

**Record of Decision
Operable Unit 3
Former Nebraska Ordnance Plant
Mead, Nebraska**

**U.S. Army Corps of Engineers
Kansas City District**

April 2013

**Record of Decision
Operable Unit 3
Former Nebraska Ordnance Plant
Mead, Nebraska**

Date Issued – April 2013

U.S. Army Corps of Engineers – Kansas City District
635 Federal Building
601 E. 12th Street
Kansas City, Missouri 64106-2896

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ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
ARDC	Agricultural Research and Development Center
AST	above ground storage tank
bgs	below ground surface
BLRA	Baseline Risk Assessment
CENWK	U. S. Army Corps of Engineers, Kansas City District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information Act
CON/HTRW	Containerized Hazardous, Toxic, and Radioactive Waste
COPEC	contaminant of potential ecological concern
CSM	Conceptual Site Exposure Model
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FS	Feasibility Study
ft	foot or feet
FUDS	Formerly Used Defense Sites
HI	Hazard Index
ILCR	Incremental Lifetime Cancer Risk
LL	Load Line
mg/kg	milligrams per kilogram
MMRP	Military Munitions Response Program
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDEQ	Nebraska Department of Environmental Quality
NFA	No Further Action
NRD	Natural Resources District
NOP	Nebraska Ordnance Plant
OU	Operable Unit
PA	Preliminary Assessment
RI	Remedial Investigation
ROD	Record of Decision
SL	Screening Level
SVOC	semi-volatile organic compound
TCE	trichloroethene
UNL	University of Nebraska – Lincoln
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound

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Former Nebraska Ordnance Plant Operable Unit 3



*Mead
Saunders County, Nebraska
April, 2013*

*U.S. Army Corps of Engineers
Kansas City District (CENWK)*

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Former Nebraska Ordnance Plant, Mead, Nebraska
CERCLIS Identification Number: NE6211890011
FUDS Property/Project Number: B07NE0037
Former Nebraska Ordnance Plant Subsite: Operable Unit 3 (OU3)

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the Selected Remedy for the former Nebraska Ordnance Plant (NOP), in Mead, Nebraska, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for this site.

The State of Nebraska concurs with the Selected Remedy. A copy of the Nebraska Department of Environmental Quality (NDEQ) Concurrence Letter is included in Appendix A.

1.3 DESCRIPTION OF THE SELECTED REMEDY

This is the third operable unit (OU) to reach a final-action ROD for the former NOP. This ROD records a No Further Action (NFA) decision in accordance with U.S. Environmental Protection Agency (EPA) Guidance.

1.4 STATUTORY DETERMINATION

The final remedy for OU3 is NFA. There is no requirement for the evaluation of remedial alternatives for OU3. No remedial action is necessary to ensure protection of human health and the environment for OU3.

1.5 AUTHORIZING SIGNATURES

Acceptance of this ROD is indicated by the signature of the Superfund Division Director, EPA Region 7, and the U.S. Department of the Army Representative. Copies of the signature pages follow on pages 3 and 5. This ROD will be incorporated into the Administrative Record file for OU3 which is available for public view at the Mead Library, 316 South Vine Street, Mead, Nebraska 68041.

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EPA ACCEPTANCE
OF THE RECORD OF DECISION
OPERABLE UNIT 3
FORMER NEBRASKA ORDNANCE PLANT
MEAD, NEBRASKA

The signature of the Superfund Division Director, U.S. Environmental Protection Agency Region 7, denotes acceptance of the Record of Decision for the final remedy for Operable Unit 3 at the former Nebraska Ordnance Plant near Mead, Nebraska. The final remedy for Operable Unit 3 is No Further Action.



Signature

Cecilia Tapia

Typed or Printed Name

Director, Superfund Division, Region 7
U.S. Environmental Protection Agency

5/2/13

Date of Signature

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ARMY ACCEPTANCE
OF THE RECORD OF DECISION
OPERABLE UNIT 3
FORMER NEBRASKA ORDNANCE PLANT
MEAD, NEBRASKA

The signature of the Army Representative of the U.S. Army Corps of Engineers, Kansas City District, denotes acceptance of the Record of Decision for the final remedy for Operable Unit 3 at the former Nebraska Ordnance Plant near Mead, Nebraska. The final remedy for Operable Unit 3 is No Further Action.

Anthony J. Hofmann, COL, EN

Signature

Anthony J. Hofmann

Typed or Printed Name

Colonel, Corps of Engineers
District Commander

1 MAY 2013

Date of Signature

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2.0 DECISION SUMMARY

The Decision Summary identifies that no remedy is being selected, explains how no remedial action is necessary to ensure protection of human health, and provides a substantive summary of the Administrative Record file that supports the remedy selection decision.

2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

Site Name: Former Nebraska Ordnance Plant

Location: Mead, Nebraska

CERCLIS Identification No. NE6211890011

Lead Agency: U.S. Army

Federal Support Agency: U.S. Environmental Protection Agency – Region 7

State Support Agency: Nebraska Department of Environmental Quality

Source of Cleanup Monies: Funding for remedial activities is provided by the Defense Environmental Restoration Account; a funding source approved by Congress to clean up contaminated sites on the U.S. Department of Defense (DoD) installations.

Site Type: Former DoD Industrial Complex with Contaminated Soil and Groundwater.

Site Description: The former NOP occupies approximately 17,250 acres and is located approximately 0.5 miles south of the Village of Mead and 30 miles west of Omaha in Saunders County, Nebraska (Figure 1). The facility was active during World War II and the Korean Conflict. After decommissioning in mid-1960s, the site has been developed for industrial and agricultural land use with a small number of residences.

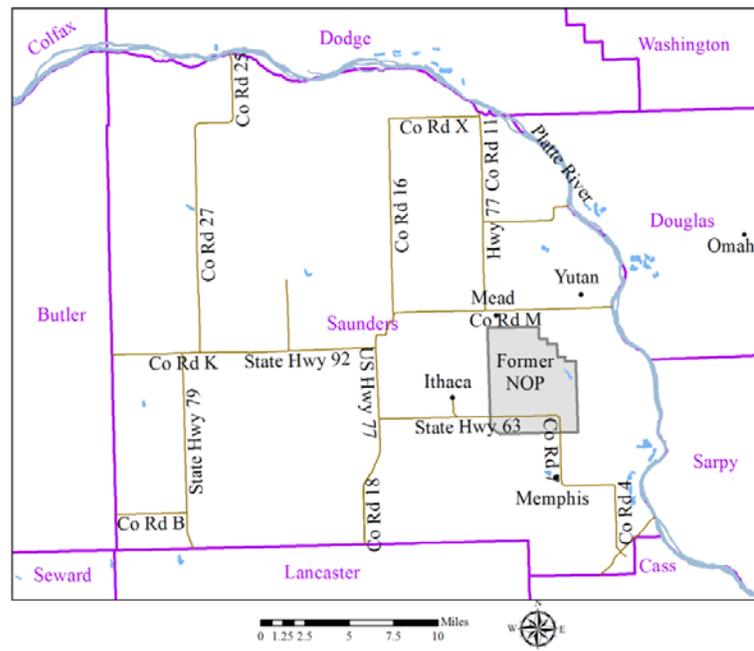


Figure 1. Location of Former NOP

2.2 SITE HISTORY

2.2.1 Nebraska Ordnance Plant Operations and Decommissioning

During World War II, bombs, shells, and boosters were loaded, assembled, and packed at the former NOP site. Ordnance production was temporarily terminated in 1945 and the facility was placed on standby; decontamination and shutdown procedures were initiated. Between 1945 and 1949, the buildings were decontaminated and used primarily for storage and disposal of bulk explosives and munitions.

In 1950, the plant was temporarily reactivated and produced an assortment of weapons for use in the Korean Conflict. The plant was again placed on standby status in 1956. In 1959, the former NOP site was transferred to the General Services Administration for disposition. Approximately 1,000 acres were retained by the Army for National Guard and Army Reserve training, 12 acres were retained by the Army for use as a Nike Missile Maintenance Area, 2,000 acres were transferred to the U.S. Air Force to build the Offutt Air Force Base Atlas Missile Area, and 40 acres were transferred to the Department of Commerce.

2.2.2 Post-Nebraska Ordnance Plant History and Uses

From 1959 to 1960, the Offutt Air Force Base Atlas Missile Area S-1 launch area was built north of Load Line (LL) 4 (Investigation Areas 18 and 19 on Figure 2). The Air Force also occupied 34 acres of the northern portion of LL 1 (Investigation Areas 12 and 13 on Figure 2) for use as the Air Force Ballistic Missile Division Technical Area. The missile facilities were deactivated in 1964 and the Atlas Missile Area and the Nike Missile Maintenance Area were transferred to the Nebraska National Guard.

In 1962, approximately 9,600 acres of the former NOP site were purchased by the University of Nebraska – Lincoln (UNL) for use as an agricultural research farm. An additional 600 acres were obtained by UNL in 1964. Private individuals and corporations purchased 5,250 acres. Currently, most of the site is owned by UNL for the operation of the Agricultural Research and Development Center (ARDC). The remaining area is owned by the Nebraska National Guard, Army Reserves and private individuals. Adjacent land use is primarily agricultural, except for the Village of Mead, which is located north of the site.

2.3 SCOPE AND ROLE OF OPERABLE UNIT 3

OU3 includes a former on-site landfill and former waste disposal areas. OU3 includes soil in several investigation areas, as well as surface water (Figure 2), and areas of potential vapor intrusion located above the OU2 groundwater plumes. Five areas investigated during the Remedial Investigation (RI) included underground storage tanks (USTs)/above ground storage tanks (ASTs). These were addressed under the U.S. Army Corps of Engineers (USACE) Containerized Hazardous, Toxic, and Radioactive Waste (CON/HTRW) program.

2.4 SITE CHARACTERISTICS

2.4.1 Topography, Hydrogeology, and Climate

Elevations at the former NOP site range from 1,210 feet above mean sea level (amsl) in the northeastern portion of the site to 1,105 feet amsl in the southwestern corner near Silver Creek (USGS 1981).

Three major aquifers are present at and in the vicinity the former NOP site: the Todd Valley aquifer, the Platte River alluvial aquifer, and the Omadi Sandstone aquifer (ECC 2009). Within the northwestern

portion of the former NOP site, the Omadi Shale acts as an aquitard between the Todd Valley aquifer and the Omadi Sandstone aquifer (URS 2008). Where the Omadi Shale is absent (i.e., in the southeastern portion of the former NOP site), the Todd Valley aquifer and the Platte River alluvial aquifer are hydraulically connected with the Omadi Sandstone (ECC 2009).

Saunders County, Nebraska is subjected to cold northerly winds in the winters and hot southerly winds in the summer. April and September are the wettest months, with annual precipitation averaging 28.3 inches per year (HPRCC 2012). An average snowfall of 31 inches occurs annually, with January exhibiting the coldest temperatures [average low temperature of 10.5 degrees Fahrenheit (°F), HPRCC 2012]. An average high temperature of 87.6°F occurs in July (HPRCC 2012).

2.4.2 Surface Water

A number of streams are located within, and near, the former NOP site. The three largest streams are Johnson, Clear, and Silver Creeks. Johnson Creek merges with Clear Creek southeast of the site and continues downstream as Clear Creek.

Silver Creek (Figure 2) is located on the southwest corner of the site and drains into Wahoo Creek south of the former NOP site and north of the city of Ashland. A diversion channel was built to redirect the upper portion of Silver Creek such that it flows into Wahoo Creek. Wahoo Creek flows into Salt Creek, which discharges into the Platte River near the southeastern corner of Saunders County.

The majority of surface runoff from the former NOP site flows into Johnson Creek. Surface runoff from the western portion of the former NOP site drains southward and eventually enters Silver Creek. The surface drainage area for Silver Creek includes LL1, the former Administration Area, and the Bomb Booster Assembly Area.

The Todd Valley aquifer discharges to Johnson Creek and Clear Creek southeast of the site, and to Silver and Wahoo Creeks south of the site.

2.5 PREVIOUS INVESTIGATIONS AND RESPONSE ACTIONS

The former NOP site was placed on the EPA National Priorities List of Superfund sites under Section 105 of CERCLA, in August 1990 after several environmental investigations. In September of 1991, USACE, EPA, and NDEQ entered into an Interagency Agreement under Section 120 of CERCLA to investigate environmental contamination at the former NOP site. USACE has conducted these activities under the Defense Environmental Restoration Program.

Due to the size and complexity of the former NOP site, as with many Superfund sites, the site was organized into OUs. The focus of this ROD is OU3 which, as noted previously, includes a former on-site landfill and former waste disposal areas.

OU1 addressed the risk due to exposure to explosives-contaminated soil (top four feet of soil). A ROD for OU1 was issued in November 1995 and is available in the Information Repository located in the Mead Public Library. The remedy was completed in 1997.

OU2 addressed the remediation of contaminated groundwater and soil contaminated with volatile organic and explosive compounds (exclusive of those addressed in OU1) which may continue to be a source of groundwater contamination. The ROD for OU2 was issued in October 1996. The final decision selected in the ROD was containment and focused extraction of groundwater and soil removal. The groundwater extraction system is currently operating on-site.

OU3 includes a former on-site landfill and former waste disposal areas. OU3 includes soil in several investigation areas, as well as surface water (Figure 2), and areas of potential vapor intrusion located above the OU2 groundwater plumes. Five areas investigated during the RI included USTs and ASTs. These were addressed under the USACE CON/HTRW program.

OU5 addresses the areas of the former NOP site where UNL disposed of wastes, including a permitted landfill. The lead agency for OU5 is EPA. UNL continues to implement response actions at the site. Removal activities took place in 2007 and 2008 and a RI/Feasibility Study (FS) was completed. A Proposed Plan was announced and comments were received from July 1, 2011, through August 1, 2011. A ROD is scheduled to be issued by EPA.

Several OUs physically overlap with OU3. OU1 contained the top four feet of explosives-contaminated soil; a few areas that were remediated in OU1 are included in OU3 for other compounds in soil. OU5 contains sites used by UNL which overlap with several areas included in OU3. OU5 was characterized during an RI and some response actions have been completed during a Non-Time Critical Removal Action. Additional response actions will be implemented after the ROD is issued. Military Munitions Response Program (MMRP) areas of concern also overlap some OU3 investigation areas (Section 2.5.3).

2.5.1 Operable Unit 3

There have been multiple environmental investigations at OU3 which have been documented in the following reports:

- Preliminary Assessment (PA) of Ordnance Contamination, 1991 (TCT 1991)
- RI Report, 1997 (Woodward-Clyde 1997)
- RI Report Addendum, 2000 (URS 2000a)
- Revised Baseline Risk Assessment (BLRA), 2000 (URS 2000b)
- FS, 2000 (URS 2000c)
- Engineering Evaluation/Cost Analysis (EE/CA) Addendum to the FS, 2007 (URS 2007)
- Non-Time Critical Removal Action, 2008 (Kingston 2008)
- Supplemental RI Report and Supplemental BLRA, 2012 (GEO 2012)

This ROD sets forth NFA for the 27 areas included in OU3 shown in Figure 2. The majority of these sites have been evaluated in either the risk screening process of the RI, the 2000 Revised BLRA, or the 2012 Supplemental RI/BLRA. Several UST sites were originally evaluated or addressed in conjunction with earlier OU3 efforts, however, as USTs are not addressed under CERCLA, these are not considered in the recommended remedy. In addition, some sites contained explosives contaminated soils which were addressed in either OU1 or OU2 but may remain in OU3 due to continued evaluations of other compounds. Table 1 provides an explanation of where each site was investigated, evaluated, or in some cases, re-evaluated, and the basis for the risk determination at the site. It also indicates if these sites were addressed in OU1 or OU2 for explosives contamination.

2.5.2 Removal Actions

The antimony contaminated soils identified in the 2000 Revised BLRA were excavated in 2008. These soils had concentrations over the risk-based remediation goal of 31 milligrams per kilogram (mg/kg). Approximately 575, 310, and 175 cubic yards were removed from the Potential Landfill Area (Investigation Area 24 in Figure 2), LL2 Paint Operations Area (Investigation Area 15 on Figure 2), and

LL4 Paint Operations Area (Investigation Area 19 on Figure 2), respectively, and backfilled with clean soil. The excavated soil from all three areas was disposed of in the Butler County Landfill. During excavation in the Potential Landfill Area, a pocket of approximately 3 cubic yards of transite tiles (asbestos-containing material) was found; the tiles were set aside in a separate area and removed from the site under the supervision of a Nebraska certified Asbestos Supervisor and disposed of in the Butler County Landfill.

2.5.3 Military Munitions Response Program

Environmental investigations and remedial actions to address explosive hazards and chemical warfare material are being conducted under MMRP. A Military Munitions Site Inspection is also being conducted on-site. This Site Inspection is part of the MMRP being conducted by USACE, but is considered separate from the OUs. There are three sites being investigated: one near the former Detonation Craters, one near the former NOP Landfill Area, and one near the Potential Landfill Area.

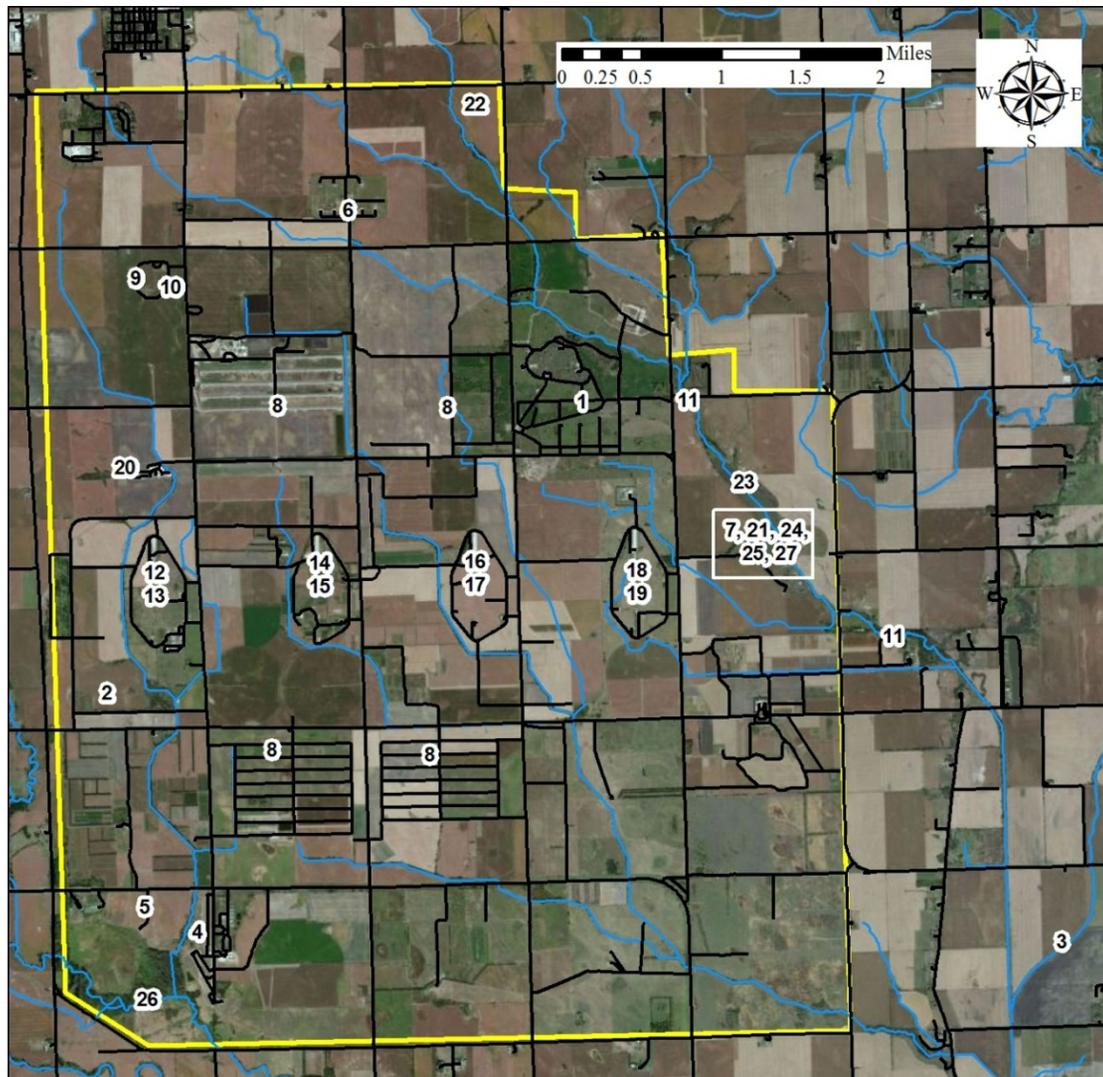
2.6 COMMUNITY PARTICIPATION

USACE has conducted public meetings since 1990 and quarterly Open House presentations since 2008. The purpose of the Open House presentations are to keep the public informed of ongoing investigations and foster communication between USACE, EPA, NDEQ, and the local community.

In addition to the Quarterly Open House presentations, the Army has held a public availability session to discuss the NFA recommendation in the Proposed Plan. The public meeting was held on November 14, 2012, to present the NFA recommendation of the OU3 Proposed Plan. Notices for the public meeting and the public comment period were advertised in the local print media, the *Wahoo Newspaper* and *Ashland Gazette* on October 25, 2012. The public comment period was held from October 25, 2012 to November 24, 2012. A public meeting was held on November 14, 2012, at the Yutan Veterans Country Club, where representatives of USACE presented the Proposed Plan. There were no comments presented by the public at the meeting. Two written comments were received during the comment period and no changes were made to the NFA recommendation.

The Proposed Plan for OU3 was made available to the public on October 25, 2012. A copy of the Administrative Record file, which contains the Proposed Plan and its supporting documentation, is available at the following location:

Mead Public Library
316 South Vine Street
Mead, Nebraska 68041
(402) 624-6605



- Investigation Area:
- 1 Former Atlas Missile Area Potential Waste Area
 - 2 Bermed Area
 - 3 Clear Creek
 - 4 Former Demolition Ground
 - 5 Former Detonation Craters
 - 6 Former Ammonium Nitrate Plant Potential Waste Area
 - 7 Former NOP Landfill Area
 - 8 Former Raw Product Igloo Storage Areas
 - 9 Former Teteryl Pelleting Area
 - 10 Former Potential Waste Area
 - 11 Johnson Creek
 - 12 Former LL1 Bomb Production Building
 - 13 Former LL1 Paint Operations Area
 - 14 Former LL2 Bomb Production Building
 - 15 Former LL2 Paint Operations Area
 - 16 Former LL3 Bomb Production Building
 - 17 Former LL3 Paint Operations Area
 - 18 Former LL4 Bomb Production Building
 - 19 Former LL4 Paint Operations Area
 - 20 Potential Waste Disposal Area
 - 21 Former North Burning Ground
 - 22 Northeast Boundary Area
 - 23 Natural Resources District Reservoir
 - 24 Potential Landfill Area
 - 25 Former Proving Grounds
 - 26 Silver Creek
 - 27 Former South Burning Ground

Figure 2. Locations of OU3 Investigation Areas
 (Note: Locations are approximate)

Table 1. Summary of OU3 Investigation Areas

Investigation Area	Description	PA of Ordnance Contamination# (TCT 1991)	Result of RI Phase I and II (Woodward-Clyde 1997)	Result of RI Phase III (URS 2000a)	Result of Revised BLRA (URS 2000b)	Result of Supplemental RI (GEO 2012)	Result of Supplemental BLRA (GEO 2012)	Remedial Actions/ Removal Actions#
1	Former Atlas Missile Area – Potential Waste Area	--	One isolated detection above SLs, NFA	--	--	--	--	--
2	Bermed Area	--	No compound detected above SLs, NFA	--	--	--	--	--
3	Clear Creek	--	Metals detected above SLs	Metals detected above SLs	HI hazard to Adult and Child Recreational Fisherman	VOCs detected above SLs	Hazard/Risk below an HI of 1 and within 10 ⁻⁶ to 10 ⁻⁴ , NFA	--
4	Former Demolition Ground	No UXO or ordnance debris	No compound detected above SLs, NFA	--	--	--	--	--
5	Former Detonation Craters	No UXO or ordnance debris	One isolated detection above SLs, NFA	--	--	--	--	--
6	Former Ammonium Nitrate Plant – Potential Waste Area	--	No compound detected above SLs, NFA	--	--	--	--	--
7	Former NOP Landfill Area	--	No compound detected above SLs, NFA	--	--	--	--	--
8	Former Raw Products Igloo Storage Areas	--	No compound detected above SLs, NFA	--	--	--	--	--
9	Former Tetryl Pelleting Area	--	Four isolated detections above SLs, NFA	--	--	--	--	--
10	Former Potential Waste Area SE of Bomb Booster Area	--	No compound detected above SLs, NFA	--	--	--	--	--
11	Johnson Creek	--	Metals detected above SLs	Metals detected above SLs	HI hazard to Adult and Child Recreational Fisherman	VOCs detected above SLs	Hazard/Risk below an HI of 1 and within 10 ⁻⁶ to 10 ⁻⁴ , NFA	--
12	Former LL1 Bomb Production Building	Explosives found in surface drainage areas, no UXO located	Metals and explosives detected above SLs	Not sampled	Hazard/Risk below an HI of 1 and within or below 10 ⁻⁶ to 10 ⁻⁴ , NFA	--	--	LL1 explosives contamination addressed in OU1 and OU2 remedial actions
13	Former LL1 Paint Operations Areas		Metals detected above SLs	Not sampled	Hazard below an HI of 1, NFA*	--	--	
14	Former LL2 Bomb Production Building	Explosives found in surface drainage areas, no UXO located	Metals and explosives detected above SLs	Not sampled	Hazard/Risk below an HI of 1 and within or below 10 ⁻⁶ to 10 ⁻⁴ , NFA	--	--	LL2 explosives contamination addressed in OU1 and OU2 remedial actions; OU3 removal action completed for antimony-contaminated soils, NFA
15	Former LL2 Paint Operations Areas		Metals detected above SLs	Not sampled	HI hazard to a resident child	--	--	
16	Former LL3 Bomb Production Building,	Explosives found in surface drainage areas, no UXO located	Metals and explosives detected above SLs	Not sampled	Hazard/Risk below an HI of 1 and within or below 10 ⁻⁶ to 10 ⁻⁴ , NFA	--	--	LL3 explosives contamination addressed in OU1 and OU2 remedial actions
17	Former LL3 Paint Operations Areas		Metals detected above SLs	Not sampled	Hazard below an HI of 1, NFA*	--	--	
18	Former LL4 Bomb Production Building,	No UXO located.	Metals and explosives detected above SLs	Not sampled	Hazard/Risk below an HI of 1 and within or below 10 ⁻⁶ to 10 ⁻⁴ , NFA	--	--	LL4 explosives contamination addressed in OU1 and OU2 remedial actions; OU3 removal action completed for antimony-contaminated soils in Paint Operations Area , NFA
19	Former LL4 Paint Operations Areas		Metals detected above SLs	Not sampled	HI hazard to a resident child*	--	--	
20	Former Potential Waste Disposal Area	--	No compound detected above SLs, NFA	Not sampled	--	--	--	--
21	Former North Burning Ground	Ordnance debris. No explosive components.	Metals detected above SLs	Metals detected above SLs	Hazard/Risk below an HI of 1 and below 10 ⁻⁶ to 10 ⁻⁴ , NFA	Metals detected above SLs	Hazard/Risk below an HI of 1 and within or below 10 ⁻⁶ to 10 ⁻⁴ , NFA	Burn Layer identified in UNL Removal Action, NFA
22	Northeast Boundary Area	--	Not sampled	Metals detected above SLs	Hazard below an HI of 1, NFA*	--	--	--
23	Natural Resources District Reservoir	--	Not sampled	Metals detected above SLs	Hazard/Risk below an HI of 1 and below 10 ⁻⁶ to 10 ⁻⁴ , NFA	--	--	--
24	Potential Landfill Area	--	Anomalies detected	Metals and explosives detected above SLs	HI hazard to a resident child Risk within or below 10 ⁻⁶ to 10 ⁻⁴ .	Metals detected above SLs	Hazard/Risk below an HI of 1 and within or below 10 ⁻⁶ to 10 ⁻⁴ , NFA	Removal action completed for antimony-contaminated soils, NFA
25	Former Proving Grounds	High explosives on surface, no UXO located	Anomalies identified	Metals and explosives detected above SLs	Hazard/Risk below an HI of 1 and below 10 ⁻⁶ to 10 ⁻⁴ , NFA	--	--	Explosives contamination addressed in OU1 remedial action
26	Silver Creek	--	Metals detected above SLs	Metals detected above SLs	Hazard/Risk below an HI of 1 and below 10 ⁻⁶ to 10 ⁻⁴ , NFA	VOCs detected above SLs	Hazard/Risk below an HI of 1 and within or below 10 ⁻⁶ to 10 ⁻⁴ , NFA	--
27	Former South Burning Grounds	Propellant on surface, no UXO located	SVOCs detected above SLs	Not sampled	--	--	--	SVOC detected above SLs removed in OU1 remedial action, NFA.
--	Vapor Intrusion	--	Not sampled	Not sampled	Not sampled	VOCs detected above SLs	Hazard/Risk below an HI of 1 and within 10 ⁻⁶ to 10 ⁻⁴ , NFA	--

*no carcinogens carried forward into risk assessment

#Unless otherwise noted, the entire LL was treated as one investigation area during the PA and any Remedial or Removal Actions.

LL: Load Line; NFA: No Further Action; OU: Operable Unit; PA: Preliminary Assessment; RI: Remedial Investigation; SLs: Screening Levels; SVOC: semi-volatile organic compound; VOC: volatile organic compound; UXO: unexploded ordnance

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2.7 CURRENT AND POTENTIAL FUTURE LAND USE

The majority of the former NOP site is currently owned by UNL-ARDC (approximately 9,536 acres). Approximately 2,176 acres are owned by the U.S. government and used by the Nebraska National Guard, the U.S. Air Force, and the Army Reserves. Privately-owned crop and pasture land makes up the majority of the rest of the area with the Mead Cattle Company occupying approximately 2,240 acres. Most of the adjacent land is used for agriculture, with the exception of the town of Mead. The current use of the site is expected to remain the same over the foreseeable future.

The former North Burning Grounds is currently used by UNL as a wildlife plantings area for tall grasses and weeds. A Permanent Deed Notation established by UNL exists for the North Burning Ground (Figure 2) and Potential Landfill Area that prohibits any land use other than a wildlife habitat (US 2005a). Another Permanent Deed Notation exists for a former UNL solid waste disposal area (US 2005b) located near the former NOP Landfill Area (Figure 2) states “any future use of the site must not disturb the integrity of the containment or monitoring system unless approved by NDEQ” (US 2005b). No other deed restrictions exist for the site.

2.8 SUMMARY OF SITE RISKS

This section summarizes the human health and ecological risk assessments that were performed for OU3.

2.8.1 Summary of Human Health Risks

The BLRA focused on health effects for both children and adults. Conceptual Site Exposure Models (CSMs) are shown in Appendix B. Chemicals of concern carried forward into the BLRAs for each Investigation Area are shown in Table 2. The BLRA calculated a baseline risk which is an estimate of the likelihood of health problems occurring without cleanup. Information on the concentration of compounds found at the site is combined with ways that people might be exposed to the compounds (CSMs located in Appendix B) and used to determine cancer or non-cancer risks. Incremental Lifetime Cancer Risks (ILCRs) represent the additional probability that a person may develop cancer as a result of exposure to chemicals at the site. These risks are reported as numerical probabilities (e.g., a 2×10^{-4} for a 2 in 10,000 increase in the chance of a person getting cancer as a result of chemical exposure). An acceptable risk range for ILCRs is 10^{-4} to 10^{-6} . Non-cancer risks have been addressed by calculating a Hazard Index (HI). An HI of 1 or less indicates that adverse non-cancer health effects are considered extremely unlikely while an HI greater than 1 indicates that adverse health effects may occur. Two BLRAs were conducted for OU3: a Revised BLRA in 2000 and a Supplemental BLRA in 2012.

Surface soil for several Investigation Areas was analyzed in both the Revised BLRA and Supplemental BLRA. Tables 3 and 4 report the ILCRs and HI values for all receptors included for each Investigation Area. The ILCRs for surface soil were within or below the acceptable range of 10^{-4} to 10^{-6} (Table 3). HI values over 1 were found for the Resident Farmer Child in surface soil in the Revised BLRA (Table 4). The affected soils were removed during the 2008 Removal Action (Section 2.3.2).

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Table 2. Chemicals of Concern for Investigation Areas Carried into the Risk Assessment

Investigation Area	Description	Media ^[a]	Revised BLRA Chemicals of Concern (URS 2000b)	Supplemental BLRA Chemicals of Concern (GEO 2012)
3	Clear Creek	Surface Water	Al, Ba, Be, Co, Fe, Pb, Ni, Tl, V, methylene chloride, toluene	Acetone, 2-butanone, TCE, RDX
		Sediment	Ag, 4-Methylphenol, Di-n-butylphthalate, pyrene, acetone, toluene	--
		Fish Tissue	Al, Ba, Be, Co, Fe, Pb, Ni, Tl, V, methylene chloride, toluene	--
11	Johnson Creek	Surface Water	Al, Ba, Be, Co, Fe, Pb, Ni, Tl, V, methylene chloride, toluene	Acetone, chloroform, cis-1,2-dichloroethene, toluene, TCE, 1,3-dinitrobenzene, 2,6-dinitrotoluene, 4-Am-DNT, RDX, HMX
		Sediment	Ag, 4-Methylphenol, Di-n-butylphthalate, pyrene, acetone, toluene	--
		Fish Tissue	Al, Ba, Be, Co, Fe, Pb, Ni, Tl, V, methylene chloride, toluene	--
12	Former LL1 Bomb Production Building	Surface Soil	TNB, TNT, 2-Am-DNT, 4-Am-DNT, RDX, Tetryl, HMX, Al, Sb, As, Ba, Be, Cd, Co, Pb, Ni, V	--
13	Former LL1 Paint Operations Areas	Surface Soil	Sb, Cd, Pb, Ni	--
14	Former LL2 Bomb Production Building	Surface Soil	TNB, TNT, 2-Am-DNT, 4-Am-DNT, RDX, Tetryl, HMX, Sb, As, Ba, Cd, Ni	--
15	Former LL2 Paint Operations Areas	Surface Soil	Sb, As, Cd, Co, Pb, Hg, Ni	--
16	Former LL3 Bomb Production Building	Surface Soil	TNB, TNT, 2-Am-DNT, 4-Am-DNT, RDX, HMX, Sb, Ba, Cd, Pb, Hg, Ni	--
17	Former LL3 Paint Operations Areas	Surface Soil	Sb, Ba, Cd, Co, Pb, Hg, Ni	--
18	Former LL4 Bomb Production Building	Surface Soil	TNT, 2-Am-DNT, 4-Am-DNT, RDX, HMX, Sb, Ba, Cd, Pb, Hg, Ni	--
19	Former LL4 Paint Operations Areas	Surface Soil	Sb, Cd, Pb	--
21	Former North Burning Ground	Surface Soil	--	Sb, As
		Surface + Subsurface Soil	--	Sb, As, Co, Fe
22	Northeast Boundary Area	Surface Soil	Al, Cd, Co, V, 2,6-DNT, benzo(g,h,i)perylene, fluoranthene, pyrene	--
		Surface + Subsurface Soil	Al, Cd, Co, V, 2,6-DNT, benzo(g,h,i)perylene, fluoranthene, pyrene	--
23	Natural Resources District Reservoir	Surface Water	2-Am-DNT, Hg	--
		Sediment	Nitrobenzene, Al, As, Ba, Be, Cd, Ni, Tl	--
		Fish Tissue	2-Am-DNT, Al, Ba, Cd, Cu, Pb, Ni, Se, Ag	--
24	Potential Landfill Area	Surface Soil	TNB, TNT, DNT, 2-Am-DNT, 4-Am-DNT, RDX, Tetryl, HMX, Sb, Cd, Co, Pb, Si, Tl, Benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, chrysene, diethylphthalate, di-n-butylphthalate, phenol, pyrene	Sb, As
		Surface + Subsurface Soil	-same as surface soil-	Sb, As, Co, Fe
25	Former Proving Grounds	Surface Soil	TNT, 2-Am-DNT, 4-Am-DNT, 4-Nitrotoluene, RDX, Tetryl, HMX, Sb, Cd, Pb, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, Di-n-butylphthalate, pyrene, 2-hexanone, acetone, methylene chloride, toluene, TCE	--
		Surface + Subsurface Soil	-same as surface soil-	--
26	Silver Creek	Surface Water	Al, Ba, Be, Co, Fe, Pb, Ni, Tl, V, methylene chloride, toluene	Acetone, 4-Am-DNT
		Sediment	Ag, 4-Methylphenol, Di-n-butylphthalate, pyrene, acetone, toluene	--
		Fish Tissue	Al, Ba, Be, Co, Fe, Pb, Ni, Tl, V, methylene chloride, toluene	--
--	Vapor Intrusion	Ambient Air Indoor Air Subslab Soil Gas	--	TCE

[a] Separate risk assessments were conducted for surface soil including data from 0-0.5 ft bgs, and surface soil including data from 0-2 ft bgs. The risk assessment for surface soil + subsurface soil considered data from all depth intervals.

bgs—below ground surface; ft—feet or foot; TNB—1,3,5-Trinitrobenzene; TNT—2,4,6-Trinitrotoluene; 2-Am-DNT—2-Amino-4,6-dinitrotoluene; 4-Am-DNT—4-Amino-2,6-dinitrotoluene; RDX—hexahydro-1,3,5-trinitro-1,3,5 triazine; DNT—2,4-dinitrotoluene; Tetryl—2,4,6-trinitrophenyl-*n*-methylnitramine; HMX—Octahydro-1,3,5,7-tetranitro-1,3,5,7 tetrazocine; DEHP—bis(2-Ethylhexyl)phthalate; TCE—Trichloroethene; As—Arsenic; Ba—Barium; Be—Beryllium; Cd—Cadmium; Co—Cobalt; Hg—Mercury; Ni—Nickel; V—Vanadium; Sb—Antimony; Cd—Cadmium; Pb—Lead; Fe—Iron; Ag—Silver; Se—Selenium; Cu—Copper ; Tl—Thallium

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Table 3. Incremental Lifetime Cancer Risks Calculated for OU3 Surface Soil

Investigation Area	Description	Result of Revised BLRA (0 to 2 ft bgs) (URS 2000b)						Result of Revised BLRA (0 to 0.5 ft bgs) (URS 2000b)						Result of Supplemental BLRA (0 to 0.5 ft bgs) (GEO 2012)					
		Resident Farmer Adult	Resident Farmer Child	Trespasser Adult	Trespasser Juvenile	On-Site Worker	Construction Worker	Resident Farmer Adult	Resident Farmer Child	Trespasser Adult	Trespasser Juvenile	On-Site Worker	Construction Worker	Resident Adult	Resident Child	Trespasser Adult	Trespasser Juvenile	Maintenance Worker	Construction Worker
12	Former LL1 Bomb Production Building	5.0x10 ⁻⁵	2.4x10 ⁻⁵	2.4x10 ⁻⁶	3.0x10 ⁻⁷	5.9x10 ⁻⁶	NR	1.7x10 ⁻⁵	2.3x10 ⁻⁶	4.9x10 ⁻⁶	6.0x10 ⁻⁹	1.7x10 ⁻⁷	NR	--	--	--	--	--	--
13	Former LL1 Paint Operations Areas	NC	NC	NC	NC	NC	NR	NC	NC	NC	NC	NC	NR	--	--	--	--	--	--
14	Former LL2 Bomb Production Building	4.1x10 ⁻⁵	1.7x10 ⁻⁵	1.3x10 ⁻⁶	1.7x10 ⁻⁷	2.1x10 ⁻⁶	NR	4.7x10 ⁻⁵	1.8x10 ⁻⁵	1.7x10 ⁻⁶	2.2x10 ⁻⁷	4.3x10 ⁻⁶	NR	--	--	--	--	--	--
15	Former LL2 Paint Operations Areas	2.9x10 ⁻⁵	1.8x10 ⁻⁵	2.0x10 ⁻⁶	2.6x10 ⁻⁷	4.9x10 ⁻⁶	NR	2.9x10 ⁻⁵	1.8x10 ⁻⁵	2.0x10 ⁻⁶	2.6x10 ⁻⁷	4.9x10 ⁻⁶	NR	--	--	--	--	--	--
16	Former LL3 Bomb Production Building	4.7x10 ⁻⁵	1.8x10 ⁻⁵	1.7x10 ⁻⁶	2.2x10 ⁻⁷	4.3x10 ⁻⁶	NR	2.2x10 ⁻⁵	2.9x10 ⁻⁶	5.1x10 ⁻⁸	9.2x10 ⁻⁹	1.7x10 ⁻⁷	NR	--	--	--	--	--	--
17	Former LL3 Paint Operations Areas	NC	NC	NC	NC	NC	NR	NC	NC	NC	NC	NC	NR	--	--	--	--	--	--
18	Former LL4 Bomb Production Building	4.4x10 ⁻⁵	1.9x10 ⁻⁵	1.8x10 ⁻⁶	2.3x10 ⁻⁷	4.5x10 ⁻⁶	NR	4.4x10 ⁻⁵	1.8x10 ⁻⁵	1.7x10 ⁻⁶	2.2x10 ⁻⁷	4.3x10 ⁻⁶	NR	--	--	--	--	--	--
19	Former LL4 Paint Operations Areas	NC	NC	NC	NC	NC	NR	NC	NC	NC	NC	NC	NR	--	--	--	--	--	--
21	Former North Burning Ground*	--	--	--	--	--	--	--	--	--	--	--	--	NR	NR	1x10 ⁻⁶	3x10 ⁻⁶	4x10 ⁻⁶	3x10 ⁻⁷
22	Northeast Boundary Area	NC	NC	NC	NC	NR	NC	NC	NC	NC	NC	NR	NC	--	--	--	--	--	--
24	Potential Landfill Area*	2.8x10 ⁻⁵	3.9x10 ⁻⁶	1.2x10 ⁻⁷	1.5x10 ⁻⁸	NR	See Table 5	4.6x10 ⁻⁶	6.3x10 ⁻⁷	4.7x10 ⁻⁸	5.7x10 ⁻⁹	NR	See Table 5	NR	NR	1x10 ⁻⁶	3x10 ⁻⁶	4x10 ⁻⁶	3x10 ⁻⁷
25	Former Proving Grounds	3.4x10 ⁻⁶	4.4x10 ⁻⁷	7.2x10 ⁻⁹	8.7x10 ⁻¹⁰	NR	See Table 5	1.4x10 ⁻⁶	1.8x10 ⁻⁷	3.7x10 ⁻⁹	4.5x10 ⁻¹⁰	NR	See Table 5	--	--	--	--	--	--

bgs: below ground surface, BLRA: Baseline Risk Assessment, ILCR: Incremental Lifetime Cancer Risk, LL: Load Line; NC: No carcinogens carried forward into the risk assessment, NR: Not a receptor for location/media shown.

*The Former North Burning Ground and Potential Landfill area were analyzed together in the Supplemental BLRA.

Table 4. Hazard Index Values Calculated for OU3 Surface Soil

Investigation Area	Description	Result of Revised BLRA (0 to 2 ft bgs) (URS 2000b)						Result of Revised BLRA (0 to 0.5 ft bgs) (URS 2000b)						Result of Supplemental BLRA (0 to 0.5 ft bgs) (GEO 2012)					
		Resident Farmer Adult	Resident Farmer Child	Trespasser Adult	Trespasser Juvenile	On-Site Worker	Construction Worker	Resident Farmer Adult	Resident Farmer Child	Trespasser Adult	Trespasser Juvenile	On-Site Worker	Construction Worker	Resident Adult	Resident Child	Trespasser Adult	Trespasser Juvenile	Maintenance Worker	Construction Worker
12	Former LL1 Bomb Production Building	0.130	0.500	0.006	0.010	0.052	NR	0.130	0.500	0.006	0.010	0.052	NR	--	--	--	--	--	--
13	Former LL1 Paint Operations Areas	0.023	0.170	0.002	0.003	0.011	NR	0.100	0.790	0.007	0.013	0.051	NR	--	--	--	--	--	--
14	Former LL2 Bomb Production Building	0.130	0.650	0.004	0.008	0.025	NR	0.190	0.880	0.009	0.015	0.070	NR	--	--	--	--	--	--
15	Former LL2 Paint Operations Areas	0.140	0.840	0.008	0.014	0.055	NR	0.270	2.000†	0.018	0.033	0.130	NR	--	--	--	--	--	--
16	Former LL3 Bomb Production Building	0.190	0.880	0.009	0.015	0.010	NR	0.100	0.290	0.003	0.004	0.048	NR	--	--	--	--	--	--
17	Former LL3 Paint Operations Areas	0.054	0.390	0.004	0.007	0.027	NR	0.099	0.730	0.007	0.012	0.048	NR	--	--	--	--	--	--
18	Former LL4 Bomb Production Building	0.130	0.580	0.005	0.009	0.036	NR	0.130	0.580	0.005	0.009	0.036	NR	--	--	--	--	--	--
19	Former LL4 Paint Operations Areas	0.087	0.650	0.006	0.010	0.040	NR	0.560	4.200†	0.039	0.070	0.270	NR	--	--	--	--	--	--
21	Former North Burning Ground*	--	--	--	--	--	--	--	--	--	--	--	--	NR	NR	0.01	0.02	0.05	0.2
22	Northeast Boundary Area	0.066	0.490	0.005	0.008	NR	See Table 5	0.003	0.021	0.0002	0.0004	NR	See Table 5	--	--	--	--	--	--
24	Potential Landfill Area*	0.400	2.400†	0.022	0.039	NR	See Table 5	0.087	0.470	0.004	0.008	NR	See Table 5	NR	NR	0.01	0.02	0.05	0.2
25	Former Proving Grounds	0.035	0.190	0.002	0.003	NR	See Table 5	0.014	0.079	0.001	0.001	NR	See Table 5	--	--	--	--	--	--

-- Not included in BLRA, †HI value greater than 1 that was remediated during the Non-Time Critical Removal Action, bgs: below ground surface, BLRA: Baseline Risk Assessment, HI: Hazard Index, LL: Load Line; NC: No carcinogens carried forward into the risk assessment, NR: Not a receptor for location/media shown.

*The Former North Burning Ground and Potential Landfill area were analyzed together in the Supplemental BLRA.

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A combination of surface and subsurface soils for several Investigation Areas were analyzed in both the Revised BLRA and Supplemental BLRA for a construction worker receptor. Table 5 reports both the ILCRs and HI values for surface + subsurface soils. The ILCRs were within or below the acceptable range of 10^{-4} to 10^{-6} and the HI values were below 1.

Table 5. Incremental Lifetime Cancer Risks and Hazard Indexes Calculated for OU3 Surface and Subsurface Soils

Investigation Area	Description	ILCR from Revised BLRA (URS 2000b)	ILCR from Supplemental BLRA (GEO 2012)	HI from Revised BLRA (URS 2000b)	HI from Supplemental BLRA (GEO 2012)
		Construction Worker			
21	Former North Burning Ground*	--	2×10^{-7}	--	0.03
22	Northeast Boundary Area	NC	--	0.16	--
24	Potential Landfill Area*	2.6×10^{-8}	2×10^{-7}	0.46	0.03
25	Former Proving Grounds	1.0×10^{-9}	--	0.001	--

BLRA: Baseline Risk Assessment, ILCR: Incremental Lifetime Cancer Risks, HI: Hazard Index, NC: no carcinogens carried forward into the BLRA

*The Former North Burning Ground and Potential Landfill area were analyzed together in the Supplemental BLRA.

Risk assessment results for surface water Investigation Areas are shown in Tables 6 and 7. The ILCRs for surface water are within or below the acceptable range of 10^{-4} to 10^{-6} (Table 6). HI values were above 1 when analyzed in the Revised BLRA; however, when Johnson Creek and Clear Creek were reanalyzed in the Supplemental BLRA with data collected since 2000, the HI values were below 1 (Table 7). The Natural Resources District (NRD) Reservoir indicated hazards in excess of an HI of 1 for the child recreational fisherman receptor (HI of 1.2). This HI was due primarily to ingestion of fish (HI of 0.36) and the majority of the ingestion risk was due to selenium (HI of 0.2). This HI value reported was the sum of the HIs for all chemicals without regard for the target organs. When the chemicals of concern were re-evaluated by target organ, the recalculated HIs are all below 1 for each target organ.

Table 6. Incremental Lifetime Cancers Risks for OU3 Surface Water

Investigation Area	Description	Result of Revised BLRA (URS 2000b)		Result of Supplemental BLRA (GEO 2012)	
		Adult Recreational Fisherman	Child Recreational Fisherman	Adult Recreational Fisherman	Child Recreational Fisherman
3	Clear Creek*	7.0×10^{-5}	1.5×10^{-5}	2×10^{-7}	5×10^{-8}
11	Johnson Creek*			2×10^{-6}	5×10^{-7}
23	Natural Resources District Reservoir	NC	NC	--	--
26	Silver Creek	1.8×10^{-5}	4.0×10^{-6}	NC	NC

BLRA: Baseline Risk Assessment, NC: no carcinogens carried forward into the BLRA

*Clear Creek and Johnson Creek were analyzed together during the Revised BLRA.

Table 7. Hazard Index Values Calculated for OU3 Surface Water

Investigation Area	Description	Result of Revised BLRA (URS 2000b)		Result of Supplemental BLRA (GEO 2012)	
		Adult Recreational Fisherman	Child Recreational Fisherman	Adult Recreational Fisherman	Child Recreational Fisherman
3	Clear Creek*	2.00 [^]	4.00 [^]	0.006	0.02
11	Johnson Creek*			0.07	0.2
23	Natural Resources District Reservoir	0.40	1.20 [‡]	--	--
26	Silver Creek	0.08	0.20	0.0006	0.002

BLRA: Baseline Risk Assessment, NC: no carcinogens carried forward into the BLRA

*Clear Creek and Johnson Creek were analyzed together during the Revised BLRA.

[^]HI value greater than 1 that was reanalyzed in 2012 and found to be below 1.

[‡]HI value greater than 1 that is below 1 when reanalyzed by target organ.

Two buildings were carried forward into the Supplemental BLRA for Vapor Intrusion. Receptors were analyzed for inhalation exposure from trichloroethene (TCE) detected in indoor air samples. The ICLR values were within or below the acceptable range of 10^{-4} to 10^{-6} (Table 8). The HI values did not exceed 1 for either building (Table 9).

Table 8. Incremental Lifetime Cancer Risk Calculated for OU3 Vapor Intrusion

Investigation Area	Description	Result of Supplemental BLRA (GEO 2012)			
		Residential Adult	Residential Child	Industrial Worker (8 hrs/day)	Industrial Worker (1 hrs/day)
--	Unit 001 (Residential)	3×10^{-6}	5×10^{-7}	--	--
--	Unit 006 (Industrial)	--	--	3×10^{-6}	4×10^{-7}

BLRA: Baseline Risk Assessment, hrs: hours

Table 9. Hazard Index Values Calculated for OU3 Vapor Intrusion

Investigation Area	Description	Result of Supplemental BLRA (GEO 2012)			
		Residential Adult	Residential Child	Industrial Worker (8 hrs/day)	Industrial Worker (1 hrs/day)
--	Unit 001 (Residential)	0.3	0.3	--	--
--	Unit 006 (Industrial)	--	--	1	0.1

BLRA: Baseline Risk Assessment, hrs: hours

2.8.2 Summary of Ecological Risks

An ecological risk assessment was performed as part of the 2000 BLRA. A qualitative assessment was conducted for three reaches of Johnson Creek (including the NRD Reservoir), one reach of Clear Creek, and two reaches of Silver Creek for suitability as a habitat for the plains minnow (a species of concern). The habitat assessment determined that habitat conditions did not favor the plains top minnow.

Five receptors were selected for the ecological risk assessment:

- Benthic macroinvertebrate communities
- Benthivorous Fish (bullhead and common carp)
- Mallard duck (waterfowl)
- Great Blue Heron (wading birds)
- Raccoon (omnivorous mammal)

Surface water, sediment, and fish tissue were collected and analyzed. The chemicals considered were explosives, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals. Data were screened against appropriate screening levels to determine contaminants of potential ecological concern (COPECs).

No surface water chemicals were retained as COPECs. No COPECs were retained for the NRD Reservoir. Silver was retained as a COPEC for sediment in Johnson/Clear Creek. Silver, selenium, and p-Cresol were retained for sediment in Silver Creek (Table 10). The ecological assessment used both the qualitative weight-of-evidence approach and the semi-quantitative ecotoxicity quotient approach and found that the COPECs presented negligible risk to aquatic and terrestrial receptors on-site (Table 11).

Table 10. Contaminants of Concern for Investigation Areas in the Ecological Risk Assessment

Investigation Area	Description	Media	Revised BLRA Chemicals of Concern (URS 2000b)
3/11*	Clear Creek/ Johnson Creek*	Sediment	Silver
26	Silver Creek	Sediment	Silver, selenium, p-Cresol

*Clear Creek and Johnson Creek were analyzed together during the Revised BLRA.
BLRA: Baseline Risk Assessment

Table 11. Ecotoxicity Quotients Calculated for OU3 Surface Water

Investigation Area	Description	Result of Revised BLRA (URS 2000b)		
		Mallard Duck	Great Blue Heron	Raccoons
3/11*	Clear Creek/Johnson Creek*	0.0008	0.0047	0.0008
26	Silver Creek	0.1052	0.5779	0.2084

Note: An Ecotoxicity Quotient of 1 or less is considered unlikely to pose any risk.

BLRA: Baseline Risk Assessment

*Clear Creek and Johnson Creek were analyzed together during the Revised BLRA.

2.9 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for OU3 was released for public comment on October 15, 2012. The Proposed Plan identified NFA as the recommendation for OU3. No verbal public comments were received, including, during the public meeting. Two written public comments were received as shown in Section 3.1. No changes to the proposed recommendation are necessary.

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3.0 RESPONSIVENESS SUMMARY

This section provides a summary of the public comments regarding the Proposed Plan for OU3 and the USACE response to comments. At the time of the public review period, USACE had selected NFA as the recommended action for the site.

3.1 STAKEHOLDER COMMENTS AND LEAD AGENCY RESPONSES

Two written comments were received during the public comment period from Jenner & Block, LLP on behalf of The Dow Chemical Company and General Dynamics Corporation.

Comment 1 – Load Lines 1-4

“The Proposed Plan for OU3 recommends NFA for the bomb production buildings and paint operation areas at each of the four load lines at NOP. However, the OU3 RI testing at these specific locations was limited to explosives and metals in soil (surface and subsurface). The OU-3 RI report repeatedly referenced the fact that VOC-contaminated groundwater and soils were being investigated and addressed as part of OU2. *See e.g.*, Remedial Investigation Report, Operable Unit No. 3, at 0-3. In fact, however, characterization of the nature and extent of VOCs in soil and groundwater at each of the four load lines remains incomplete many years after the Record of Decision for OU2 was issued.

The focus of the OU1 RI was on explosives and therefore little effort was made to evaluate whether VOCs were present at the load lines. Only 19 of the over 2,000 soil samples collected as part of the OU1 RI were evaluated for VOC contamination. *See e.g.*, Supplemental Remedial Investigation Report, at page 2 of the Executive Summary. Of these 19 VOC samples, none were collected from the bomb production areas in any of the load lines. The northern section of Load Line 1 (north of the bomb production area) was the only load line where the soil samples were analyzed for VOCs during the OU-1 RI¹. *See* Remedial Investigation Report, Operable Unit 1, Figure 52. The focus of the OU-2 investigation was on contaminated groundwater and explosive- and VOC contaminated soils that were not addressed as part of the OU-1 investigation and remediation. *See* Record of Decision, OU2, at Section 1.0. With respect to VOC soil contamination, the same assumptions that narrowed the focus of the OU-1 sampling activities were carried forward into the OU2 remedial investigation².

In reliance on the results of the 1990 soil gas survey conducted by Law Environmental (which itself was limited in nature), the OU2 VOC RI focused on the northern section of Load Line 1 (north of the bomb production area)³. *See* Remedial Investigation Report, Operable Unit No. 2, at 1-11. The OU2 RI obtained substantial additional soil gas and soil data from these locations. In fact, more than 200 soil gas samples were collected and soil samples were obtained from approximately 20 locations on the northern section of Load Line 1. *Id.* at 2-18—2-19. Of these 200-plus samples, only one soil gas/soil boring data point was obtained south of the amatol screening and melting operations at Load Line 1; TCE was identified in soil gas at this location.

¹ The expressed rationale for focusing the soil investigation on the northern part of Load Line 1 was the 1990 Law Environmental Soil Gas Survey.

² The OU2 RI repeatedly focused on potential TCE releases from the Atlas missile operations while ignoring potential releases attributable to ordnance operations.

³ The 1990 soil gas survey and the 1989 Confirmation Study did not identify significant quantities of VOCs at Load Lines 2, 3 or 4; therefore, the OU2 RI made little no effort to obtain VOC soil samples from these locations.

Notwithstanding the detection of TCE at this location, the OU2 RI made no additional effort to investigate VOC-contamination in soils in the drainage ditches or in the vicinity of the amatol screening/melting operations at Load Line 1. In addition, the OU2 RI made no effort to obtain soil gas or soil samples at Load Lines 2-4.

Of course, recent monitoring well data have identified TCE groundwater plumes at Load Lines 2 and 3. The Final Aquifer Characterization Report OU2 (March 2011) shows elevated concentrations of TCE in the shallow and intermediate zones downgradient of the bomb production areas at Load Lines 1,3 and 4. Elevated TCE contaminated groundwater was also found at EW-11. *Id.* Even after the unexpected discovery of elevated concentrations of TCE in groundwater in the vicinity of EW-11, although a supplemental groundwater investigation was conducted at Load Line 1, no effort was made to obtain soil gas or soil data in order to identify a source of the elevated groundwater contamination identified at EW-11. *See* Supplemental OU2 Groundwater Investigation Report. Moreover, no effort has ever been made to identify the source of the TCE contamination at Load Lines 2 and 3 (or the more recent discovery of TCE in shallow and intermediate groundwater at Load Line 4). The detection of TCE in groundwater downgradient of each of the bomb production areas strongly suggests an association with bomb production operations and the release of TCE to the subsurface. It is known that the bomb production areas contained waste drainage infrastructure (including drainage ditches, troughs and sumps) to discharge wastes away from various production buildings at each load line; these areas may therefore be source areas for TCE contamination. In light of the limited nature of the soil and groundwater TCE investigation in these areas as part of the OU1 and OU2 investigations and the absence of any TCE investigation of these areas as part of the OU3 investigation, there is insufficient data to conclude that there is not TCE in surface and subsurface soil at concentrations that pose a significant risk to human health and the environment at these load lines.

In summary, based on the current TCE groundwater data for the site, there is a strong probability that TCE remains in soils at each of the bomb production areas. There is evidence that TCE was used in conjunction with the ordnance activities during World War II and the Korean Conflict. TCE should have been one of the contaminants of concern that were tested and investigated in the bomb production areas, especially in the amatol melt and screening areas and bomb wash pits. The potential risk to human health and environment from TCE in soil at former waste disposal areas at the bomb production areas and the impact to soil gas is still not known nor has an adequate investigation been conducted to identify all sources of the TCE groundwater plumes at each of the four load lines. Therefore, the NFA recommendation as stated in the Proposed Plan is premature until, at a minimum, this potential risk of TCE in the bomb production areas is fully evaluated.”

Response

Soil contaminated with VOCs and explosive compounds would be addressed in OU2 and are not included in OU3.

Comment 2 – Waste Disposal Locations to the East of Load Line 4

“The Proposed Plan for OU3 recommends NFA for the following locations that were included within the scope of OU3:

- a) North Burning Ground;
- b) South Burning Ground;
- c) Proving Grounds;
- d) Potential Landfill Area; and
- e) NOP Landfill Area.

The investigation conducted at each of these locations was flawed in that it failed to adequately and fully investigate the nature, delineate the extent, and identify the source of TCE contamination at these locations. As such, the proposed NFA recommendation for each of these locations is inappropriate at this time.

The OU1 investigation of these locations was limited to the North and South Burning Grounds and the Proving Ground. As part of the OU-1 Supplemental Remedial Investigation, only six soil sediment samples and five soil samples were collected in these areas. TCE was identified in certain of these samples. However, no further TCE evaluation of these locations was conducted as part of the OU1 RI.

As part of the OU2 investigation, five groundwater well clusters were installed in the Burning and Proving Ground general areas. *See* Remedial Investigation Report, Operable Unit No. 2, Drawing 2-3. TCE was identified in several of these monitoring well clusters. *Id.* at 4-14. However, no soil gas and/or soil borings were obtained at these locations as part of the OU2 investigation.

The RI for OU2 stated that "it cannot be concluded that the landfill is a source of contamination to groundwater [explosives or VOCs] because the contamination quantified in the Landfill Area wells is not discernable from the regional contamination associated with Load Lines 1, 2, 3, and 4, the Atlas Missile Area, and the North Burning Grounds." *Id.* at 6-8. The OU2 RI therefore stated that the TCE contamination in these areas would be included as part of the discussion of the TCE plume originating from the Atlas Missile Area ("AMA"). Of course, the more recent groundwater data clearly evidences a separate TCE plume emanating from these locations.

As part of the OU3 RI, VOC soil samples were collected at these various locations:

- North Burning Ground (12 shallow soil samples; two deep soil samples);
- Proving Ground (10 shallow soil samples; four deep soil samples);
- South Burning Ground (17 shallow soil samples);
- Potential Landfill Area (14 shallow soil samples; 10 deep soil samples);
- Former NOP Landfill Area (no soil samples collected).

TCE was detected in soil at these locations, although not at levels that exceeded the screening level for TCE (7,100 ppb). Since one would expect TCE in shallow soils to volatilize over time, the absence of TCE above the screening level in these shallow soil samples many decades after ordnance activities ceased cannot be relied upon to conclude that there is no source of TCE at these locations. In addition, although there were a limited number of deeper soil samples collected, none of those deeper soil samples were collected from locations that coincide with the current known locations of the TCE plume. Because there were so few samples taken in these areas, there is a high probability that the TCE that was identified in soil was at the edge of contaminated areas that have not been adequately investigated.

Groundwater samples collected as part of the OU3 RI at these locations contained TCE, providing further corroboration of the existence of a TCE source in these areas. However, rather than attempting to identify the source (historical and/or continuing) of the TCE contamination in groundwater, the OU3 RI continued to attribute the TCE groundwater contamination in these areas to historical releases from the AMA. *Id.* at 6-6.

The more recent RI conducted by the University of Nebraska for OU5 did evaluate TCE contamination in soils and groundwater in these areas. More specifically, the OU5 RI focused on an Agricultural Research and Development Center ("ARDC") landfill (which is located in close

proximity to the Former NOP Landfill Area) and several burial sites located to the east of Load Line 4. *See* Remedial Investigation/Feasibility Report for Operable Unit 5, Figure 1.2. The OU5 RI concluded that groundwater beneath and to the east of the ARDC landfill and burial sites were impacted by TCE plumes originating from locations to the east and upgradient of these locations⁴. *Id.* at 4-12. However, the OU5 RI made no effort to identify the source of these TCE plumes nor was any effort made to evaluate whether TCE in surface soils, subsurface soils, surface water, and/or soil gas at the Burning and Proving Grounds pose a significant risk to human health and the environment.

There is evidence that TCE was used in the course of ordnance production during World War II and the Korean Conflict. Drainage ditch sludges, wastes and other material from the bomb production areas were transported to these disposal locations to the east of Load Line 4. Yet a full characterization to understand the nature and extent of contamination in these areas has not been performed. The soil that is left in place at these locations could still contain TCE at the ground surface and below the ground surface at concentrations that are a significant risk to human health and the environment and/or pose a continuing threat to groundwater. As such, the proposed NFA recommendations for each of the following locations are inappropriate at this point in time:

- a) North Burning Ground;
- b) South Burning Ground;
- c) Proving Grounds;
- d) Potential Landfill Area; and
- e) NOP Landfill Area.”

Response

Soil contaminated with VOCs and explosive compounds would be addressed in OU2 and are not included in OU3.

3.2 TECHNICAL AND LEGAL ISSUES

No technical or legal issues were identified during the public review period of the Proposed Plan.

⁴ The OU-3 RI states that the Former NOP Landfill Area was addressed as part of the OU-1 Engineering Evaluation/Cost Analysis ("EE/CA") which recommended no further intrusive investigation of the landfill. The OU-3 RI ignores, however, that the OU-1 EE/CA was focused on explosives and mustard gas and not on VOCs at this location.

4.0 REFERENCES AND KEY DOCUMENTS

- ECC (Environmental Chemical Corporation) 2009. Draft *Final. Site-Wide Work Plan. Support Services*. Former Nebraska Ordnance Plant, Mead, Nebraska.
- GEO (GEO Consultants, LLC) 2012. *Supplemental Remedial Investigation, Operable Unit-3, Former Nebraska Ordnance Plant, Mead, Nebraska*.
- High Plains Regional Climate Center (HPRCC) 2012. Mead 4 SSE, Nebraska (255362) Historical Climate Data Summaries. Accessed online November 2012 at:
<http://www.hprcc.unl.edu/data/historical/>
- Kingston (Kingston Environmental Services, Inc.) 2008. *Final. Removal Action Report. Non-Time Critical Removal Action for Operable Unit (OU) #3*. Former Nebraska Ordnance Plant, Mead, Nebraska.
- TCT (Twin City Testing Corporation) 1991. *Final Engineering Report. Preliminary Assessment of Ordnance Contamination at the Former Nebraska Ordnance Plant, Mead, Nebraska*.
- URS 2000a. *Remedial Investigation Addendum Report. Operable Unit No. 3. Former Nebraska Ordnance Plant. Mead, Nebraska*.
- URS 2000b. *OU3 Draft Final Revised Baseline Risk Assessment, Former Nebraska Ordnance Plant, Mead, Nebraska*. (Including Replacement Pages dated Dec 2000), URS Greiner Woodward-Clyde Federal Services.
- URS 2000c. *Feasibility Study Report, Operable Unit No. 3, Former Nebraska Ordnance Plant, Mead, Nebraska*.
- URS 2007. *Feasibility Study Report with Engineering Evaluation and Cost Analysis Addendum. For Non-Time Critical Removal Action. Operable Unit No 3, Former Nebraska Ordnance Plant, Mead, Nebraska*.
- URS 2008. *Draft Final. 2007 Contaminant Evaluation. Operable Unit No. 2. (Groundwater)*. Former Nebraska Ordnance Plant, Mead, Nebraska.
- US 2005a. Permanent Deed Notation: Mead, North Proving Grounds.
- US 2005b. Permanent Deed Notation: Former UNL Solid Waste Disposal Area.
- USGS (U.S. Geologic Survey) 1981. *Mead Quadrangle Topographic Map*.
- Woodward-Clyde 1997. *Remedial Investigation Report. Operable Unit 3. Former Nebraska Ordnance Plant, Mead, Nebraska*.

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5.0 GLOSSARY OF TERMS

This glossary defines the technical terms used in this Record of Decision. These terms and abbreviations contained in this glossary are often defined in the context of hazardous waste management, and apply specifically to work performed under the Superfund program. Therefore, these terms may have other meanings when used in a different context.

Administrative Record: The body of documents that forms the basis for selection of a particular response at a site.

Baseline Risk Assessment (BLRA): A study of the actual or potential danger to human health or the environment from hazardous substances at a specific site. The study includes a human health and an ecological risk component. The BLRA estimates risks at the site as it currently exists, with no remedial action taken.

Contaminants of Potential Ecological Concern (COPECs): A subset of all the chemicals detected at the site that represent those contaminants posing the greatest potential risk to the environment at the site due to their inherent toxicity or prevalence at the site.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): CERCLA is also referred to as “Superfund.” A federal law that addresses the release and remediation of hazardous substances, pollutants, and contaminants into the environment. It provides for a structured remedial system, makes any entity that had a role in the contamination liable for the cleanup, arranges for the funding of abandoned sites, and authorizes the National Contingency Plan (NCP).

Ecological Risk Assessment: The portion of a BLRA that addresses risks to ecological receptors.

Engineering Evaluation/Cost Analysis (EE/CA): A document used to identify the objectives of the removal action and analyze the effectiveness, implementability, and cost of various alternatives, it also documents the recommended action and describe reasons for the recommendation. The NCP requires an EE/CA for all non-time critical removal actions.

Feasibility Study (FS): A comprehensive evaluation of potential alternatives for remediating contamination. The FS identifies general response actions, screens potentially applicable technologies and process options, assembles alternatives, and evaluates detailed alternatives.

Groundwater: Water found beneath the ground surface that fills pores between materials such as sand, silt, gravel, or rock which is often used as a source of drinking water via municipal or domestic wells.

Hazard Index (HI): A numerical representation of the health hazard, unrelated to cancer, posed by contaminants through one or more exposure pathways. An HI value of 1 is similar in concept to a “threshold value” for non-cancer toxicity. An HI value less than one indicates the lack of any non-cancer hazard, while a value greater than 1 indicates a potential health concern.

Ingestion: To come into contact with a contaminant by means of eating or drinking contaminated soils or water.

Inhalation: To come into contact with a contaminant by means of breathing in contaminated air or vapor.

Incremental Lifetime Cancer Risk (ILCR): Incremental probability of an individual developing cancer as a result of potential carcinogen exposure averaged over a lifetime.

Interagency Agreement (IAG): A written agreement between EPA and another federal agency carrying out site cleanup activities (e.g., the Department of Defense), that sets forth the roles and responsibilities of the agencies for performing and overseeing the activities. States are often parties to IAGs.

Landfill: A disposal facility where waste is placed in or on land.

Metals: Chemical elements such as iron and aluminum generally characterized by ductility, malleability, luster, and conductivity of heat and electricity. Metals naturally exist in soils.

National Oil and Hazardous Substance Pollution Contingency Plan (NCP): The federal regulations specifying the methods and criteria for cleaning up Superfund sites.

National Priorities List (NPL): EPA's list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide EPA in determining which sites warrant further investigation.

Operable Unit (OU): A term which refers to a portion of a Superfund site where action is undertaken in incremental steps to remedy risks to human health or the environment.

Ordnance: Military supplies, including weapons, ammunition, combat vehicles, maintenance tools, and equipment. The ordnance assembled at the site were explosive devices such as bombs.

Record of Decision (ROD): The decision document in which USACE or EPA selects a remedy for a Superfund site.

Remedial: An adjective describing the course of study combined with actions to correct site contamination problems through identifying the nature and extent of cleanup strategies under the Superfund program.

Remedial Investigation (RI): The first part of a two-part study which determines how much and what kind of contamination exists at a site. A RI generally involves collecting and analyzing samples of groundwater, surface water, soil, sediment, and air. The second part of the study is a FS (see above).

Responsiveness Summary: A portion of the ROD in which public comments are summarized and responses to comments are made. The responsiveness summary addresses public comments on the Proposed Plan and other documents.

Semi-volatile Organic Compounds: A group of organic compounds that have a tendency to change from liquids to gases as relatively low temperatures, higher than ambient temperatures.

Soil Gas: Gas occurring in the unsaturated soil pore spaces.

Superfund: The common name given to CERCLA (see above).

Surface Soil: Soil samples taken from the top 0.5 feet of soil from the ground surface.

Trichloroethene (TCE): A stable, colorless liquid with a low boiling point. TCE has many industrial applications, including use as a solvent and as a metal degreasing agent. TCE may be toxic to humans when inhaled, ingested or through skin contact and can damage vital organs, especially the liver [see also Volatile Organic Compounds].

Vapor Intrusion: The migration of volatile chemicals from contaminated groundwater or soil into an overlying building.

Volatile Organic Compounds (VOCs): A group of organic compounds that have a tendency to change from liquids to gases at ambient temperatures and pressures.

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APPENDIX A

STATE OF NEBRASKA CONCURRENCE LETTER

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Dave Heineman
Governor

APR 03 2013

STATE OF NEBRASKA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Michael J. Linder
Director

Suite 400, The Atrium
1200 'N' Street
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Kristine Stein
U.S. Army Corps of Engineers – Kansas City District
635 Federal Building
601 E. 12th Street
Kansas City, MO 64106

RE: Former Nebraska Ordnance Plant
NDEQ ID: 67479
Program ID: SF OU3
Subject: Concurrence of Record of Decision

Dear Ms. Stein:

The Nebraska Department of Environmental Quality (NDEQ) has completed its review of the Draft Final Record of Decision (ROD) for Operable Unit 3 (OU3) at the former Nebraska Ordnance Plant, Mead, Nebraska. Following environmental investigations at 27 areas within OU3, removal activities were conducted as needed to reduce human health and ecological risks to within acceptable levels. A vapor intrusion risk assessment was also conducted. The ROD finds that no additional remedial actions are necessary to ensure protection of human health and the environment for OU3. Therefore, the final remedy for OU3 is No Further Action.

The NDEQ concurs with the selected remedy of this Draft Final Record of Decision. If you have any questions regarding this matter, please contact Stacey Stricker at (402) 471-2326.

Sincerely,

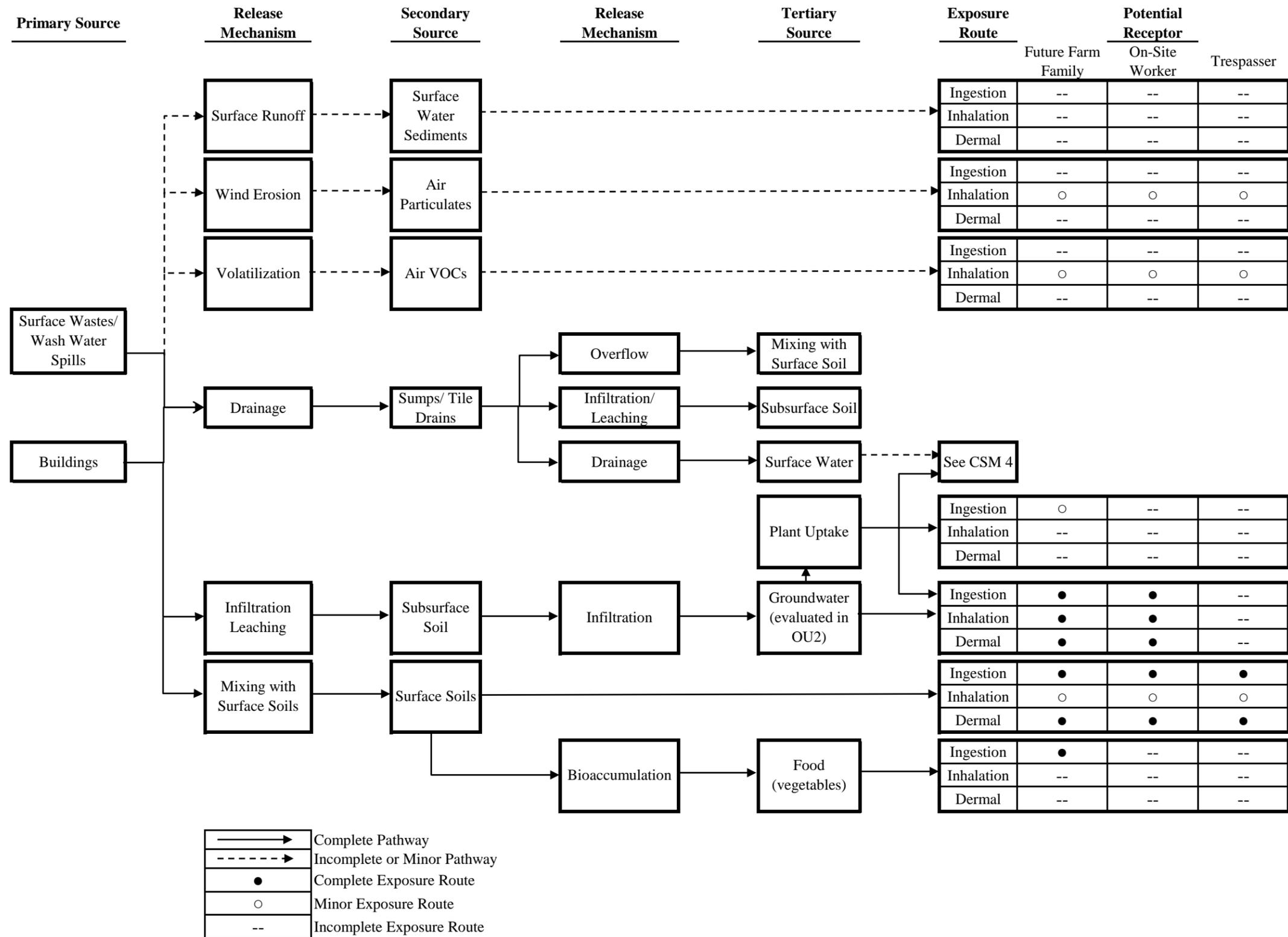
Michael J. Linder
Director

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APPENDIX B

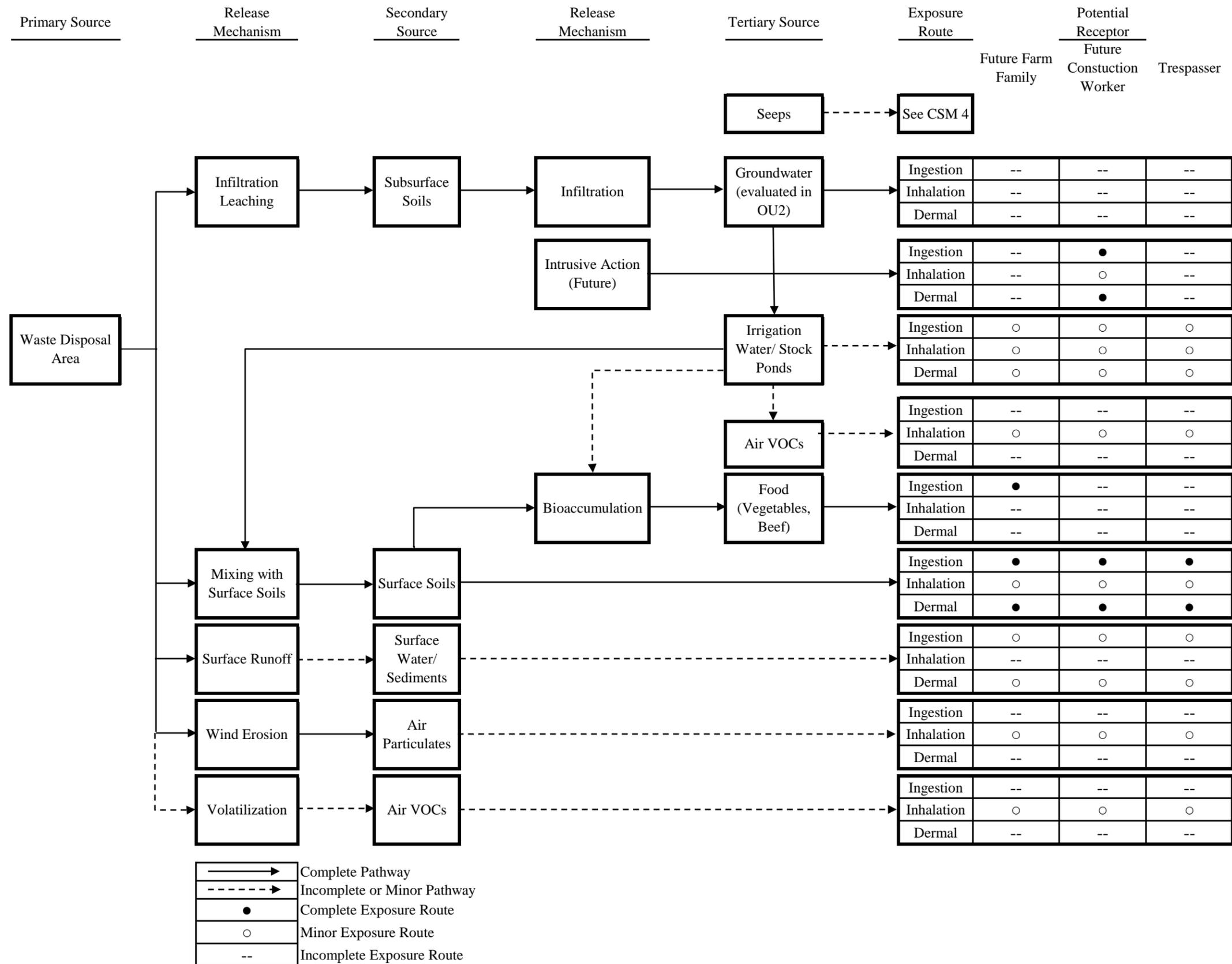
CONCEPTUAL SITE EXPOSURE MODELS

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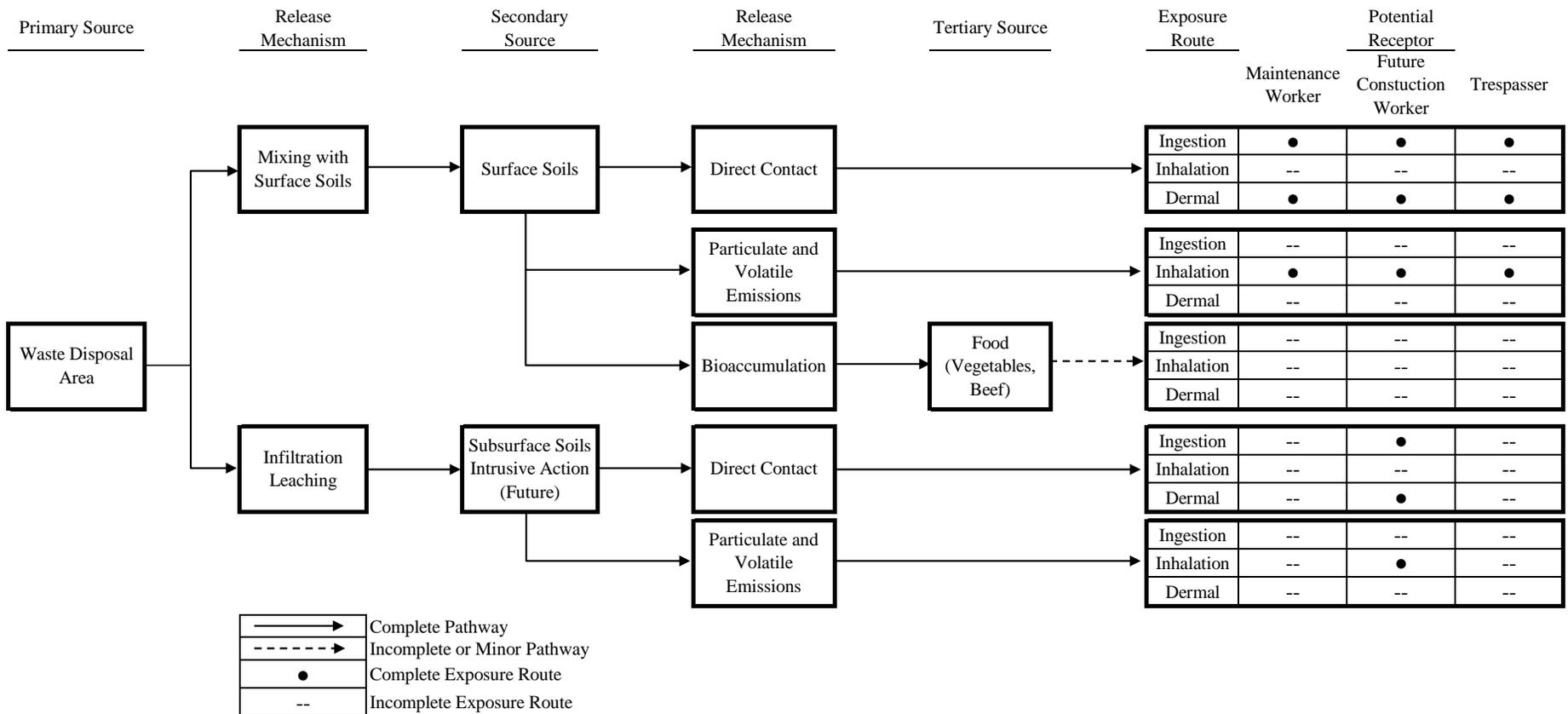
Conceptual Site Exposure Model 1: Load Line Production Buildings/Paint Operations Areas from the 2000 RI Addendum Report (URS 2000a).

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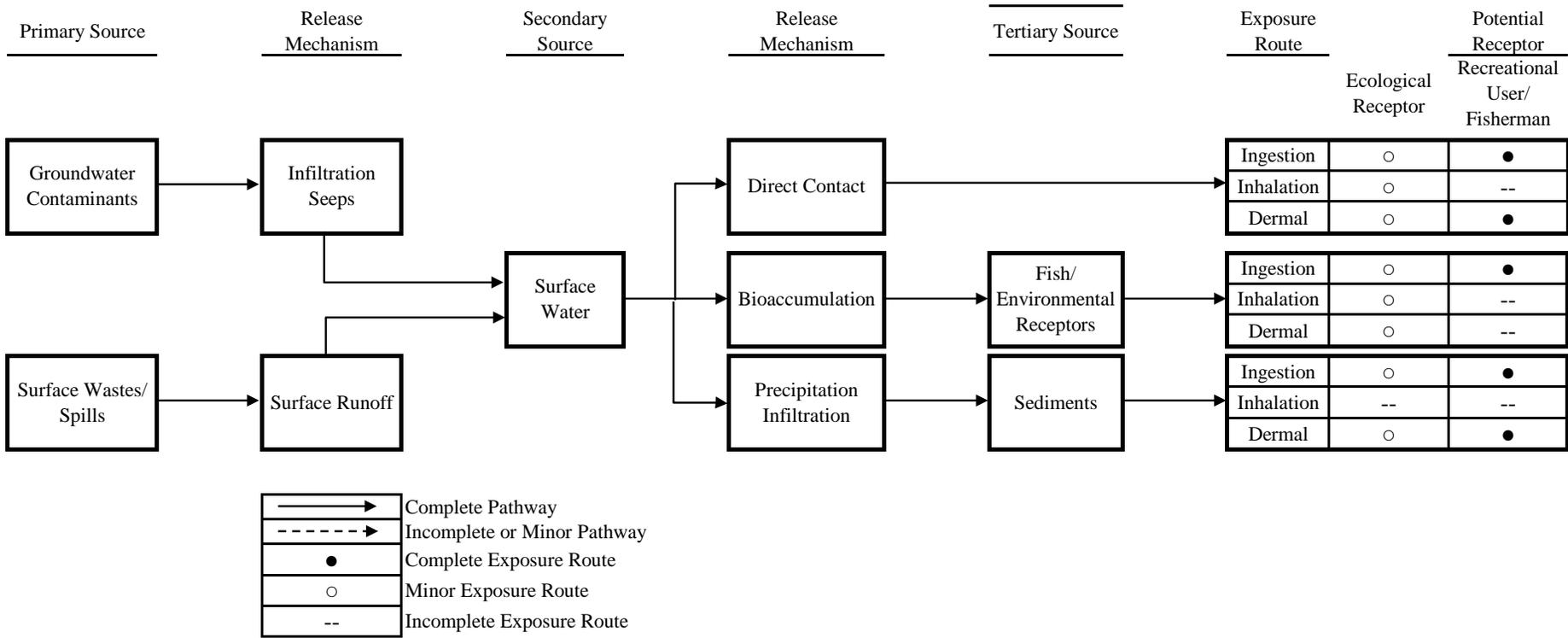


Conceptual Site Exposure Model 2: Proving Grounds, Potential Landfill Area, and Northeast Boundary Area from the 2000 RI Addendum Report (URS 2000a).

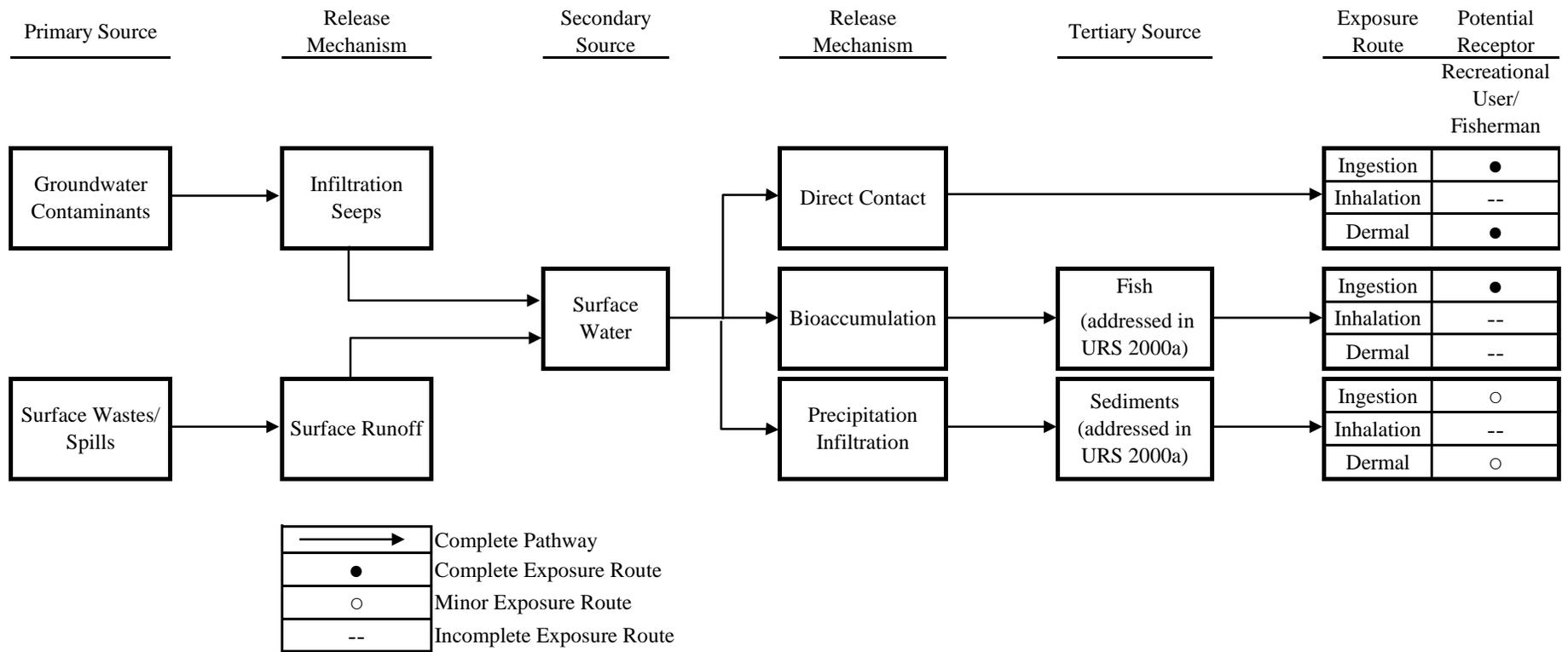
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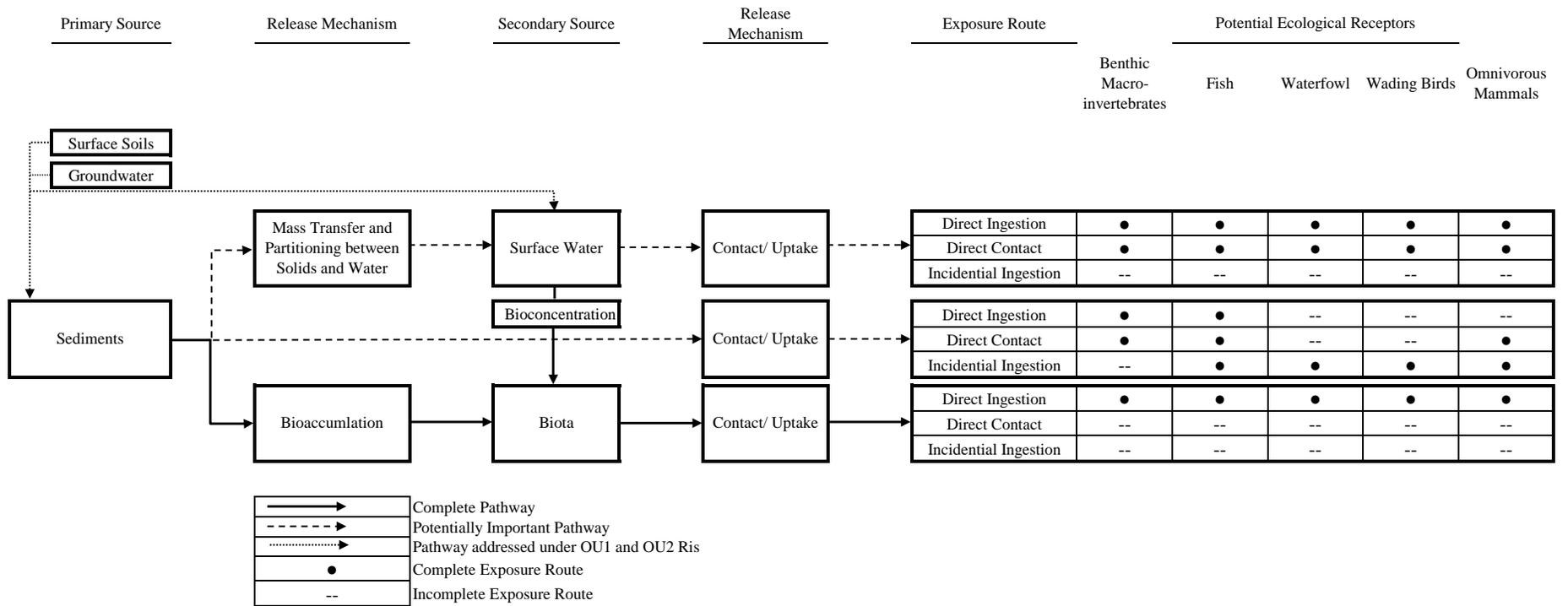
Conceptual Site Exposure Model 3: North Burning Ground and Potential Landfill Area from the 2012 Supplemental RI Report (GEO 2012).



Conceptual Site Exposure Model 4: Johnson Creek, Clear Creek, Silver Creek, and NRD Reservoir from the 2000 RI Addendum Report (URS 2000a).



Conceptual Site Exposure Model 5: Johnson Creek, Clear Creek, and Silver Creek from the 2012 Supplemental RI Report (GEO 2012).



Conceptual Site Exposure Model 6: Ecological Conceptual Site Model from the 1997 RI Report (Woodward-Clyde 1997).