in a range of 10 to 40 µg/l across the ADA (see Table 3); there is no apparent correlation between arsenic levels in ground water and arsenic levels in contaminated soil at the ADA; and, the value established in the RI as background was based on much more limited sampling. Moreover, in no case does arsenic exceed the regulatory maximum contaminant level (MCL) for arsenic of 50 µg/l.

- Second, residential use represents the most conservative of the future use scenarios and a future use of residential for the ADA is extremely unlikely due to the presence of UXO. To evaluate the degree of conservatism represented by a future residential use over the more likely future industrial use for the ADA, the RA included a calculation of carcinogenic risks and noncarcinogenic hazards for both future use scenarios at Site 31. The results of these calculations showed that the risks and hazards for residential users are three times greater than those for industrial users. As with the future residential use scenario, the risks and hazards of exposure to ground water for future industrial users at Site 31 were due to the presence of arsenic.

Based on the discussion above as well as the results of the RI with respect to ground water characterization as presented in Table 3, no remedial action is required for the cleanup of ground water at the ADA.

2.6.2 Environmental Evaluation

As part of the Remedial Investigation, an Ecological Assessment (EA) was performed for UMDA. This EA involved a process to evaluate the current and potential effect to site biota from contaminants in soil at UMDA. In this process, the toxicity and environmental fate of contaminants of concern were evaluated on an installation-wide basis for contaminants found at or near the surface. Thirty contaminants of concern were identified at locations at which wildlife might be exposed. These 30 contaminants include metals, explosives and their derivatives, and pesticides. Of these, the most significant in terms of volume, distribution, and relative toxicity, are lead, zinc, aluminum, 2,4,6-TNT, HMX, RDX, and tetryl. These contaminants are found in soils at the ADA.

The chronic toxicities imposed by the contaminants of concern were developed by calculating the ratio of estimated daily contaminant uptake rates to No Observed Adverse Effect Levels (NOAELs) for four indicator species: field mouse, pronghorn antelope, American badger, and Swainson's hawk. Daily contaminant uptake rates are a function of contaminant concentration and exposure pathways. Exposure pathways considered in this assessment include direct or indirect ingestion of soil by the indicator species. The ratio of contaminant uptake rates to NOAELs is represented by a hazard quotient (HQ) for each of the contaminants of concern.

Currently one indicator species, the pronghorn antelope, is excluded from the ADA by a fence. In the event that fence removal occurs in the future, the pronghorn would likely still have no exposure to contaminants in the ADA because it is expected that they will be confined in a new fenced wildlife area at UMDA, moved to another reservation, or harvested.

A summary of the risk characterization performed for the principal contaminants of concern at the ADA is presented in Table 8. As can be seen, contaminants at Sites 15, 19, and 31 present the greatest concern in terms of magnitude of worst-case HQ. In order to determine the variability in individual site HQs, median values of HQ were determined for selected site/contaminant/species combinations as shown. Note that these median values are significantly less than the worst-case values (in fact, often these values were 0 or close to 0) indicating that the worst-case values are not representative of the ADA as a whole.

In summary, sites that represent potentially unacceptable levels of risks to indicator species are also the sites that represent a threat to human health. The implementation of a response action at those sites to the degree necessary to reduce the threat to human health will also reduce the threat to the environment.

2.6.3 Remedial Action Criteria

Neither state nor federal regulations contain chemical-specific soil cleanup standards for the contaminants of concern. However, both authorities provide a framework for developing risk-based remedial action criteria. The State of Oregon requires cleanup to background or, if that is not feasible, the lowest levels that are protective of human health and the environment and feasible. The NCP provides guidelines in terms of acceptable carcinogenic and non-carcinogenic risk.

Potential risk-based remedial action criteria (RAC) were calculated based on direct contact with ADA soils. RAC for the contaminants of concern present at the sites to be subjected to remedial action are presented in Table 9. These RAC represent soil concentrations for future residential and industrial uses equivalent to excess cancer risks of 1×10^{-6} and

Table 9: Risk-Based Remedial Action Criteria

Contaminant of Concern	CRLs(a) ppm	Background(b) ppm	Risk-Based Remedial Action Criteria: Residential Risk-based (c) ppm	Light Industrial Risk-based (d) ppm	Light Industrial Risk-based (e) ppm
Antimony	3.8	3.8	110	818	818
Arsenic	0.25	5.24	0.363	0.898	8.98
Barium	29.6	233	13700	861	861
Beryllium	1.86	1.86	0.148	0.809	8.09
Cadmium	3.05	3.05	127	2.75	27.5
Chromium	12.7	32.7	19	0.413	3.71
Cobalt	15	15	2.74	20.2	20.2
Lead	6.26	8.37	(f)	(f)	(f)
Mercury	0.05	0.056	81.9	292	292
Nickel	12.6	12.6	470	10.2	102
Selenium	0.25	0.25	1370	10200	10200
Silver	0.025	0.038	1370	10200	10200
Thallium	31.3	31.3	21.9	164	164
Zinc	30.2	94	54800	409000	409000
Nitrate/nitrite	0.6	9.9	438000	NA	NA
Trichloroethylene	0.003	NSA	58	441	4410
Xylenes	0.002	NSA	354000	382000	382000
135 TNB	0.488	NSA	1.05	2.27	2.27
246 TNT	0.456	NSA	1.64	4.24	22.7
24 DNT	0.424	NSA	0.0723	0.187	1.87
26 DNT	0.085	NSA	0.0723	0.187	1.87
HMX	0.666	NSA	1050	2270	2270
RDX	0.587	NSA	5.81	52	520
Nitrobenzene	2.41	NSA	10.5	22.6	22.6
Tetryl	0.731	NSA	211	454	454
DDD	0.008	NSA	2.66	23.8	238
DDE	0.008	NSA	1.88	16.8	168
DDT	0.007	NSA	1.88	12.7	127
Dieldrin	0.006	NSA	0.0399	0.269	2.69
Endrin	0.007	NSA	82.1	613	613

Notes:

NA - Not applicable

NSA - No standard available

(a) Certified Reporting Limit used in RI

(b) Background Concentration established in RI

(c) Based on a Residential cancer risk of 1E-06 or an HQ of 1

(d) Based on a Light Industrial cancer risk of 1E-06 or an HQ of 1

(e) Based on a Light Industrial cancer risk of 1E-05 or an HQ of 1

(f) Cleanup level for lead established at 500 ppm

Table 10: Cleanup Levels for Contaminants at the ADA

Contaminant	Cleanup Level (ppm)	Background Level (ppm)	Concentration in Soil (a) (ppm)				
			Site 15	Site 17	Site 19	Site 31	Site 32-II
Antimony	820	3.8	3396	85	3128	NA	30.6
Arsenic	15	5.24	20	BB	244	BB	BB
Barium	860	233	7781	BB	25678	315	23274
Beryllium	8.1	1.86	12.9	3	NA	NA	NA
Cadmium	28	3.05	2935	5.25	641	NA	NA
Chromium	40	32.7	7160	NA	43.9	BB	NA
Cobalt	25	15	239	23.7	NA	NA	NA
Lead	500	8.37	695	1460	3908	BB	1263
Thallium	160	31.3	708	NA	NA	NA	NA
RDX	52	NSA	126	1.32	3.5	3.08	NA
135-TNB	2.3	NSA	1.42	NA	143	16	NA
246-TNT	23	NSA	178	3.01	36045	2180	NA
24-DNT	1.9	NSA	NA	NA	1.39	2.08	1.61

Notes:
(a)–95% UCL Concentration (shading indicates that concentration is above the cleanup level)
NA–Not Analyzed
BB–Below Background
NSA–No Standard Available
ppm–Parts per million

This alternative does not meet the Oregon requirement for cleanup to background, or the lowest levels that are protective and feasible, nor does it achieve protection of human health and the environment within the guidelines of the NCP. The human health risks presented in Table 6 are not reduced.

UXO would remain present at the ADA and would continue to present safety and environmental risks due to the potential for accidental detonation and exposure.

Alternative 1 requires no time to implement and involves no capital or O&M costs.

2.7.2 Alternative 2: Containment of Contaminated Soil by Soil Cover

Alternative 2 involves placing a layer of clean soil over areas of contaminated soil to minimize potential contact with and exposures to contaminated soil while preventing the spread of contamination as dust. The primary actions involved in implementing this alternative include:

- Clear UXO at the contaminated sites to the degree necessary to safely perform soil containment action (assumes a UXO clearance to a maximum of 5 feet in depth).
- Place soil cover over the contaminated areas. The soil cover consists of an 18-inch layer of clean soil obtained from uncontaminated areas at UMDA.
- Plant vegetation on clean soil cover to restore area and prevent erosion.

Estimates of the cost of implementing this alternative were developed based on an estimate of contaminated soil surface area to be covered of 125,000 square feet. The present worth of the alternative assumes completion of the action within 15 months. The estimated costs of implementing Alternative 2 are:

- Capital Costs: $290,000
- O&M Costs: $10,000
- Present Worth: $300,000

The following major ARAR is cited for Alternative 2:

- Alternative 2 may not comply with state requirements for cleanup. Contaminant concentration levels are not reduced in Alternative 2. The state of Oregon considers the use of caps or covers as measures to supplement cleanups. They may be used as substitutes for cleanup only if it is determined that no other cleanup methods are protective and feasible.

2.7.3 Alternative 3: On-Site Treatment of All Contaminated Soil by Solidification/Stabilization and On-Site Disposal

In this alternative, excavated contaminated soil would be treated by solidification/stabilization. Treated materials would be placed in the on-site UMDA landfill. Primary actions involved in implementing this alternative include:

- Clear UXO at the contaminated sites to allow for safe access to, and excavation of, contaminated soil.
- Excavate contaminated soil.
- Conduct treatability studies of the use of solidification/stabilization.
- Treat contaminated soil by solidification/stabilization.
- Confirm, by testing and analysis, that treatment residuals are nonhazardous.
- Dispose of the treatment residuals in the on-site UMDA landfill.

- This alternative complies with state of Oregon Air Pollution Control Regulations that require control of emission involved in the excavation and handling of contaminated soil.

2.7.4 Alternative 4: On-Site Treatment of All Contaminated Soil by Both Incineration and Solidification/Stabilization and On-Site Disposal

This alternative is similar to Alternative 3, except that soils contaminated with organic compounds are treated in a mobile incinerator brought on site rather than by solidification/stabilization. This would result in the destruction of the organic contaminants. The ash resulting from the incineration of these soils would contain most of the metals contained in the incinerated soils. This ash would be combined with the soils containing metals only and treated by solidification/stabilization as described in Alternative 3. The treated soils (and ashes) would be disposed of on site in the UMDA landfill.

Primary actions involved in implementing this alternative include:

- Clear UXO at the contaminated sites to allow for safe access to, and excavation of, contaminated soil.
- Excavate contaminated soil.
- Mobilize incinerator on site.
- Conduct trial burns.
- Incinerate organic-contaminated soil.
- Conduct treatability studies of the use of solidification/stabilization.
- Treat contaminated soil and incinerator residues by solidification/stabilization.
- Confirm, by testing and analysis, that treatment residuals are nonhazardous.
- Dispose of the treatment residuals in the on-site UMDA landfill.

Rotary kiln incineration has been proven in similar remediations to reduce concentrations of explosives in soil to below detection limits. As a contaminant destruction technology for organics, it is protective of human health. Metal contaminants are not destroyed but are contained in fly ash or the treated soil (ash). Solidification/stabilization would be used to treat the metal-containing incineration residues as well as to treat those soils that contain metals contaminants only.

Mobile, or transportable, incineration systems are available in a range of sizes with varying feed rates. In this analysis, it is assumed that a rotary kiln incinerator designed to process 4 tons of material per hour will be used. A treatment area would be developed in close proximity to the ADA, with concrete and asphalt pads for the incinerator and feed staging operations. A trial burn would be conducted to verify the destruction and removal efficiency for the organic compounds and demonstrate performance of the air emission controls.

Estimates of the cost of implementing this alternative were developed based on an estimate of contaminated soil volume of 14,000 cy. The present worth of the alternative assumes completion of the action within 20 months. The estimated costs of implementing Alternative 4 are:

- Capital Costs: $3,400,000
- O&M Costs: $4,100,000
- Present Worth: $6,900,000

The following major ARARs are cited for this alternative:

assumes completion of the action within 12 months. The estimated costs of implementing Alternative 5 are:

- Capital Costs: $3,200,000
- O&M Costs: $0
- Present Worth: $3,200,000

The following major ARARs are cited for this alternative:

- This alternative complies with the state of Oregon cleanup requirements. Although cleanup to background is not achieved, the feasibility of cleanup to background was evaluated and considered not cost effective. This alternative provides for the required level of risk reduction to meet industrial future use standards at the ADA.

- This alternative complies with RCRA requirements for hazardous waste identification and analysis (40 CFR 261.3); standards applicable to generators of hazardous wastes (40 CFR 262); closure requirements for interim status units (40 CFR 265, Subpart G); requirements applicable to treatment of hazardous wastes by off-site facilities that meet RCRA Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF) (40 CFR 264); and land disposal restrictions (LDR) (40 CFR 268). The applicability of LDR will be determined by analyses to determine the hazardous characteristics of the soil with respect to the presence of toxic or reactive concentrations of metals, explosives, and/or pesticides.

- This alternative complies with state of Oregon Air Pollution Control Regulations that require control of emission involved in the excavation and handling of contaminated soil.

2.7.6 Institutional Controls

Implementation of each of the above alternatives for the cleanup of contaminated soil would require that institutional controls be placed upon the ADA because of the presence of UXO. The cost and scope of these controls will depend on the amount of site wide UXO clearance performed after the soil cleanup. In the absence of any site wide UXO clearance, maintaining controls equal to current Army security would be required. These controls include restricted access, fence maintenance, and security surveillance. The present worth cost of permanently maintaining these existing controls is estimated at $1,000,000.

2.7.7 UXO Clearance

For any future use of the ADA that is different from the current use, some degree of UXO removal, or clearance, will be required. The level of clearance required will be specifically dependent on the future use decided upon for the ADA. For this reason, approaches based on different levels of clearance were evaluated. These approaches include:

- Removal of UXO from the ground surface (surface clearance)
- Detection and clearance of UXO to a depth of 1 foot (subsurface clearance)
- Detection and clearance of UXO to a depth of 5 feet (subsurface clearance)
- Detection and clearance of UXO to a depth of 20 feet (subsurface clearance)

for the property. All parties must respond within 30 days with requirements for future use.

2. The department or agency that demonstrates an initial interest in the closing property must submit a firm proposal on the future use of that property. The requesting department or agency must agree to reimburse the Army for the full fair market value of the property and transfer funds within two years of the initial request for the property.

3. If not claimed under Steps One and Two, the property will be offered through the Department of Housing and Urban Development for homeless assistance purposes.

4. Local redevelopment authorities will be advised with respect to the availability of remaining unclaimed property. The redevelopment authority will have one year in which to express interest in writing for use of any buildings or property not claimed.

5. Any remaining surplus property will be screened with state and local governments for public purposes. A public agency will be required to advise of its need for the property within 20 calendar days. The state will be allowed 60 days to comment.

6. Any remaining property will be offered for sale to the general public on a competitive basis.

Upon completion of this screening process and the establishment of a future use for the ADA (that is approved by DoD, the state of Oregon, and the local reuse committee), additional clearance of UXO to a depth that is protective for the final land use will be conducted. This Phase II clearance will be initiated within 15 months after the final land use decision has been reached.

Because the full extent of UXO present at the ADA is unknown now, UXO removal costs could easily vary. Table 11 illustrates the relationship between the possible future land uses and corresponding depths of UXO clearance, estimated costs of clearance, and the degree of institutional controls needed.

When the Phase II clearance of UXO has been completed, appropriate institutional controls will be applied to the ADA to permanently limit the use of, and access to, the ADA consistent with the final use selected for the area and the degree to which UXO are cleared. The present worth cost of permanently maintaining these controls is estimated at $1,000,000.

2.8 Summary of Comparative Analysis of Alternatives

This section provides a summary of the relative performance of each of the remedial alternatives with respect to the nine CERCLA evaluation criteria.

2.8.1 Threshold Criteria

Overall protection of human health and the environment. Alternative 1, the No Action alternative, is not protective of human health and the environment. Alternative 2 will not result in the treatment or removal of any of the contaminated soil; however, this

alternative will reduce the risks associated with potential contacts with the soil and spread of contamination by dust.

Alternatives 3 and 4 provide the best potential for effectively protecting human health and the environment from soil contamination at the ADA. These alternatives result in the removal of all contaminated soil followed by treatment to prevent further threats imposed by the contaminants. Following treatment, the treated soils will be placed in the on-site UMDA landfill that will be properly maintained and monitored to ensure that overall protection is maintained. In these alternatives, all actions associated with the cleanup are conducted on site and therefore preclude any risks associated with off-site transport of contaminated or treated soils.

Alternative 5 involves the treatment of only those soils that are defined as hazardous – contaminants in the other soils would be left untreated. However, the disposal of both treated soil and untreated nonhazardous soil in Alternative 5 would be to a properly maintained and monitored landfill. This alternative involves the transport of contaminated soil off site, which presents potential risks to human health and the environment outside the boundaries of UMDA.

Removal of UXO consistent with the selected land use will provide for a reduction of risks and hazards associated with their presence at the ADA. The continued use of institutional controls will further provide long-term protection of human health and safety with respect to UXO.

Compliance with ARARs. Alternative 1 does not comply with ARARs. Alternatives 3, 4, and 5 comply with all ARARs.

State soil cleanup requirements are met by Alternatives 3, 4, and 5 in that contaminants at the ADA sites are reduced to the lowest levels that are protective and feasible. The state of Oregon requirement to determine the feasibility of cleanup to background was evaluated by estimating costs to clean up all the ADA to standards based on residential land use that most closely match background levels. The cleanup to residential land use standards at the ADA would cost approximately twice as much as cleanup to industrial use standards. Since both cleanups would achieve the required level of risk reduction to meet industrial future use standards at the ADA, the additional cleanup cost to reach residential (or background) standards is not cost-effective.

Contaminant concentrations are not reduced in Alternative 2. The state of Oregon considers the use of caps or covers as measures to supplement cleanups. They may be used as substitutes for cleanup only if it is determined that no other cleanup methods are protective and feasible. As a result, Alternative 2 may not meet state requirements.

Alternatives 3, 4, and 5 will comply with applicable RCRA regulations and standards including those establishing requirements for meeting treatment standards for hazardous wastes, hazardous waste analysis and identification, hazardous waste incineration, standards for generators of hazardous wastes, hazardous waste transport and treatment, and closure of interim status units.

Alternatives 3, 4, and 5 will comply with state and federal ARARs that regulate and control air emissions resulting from remedial actions including soil excavation and treatment.

immobilization of contaminants (by trapping them in a concrete-like material); however, only Alternatives 3 and 4 will result in the immobilization of all contaminants.

Alternative 4 will result in the destruction of explosive contaminants by incineration, thereby decreasing their toxicity and volume.

The removal and deactivation of UXO will reduce the volume of contaminants present at the ADA.

Short-term effectiveness. Alternative 1 is effective in the near term, since public access to UMDA is currently restricted. Operations associated with Alternative 2 are not expected to increase the risks to the community since no contaminants will be released to the environment. Operations associated with Alternatives 3, 4, and 5 provide the potential for risks to human health and the environment as they involve the removal, handling, treatment, and transport of contaminated soil and treated soil. Risks to the environment as well as workers involved in the various activities of these alternatives will be minimized through the application of proper engineering controls (such as wetting the soil to minimize dust emissions) and the use of personal protective equipment. Alternatives 3 and 4 will present fewer risks to the community than Alternative 5 since no actions are conducted off site.

Safety risks and hazards associated with the removal and deactivation of UXO will be minimized by using trained safety personnel and maintaining adequate distances between clearance operations and other activities.

Alternatives 2 through 5 and UXO clearance could be implemented in one to two years.

Implementability. There are no technical or administrative difficulties likely in implementing Alternative 1 since no actions will be required. Activities involved in carrying out Alternatives 2 through 5, as well as UXO clearance, have been successfully used in other cleanups. Services, materials, and equipment are readily available for their performance. Administrative difficulties are expected to be fewest for Alternative 3. Solidification/stabilization will require treatability studies to develop a chemical additive mixture that will meet treatment requirements. Administrative difficulties are more likely for Alternative 4, which requires a trial burn for incineration, and Alternative 5, which involves the off-site transport of hazardous soils.

Cost. The estimated capital, O&M, and present worth costs for each remedial alternative are as follows:

Alternative	Capital Cost	O&M Cost	Present Worth Cost
1	0	0	0
2	$ 290,000	$ 10,000	$ 300,000
3	$ 1,100,000	$ 1,300,000	$ 2,400,000
4	$ 3,400,000	$ 4,100,000	$ 6,900,000
5	$ 3,200,000	0	$ 3,200,000

Present worth costs to conduct the various levels of UXO clearance evaluated are estimated as:

additional UXO clearance will be conducted to a depth that is protective for the final land use (as shown in Table 11).

Upon completion of Phase II UXO clearance actions, appropriate institutional controls will be applied to the ADA to permanently limit the use of, and access to, the ADA consistent with the final use selected for the area and the degree to which UXO are cleared. Such controls may include deed restrictions, maintenance of existing fencing, and/or security. The present worth cost of permanently maintaining these controls is estimated at $1,000,000.

In summary, Phase I of the UXO removal will be conducted concurrently with the cleanup of contaminated soil. Phase II will be initiated within 15 months after the final land use and disposal decision is made on the ADA.

In order to ensure that this cleanup remedy continues to be protective, a site review will be conducted every five years. This review will include verifying that institutional controls remain in place and that land use of the ADA has not changed. In addition, any land transfer will be subject to CERCLA/SARA Section 120(h) provisions.

2.10 Statutory Determinations

The selected remedy satisfies the following requirements under Section 121 of CERCLA:

- Protect human health and the environment
- Comply with ARARs
- Be cost effective
- Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable
- Satisfy the preference for treatment as a principal element

2.10.1 Protection of Human Health and the Environment

The selected remedy, Alternative 3, will reduce risks posed to future users of the ADA through treatment of excavated soils by stabilization/solidification, followed by on-site disposal of the treated soils in the UMDA landfill, and restoration of excavated areas with clean backfill and vegetation. The clean backfill and vegetation will minimize direct contact with any residual contamination remaining after excavation. Excavation of contaminated soil followed by treatment and disposal of treated soil in a maintained and monitored landfill should achieve the following:

- Health risks associated with exposure to carcinogens in the treated soil and in soil that remains in place will be reduced to within the NCP's acceptable range of 1×10^{-4} to 1×10^{-6} (for an industrial use scenario).
- Noncarcinogenic health risks will be reduced to levels at or below a hazard quotient of one.
- Environmental protection is achieved by reducing contaminant concentrations and providing a clean soil layer to support a vegetative cover.
- Health, safety, and environmental risks are reduced by removing UXO to a depth consistent with the selected final land use, thereby significantly reducing the potential for contact and accidental detonation.

2.10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy is a permanent solution that provides the best balance of tradeoffs among the alternatives. Alternative 1 fails to meet the threshold criteria of overall protection and compliance with ARARs and is thus clearly unacceptable. Although Alternative 2 provides a degree of overall protection, it does not comply with ARARs. Alternatives 3, 4, and 5 meet the threshold criteria. These alternatives are comparable in terms of short-term effectiveness and implementability. These alternatives differ in terms of degree of protectiveness afforded and cost. Alternatives 3 and 4 provide a greater degree of protectiveness than Alternative 5 since they involve the treatment of all contaminated soil excavated from the ADA sites. Alternative 3 is the lowest cost of these three alternatives. Alternative 3 is the least costly of these alternatives, and since it meets all of the criteria of the protective alternatives, its selection as the selected remedy is justified.

The selected remedy meets the statutory requirement to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

2.10.5 Preference for Treatment as a Principal Element

The statutory preference for treatment is satisfied by using stabilization/solidification to treat all contaminated soil excavated from the ADA sites.

2.11 Documentation of Significant Changes

The selected remedy was the preferred alternative presented in the Proposed Plan. No changes have been made.

3.0 Responsiveness Summary

The final component of the ROD is the Responsiveness Summary, which serves two purposes. First, it provides the agency decision makers with information about community preferences regarding the remedial alternatives and general concerns about the site. Second, it demonstrates to members of the public how their comments were taken into account as part of the decision-making process.

As part of the installation's community relations program, the UMDA command assembled in 1988 a TRC composed of elected and appointed officials and other interested citizens from the surrounding communities. Quarterly meetings provide an opportunity for UMDA to brief the TRC on installation environmental restoration projects and to solicit input from the TRC. Two TRC meetings were held that included presentations and discussions on the remedial alternatives considered and evaluated as part of the feasibility study for the ADA Operable Unit.

In December 1993, the TRC was expanded to a Restoration Advisory Board (RAB) in accordance with DoD guidance. Two RAB meetings were held during the selection of the proposed cleanup alternative for the ADA.

The Feasibility Study and Proposed Plan for the ADA Operable Unit were made available to the public on February 15, 1994. These documents were made available at the following locations: UMDA Building 32, Hermiston, Oregon; the Hermiston Public Library, Hermiston, Oregon; and the EPA office in Portland, Oregon. Notice of the public comment period, public meeting, and availability of the Proposed Plan was published in the *Hermiston Herald*, the *Tri-City Herald*, and the *East Oregonian* in February 15, 1994. The public comment period ended on March 17, 1994.

A public meeting was held at Armand Larive Junior High School, Hermiston, Oregon, on March 2, 1994, to inform the public of the preferred alternative and to seek public comments. At this meeting, representatives from UMDA, USAEC, EPA, ODEQ, and Arthur D. Little, Inc. presented the proposed remedy. Approximately 10 persons from the public and media attended the meeting. There were no questions asked during the informal question and answer period specific to the Proposed Plan for the ADA.

A formal statement regarding the Proposed Plan for the ADA was made by a member of the Oregon National Guard (ONG). This statement was made to convey a preliminary interest in the future use of the ADA for ONG training purposes. A potential future use of the ADA under consideration by the ONG includes the use of a 2,000 meter by 2,000 meter area for tracked vehicles and maintaining other ADA property as an impact area.

Two written comments were received during the comment period and expressed concern about the incineration of explosives and weapons on site at UMDA. The comments were not addressed to a specific operable unit; however, they appear to relate specifically to the Explosives Washout Plant Operable Unit since the proposed remedy for the cleanup of that site involves the thermal oxidation of explosive contaminants in an afterburner. No aspect of the proposed cleanup for the ADA involves incineration.

Attachment A
Site Investigation and Assessment Documents

The following documents contain the results of the site investigation and assessments of cleanup actions for the ADA. These documents were made available to the public at the information repositories located at UMDA Building 32, Hermiston, Oregon; the Hermiston Public Library, Hermiston, Oregon; and the EPA offices in Portland, Oregon.

Remedial Investigation Report for the Umatilla Depot Activity, Hermiston, Oregon. Prepared by Dames & Moore for the U.S. Army Toxic and Hazardous Materials Agency, 1992.

Human Health Baseline Risk Assessment Umatilla Depot Activity, Hermiston, Oregon. Prepared by Dames & Moore for the U.S. Army Toxic and Hazardous Materials Agency, 1992.

Ecological Assessment (EA) Report, Umatilla Depot Activity, Hermiston, Oregon. Prepared by Dames & Moore for the U.S. Army Toxic and Hazardous Materials Agency, 1993.

Feasibility Study for the Ammunition Demolition Activity Area (Operable Unit 4) at the Umatilla Depot Activity. Prepared by Arthur D. Little, Inc. for the U.S. Army Environmental Center, 1993.

Attachment B
State of Oregon Letter of Concurrence

Oregon

DEPARTMENT OF ENVIRONMENTAL QUALITY

July 26, 1994

Mr. Chuck Clarke
Regional Administrator, Region 10
U. S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101

Re: Umatilla Depot Activity
Ammunition Demolition Activity
Operable Unit
Record of Decision

Dear Mr. Clarke:

The Oregon Department of Environmental Quality (DEQ) has reviewed the final Record of Decision, for the Ammunition Demolition Activity (ADA) Area Operable Unit at the U.S. Army's Umatilla Depot Activity (UMDA). I am pleased to advise you that DEQ concurs with the remedy recommended by EPA and the Army. The major components of that remedy include:

- Excavation of contaminated soil from Sites number 15, 17, 19, 31, and 32 (approximately 14,000 cubic yards of soil). Unexploded ordnance (UXO) would be removed from these sites as necessary to allow safe access and soil excavation;
- Treatment of contaminated soil by solidification/stabilization to produce a cement-like soil mixture;
- Disposal of the treated soil in the UMDA Active Landfill; and,
- Replacement of excavated soils with clean soil and revegetation of the area.

In addition, a phased approach will be taken to locate and remove UXO from the entire ADA area to a level that is consistent with the future land use selected for the ADA area. Following those actions, institutional controls will be applied to permanently control access to and use of the ADA area, consistent with the final land use selected.

I find that this remedy is protective, and to the maximum extent practicable is cost effective, uses permanent solutions and alternative technologies, is effective and implementable. Accordingly, it satisfies the requirements of ORS 465.315, and OAR 340-122-040 and 090.

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