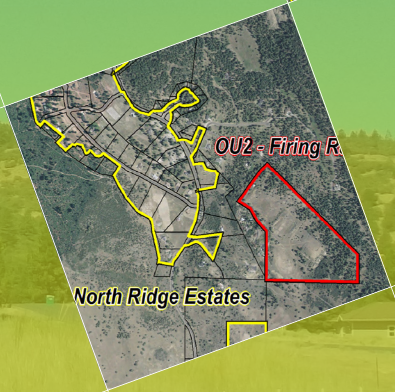
Record of Decision

North Ridge Estates Site
KLAMATH COUNTY, OR

Operable Unit 1

September 2011



RECORD OF DECISION
FOR
NORTH RIDGE ESTATES SITE
OPERABLE UNIT 1
KLAMATH COUNTY, OREGON

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NORTH RIDGE ESTATES SITE

OPERABLE UNIT 1

KLAMATH COUNTY, OREGON

Part 1
Declaration

Site Name and Location

The North Ridge Estates (NRE) site (Comprehensive Environmental Response, Compensation, and Liability Information System number ORN001002476) is located approximately 3 miles north of the City of Klamath Falls, in Klamath County, Oregon, on Old Fort Road and North Ridge Drive. The NRE site is named after the North Ridge Estates residential subdivision built on a portion of the property that is now included in the site boundary. The site is largely comprised of privately owned parcels and parcels managed by a court-appointed Receiver.

The NRE site has been divided into two operable units (OUs):

- ***OU1*** (the focus of this record of decision [ROD]) encompasses the footprint of a former Marine Recuperation Barracks (MRB) and includes all areas where asbestos-containing material (ACM) and/or asbestos have been observed and/or detected with the exception of the former firing range. OU1 is estimated to include approximately 125 acres. Appendix A shows the OU1 site boundary and parcel ownership (either privately-owned or receiver-managed).

- ***OU2*** includes the area of the former firing range and is estimated to include approximately 46 acres.

The remedy selected herein is intended to be the final remedial action for OU1 of the NRE site. The OU1 remedial action will build on the numerous removal actions already implemented at the site. The specific remedial actions that will be taken at OU1 as a result of the ROD are discretely separate from OU2. OU2 is geographically distinct from OU1, and may have contaminants of potential concern (COPCs) that require additional investigation at a later time.

Statement of Basis and Purpose

This decision document presents the U.S. Environmental Protection Agency's (EPA's) selected remedy for OU1. The remedy selected in this ROD was chosen according to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and according to the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). The decision is based on the administrative record file for the NRE site. This document is issued by EPA Region 10, the lead agency, and the Oregon Department of Environmental Quality (ODEQ), the support agency. ODEQ concurs with the selected remedy presented herein.

Assessment of Site

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of Selected Remedy

A large portion of OU1 has undergone emergency removal actions that have reduced the volume of contaminated materials such as ACM and asbestos-containing soils exposed at the site, but have not eliminated the pathways for receptors to be exposed to asbestos. The selected remedy for OU1 will address the remaining threats to human health and the environment posed by exposure to asbestos contamination within this OU. OU2 is geographically distinct from OU1 and requires additional investigation, so OU2 will be addressed at a later time.

The selected remedy for OU1 includes the following components:

- Excavation of most of contaminated materials (in surface and subsurface soils) on privately owned and receiver-managed parcels.

- Installation of a visible marker layer to denote the vertical extent of contaminated material excavation on each parcel.

- Capping of remaining soils on the parcels with clean cover soils of sufficient thickness to break the soil-to-air exposure pathway associated with residual ACM or asbestos fibers left in the soils. The caps will also keep ACM from migrating to the surface through natural processes such as frost heave or erosion. Caps on OU1 will include 1) onsite repositories, 2) soil caps on parcels, and 3) existing structures, such as buildings, driveways, and existing roads.

- Consolidation and placement of excavated contaminated material in one or more onsite ACM repositories.

- Capping of the onsite repositories with a barrier of clean cover soil of sufficient thickness to break the soil-to-air exposure pathway and keep contaminated materials from migrating to the surface through natural processes such as frost heave and erosion. Access controls (signs and fencing) will be used as necessary to protect the repositories.

- Institutional controls (ICs) at the entire site to prevent disruption of residual contamination within parcels and consolidated material in the onsite repositories.

- Maintenance with ongoing monitoring (inspections and sampling) to ensure that capped areas are maintained and not damaged, exposure does not occur, and caps remain protective.

- <u>Contingency</u>: Current sampling data indicate that indoor air in OU1 residences is protective of human health. Therefore, EPA has no reason to remediate indoor living spaces at this time. However, the selected remedy includes a contingency for interior cleaning, if necessary. After excavation and capping are completed on each parcel, sampling will be conducted in indoor living spaces (residences). If sampling shows a risk of greater than 1E-04 in any home, EPA will invoke a post–ROD change (such as an explanation of significant differences), to reflect this determination, to indicate which living spaces will need to be cleaned, and to share information with the public about how indoor cleaning will be conducted.

- There are no indications that surface water or groundwater at OU1 has been impacted by site contamination. EPA will perform sampling of surface water and groundwater on or near OU1 to confirm that there are no impacts to these media.

Statutory Determinations

The selected remedy meets the mandates of CERCLA §121 and the NCP. The remedy is protective of human health and the environment. It complies with all federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The selected remedy does not satisfy the statutory preference for treatment of principal threat wastes.

Principal threat wastes are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present significant risk to human health or the environment should exposure occur. The ACM and asbestos-contaminated soil at OU1 is considered a principal threat waste. This waste is the source for direct exposure to asbestos fibers when these materials are encountered and disturbed. As such, the waste would present a significant risk to human health should exposure occur. The selected remedy will eliminate exposure to the principal threat waste at OU1, ACM and asbestos-contaminated soil, as well as arsenic contamination from the former power plant area by excavating the contaminated materials to the extent practicable, consolidating contaminated materials in capped onsite repositories, and capping remaining soils in excavated areas that may contain residual ACM or asbestos fibers.

The selected remedy does not use treatment of principal threat wastes as a principal element of the remedy primarily because the extraordinary volume of materials and complexity of the site make treatment impracticable. The 125-acre area is estimated to contain 189,000 cubic yards of ACM, contaminated debris, and ACM- and arsenic-contaminated soils, which will be excavated and consolidated as part of the selected remedy. Approximately two thirds of those materials are at the surface or near-surface, and approximately one third of those materials is in deeper burial locations. In addition to the extraordinary volume, treatment is not practicable at this site because of the complexity and heterogeneity of the contaminated materials at the site, with ACM present in bulk form, in particles within the soil matrix, and fibers entrained in fissures of subsurface bedrock.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

ROD Data Certification Checklist

The following information is included in the Decision Summary section (Part 2) of this ROD. Additional information can be found in the administrative record file for the NRE site.

- Contaminants of concern (COCs) and their respective concentrations (Section 5 – Summary of Site Characteristics)
- Current and reasonably anticipated future land use assumptions used in the baseline risk assessment (Section 6 – Current or Potential Future Land and Resource Uses)

- Baseline risks represented by the COCs (Section 7 – Summary of Site Risks)
- Cleanup levels established for COCs and the basis for the levels (Section 8 – Remedial Action Objectives)
- How source materials constituting principal threats are addressed (Section 12 – Selected Remedy)
- Potential land use that will be available at the site as a result of the selected remedy (Section 12 – Selected Remedy)
- Estimated capital, annual operation and maintenance (O&M), and total present value (worth) costs, discount rate, and the number of years over which the remedy cost estimates are projected (Section 12 – Selected Remedy)
- Key factors that led to selecting the remedy (Section 12 – Selected Remedy)

Cleanup levels (CULs) for COCs and the basis for the levels are typically included in the ROD. Normally, CULs would be developed by computing the concentrations of COCs that correspond to an excess cancer risk of 1E-06 for media that have exposure pathways to receptors. However, such a computation for asbestos in soil is not possible at present because of the high variability in the relationship between asbestos in soil and asbestos in air. Even if the computations were possible, the ability to measure asbestos in surface and subsurface soil is presently limited by the available technologies and methods. Non-cancer risks from inhalation of asbestos fibers from ACM have also been recognized, but there is no applicable methodology to quantify non-cancer risks for asbestos at the NRE site OU1.

For these reasons, CULs for asbestos have not been established for ACM (site debris) and soil. If the remedial action objectives (RAOs) for asbestos contamination are achieved through implementation of remedial measures that eliminate the exposure pathways, then risks to humans from inhalation exposures to asbestos are expected to be acceptable.

Arsenic was also identified at concentrations that could pose an exposure risk to human receptors through ingestion or inhalation of soil in the vicinity of the former power plant.

The regional screening level identified by EPA as protective for arsenic concentrations in residential soil is 0.39 milligrams per kilogram (mg/kg). The arsenic concentrations in soil at the former power plant range from 0.5 mg/kg to 27.2 mg/kg. However, arsenic is a metalloid that occurs naturally within soils developed over volcanic rocks such as those that underlie and outcrop near the site. A site-specific background study has not yet been performed.

The CUL for arsenic will be identified as 0.425 mg/kg (derived by back calculating from an exposure point concentration of 17 mg/kg, which corresponds to an excess lifetime cancer risk of 4E-05) or site-specific background, whichever is higher. A site-specific background study will be performed before implementation of the remedial action to determine the background concentration for arsenic in soil.

Authorizing Signature

Daniel D. Opalski, Director
Office of Environmental Cleanup

9/22/2011
Date

RECORD OF DECISION

FOR

NORTH RIDGE ESTATES SITE

OPERABLE UNIT 1

KLAMATH COUNTY, OREGON

Part 2
Decision Summary

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Part 2 Decision Summary

List of Exhibits

Appendix

Acronyms

1E-04	one part in 10 thousand
1E-05	one part in 100 thousand
1E-06	one part in 1 million
ABS	activity-based sampling
ACM	asbestos-containing material
ARAR	applicable or relevant and appropriate requirement
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BLRA	baseline risk assessment
CAB	cement asbestos board
CC&R	covenants, conditions, and restrictions
CDM	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
COI	contaminant of interest
COPC	contaminant of potential concern
CSM	conceptual site model
CTE	central tendency exposure
CUL	cleanup level
cy	cubic yards
DCA	1,2-dichloroethane
DCE	cis-1,2-dichloroethylene
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DHS	Oregon Department of Human Services
E&E	Ecology & Environment, Inc.
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESD	explanation of significant differences
f/cc	fibers per cubic centimeter
FS	feasibility study
GRA	general response actions
GSA	General Services Administration
HIF	human intake factor
HQ	hazard quotient
IC	institutional control
IRIS	Integrated Risk Information System
ISO	International Organization of Standards

LOAEL	lowest observed adverse effect level
LTSM	long-term site management
MAG	magnesium silicate asbestos
MBK	Melvin Bercot Kenneth Partnership
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MRB	Marine Recuperation Barracks
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHPA	National Historic Preservation Act
NOAEL	no observed adverse effect level
NPL	National Priorities List
NRCS	Natural Resources Conservation Service
NRE	North Ridge Estates
ODEQ	Oregon Department of Environmental Quality
OIT	Oregon Institute of Technology
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
OTI	Oregon Technical Institute
OU	operable unit
PA	preliminary assessment
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PCM	phase contrast microscopy
PCME	phase contrast microscopy equivalent
PLM	polarized light microscopy
PRG	preliminary remedial goal
QA	quality assurance
QC	quality control
RAGS	Risk Assessment Guidance for Superfund
RAO	remedial action objective
RfD	reference dose
RG	remediation goal
RI	remedial investigation
ROD	record of decision
RME	reasonable maximum exposure
SARA	Superfund Amendments and Reauthorization Act of 1986
S/cc	structures per cubic centimeter
SL	screening level
SSL	soil screening level
SWL	static water level
TCE	trichloroethylene
TEM	transmission electron microscopy

UCL	upper confidence limit
USGS	U.S. Geologic Survey
VAT	vinyl asbestos tile
VOC	volatile organic compound
WWTP	wastewater treatment plant
μm	micron or micrometer

Section 1 Introduction

1.1 Site Name and Location

Exhibit 1-1. Site Location Map

The North Ridge Estates (NRE) site (Comprehensive Environmental Response, Compensation, and Liability Information System number ORN001002476) is located approximately 3 miles north of the City of Klamath Falls, in Klamath County, Oregon, on Old Fort Road and North Ridge Drive (Exhibit 1-1).

The NRE site is named after the North Ridge Estates residential subdivision built on a portion of the property that is now included in the site boundary. The site is largely comprised of privately owned parcels and parcels managed by a court-appointed Receiver.

The NRE site includes areas affected by asbestos-related releases or threatened releases within approximately 422 acres. Specifically, these areas include the 125 acres of the former Marine Recuperation Barracks (MRB) location and the approximately 46 acres of the Kingsley Firing Range, identified as operable units (OUs) 1 and 2 (OU1 and OU2), respectively. The NRE site may not be limited to these areas or releases. Until the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site investigation process has been completed for OU2 and a remedial action (if any) selected for OU2, EPA can neither estimate the extent of the release, nor describe all the areas of the site.

The U.S. Environmental Protections Agency (EPA) will be the lead agency for the remedial actions at OU1, and Oregon Department of Environmental Quality (ODEQ) will provide support via state concurrence on this record of decision (ROD) and long-term operation and maintenance (O&M) of the remedy implemented by EPA.

EPA and ODEQ proposed listing of the NRE site to the National Priorities List (NPL) on March 10, 2011, and received no comments on the proposal during the public comment period. The Federal Register Notice dated September 16, 2011, finalizes the addition of NRE to NPL.

1.2 Key Features of the Site and OU1

1.2.1 Site OUs

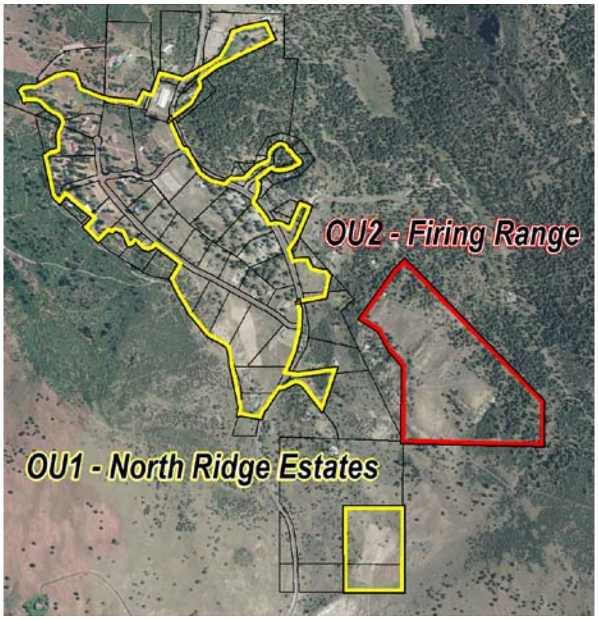
The NRE site has been divided into OUs (Exhibit 1-2):

- ***OU1*** (noted by the yellow line in Exhibit 1-2) is the focus on this ROD. OU1 encompasses the footprint of the former MRB and includes all areas where asbestos-containing material (ACM) and/or asbestos have been observed and/or detected with the exception of the former firing range. OU1 is estimated to include approximately 125 acres. Appendix A shows the OU1 site boundary and parcel ownership (either privately owned or receiver-managed).

- ***OU2*** (noted by the red dotted line in Exhibit 1-2) includes the area of the former firing range and is estimated to include approximately 46 acres.

1.2.2 Site Contamination

Exhibit 1-2. OUs at the NRE Site



The main contaminant of concern (COC) at OU1 is asbestos. The main source of asbestos is ACM that was used in the original construction of the MRB. As was common in the 1940s, a variety of different types of ACM was used in the construction of the barracks, including cement asbestos board (CAB) on exterior and interior walls, asphalt-asbestos roofing material, vinyl asbestos tile (VAT), floor tile mastic, and several types of asbestos steam pipe insulation. When buildings containing ACM were demolished, some of the ACM debris was consolidated into waste piles or burial pits and the rest of the ACM was dispersed in surface and subsurface soil in the vicinity of the demolition. During development of the NRE residential housing area most of this ACM was covered or buried with soil, but some was left exposed. Over time pieces of ACM in the shallow subsurface soil have appeared at the surface. This is believed to be due to repeated cycles of frost heave, surface soil erosion, and/or transport by water runoff. Once at the surface the ACM can release asbestos fibers to surface soil and/or air, especially when the ACM and soil is disturbed by human or mechanical forces.

Types of ACM and Asbestos at NRE, OU1

The types of ACM present at OU1 include: CAB, VAT, floor tile mastic, roofing material, and steam pipe wrap consisting of insulation (AirCell and magnesium silicate asbestos [MAG]) and tar paper. CAB, VAT, floor tile mastic, roofing materials, and tar paper found at the site contain chrysotile asbestos. Two of the lesser known types of ACM, AirCell and MAG, are discussed below.

The steam pipe wrap used at OU1 contains AirCell and MAG ACMs. AirCell is a type of thermal system insulation; it was manufactured in the form of a corrugated asbestos paper product for use as an outer coating for pipe insulation. MAG is another type of thermal system insulation material used to insulate high temperature utilities such as steam or condensate lines. This insulation material is called MAG because the major asbestos content in the product is a magnesium silicate. Samples of the insulation present at OU1 indicate that the AirCell contains chrysotile asbestos and the MAG contains chrysotile and amosite asbestos. Exhibit 1-3 summarizes the asbestos concentrations measured in ACM at OU1 (ODEQ 2001 and Ecology and Environment, Inc. [E&E] 2006).

Exhibit 1-3. Summary of Asbestos Content of ACM at OU1

Material Type	Asbestos Type	% Asbestos
CAB	Chrysotile	3 - 25
Roofing Material	Chrysotile	30 – 45
VAT	Chrysotile	<1 – 10
AirCell	Chrysotile	35 – 45
MAG Insulation	Chrysotile	3 – 40
	Amosite	20 - 55
Tar Paper	Chrysotile	35 - 40

Other Contaminants of Potential Concern (COPCs)

Soil samples from OU1 were analyzed for 150 different non-ACM chemicals to determine what non-asbestos contamination, if any, might be found at the site. Only 10 chemicals were identified with the maximum detected concentration exceeding human health screening levels (SLs) in soil. Those 10 chemicals were retained as COPCs for further evaluation of risks to residents at OU1. The 10 chemicals are:

- Arsenic
- Lead
- Polychlorinated biphenyls (PCBs)
- Mercury
- Benzene
- Chloroform
- cis-1,2-dichloroethylene (DCE)
- Tetrachloroethylene (PCE)
- 1,2-dichloroethane (DCA)
- Trichloroethylene (TCE)

Based upon the risk characterization conducted in the OU1 baseline risk assessment (BLRA), risks from direct contact with non-asbestos chemicals in soil appear to be below a level of concern to current and future residents and workers at OU1, with the exception of arsenic at the former power plant. Only arsenic was retained as a non-asbestos COC for OU1.

The data set for arsenic in the area of the former power plant are limited and the exposure point concentration (EPC) is elevated as compared with typical background soil levels for Oregon. The risks to residents from arsenic at the former power plant are at a level of 4E-05. These risks are within EPA's acceptable cancer risk range of 1E-06 (1 in 1 million) to 1E-04 (1 in 10,000), but exceed ODEQ's cancer risk threshold of 1E-06. The arsenic in soils in the former power plant area are co-located with ACM and/or asbestos contamination; therefore, the feasibility study (FS) assumed the arsenic contamination found in these areas would be addressed during ACM/asbestos remediation.

Results from the air and soil gas sampling at residential homes in 2008 indicate that volatile organic compounds (VOCs) are also present at concentrations below established background concentrations (EPA 2008 as presented in Table 5-2 of EPA's risk assessment addendum). They are also below a level of concern as defined by the EPA's cancer risk range (i.e., 1E-06 to 1E-04), presented in the site's risk assessment addendum. Therefore, remediation is not required to address the VOC contaminants observed in air or soil gas.

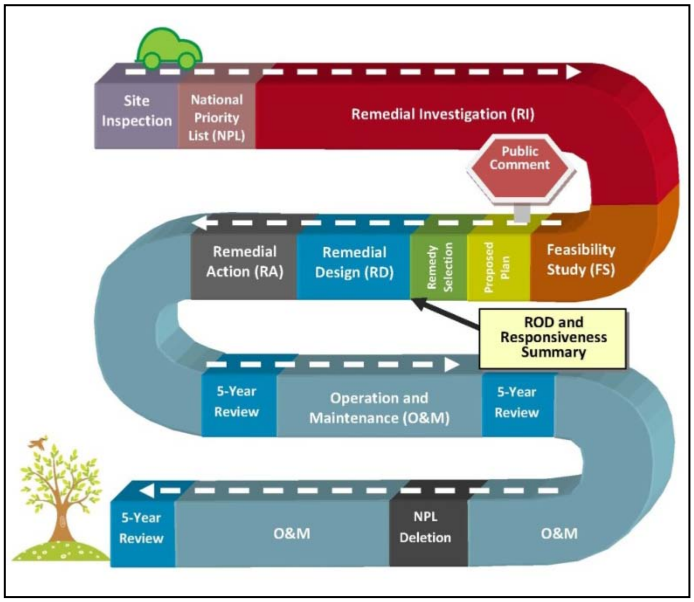
Non-asbestos contaminants do not appear to be of concern to ecological receptors. The details regarding how the above conclusions were reached are provided in the remedial investigation (RI) report (CDM Federal Programs Corporation [CDM] 2010a) and are briefly discussed in Section 2.

1.3 ROD Format

This ROD is the decision document at the end of a detailed investigation and evaluation of conditions and cleanup alternatives at OU1 (Exhibit 1-4). Because the selected remedy will leave contamination in place, the remedy will be evaluated at least every 5 years to ensure that the remedy remains protective. New information that may impact protectiveness of the remedy will be considered according to the review requirements of CERCLA Section 121(c). If unacceptable exposures are identified, EPA may take additional action to ensure that the soil-to-air exposure pathway is broken. Actions may include indoor cleaning, additional excavation, improving caps, and/or strengthening institutional controls (ICs).

Once the remedy has been implemented and performance standards have been met, ICs, O&M, and periodic reviews will continue to be required; however, there may be an opportunity to delete this OU from the NPL. Deletion from the NPL does not preclude additional response actions to ensure protectiveness of the remedy.

Exhibit 1-4. The Superfund Process – The Road to the ROD



EPA's detailed investigation and evaluation of conditions at OU1 included performance of an RI/FS for OU1 and the completion of numerous removal actions under authority of CERCLA §104 to address significant human health risks during completion of the RI and FS. The RI report for OU1 includes a comprehensive description of the nature and extent of contamination and a description of past investigative and removal actions at the site. The OU1 RI report also presents results from the site BLRA. The FS report for OU1 uses information from the RI to perform a systematic analysis to determine the need for, and scope of, any required remedial action. The steps leading up to the ROD also included numerous opportunities for public involvement, including preparation of a proposed plan (released on April 1, 2010), a public meeting, and a 38-day public comment period.

This ROD documents EPA's selected remedy for OU1. The next step in the Superfund process will be completion of a remedial design followed by implementation of a remedial action based on the selected remedy documented in this ROD.

This ROD is organized into the following sections:

Part 1: Declaration. Functions as the abstract and data certification for key information in the ROD and contains the formal authorizing signature page for the ROD.

Part 2: Decision Summary. Provides an overview of the site characteristics, site risks, the alternatives evaluated, and analysis of these alternatives. This section also identifies the selected remedy and explains how the remedy fulfills statutory and regulatory requirements.

- **Section 1 – Introduction**. Provides a very brief introduction to the ROD.
- **Section 2 – Site History and Enforcement Activities.** Provides a brief history of the NRE site in general and OU1 in particular, and EPA's activities.
- **Section 3 –Community Participation.** Describes the range of community outreach activities conducted site-wide and at OU1.
- **Section 4 – Scope and Role of OU**. Describes how the actions taken at OU1 fit into the overall scope of the NRE site.
- **Section 5 – Summary of Site Characteristics.** Contains an overview of the NRE site in general and OU1 in particular, conceptual site model (CSM), and a summary of the results of the OU1 RI.
- **Section 6 – Current and Potential Future Land and Resource Uses**. Describes land use and how resources (e.g., land surfaces) will be addressed.
- **Section 7 - Summary of Site Risks**. Discusses the human health and ecological risk assessment for OU1, including risk estimates.
- **Section 8 - Remedial Action Objectives**. Discusses the goals and objectives developed by EPA to protect human health and the environment at the NRE site in general and OU1 in particular.
- **Section 9 - Description of Alternatives**. Describes the remedial alternatives developed and evaluated in the FS, including a description of remedy components, common elements and distinguishing features, and expected outcomes.
- **Section 10 - Comparative Analysis of Alternatives**. Presents a summary of the remedial alternatives that were retained for detailed analysis against the two threshold criteria and five

balancing criteria in the FS. The two modifying criteria as they relate to the preferred alternative are also discussed.

- **Section 11 - Principal Threat Wastes**. Identifies the principal threat waste at OU1 and discusses how the selected remedy will prevent exposure to this waste.

- **Section 12 – Selected Remedy**. Provides a detailed description of the selected remedy, including its components, cost, expected outcomes, performance standards, and compliance with EPA's environmental justice mandate.

- **Section 13 –Statutory Determinations**. Describes how the selected remedy is protective of human health and the environment, complies with or appropriately waives applicable or relevant and appropriate requirements (ARARs), is cost effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

- **Section 14 – Documentation of Significant Changes from Preferred Alternative of Proposed Plan**. Confirms that no significant changes were made to the preferred remedy alternative that was outlined in the proposed plan before it became the selected remedy described in this ROD.

- **Section 15 – Listing of North Ridge Estates to NPL.** Provides a discussion of the March 10, 2011 proposed listing and the September 16, 2011 final listing of the NRE site to the NPL.

- **Section 16 –References**. Provides a list of references cited in the ROD.

Part 3: Responsiveness Summary. Presents stakeholder concerns and comments about the site and preferences regarding the remedial alternatives. This section also explains how those concerns were addressed and the preferences were factored into the remedy selection process.

Section 2 – Site History and Response Activities

This section summarizes the site history of the NRE site in general and OU1 in particular, and previous investigations and removal activities that have occurred at OU1.

2.1 Site Background and History

2.1.1 Marine Recuperation Barracks (1944 to 1946)

The NRE site, OU1, is the location of the former Klamath Falls MRB. The barracks were constructed by the U.S. Department of Defense to treat Marines suffering from tropical diseases contracted during World War II. The site was chosen as the location for the MRB because it was thought its elevation would act to moderate the effects of malaria. On June 24, 1944, the U.S. Department of the Navy (Navy) purchased approximately 745 acres of land for the MRB, including nearly 11 acres for utility easements, near Klamath Falls, Oregon, from private parties.

The original facility was composed of 82 buildings designed to accommodate 5,000 Marines. Most of the buildings were constructed between Old Fort Road and present day North Ridge Drive. The structures built on the MRB site included a sewage treatment plant, horse stables, warehouse, brig, medical officers quarters, animal hospital, dependent hospital, post exchange, auditorium, gymnasium, swimming pool, fire house, mess hall, dispensary, laboratory, laundry, bakery, maintenance garage, bachelors quarters, central power plant, library, and 30 barracks.

The ACM used in construction of the barracks included CAB used on exterior walls as siding and on interior walls as wainscoting, asphalt-asbestos roofing material, VAT, floor tile mastic, and steam pipe insulation. The amount of ACM used during the construction of the MRB has been estimated to be 1,522 tons (Kennedy/Jenks 2005).

Personnel staffed the base by April 30, 1945, and the first contingent of Marine casualties arrived on May 27, 1945. The barracks officially closed on February 28, 1946. All 745 acres were declared surplus property by the Navy on March 1, 1946, and the land was transferred to the War Assets Administration for distribution (Matthews 1992).

2.1.2 Oregon Technology Institute (1947 to 1964)

The State of Oregon acquired the property through a quit-claim deed on October 28, 1947, to be utilized for the Oregon Technology Institute (OTI). OTI offered vocational courses in the fall of that year including medical and x-ray technology; automobile, truck, and diesel engine maintenance; automobile body repair and painting; printing technology; metallurgy, welding and machining; dry cleaning; and refrigeration service (Matthews 1992).

During OTI's occupancy of the site, six structures were demolished: the animal hospital, barrack building B-1, the fire hall's hose tower, gatehouse, dog kennel, and dependent hospital building. The dependent hospital was destroyed by snow load and removed. It is believed that material from the demolition of these structures was used by the OTI Superintendent of Facilities to repair and maintain other buildings on site (Lynch 2005). OTI moved from the site in May 1964, having added seven new buildings and acquired 40 additional acres of land.

2.1.3 General Services Administration (1964 to 1965)

Ownership of the site was transferred to the General Services Administration (GSA) in December 1964, when OTI left the property. An inspection conducted by GSA in July 1964 showed the site to be virtually intact; however, some buildings had fallen into disuse and were shuttered and boarded (Lynch 2005).

2.1.4 Private Ownership (1965 to 1977)

In 1965, a partnership of private individuals purchased the property from GSA. This private partnership owned the property until 1977. GSA reports that during this time, nothing was done to repair the buildings and signs of vandalism were noted. While this partnership owned the site, it is reported the owners stripped the vacant buildings of salvageable materials such as equipment, furnishings, copper, and wood. According to former site workers, asbestos insulation was stripped from piping and boilers, the stripped metal was sold, and the asbestos insulation remained at the site (Isom 2003). Based on historical aerial photographs, at least 22 buildings were demolished during the time this partnership owned the property.

2.1.5 MBK Ownership (1977 to 2005)

In December 1977, Melvin Bercot Kenneth Partnership (MBK) purchased the property. A former site worker has reported that at least 32 buildings were still standing at the site in 1978 (Isom 2003). Based on this statement and a 1979 aerial photograph, significant demolition occurred between 1978 and June 1979. Many of the site buildings were demolished before the June 1979 aerial photograph was taken. Buildings not demolished included the gymnasium, power house, warehouse, stables, brig, rifle range guard house, and the medical officers' quarters on Thicket Court. Based on records from MBK, 34 buildings were removed between 1978 and 1991.

The former site worker who reported at least 32 buildings were standing in 1978 also reported that substantial amounts of building materials were burned and that remaining unburnable materials were buried on site. The worker also reported that the boiler and gymnasium building were demolished between 1992 and 1995 without the removal of ACM (Isom 2003).

In 1989, one member left the MBK partnership, and the remaining partners began planning a residential subdivision. In 1993, Klamath County approved subdivision plans, and construction of homes in the subdivision began later that year. According to the Public Health Consultation report published by the Oregon Department of Human Services (DHS) Superfund Health Investigation and Education Program, the NRE subdivision planned to be developed by MBK was 422 acres, although many of the lots had not been sold. Klamath County Public Health Division records related to test pits for septic system approval at the site occasionally noted the presence of asbestos debris in the soil. A test pit record dated June 27, 1996, for Township 38, Range 9, Section 15, Lot 6 indicated encountering "an old heat duct (cast iron pipe with asbestos & pipe sleeve around it)" at a depth of 0 to 6 inches below ground surface (bgs) (Kennedy/Jenks 2005).

MBK began selling properties in the subdivision by 1994, and continued to sell lots until 2002. During this period, MBK conducted removal of some of the ACM under an order with ODEQ and later with EPA. As a result of the ACM contamination, a group of subdivision homeowners sued the MBK partnership and the partners in 2003. In 2004, MBK filed for bankruptcy. In January 2006, a settlement between the subdivision homeowners and MBK was announced, whereby MBK agreed to compensate the homeowners to allow them to relocate to new, permanent residences. MBK also entered into a consent decree that provided for a Receiver to hold title to the property and search for a purchaser willing to implement final cleanup measures to be selected by EPA (U.S. Department of Justice press release, January 23, 2006). The settling homeowners have relocated.

2.1.6 Receivership (2006 to present)

In January 2006, a federal consent decree was approved with parties including the developer, the homeowners, the U.S. Department of Justice, and EPA. Most of the settlement cash compensated homeowners to allow them to relocate to new permanent residences. The consent decree also provided for a Receiver to manage and hold title to the properties as a potential resource for funding cleanup activities. As a result of the January 2006 consent decree, OU1 is comprised of a mixture of privately owned properties and receiver- managed parcels.

In addition to removal actions conducted by MBK, discussed above, EPA conducted several more emergency removals between 2005 and 2009. While the removals were successful in consolidating large volumes of ACM and associated soils into onsite repositories and reducing the amount of friable ACM at the surface, new ACM surfaced each year because of frost heave and erosion. The removals were not able to permanently eliminate unacceptable risks at the affected properties.

OU1 is comprised of a mixture of privately owned properties and properties held in receivership. The site contains 39 single-family homes (21 of the homes are privately owned and 18 homes held by the Receiver are vacant), 1 occupied apartment building, 8 undeveloped vacant lots held by the Receiver, 2 privately held undeveloped vacant lots, part of a property that is used as a gravel pit, a warehouse, and a memorial park.

On August 31, 2010, Oregon Governor Kulongoski sent a letter to EPA nominating the NRE site for placement on the NPL consistent with the state's authority under CERCLA. On March 10, 2011, EPA proposed listing the NRE site to the NPL and final listed the site on September 16, 2011. The site is now eligible for federal funding to conduct remedial action (cleanup) of the contamination on the site.

2.2 History of Site Regulatory Activities

2.2.1 Unilateral Order

A unilateral order became effective on April 4, 2005, that directed the MBK partnership to conduct RI/FS activities at the NRE site under the oversight of EPA. Key documents to be delivered and activities to be performed, to be consistent with CERCLA guidance and subject to EPA review and approval, included:

- Prepare and submit to EPA an RI/FS work plan

- Prepare and submit a sampling and analysis plan that includes a field sampling plan and quality assurance project plan
- Prepare and submit a site health and safety plan
- Prepare and submit a community relations plan and a technical assistance plan
- Perform site characterization
- Develop a draft RI report
- Develop and submit to EPA a BLRA
- Perform treatability studies unless the potentially responsible parties show that the studies are not required
- Develop and screen remedial alternatives
- Perform a detailed analysis of remedial alternatives
- Develop and submit an FS report

MBK was to also perform a number of other activities, such as progress reporting per the consent order. The MBK partnership submitted several of the draft documents for EPA review. The subsequent legal settlement relieved MBK of further responsibilities for the RI/FS. Therefore, EPA issued a stop work notice to MBK on July 18, 2005. Since the January 2006 federal consent decree, EPA has taken the lead related to the investigation and completion of CERCLA documents for the NRE site using funds from the 2006 settlement.

2.2.2 History of Site Regulatory Activities

ODEQ responded to a complaint in 1978 of openly accumulated asbestos debris at the property owned and operated by MBK. ODEQ staff observed a bulldozer being driven over 4 to 6 acres of demolition debris and described "a great amount of white, fluffy insulation materials being blown by strong winds." ODEQ then directed the collection and onsite burial of some asbestos demolition material (ODEQ 1978).

In September 1979, EPA Region 10 issued Compliance Order No X79-08-14-113 regarding hazardous air pollutants to MBK. The compliance order included findings that MBK engaged in demolition of structures that contained asbestos and worked in an area with asbestos debris causing release of asbestos. The asbestos release resulted from failing to remove ACM from buildings before their demolition as required by state and federal air quality regulations, and failing to contain ACM according to disposal practices in those regulations (EPA 1979). On October 4, 1979, Bercot, on behalf of MBK, indicated that they would comply with EPA's compliance order.

On July 29, 2001, ODEQ received a complaint about asbestos pipe insulation exposed to the atmosphere on North Ridge Drive in the NRE development. On July 31, 2001, ODEQ visited the site and observed two large piles of pipe on the surface of the ground that contained insulation (approximately 180 linear feet). In addition, white to pale brown-colored, "platy-looking" rock fragments (presumably CAB, which is manufactured in thin layers) were observed on the ground of the property and surrounding properties. During this visit, samples were taken from the pipe insulation and the assumed CAB. Analysis of the samples showed that the material removed from the piping, described as white insulation from pipe, was 90 percent asbestos (amosite and chrysotile). Other material sampled from the pipe insulation contained 40 to 70 percent chrysotile. The sample of CAB contained 10 percent chrysotile. Tomahawk Abatement removed 180 feet of piping in August 2001. ODEQ issued a notice of noncompliance to MBK in September 2001 regarding the asbestos violations discovered during the July incident (ODEQ 2001).

In June 2002, MBK entered into a mutual agreement order with ODEQ (Order No. AQ/AB-ER-01-250A), which required a survey of all properties currently or previously owned by the MBK partnership for the presence of ACM, and required the removal of openly accumulated ACM. Additional requirements for MBK included either removing buried ACM or placing a deed restriction on properties known to have buried ACM pursuant to the 1979 EPA compliance order. Approximately 50 tons of ACM were collected from OU1 and disposed of by Malot Environmental, Inc., an MBK contractor, in 2002 (E&E 2005).

In March 2003, ODEQ and DHS determined that the friable asbestos not removed from the site in 2002 continued to pose a significant public health hazard. ODEQ then began negotiations with MBK to prepare an RI/FS to include a site characterization, human health risk assessment, and remedy identification. MBK and ODEQ were unable to agree on the scope of the RI/FS. ODEQ requested a referral to EPA on April 14, 2003, for emergency removal and assessment. On May 20, 2003, MBK entered into an administrative order on consent with EPA (EPA 2003).

Consistent with the administrative order on consent, MBK conducted a time-critical removal action, streamlined risk assessment, and reimbursed EPA's costs to that point. A unilateral order, as described in Section 2.2.1, became effective on April 4, 2005. A subsequent legal settlement relieved them of this obligation, and EPA became the lead agency for remaining work at the NRE site.

2.3 Response Activities

Multiple investigations and removal events have occurred at OU1 to date. Most of these activities were conducted by EPA, with the remainder being conducted by MBK. These activities are detailed in the OU1 RI report, along with tables of analytical results and figures showing the locations of the specific activities. This section provides only a very brief overview. Investigation activities are summarized in Exhibit 2-1, and removal activities are summarized in Exhibit 2-2.

Exhibit 2-1. Investigation Activities at OU1

Investigation	Activity Lead
2003 Activities	
Baseline and "Hot Spot" Soil Sampling	*MBK**
Residential Air Sampling	*MBK**
Burial Pile Exploration	*MBK**
Burial Pile Stabilization	*MBK**
Steam Pipe Investigation	*MBK**
Residential Soil Sampling	*EPA*
Ambient Air Sampling	*EPA*
Lead Soil Sampling	*EPA*
PCB Soil Sampling	*EPA*
2004 Activities	
Activity-Based Sampling (ABS)	*EPA*
2005 Activities	
Collection of Soil Samples to Determine Free Asbestos Fibers Content	*EPA*
Fiber Distribution Study	*EPA*
Ambient Air Sampling	*EPA*
PCB Investigation	*EPA*
2006 Activities	
Non-ACM RI Investigation	*EPA*
ACM/Asbestos RI Investigation	*EPA*
ABS	*EPA*
2007 Activities	
Non-ACM UST and VOC Investigation	*EPA*
2008 Activities	
Non-ACM VOC Investigation and ABS	*EPA*

Notes:
PCB – polychlorinated biphenyls; RI – remedial investigation; ACM – asbestos containing material; ABS – activity-based sampling; UST – underground storage tank; VOC – volatile organic compound; EPA – U.S. Environmental Protection Agency; MBK – Melvin Bercot Kenneth partnership. ***** MBK activities were conducted under ODEQ and EPA oversight.

2.3.1 Investigation Activities

- **2003 Baseline and "Hot Spot" Soil Sample Collection -** Ten baseline samples were collected to evaluate the baseline conditions at OU1. During the same sampling event, seven soil samples were collected from concentrated ACM hot spot locations. Samples were prepared and analyzed as described in the modified elutriator method using transmission electron microscopy (TEM) with International Organization of Standards (ISO) 10312 counting rules. The elutriator method provides values in units of phase contrast microscopy equivalent (PCME) fibers per gram respirable dust released from soil. Although the elutriator method has not been validated for use by EPA, the data are considered to be acceptable for use in screening assessments. One of the baseline samples contained asbestos at a concentration of 2.0E+06 fibers per gram and five of the seven hot spot samples contained asbestos ranging in concentrations of 2.0E+06 to 8.6E+07 fibers per gram.

- **2003 Burial Pile Exploration Activities** - Thirteen suspected burial locations were investigated and 32 test pits were excavated. In general, areas with unnatural topography such as mounds or areas with high concentrations of surfacing ACM debris were investigated as part of this investigation. According to PBS Engineering and Environment, the full horizontal and vertical extent of the piles was not determined (E&E 2005). Of the 13 suspected burial piles investigated, seven were found to contain ACM.

- **2003 Steam Pipe Investigation -** A geophysical survey was conducted at OU1 to locate buried steam pipe. Several thousand feet of buried steam pipe were located with a magnetometer. Because of the construction activities that have occurred, it is unknown if all buried, asbestos-insulated pipe was identified. To confirm the presence of buried steam pipe along the routes identified, several test pits were excavated. The presence of steam pipe was verified when corrugated steel, which wrapped the insulated piping, was observed at depths ranging from 2 to 6 feet bgs (E&E 2005).

- **2003 Residential Soil Sampling -** Twenty-two residential properties were sampled, with ten subsamples collected from each property. The subsamples were then combined to yield one composite sample per property. The subsamples were collected in targeted areas on each residence suspected of containing ACM and/or from areas on each property that were utilized frequently by residents. Samples were collected from 0 to 2 inches within an 8-inch by 8-inch template. As a result of collecting from this depth, visible ACM was observed in many of the samples. Twelve of the 22 samples were randomly chosen and processed by the elutriator method. Interpretation of these data is detailed in the preliminary risk assessment report submitted by Dr. Berman on behalf of MBK (Berman 2004). The data as interpreted by Dr. Berman indicated that risk to residents was associated primarily with MAG, and at the time of Dr. Berman's risk assessment, amosite was only rarely observed at the surface.

- **2003 Residential Air Sampling** - Air sampling was conducted on 22 residential properties to measure the concentration of asbestos in indoor and outdoor air (E&E 2005). A total of 46 samples were collected at 22 residences. In addition, three background samples were collected each week on a hillside south of OU1, for a total of nine background samples. PCME fibers were observed in two of the indoor and two of the outdoor residential samples (all at a concentration of 0.0001 structures per cubic centimeter [S/cc]) and in none of the background samples (E&E 2005).

- **2003 Ambient Air Sampling -** Ambient air sampling was conducted at OU1 over several weeks in the fall of 2003 and again in spring of 2004 to assess general levels of airborne asbestos particles. A total of 90 air samples were collected and analyzed by TEM using the Modified EPA-II Method. All of the ambient air samples yielded no asbestos structures counted, with the exception of one actinolite structure at a concentration of 0.001 S/cc.

- **2003 Lead Soil Sampling** - One of the secondary concerns at the site was the potential presence of lead in soils resulting from lead-based paint that coated most of the buildings. Soil samples for lead were collected from a total of 150 locations on 35 properties targeting areas of visual soil staining, exposed soils, and areas where debris was visible. Confirmation analytical results from the analytical laboratory indicated that only one sample exceeded the

EPA Region 9 preliminary remedial goal (PRG) for lead in residential soil (400 milligrams per kilogram [mg/kg]). This sample was collected from one of the MBK properties, specifically the property identified as MBK-C, and contained 1,500 mg/kg lead (E&E 2005). To delineate the extent of contamination at the MBK-C property a concentrated soil sampling grid was established and an additional 49 samples were collected for lead screening. Based on this second sampling effort, it was determined that the area of soil with lead concentrations greater than the EPA Region 9 residential lead PRG was approximately 25 feet in diameter (E&E 2005). These soils were removed in a 2004 removal action, see Section 2.2.3.

- **2003 PCB Soil Sampling** - The use of PCBs in transformers located at OU1 had been suspected. Samples were collected at a site suspected to be the location of a PCB spill. The samples were analyzed in the field using the Clor-N-Soil™ PCB screening kit. PCB screening results for the transformer site were less than 50 parts per million (E&E 2005). Additional PCB sampling was conducted during the 2005 and 2007 investigations as described in later in this section. Removal activities were conducted in 2008 as described in Section 2.3.2.

- **2004 Activity-Based Sampling**- EPA conducted activity-based sampling (ABS) in 2004 to assess the exposure risk associated with physical disturbance of asbestos-contaminated soils. A range of soil disturbance activities were conducted, including weed-trimming with an electric trimmer, tilling soil with a gas-powered rototiller, and actions simulating a child playing in ACM-containing soil. PCME asbestos structures were detected in all ABS air samples at concentrations ranging from 0.012 to 0.058 S/cc, with the highest concentrations observed in the samples collected during the simulated child play activities.

- **2005 Collection of Soil Samples to Determine Free Asbestos Fiber Content –** Sixteen surface soil samples were collected from areas where ACM was observed on the surface. Asbestos and ACM were detected in all 16 of the surface soil samples. Polarized light microscopy (PLM) analysis detected chrysotile and amosite fibers in the surface soil samples. Chrysotile was observed at concentrations ranging from 0.002 to 0.21 percent and amosite was observed at concentrations ranging from non-detect to 0.05 percent (E&E 2006).

- **2005 Fiber Size Distribution Study** - Six types of ACM found at OU1 were collected and submitted for a fiber size distribution study. Results of the fiber size distribution study are summarized in Appendix D of E&E’s 2005 Removal Action Report (E&E 2006).

- **2005 Ambient Air Sampling** - A total of 96 ambient air samples were collected in June, July, August, and September 2005 from the six sample locations at OU1. In addition, 12 air samples were collected to assess ambient air conditions during excavation and surface clean-up activities. Of the 108 samples collected, asbestos PCME fibers were observed in 18 samples. Concentrations of PCME asbestos fibers in the 18 ambient air samples with detections ranged from 0.0000984 fibers per cubic centimeter (f/cc) to 0.0002 f/cc, with the highest concentration observed in a sample collected during excavation activities. (E&E 2006).

- **2005 PCB Investigation -** PCB contamination was investigated along an area to the west of OU1, on the hill side between OU1 and Klamath Falls. A radio antenna with an associated power building was believed to have been part of the former MRB or OTI. Two wipe and two soil samples were collected within this area and were analyzed by SW-846 Method 8082. The results for the two soil samples indicate that one PCB congener, Aroclor 1260, was detected at concentrations of 0.0222 J and 0.0787 J mg/kg, which is below the EPA Region 6 screening level of 0.22 mg/kg. No PCBs were detected in the wipe samples. The detection limit for the wipe samples was 0.5 micrograms. (E&E 2006).

- **2006 Site-Wide Asbestos Investigation -** Based on previous asbestos investigations at OU1, objectives were developed as part of the ACM/asbestos June 2006 field program. The main objectives of this sampling effort were to:

  - Determine the lateral and vertical extent of ACM contamination at residential properties at OU1 to the extent practical to support FS needs.

  - Determine the lateral and vertical extent practical to support FS needs of ACM contamination at three large land units: the former landfill, clarifiers at the former wastewater treatment plant, and the former swimming pool.

  EPA developed a modified sampling strategy that initially was based on a parcel classification system for the residential parcels (e.g., Bin A, Bin B, and Bin C), in addition to a large land units sampling category. The parcel classification system is no longer used for OU1.

  Investigations at Bin A properties consisted of the use of techniques (test pits and boreholes using direct-push technology) to define the extent of ACM already known to exist over a large portion of these properties. A total of 176 test pits were excavated and 224 boreholes were advanced at Bin A properties. Investigations at Bin B properties were similar to Bin A properties. A total of six test pits were excavated and six boreholes were advanced at Bin B properties. Investigations at Bin C included bulk soil sampling to determine proper categorization and to supplement previous data. A total of 31 bulk soil samples were collected from eight properties. Results from the investigation led to re-categorizing one property to Bin B.

  In the vicinity of the former landfill, 10 test pits were excavated and inspected for presence of ACM. These test pits, mainly through the center of the former landfill, were completed to depths ranging from 2.5 to 4 feet bgs. The perimeter of the landfill was investigated by completing 31 boreholes advanced to 5 feet bgs.

  One test pit was completed in each of two clarifiers located at the former wastewater treatment plant (WWTP). These test pits were each completed to a depth of 4 feet. The investigation also advanced 12 boreholes around the perimeter of the area to 5 feet bgs.

  Five test pits were completed, primarily along a line the length of the former swimming pool, located such that excavation could occur in both the deep and shallow sections of the former swimming pool. These test pits were completed around the perimeter of this area to depths of 4 to 5 feet bgs.

Findings from these investigations revealed that ACM was present at the surface and subsurface at varying depths throughout OU1 resulting in approximately 189,000 cubic yards (cy) of ACM, contaminated debris, and ACM-contaminated soils.

- **2006 Outdoor ABS -** The ABS conducted at OU1 included three activities conducted with standard scripts to simulate adults and children participating in trimming weeds, raking, and playing. ABS was conducted at four occupied properties where surficial ACM was observed. These locations were biased to be co-located with visible MAG ACM, where possible. Each of the activities was first conducted in each of the four areas where ACM was observed and left in place at the surface or had accumulated via erosion/frost heave. In total, 36 stationary air and 32 personal air samples were collected during the ABS sampling activities from locations where ACM was observed and left in place at the surface. Following the completion of ABS in these areas, an asbestos abatement contractor removed all visible surface ACM from a secondary smaller area at three of the properties. The raking activity was then conducted in the area where ACM had been removed.

  Two downwind stationary air sample results contained a PCME concentration of chrysotile ranging from 0.0011 S/cc to 0.00202 S/cc. Five downwind stationary air sample results contained a PCME amosite ranging from 0.000701 S/cc to 0.0187 S/cc. Of the 32 personal air samples collected, a total of 18 were analyzed (15 by indirect ISO Method 13794 and three by direct ISO Method 10312). A total of 10 personal air sample results contained a PCME concentration of chrysotile ranging from 0.001 S/cc to 0.0162 S/cc and eight contained a PCME concentration of amosite ranging from 0.00192 S/cc to 1.35 S/cc. Only one air sample result contained a PCME concentration of actinolite of 0.001 S/cc.

  After the scenario sampling was completed, a total of 16 soil samples were collected from the ABS area. Free amosite asbestos fibers were observed in one soil sample (at a concentration of 0.75 percent by PLM analysis) while all remaining sample results did not contain any asbestos fibers.

- **2006 Indoor Air Sampling** - Indoor stationary air sampling was conducted at four onsite occupied properties. One sample was collected at each of the four properties over a period of 8 continuous hours. In total, four indoor stationary air samples were collected. Asbestos fibers were not observed in any of the indoor air samples collected.

- **2006 Indoor Dust Sampling** - Indoor dust sampling was completed at the same four properties where indoor air sampling was conducted. Two samples, one from horizontal surfaces and one from high traffic areas, were collected per floor from the main living structure at each of these properties. In total, 12 dust samples were collected and submitted. The only asbestos structure observed was one non-PCME chrysotile fiber.

- **2006 Non-ACM Investigations** - The main objectives of the non-ACM soil investigation activities described in the non-ACM quality assurance project plan were to:

  - Determine the types of suspected materials that were potentially used at the site and whether they exist above levels of concern.

- Determine those areas, based on previous site use and the types of materials that might have been handled, where potential releases of non-ACM COPCs could have impacted site soils.

Because of the extent of the dataset collected during the 2006 non-ACM investigation, the results of this investigation are not presented herein. Refer to Sections 4.2.4 through 4.2.11 of the RI for a summary of these results (CDM 2010a). Ultimately, arsenic was the only non-ACM retained as a COPC as a result of this investigation. Section 7.4.1 of the ROD provides a summary of the characterization of the risk posed by arsenic from direct contact with soil.

- **2007 Non-ACM Investigation Activities** - Once the results of the 2006 non-ACM investigation activities were evaluated, it was determined that additional investigation was required to further delineate the extent to VOC impacts in soil, soil gas, and indoor air at OU1. In addition to the investigation to delineate further VOC impacts in these areas, an effort was conducted to determine the exact orientation of the diesel underground storage tank discovered during the 2006 investigation activities and investigate the possibility of additional underground storage tanks in the area of the former service station.

- **2008 PCB Contaminated Soil Investigation Activities** - A surface investigation was conducted on September 11, 2008, to determine the extent of PCB contamination from old transformers at the Parcel B, Parcel AM, and the warehouse properties. A total of 10 soil samples and one field duplicate were collected and analyzed for PCBs. Results from the investigation indicate that three Aroclor 1260 results from the (b) (6) (Parcel B) property had concentrations greater than the EPA Region 6 SL of 0.22 mg/kg. All other samples had detectable concentrations of PCBs but were below EPA Region 6 SLs.

- **2008 Outdoor ABS -** This specific ABS event was completed in locations where asbestos had not been previously detected either by visual observation or bulk sample analysis. Each ABS team member conducted a raking activity at a specified location. In total, 17 personal air and 34 stationary air samples were collected during the ABS sampling activities. Five stationary air samples had detections of 0.0001 S/cc PCME structures. One stationary air had a concentration of 0.0002 S/cc. Personal air samples had a detections from 0.0049 S/cc to 0.0001 S/cc.

- **2008 VOC Delineation Sampling** - Additional VOC samples were collected because of data quality concerns with the 2007 VOC data. A total of 22 air samples were collected at eight locations (six residences and two locations near the former Maintenance Repair Shop). Sample types collected were sub-slab (four samples), crawlspace (six samples), indoor air (eight samples), soil gas (one sample), ambient air (two samples), and trip blank (one sample). Results from this sampling investigation are presented in the Appendix A of the RI and titled "*Human Health and Ecological Risk Assessment*" from October 2008 (CDM 2010a). Conclusions drawn from the risk assessment addendum indicate that non-cancer risks from inhalation of VOCs in indoor air appear to be below a level of concern (hazard quotient [HQ]<1) for current and future residents at OU1, and estimated excess cancer risks are within or below EPA's risk range (<1E-04 to 1E-06).

Exhibit 2-2. Removal Activities at OU1

EPA Removal Action Description	***Activity Lead***
2003 Activities	
Surficial and Hot Spot Removal Activities	*MBK*
2004 Activities	
Lead-Contaminated Soil Removal	*MBK*
2005 Activities	
Surficial Removal Activities	EPA
2008 Activities	
Surface and Subsurface ACM-Contaminated Soil Removal	*EPA*
PCB and Lead-Contaminated Soil Removal	*EPA*
2009 Activities	
Surficial Removal Activities	*EPA*
PCB-Contaminated Soil Removal	*EPA*

Notes: PCB - polychlorinated biphenyls; ACM – asbestos containing material; EPA – United States Environmental Protection Agency; MBK – Melvin Bercot Kenneth Partner

2.3.2 Removal Activities

- **2003 Surficial and Hot Spot Removal Activities -** MBK contractors, pursuant to the 2003 administrative order on consent with EPA, walked the site and removed ACM pieces that were equal to or greater than 1 inch in diameter by hand pickup. During this removal action, a total of 7 tons of surficial ACM was removed from 25 developed residential properties and several MBK-owned lots. It was reported that the majority of the material removed during the surficial pick up was CAB, with lesser amounts of roofing material, floor tile, and AirCell. In addition to the surficial removal activities conducted in 2003, areas of concentrated ACM debris were identified on nine properties. Approximately 77 tons of excavated material was removed from the hot spot locations for disposal as contaminated material at the Klamath County Landfill (E&E 2005).

- **2003 Burial Pile Stabilization Activities -** Because several ACM burial locations identified during the October 2003 exploration activities were either concentrated ACM debris piles or areas where concentrated ACM was surfacing along a steep embankment, EPA required stabilization in locations that were subject to rapid erosion. Stabilization included installation of water diversion piping and placement of topsoil, water-permeable fabric, and 6-inch minus rock. The locations of all these burial locations were also formally documented for possible future site actions (E&E 2005).

- **2004 Lead-Contaminated Soil Removal -** Approximately 26.5 tons of material were removed from the MBK-C property and disposed of as lead-contaminated soil at the Klamath County Landfill (E&E 2005). Additional lead contamination was identified in 2008. Removal activities were conducted at this property and are described further in this section.

- **2005 Removal Activities -** Removal actions were conducted by the responsible party and EPA in response to the large amount of AirCell and MAG that had surfaced at OU1. EPA completed a site-wide pickup of the AirCell and MAG material. EPA contractors removed approximately 350 pounds of AirCell and MAG from 24 site properties.

- **2005 Residential Relocations and MAG Removal -** On April 26, 2005, EPA signed an action memorandum approving a temporary relocation action for the NRE site, OU1. The relocation was voluntary, because EPA felt it was appropriate for immediate reduction of the risk to the public from uncontrolled release of asbestos. In June and July of 2005, PBS Engineering and Environment, the contractor for the responsible party, completed the removal of 330 pounds of MAG material from three properties at OU1.

- **2008 Surficial ACM Pickup Activities -** State-certified asbestos abatement workers contracted by EPA flagged locations of friable MAG and AirCell throughout OU1 and also flagged as much ACM as possible (mostly CAB) at select properties including Parcel AQ, Parcel AP, Parcel Y, and Parcel AR. In addition, the EPA contractor removed an estimated 1,300 pounds of ACM material from the properties. However, it was reported that several of the bags of ACM debris were not recorded, so the estimate is likely low. In general, only friable ACM (i.e., MAG and AirCell) was removed throughout OU1.

- **2008 ACM-Contaminated Soil Removal Activities -** The objective of the removal activities was to remove ACM-contaminated soil until no additional ACM was observed. This determination was largely made based on a visual basis with no specific analytical testing performed on soil samples to determine when a property was considered clear of ACM contamination. The extent and depths of the excavation areas were further influenced by other factors, including location of improvements (e.g., houses, driveways, septic systems/drainfields, and maintained lawns) and the wishes of the homeowners at occupied houses.

- **2008 Steam Pipe Removal Activities -** Portions of steam pipe were discovered and removed during removal activities in 2008. The removal activities occurred on the following properties: Parcel F, Parcel M, Parcel N, Parcel A, Parcel AG, and Parcel AK.

- **2008 Temporary, Onsite Repository -** The temporary, onsite repository is located over a portion of the MBK-E, Parcel AG, and Parcel Y properties. The repository was constructed at the general location of the former barracks swimming pool and gymnasium retaining wall. During placement of just over 23,000 cy of contaminated soil, the repository was graded to approximately a 3 horizontal: 1 vertical slope. During closure activities, the repository was covered with a geotextile fabric that was overlain with approximately 12 inches of cover material and seeded with a native mix to establish a vegetative cover. A temporary fence was installed around the perimeter of the repository to deter access, and asbestos danger signs were installed. A survey of the repository was conducted to determine the cover depth, lateral extent, and final temporary repository topography.

- **2008 PCB-Contaminated Soil Removal Activities -** Soil from the Parcel B property was excavated to an initial depth of 42 inches bgs. Additional soil was excavated to a total depth of 48 inches bgs. Because of time constraints the excavation was fenced off and no additional soil was excavated. Additional removal activities were completed in 2009 as described below. Approximately 30 cy of contaminated soil were removed in 2008.

- **2008 Lead-Contaminated Soil Removal Activities -** Lead contamination was identified on the MBK-C property at a location north of the house on Parcel Q property by EPA during previous investigations. This area had had a removal completed in the past; however, after verifying with x-ray fluorescence, residual contamination was still present. In addition, seven soil samples were also collected and analyzed for total lead. Results from the samples collected indicated that results ranged from estimated concentrations of 35.7 to 1,190 mg/kg. Five of the seven samples exceeded the EPA Region 6 SL of 400 mg/kg. The EPA contractor delineated the extent of the residual contamination and the area was re-excavated. The soil was placed adjacent to the excavation on a plastic sheet for disposal at a later date. The excavation process underwent several iterations before the area was cleared using x-ray fluorescence. Approximately 68 cy of lead-contaminated soil were removed. A soil sample was collected from the stockpiled soil to determine if the material was hazardous. The results from the sampling indicated that the concentration of lead was approximately 0.11 milligrams per liter (mg/L). Since the result was below the Resource Conservation and Recovery Act toxicity hazard limit of 5 mg/L, the soil was placed in the temporary onsite repository.

- **2009 Surficial ACM Pickup Activities -** A surface ACM pickup was conducted by an EPA subcontractor throughout areas where excavation activities had been previously completed in 2008. Additionally, pickup was focused in locations surrounding the cover material installed in 2008, throughout some of the occupied properties and at the Parcel Y, Parcel AP, and Parcel AQ properties. A total of approximately 474 cy of ACM were removed from OU1 in 2009.

- **2009 Extension of ACM Covers –** In 2008, portions of several properties had cover material placed on top of areas with visible friable ACM. In 2009 these areas were inspected to determine if the extent of the cover was still adequate. At the Parcel H, Parcel AR, and Parcel BO properties, additional friable ACM was observed on the ground surface outside the cover areas. Consequently, the cover material was extended to encompass this additional ACM. Additionally, MAG insulation was exposed at the surface across a portion of area excavated at Parcel E in 2008. Because of the quantity present, a surface pickup was not feasible and cover material was placed in this area. The extensions to the covers were constructed by placing geotextile liner over the contaminated areas and overlain by a layer of soil approximately 4 to 6 inches deep.

- **2009 PCB-Contaminated Soil Removal Activities -** As follow-up to the 2008 removal activities additional PCB contaminated soil at the Parcel B property was removed. A total of approximately 18 cy of contaminated soil were removed from this area. All soil was hauled off site for disposal at the US Ecology landfill in Grandview, Idaho. A final confirmation soil sample was collected from the bottom of the excavated area and the result was non-detect for PCBs.

- **2009 Lead-Contaminated Soil Removal Activities –** As follow-up to previously completed lead removal activities, EPA collected three composite soil samples from the excavation area at the Parcel Q/MBK-C. Lead was detected at concentrations ranging from approximately 30 to 71 mg/kg. All three samples had total lead concentrations less than the EPA Region 6 SL of 400 mg/kg.

- **2009 Erosion Mitigation -** EPA inspected areas where removal activities had been performed in 2008 to determine if erosion issues were apparent. The most significant erosion observed was at the (b) (6) and (b) (6) properties where eroded areas were present throughout much of the excavation from 2008. Other areas with minor erosion issues included Parcel AR and Parcel M properties. A series of erosion controls were installed at the affected properties to reduce the velocity of surface water flow and prevent further erosion. Heavy equipment was mobilized to construct berms perpendicular to the slopes. Temporary waddles and straw bales were also installed along the berms to further mitigate sediment migration.

2.3.3 Summary of Data Sources and Quality Assurance/Quality Control

Data from numerous sources were used in the RI (CDM 2010a), which formed the basis for the FS (CDM 2010b). EPA and/or the responsible party conducted site investigations during 2003, 2004, 2005, 2006, 2007, and 2008. Investigations were conducted by EPA, MBK, E&E, and CDM. These investigations were outlined in Section 2.3.1.

For work conducted by EPA and its contractors, quality assurance (QA)/quality control (QC) measures include, but are not limited to, the collection of QC samples (such as duplicate samples and field blanks), implementation of a laboratory QA program, review of project reports generated by CDM by an approved QA staff member, and an auditing component to assess the effectiveness of the QA program. All QA/QC components for measurement reports required by EPA Region 10 (i.e., precision, accuracy, representativeness, completeness, and comparability) are addressed in the Final RI Report (CDM 2010a). Field modifications to the governing documents were approved by EPA and implemented by field staff during activities at OU1, and are detailed in the Final RI Report (CDM 2010a).

Data collected at OU1 were evaluated by the EPA (for emergency response data) or government-contracted staff. Data were not validated past that which is required by analytical laboratories' QA/QC program. It is assumed that the raw data were useable for their intended purposes. Each guidance document referenced in this report describes the data quality objectives identified for each data collection activity conducted at OU1 or the NRE site as a whole. All work plan-specific data quality objectives were met.

2.4 Summary of Sampling and Analysis Methods

Various sampling and analysis methods were used to determine the presence of asbestos fibers in different media, such as soil, dust, and air. The following list provides examples of these types of methods that were implemented as part of the remedial activity and risk assessment evaluation at OU1:

- **ABS** - This sampling simulates routine activities to estimate potential exposures. Personal air samples are collected from the breathing zones of participants during various activities. Samples are collected at two flow rates using two different types of pumps during each two-hour event, with a new sample started at the beginning of each new period. Both the high volume and low volume samples are then submitted to the laboratory for analysis using TEM.

- **Ambient Air Sampling -** Stationary air monitoring stations are placed in the vicinity or downwind of contaminated areas to collect continuous air samples using a pump and air filtering cassette. The purpose is to determine the extent of asbestos fibers released from soil. Weather data are collected to correlate climatic conditions with measured releases of fibers. Samples are analyzed for asbestos fibers using TEM analysis.

- **PLM with stereomicroscopy analysis -** Soil samples are analyzed using EPA/600/R-93/116 with a modified protocol that uses a combination of PLM and stereomicroscopy analysis to identify bulk ACM and/or asbestos fibers that may be present in soil.

- **Visual Inspection -** A visual inspection of ACM is completed by first designating inspection areas to establish a boundary around the inspection zone. The soil is then visually inspected for ACM using subsurface excavations or boreholes or surficial visual inspection.

Section 3 Community Participation

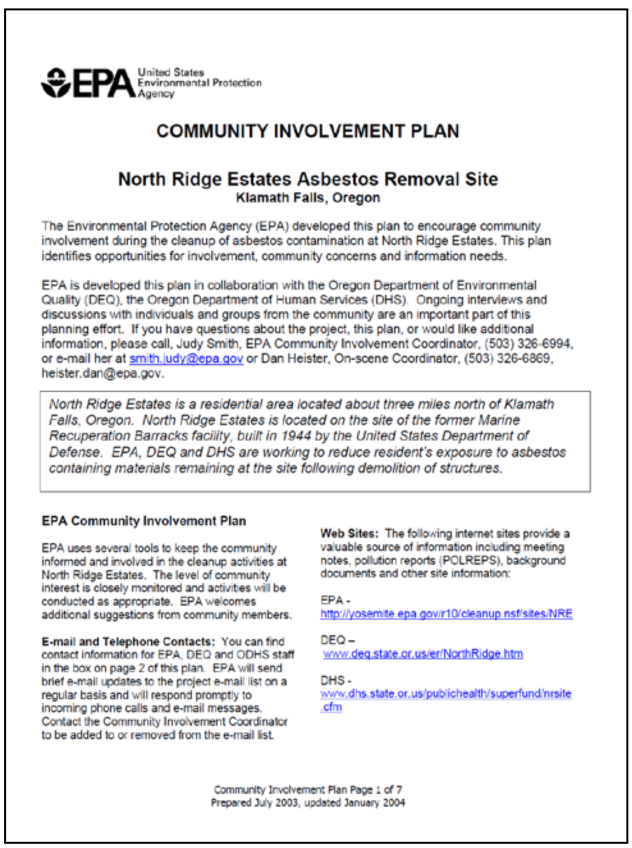
EPA has sustained a robust program of community participation at the NRE site since 2003. The following community engagement activities were conducted at the site:

- Conducted interviews and prepared the Community Involvement Plan
- Established a local information repository
- Engaged in frequent personal communications with site residents
- Held community meetings, small group meetings, and availability sessions
- Maintained and used postal and e-mail contact lists to distribute site updates
- Published notices in the Klamath Falls Herald and News and worked with local news media to share accurate information about the cleanup
- Maintained a project website and onsite access to information
- Issued proposed plan for OU1, held a public hearing, and developed responsiveness summaries and ROD for OU1

3.1 Interviews and Community Involvement Plans

In May and June 2003, EPA conducted community interviews with affected stakeholders to find out general information about the properties, community concerns, and how best to communicate with the public during time-critical response actions. Using the information from those interviews, a community involvement plan was prepared and distributed in January 2004. Additional community interviews were conducted in March 2005 when RI work got underway and the community involvement plan was formally updated and shared in June 2008.

Exhibit 3-1. Community Involvement Plan



United States Environmental Protection Agency

COMMUNITY INVOLVEMENT PLAN

North Ridge Estates Asbestos Removal Site
Klamath Falls, Oregon

The Environmental Protection Agency (EPA) developed this plan to encourage community involvement during the cleanup of asbestos contamination at North Ridge Estates. This plan identifies opportunities for involvement, community concerns and information needs.

EPA is developed this plan in collaboration with the Oregon Department of Environmental Quality (DEQ), the Oregon Department of Human Services (DHS). Ongoing interviews and discussions with individuals and groups from the community are an important part of this planning effort. If you have questions about the project, this plan, or would like additional information, please call, Judy Smith, EPA Community Involvement Coordinator, (503) 326-6994, or e-mail her at smith.judy@epa.gov or Dan Heister, On-scene Coordinator, (503) 326-6869, heister.dan@epa.gov.

North Ridge Estates is a residential area located about three miles north of Klamath Falls, Oregon. North Ridge Estates is located on the site of the former Marine Recuperation Barracks facility, built in 1944 by the United States Department of Defense. EPA, DEQ and DHS are working to reduce resident's exposure to asbestos containing materials remaining at the site following demolition of structures.

EPA Community Involvement Plan

EPA uses several tools to keep the community informed and involved in the cleanup activities at North Ridge Estates. The level of community interest is closely monitored and activities will be conducted as appropriate. EPA welcomes additional suggestions from community members.

E-mail and Telephone Contacts: You can find contact information for EPA, DEQ and ODHS staff in the box on page 2 of this plan. EPA will send brief e-mail updates to the project e-mail list on a regular basis and will respond promptly to incoming phone calls and e-mail messages. Contact the Community Involvement Coordinator to be added to or removed from the e-mail list.

Web Sites: The following internet sites provide a valuable source of information including meeting notes, pollution reports (POLREPS), background documents and other site information:

EPA -
http://yosemite.epa.gov/r10/cleanup.nsf/sites/NRE

DEQ –
www.deq.state.or.us/er/NorthRidge.htm

DHS -
www.dhs.state.or.us/publichealth/superfund/nrsite.cfm

Community Involvement Plan Page 1 of 7
Prepared July 2003, updated January 2004

3.2 Local Information Repository

The administrative record is housed at the EPA Superfund Records Center located at 1200 Sixth Avenue, Suite 900, ECL-076 Seattle, Washington 98101 with the phone number 206-553-4494 or toll-free at 1-800-424-4372. An information repository containing a subset of documents from the administrative record is located at the Klamath Public Library in Klamath Falls located at 126 S 3rd St, Klamath Falls, Oregon 97601-6319 with the phone number (541) 882-8894.

3.3 Onsite Outreach to Residents

The emergency on-scene coordinators, remedial project manager, and the community involvement coordinator worked closely with all site residents during removal actions, relocation, and RI activities. These included obtaining access agreements, briefing residents on the scope of work, providing information to support the entire temporary and permanent relocation process, and facilitating interactions between field crews and residents. When a command post was active during removal actions, a flyer-box was used so that site residents and passers-by could get information on what was happening.

3.4 Public Meetings and Availability Sessions

EPA hosted 14 public meetings in Klamath Falls between January 2003 and December 2009. On the day before and/or after large meetings, project staff had open availability for individual and small group meetings to answer questions about site-specific property concerns. EPA also provided periodic updates to Klamath County commissioners and staff.

3.5 E-Mail and Postal Updates

EPA maintained a mailing list of all interested stakeholders that included a base list of residents derived from Klamath County property ownership information. Most site residents and stakeholders preferred e-mail updates and several e-mails were sent to this list each year to provide information about removal activities, sampling results, and the availability of draft documents.

3.6 Paid Notices and Media Coverage

Over 30 articles about the NRE asbestos site appeared in the Klamath Falls Herald and News between 2003 and 2010. Articles were frequent at the beginning of EPA involvement at the site in 2003, during removal activities, temporary relocation in 2005, and permanent relocation of residents in 2006. KOTI Channel 2 television regularly covered RI sampling activities and public meetings. Other television and radio outlets also provided media coverage about the site. Paid notices were placed in the Klamath Falls Herald and News when required for availability of administrative records.

3.7 Project Website

EPA established a project website to provide access to documents and information about the site (http://yosemite.epa.gov/r10/cleanup.nsf/sites/nre). Removal information was also shared on the internet when actions were underway (http://www.epaosc.org/site/site_profile.aspx?site_id=1793).

3.8 Issued Proposed Plan, Held a Public Hearing, and Developed Responsiveness Summaries and ROD for OU1

EPA issued a proposed plan for OU1 on April 2, 2010. A notice was published in the April 2, 2010 Klamath Falls Herald and News. An e-mail containing a link to the plan and information on how to submit comments was sent to the distribution list. A postcard containing the same information was mailed to the regular mail list. Paper copies of the proposed plan were mailed out by request. A public hearing for the proposed plan was held on the evening of April 8, 2010, at which EPA gave a brief presentation and the public had an opportunity to provide oral or written comment. An open house/availability session was held on the morning of April 9, 2010. The 38-day public comment period closed on May 10, 2010. EPA received 63 comments during the public comment period.

3.9 Outreach Conducted for the Proposed Addition of North Ridge Estates to the National Priorities List.

After EPA issued its proposed plan for NRE, ODEQ concluded that it would recommend to the governor's office that Oregon should utilize its one-time nomination to place NRE on the NPL. This nomination would place NRE on the national Superfund list and make the site eligible to receive congressional funding to implement necessary cleanup at the site. In July 2010, EPA participated in a meeting hosted by ODEQ to solicit input from NRE stakeholders and the local community to gauge the level of support for superfund listing at NRE. In August 2010, Oregon Governor Kulongoski wrote a letter nominating the site. In March 2011, EPA published a notice in the Federal Register proposing the addition of NRE to the NPL. EPA Region 10 sent a news release to raise awareness about the 60-day public comment opportunity listing provided in the Federal Register. No comments were received from the public. On September 16, 2011, EPA published a notice in the Federal Register that NRE had been placed on NPL. A broadcast e-mail and news release were sent out for this final listing.

Section 4 - Scope and Role of Operable Unit

The NRE site includes areas affected by asbestos-related releases or threatened releases within approximately 422 acres. Specifically, these areas include the former MRB location and the Kingsley Firing Range. The NRE site may not be limited to these areas or releases.

As with many sites, the problems at the NRE site are complex. As a result the site has been divided into two OUs:

- ***OU1*** encompasses the footprint for the former MRB and includes all areas where ACM and/or asbestos have been observed and/or detected with the exception of the former firing range. OU1 is estimated to include approximately 125 acres.
- ***OU2*** includes the area of the former firing range and is estimated to include approximately 46 acres.

The remedy selected herein is intended to be the final remedial action for OU1 of the NRE site. The OU1 remedial action will build on the numerous removal actions already implemented at the site. The specific remedial actions that will be taken at OU1 as a result of the ROD are discretely separate from OU2. OU2 is geographically distinct from OU1, and may have COPCs that require additional investigation at a later time.

As described in Section 2, numerous investigations and removal actions have already been completed at OU1. The contamination to be addressed in this remedy is limited to the contamination remaining in OU1.

The remedy focuses primarily on preventing direct exposure to remaining areas of contamination within OU1 through a combination of excavation and/or containment. The remedy also uses engineering controls and ICs both to protect the remedy and to prevent disturbance of the deeper remaining contamination. This approach is protective of both human health and the environment.

OU2 will be addressed separately from implementation of the selected remedy at OU1. The remedy at OU1 is expected to be implemented before any required remedy at OU2.

Until the CERCLA site investigation process has been completed for OU2 and a remedial action (if any) is selected for OU2, EPA can neither estimate the extent of the release, nor describe all the areas of the site. As stated by the D.C. Circuit Court of Appeals, "EPA may alter or expand the boundaries of an NPL site if subsequent study reveals a wider-than-expected scope of contamination." Washington State Department of Transportation v. EPA, 917 F.2d 1309, 1311 (D.C. Cir. 1990) (citing Eagle-Picher Indus. v. EPA, 822 F.2d 132, 144 (D.C. Cir. 1987)).

In addition, remedial actions that result in hazardous substances, pollutants, or contaminants remaining at a site above levels that allow for unlimited use and unrestricted exposure are required to be reviewed every 5 years to ensure protection of human health and the environment. Although EPA does not anticipate the need for any further response action following implementation of the remedy for OU1, additional work may be necessary if it is determined during a 5-year review that it is required to ensure protectiveness of human health and the environment.

Section 5 Summary of Site Characteristics

This section contains an overview of the NRE site in general and OU1 in particular, and the CSM.

5.1 Site Overview

5.1.1 Surface Features and Size

The NRE site, OU1, is on the former location of an MRB and the OTI. OU1 encompasses the footprint of the former MRB and includes all areas where ACM and/or asbestos have been observed and/or detected with the exception of OU2, the former firing range. OU1 is estimated to include approximately 125 acres.

The MRB buildings remaining today include a warehouse, the former brig (renovated into a five-unit apartment building), and several residences on Thicket Court used as officers' quarters during the time the military used the property and as faculty housing during OTI occupation. A guard shack for the military base shooting range also remains standing east of the subdivision; however, the guard shack is considered part of OU2.

Although the other former military base structures at the site have been demolished, the concrete foundations for many of the buildings remain intact. Some of the old roads from the base are also still visible, although they are cracked and vegetation is growing through them. At the NRE site, Old Fort Road and North Ridge Drive appear to follow approximately the same route they did when the base was operating (DHS 2004).

OU1 is comprised of a mixture of privately owned properties and properties held in receivership. The site contains 39 single-family homes (21 of the homes are privately owned and 18 homes held by the Receiver are vacant), one occupied apartment building, eight undeveloped vacant lots held by the Receiver, two privately held undeveloped vacant lots, part of a property that is used as a gravel pit, a warehouse, and a memorial park.

5.1.2 Climate

Prevailing air masses move across Klamath County from the Pacific Ocean, but are greatly modified as they move over the Coast Range and Cascade Mountains. Continental air masses that move down from the interior of western Canada are also a major weather factor. The resulting climate in Klamath County is much drier than that of western Oregon which has more variable but generally warmer temperatures than Klamath County particularly in winter months (Natural Resources Conservation Service [NRCS] 1985).

The area receives the highest monthly precipitation in the winter months (typically December and January). A secondary peak of precipitation occurs during late spring or early summer (typically May). Seasonal characteristics are well defined, and changes between seasons are generally gradual. Average annual precipitation ranges from 10 to 15 inches in the valleys, 16 to 25 inches in nearby hills, and 30 to 40 inches at the lower levels in the Cascades to the west. About 44 percent of the moisture in the area occurs in winter, 22 percent in spring, 8 percent in summer, and 26 percent in fall. Wet days with at least 0.10 inch of moisture vary from 43 days annually in the valleys to 105 days in the mountains (NRCS 1985). Klamath Falls, considered representative of the NRE site, has received an average of 13.95 inches of precipitation annually from 1971 to 2000, with most precipitation falling in January and December. The driest months in Klamath Falls have historically been July, August, and September (Oregon Climate Society 2005).

Snowfall accounts for 30 percent of the moisture in the valleys and as much as 50 percent of the moisture in the mountains. Annual snowfall averages 15 to 45 inches in the valleys, 60 to 125 inches in the foothills, and over 160 inches in some places at more than 4,500 feet. Maximum snow depths have varied from 2 to 3 feet in the valleys and from 5 to 6 feet in the hills and mountains (NRCS 1985).

At Klamath Falls prevailing winds are southerly for November through February, westerly from March through July, and northerly during August, September, and October. Monthly speeds average from 4.4 miles per hour in September to 7.3 miles per hour in March. Wind conditions are calm 17 to 33 percent of the time. Early morning values of relative humidity average 74 to 83 percent year-round and the afternoon low values range from 26 to 33 percent in the summer to 62 to 74 percent in the winter (NRCS 1985).

5.1.3 Areas of Archeological or Historical Importance

Areas of archeological or historical importance exist within the NRE site boundary. MRB-related historical foundations and artifacts are found in buried debris at the site.

5.1.4 Geology

The location of the NRE site, in an area of transition between the Cascade Mountains and the Basin and Range provinces, results in complex geology. The Klamath Basin is primarily composed of volcanic deposits with lowland fluviolacustrine deposits that have been described as consolidated volcanic rocks consisting largely of lava, unconsolidated to semi-consolidated volcanic ejecta deposited around eruptive centers, and lowland fluviolacustrine deposits consisting of dolomite, water-lain volcanic sediment, tephra, and lava (U.S. Geologic Survey [USGS] 1999b).

The Klamath Basin is in part a composite graben formed by north and northwest trending normal faults. Vertical displacements are generally less than 330 feet, but locally exceed 1,000 feet (USGS 1999b). The Klamath graben fault system confines the Klamath Lake Basin at the intersection of the northwestern Basin and Range and Cascade Mountains in southern Oregon. The slip rate along this fault system is between 0.2 and 1.0 millimeter per year. The Klamath graben fault system is divided into three sections: the West Klamath Lake section, the East Klamath Lake section, and the South Klamath Lake section. Faults in the South Klamath Lake section form composite grabens in the vicinity of Klamath Falls. To the north large escarpments on Miocene and Pliocene bedrock define a graben that confines Upper Klamath Lake. Fault scarps are formed on Holocene and Pleistocene talus deposits along these escarpments. The lack of extensive alluvial fans at the mouths of canyons that empty into Upper Klamath Lake may indicate late Quaternary subsidence along the margins of the Upper Klamath Basin. South of Klamath Falls the graben system widens into a series of fault blocks and grabens (USGS 2002).

5.1.5 Soil

According to the NRCS soil survey of Klamath County (NRCS 1985) the three main soil types present at the site are: Royst stony loam, 5 to 40 percent north slopes; Royst stony loam, 5 to 40 percent south slopes; and Woodcock association soils, north. The majority of soil at the site is classified as Royst stony loam. The whole area south of Old Fort Road and roughly north of Hunter's Ridge Road is described as Royst stony loam, 5 to 40 percent north slopes and the area north of Old Fort Road, including Thicket Court, is described at Royst stony loam, 5 to 40 percent south slopes.

NRCS (1985) describes Royst stony loam as a well-drained soil found on timbered escarpments. It is formed in very gravelly material weathered from tuff, basalt, andesite, and a small amount of pumiceous ash. Tuffaceous bedrock is found at a depth of 25 to 40 inches. This soil type is found at elevations ranging from 4,300 to 5,500 feet, and an average annual precipitation of 15 to 18 inches. In areas of Royst stony loam the average annual air temperature is 43 to 45 degrees Fahrenheit. Permeability in these soils is slow. In unprotected or bare areas, runoff is rapid following snowmelt in spring and the hazard of erosion is high. Available water capacity is as low as 2.5 inches where depth to bedrock is 25 inches and the soil is extremely gravelly, and as high as 6 inches where depth to bedrock is 40 inches and the soil is less gravely. The water-supplying capacity for natural vegetation is about 8 to 13 inches.

Soils directly to the north of Thicket Court and continuing north to Old Fort Road are classified by NRCS as belonging to the Woodcock association, north (NRCS 1985). These soils are well-drained and are found on escarpments of fault block mountains. They formed in extremely gravelly colluvium weathered from andesite, basalt, and a small amount of cinders and ash. These soils are underlain by bedrock at a depth of more than 60 inches. Slopes are concave and vary from 500 feet to more than 3,000 feet in length. The average slope is about 20 percent. This soil type is found at elevations ranging from 4,200 to 5,900 feet and an average annual precipitation of 18 to 22 inches. In areas of Woodcock association soils the average annual air temperature is 43 to 45 degrees Fahrenheit. Permeability in these soils is moderate. Runoff is medium and the hazard of erosion is moderate. Available water capacity is 4 to 7 inches. The water-supplying capacity for natural vegetation is 11 to 16 inches (NRCS 1985).

5.1.6 Surface Water Hydrology

The site is located within the Upper Klamath Lake subbasin of the Upper Klamath Basin. Klamath Lake, the largest freshwater lake in Oregon and one of the largest in the United States, is located in the Upper Klamath Lake watershed. The Upper Klamath Basin covers 5.6 million acres with the Upper Klamath Lake subbasin comprising nearly 500,000 acres (USGS 1999a).

In the arid to semi-arid locations of Klamath County most precipitation-replenished soil moisture evaporates or is transpired by vegetation. Little is left to maintain stream flow or recharge aquifers. Precipitation that falls as snow generally does not become runoff until spring thaws begin (USGS 1999b).

The occurrence of surface water at the site is limited to an intermittent stream that flows north from the site, roughly following Old Fort Road. The stream ultimately terminates at a canal for

Upper Klamath Lake that is used to irrigate lands in the Lost River Basin of Oregon and California.

5.1.7 Hydrogeology

The primary hydrogeologic units in Klamath County were described in 1958, 1970, and 1974, as follows:

- A highly permeable lower (older) basalt unit which serves as the principal aquifer in the area
- Yonna Formation (a medial zone of stratified lacustrine deposits consisting of tuff, agglomerate, shale, diatomite, sandstone, and volcanic ash with some volcanic intrusives or interbeds of thin lava flows), which primarily confines groundwater
- Upper, younger units (lava flow forming cap rock in place, eruptive deposits, and alluvium), which occur above the water table or yield small quantities of perched water (USGS 1999a)

The USGS has worked to improve the earlier descriptions of the aquifer system in Klamath County. The USGS classifies the aquifer system underlying much of Klamath County including the area covered by the site as a volcanic and sedimentary rock aquifer. Volcanic and sedimentary rock aquifers consist of a variety of volcanic and sedimentary rocks. The volcanic rocks that compose the aquifers consist primarily of Pliocene and younger basaltic rocks; unconsolidated volcanic deposits included in the aquifers are ash and cinders. The sedimentary rocks that compose the aquifers consist primarily of semi-consolidated sand and gravel eroded mostly from volcanic rocks. In some places the aquifer might consist of a single rock type. In others the aquifers might consist of several interbedded rock types (USGS 1999b).

The permeability of the various rocks that compose the volcanic and sedimentary rock aquifers is extremely variable. Interflow zones and faults in basaltic lava flows; fractures in tuffaceous, welded silicic volcanic rocks; and interstices in coarse ash, sand, and gravel mostly yield less than 100 gallons per minute of water to wells. Rarely wells will yield several thousand gallons per minute. Where major faults are present the rocks commonly contain geothermal water under confined conditions (USGS 1999b).

The hydrogeologic characteristics of the volcanic and sedimentary rock aquifers are largely unknown. Also the subsurface extent of these aquifers is largely unknown because of limited outcrop areas where they are shown overlaying older rocks, or because they are too deep for many wells to reach economically. In Klamath and Lake Counties the volcanic and sedimentary rock aquifers are extremely permeable in places and large quantities of water are withdrawn by wells for public supply, domestic, commercial, agricultural, and industrial purposes (USGS 1999a).

Basin and range style faulting has divided the Klamath Basin into a series of small subbasins. It has been indicated that geologic structures generally impact groundwater flow locally rather than having basin-wide impacts and that groundwater moves freely across fault zones in most areas. In addition it has been found that regional, intermediate, and local groundwater flow occurs within the Klamath Basin. Groundwater flow between subbasins has been speculated to occur, although supporting data are limited. Earlier work has identified uplands as the primary groundwater recharge areas for all the flow systems because of greater precipitation and permeability. Discharge occurs locally in mountain slope springs and nearby lowlands, and regionally at the lowest basin elevations via upward seepage and springs (USGS 1999a).

Flowing artesian wells in the vicinity of Upper Klamath Lake and a large number of springs indicate that strong upward components of groundwater flow occur in many parts of the Klamath Basin. The groundwater discharge plays an important role in providing discharge to Upper Klamath Lake and base flow to streams in the basin (USGS 1999a).

A geothermal system within the Klamath Basin is indicated by the occurrence of hot springs and hundreds of warm water wells in the vicinity of the City of Klamath Falls and areas to the south near Olene Gap and Klamath Hills. Klamath Falls has developed geothermal water in the volcanic and sedimentary rock aquifers into a system for heating homes and public buildings. As many as 500 wells supply geothermal water and generally yield from 100 to 3,000 gallons per minute. A conceptual model of the geothermal system was developed in which meteoric waters in a deep regional flow system circulate to depths of up to 10,000 feet by way of interconnected fracture zones. The waters are heated to 130 degrees Celsius before they move upward into the shallow groundwater system along basin and range faults. Most of the thermal discharge does not reach the surface, but moves outward from the fault conduits into permeable zones in basalts where it mixes with cooler, shallow groundwater. The relation of the thermal groundwater system to the shallow non-thermal system is not well understood (USGS 1999a).

Information on groundwater beneath OU1 is limited, primarily because site residents are supplied by pipelines from the public water supply in Klamath Falls.

The only known drinking water well within, or near, OU1 is the well on the (b) (6) roperty within Section 22; however no well logs can be found within the Oregon Water Resources Department database. The owners stated that the original water well installed at that property was damaged in approximately 1968 because of an earthquake and subsequently abandoned. The owners also indicated that a new well (their current well) was drilled deeper and is supplied at a depth of approximately 900 feet bgs.

The preliminary assessment (PBS Engineering and Environment 2003) indicated that one other well existed close to OU1. This well (KLAM 11650) was installed in 1963 within Section 14. This well was reported to have a static water level (SWL) of 45 feet bgs, and a total depth of 172 feet bgs. However because of the location of this well (at the top of Hogback Mountain), groundwater from this well does not appear to have a connection to groundwater beneath OU1, because the bottom elevation of this well appears to be higher than the ground surface elevation at OU1. In addition, the lithology screened within the well appears to be different than the other wells researched in the preliminary assessment.

Other water wells exist within approximately 1 mile of the site, south of OU1, as indicated in the preliminary assessment (PBS Engineering and Environment 2003) and as confirmed by review of logs within the Oregon Water Resources Department database. These wells were reported to have SWLs ranging from 182 to 390 feet bgs. A review of the logs for some of these wells, KLAM 11009 and L42727, indicate SWLs of 174 and 378 feet bgs. However depth to first encountered water in these two wells is much deeper (334 and 518 feet bgs, respectively). The differences in groundwater elevations could indicate semi-confined aquifer conditions; these conditions can be found in the Klamath basin as indicated in Scientific Investigations Report 2007-5050, version 1.1 (USGS 2010).

Based on the site characteristics information presented in Section 5.1, shallow groundwater, if it exists throughout OU1, is likely to occur in discontinuous perched zones with low, intermittent flow. The only known location of shallow perched groundwater was encountered at the (b) (6) property during installation of an onsite wastewater treatment (septic) system; however no records documenting this condition can be found. It is also suspected that shallow groundwater may exist seasonally beneath the intermittent stream located in the north portion of OU1 near the landfill and warehouse that discharges north towards the former WWTP; however, this is based on visual observations of topography and has not been confirmed. There are no known uses of shallow groundwater at OU1.

Aquifers capable of providing the quantity and quality of water suitable as a source of drinking water are expected to be at a significant depth (at least several hundred feet) below the ground surface at OU1. This is based on the information concerning the water well on the (b) (6) property and interpretation of logs from water wells located in Section 22 along Old Fort Road (south of OU1) which indicate consistent screening of an aquifer consisting of black sand, sandstone, and gravel. This aquifer system also appears to be semi-confined, based on review of depth when water was first encountered relative to the final SWL.

5.2 Conceptual Site Model

The CSM is a basic description of how contaminants enter the environment, how they are transported, and what routes of exposure to organisms and humans occur. It also provides a framework for assessing risks from contaminants, developing remedial strategies, determining source control requirements, and methods to address unacceptable risks.

5.2.1 Asbestos CSM

5.2.1.1 Sources of Asbestos and ACM in Soil

ACM used in the original construction of the MRB is the main source of asbestos in site soil. As was common in the 1940s, many different types of building materials contained asbestos, including CAB used on exterior and interior walls, asphalt-asbestos roofing material, VAT, floor tile mastic, and several different types of steam pipe insulation (MAG and AirCell).

When buildings containing ACM were demolished, some of the ACM debris was consolidated into waste piles or burial pits, and the rest was dispersed in surface and subsurface soil in the vicinity of the demolition. During site development, most of this ACM was covered or buried with soil, but some was left exposed.

Over time, pieces of ACM in the shallow subsurface soil have been appearing at the surface. This resurfacing of ACM is believed to be due to repeated cycles of freeze-thaw within the soils (frost heave) and/or to surface soil erosion. Once at the surface, the pieces of ACM are a continuing source of asbestos fibers to surface soil and/or air, especially when the ACM and soil are disturbed by human or mechanical forces.

Exhibit 5-1. Estimated Amounts of ACM Used in the Construction of the MRB

Material Type	Weight of ACM (U.S. Tons)
Exterior CAB Siding	580
Interior CAB Panels	60
Roofing Material	150
Floor Tile	730
Steam Pipe Insulation	2
TOTAL	**1,522**

Estimated amounts of ACM used in the construction of the MRB are shown in Exhibit 5-1. EPA estimates that 96 percent of these building materials still remain buried in the soils on OU1. When the buildings associated with the old military barracks were demolished, these building materials mixed into surface and subsurface soils, creating approximately 189,000 cy of ACM, contaminated debris, and ACM-contaminated soils.

5.2.1.2 Migration Routes and Exposure Pathways

The ACM was brought to the site in the form of building materials used to construct nearly 80 buildings in 1944. Over the last 60 years, the buildings were demolished and the ACM was left on site. Most of the ACM on site is buried, and the depth of burial varies from 0 to 10 feet bgs. Most of the ACM at OU1 was non-friable at the time of construction. However, the ACM may have or may become friable because of a number of processes and actions. These include:

- Aboveground weathering of the ACM binding matrix resulting in the release of asbestos fibers.
- Fracturing and pulverizing of ACM binders during building demolition, bulldozing, and burial resulting in the release of asbestos fibers.
- Fracturing, degradation, or destruction of the ACM binders when burned. Cement binders would have been degraded and fractured when burned and organic binders contained in roofing, tar paper, tile flooring, and mastic would have been destroyed when burned.
- Belowground chemical and physical weathering of the buried ACM binders. Chemical weathering could result from exposure to organic acids and enzymes. Physical weathering could result from fracturing because of freezing and thawing, root penetration, and digging or chewing by animals.

There are a number of processes that result in the movement of ACM and asbestos fibers found below and at the ground surface. These include the following:

- **Migration to the ground surface** - It has been observed that ACM pieces migrate to the ground surface over time. Areas where EPA contractors have removed all visible ACM during one summer were found to have more ACM at the ground surface the following summer. This upward migration is considered to be driven primarily by freeze/thaw cycles. Given site weather and soil conditions the specific mechanism that causes the movement is likely to be "frost jacking," also known as frost heave.

  This natural process has been researched and is well understood (Anderson 1988). Frost jacking of buried items occurs in moist silty soils exposed to repeated freeze/thaw cycles. As the soil freezes, ice lenses form and the soil heaves up vertically. Depending on the rate of downward movement of the freezing front and the availability of soil moisture, frost heave can lift the soil several inches in a single freezing cycle. Buried items are lifted up by the frost heaving soil during the freezing part of the cycle. As the soil thaws from the ground surface downward, the ice lenses in the soil melt and the soil settles down and around the lifted item, so that it cannot settle back to its original position. This process of lifting buried items occurs with every freeze/thaw cycle. The depth of ground freezing is reported to be no greater than 24 inches below the ground surface in the Klamath Falls area (Oregon Codes 2008) and is highly dependent on soil type, moisture, ground cover, and exposure to sunlight. Frost jacking is likely not a mechanism that transports buried ACM to the ground surface if the ACM is buried at a depth greater than 24 inches. Freeze/thaw cycles would be expected to be more frequent in the top 12 inches than at greater depths, causing a higher rate of frost jacking near the ground surface than at greater depths.

- **Erosion of surficial soil -** Erosion of surface soils by wind and water can cause buried ACM and asbestos fibers to be exposed at the ground surface as well as result in transport of surface ACM and asbestos fibers. Erosion rates will be higher in areas with steep slopes, in areas without vegetative cover, and in areas of surface water flow.

- **Transport to the ground surface by burrowing animals -** Burrowing animals can transport buried ACM and asbestos fibers to the ground surface while removing soil for tunnels and dens. Excavated soil containing ACM and asbestos fibers have been observed spread on the ground surface near the openings to these tunnels.

- **Mechanical wedging and jacking by plant roots -** Soil containing ACM and asbestos fibers can be moved by root growth. Large pieces of ACM can be fractured as root growth expands into cracks in the ACM. Root growth near the ground surface may wedge and lift the lighter and larger pieces of ACM driving them upwards toward the surface.

- **Wind transport -** Asbestos fibers in the surface soil are released from weathered ACM and may be transported by wind. The average time for asbestos fibers to remain in the atmosphere is estimated to be about 5 to 15 days (Balkanski et al. 1993; Atkinson 1995). Asbestos fibers could be re-entrained into the atmosphere if soils are disturbed by man-made or natural activities (Air Resources Board 1986).

- **Soil-disturbing activities -** Asbestos fibers in the surface soils can be transported by activities related to gardening, landscape improvement or maintenance, recreation, or any other activity that disturbs the ground surface.

- **Site development -** The soils at a site are typically disturbed during construction and maintenance of buried utilities, roadways, building foundations, and landscaping. Transport of shallow soils for these purposes can cause buried ACM and asbestos fibers to be exposed at the ground surface.

In summary, the migration of ACM and asbestos across the site can be caused either by anthropogenic activities or naturally occurring actions. Exhibit 5-2 summarizes the activities influencing migration of ACM and asbestos at the NRE site and indicates whether the activities are related to human activities or naturally occurring actions.

Exhibit 5-2. Summary of Activities that Influence the Migration of ACM and Asbestos

Human Based Activity	Naturally Occurring Actions
Soil disturbing activities: gardening, landscaping, recreation	Migration to the ground surface through frost jacking (also known as frost heave)
Site development and maintenance	Wind and water erosion of surface soils
	Mechanical wedging and jacking by plant roots
	Wind transport
	Burrowing animals

The exposure route of chief concern for asbestos is inhalation of asbestos fibers. People on site may be exposed to asbestos in air by three main pathways:

- Inhalation of fibers released during activities that disturb soil

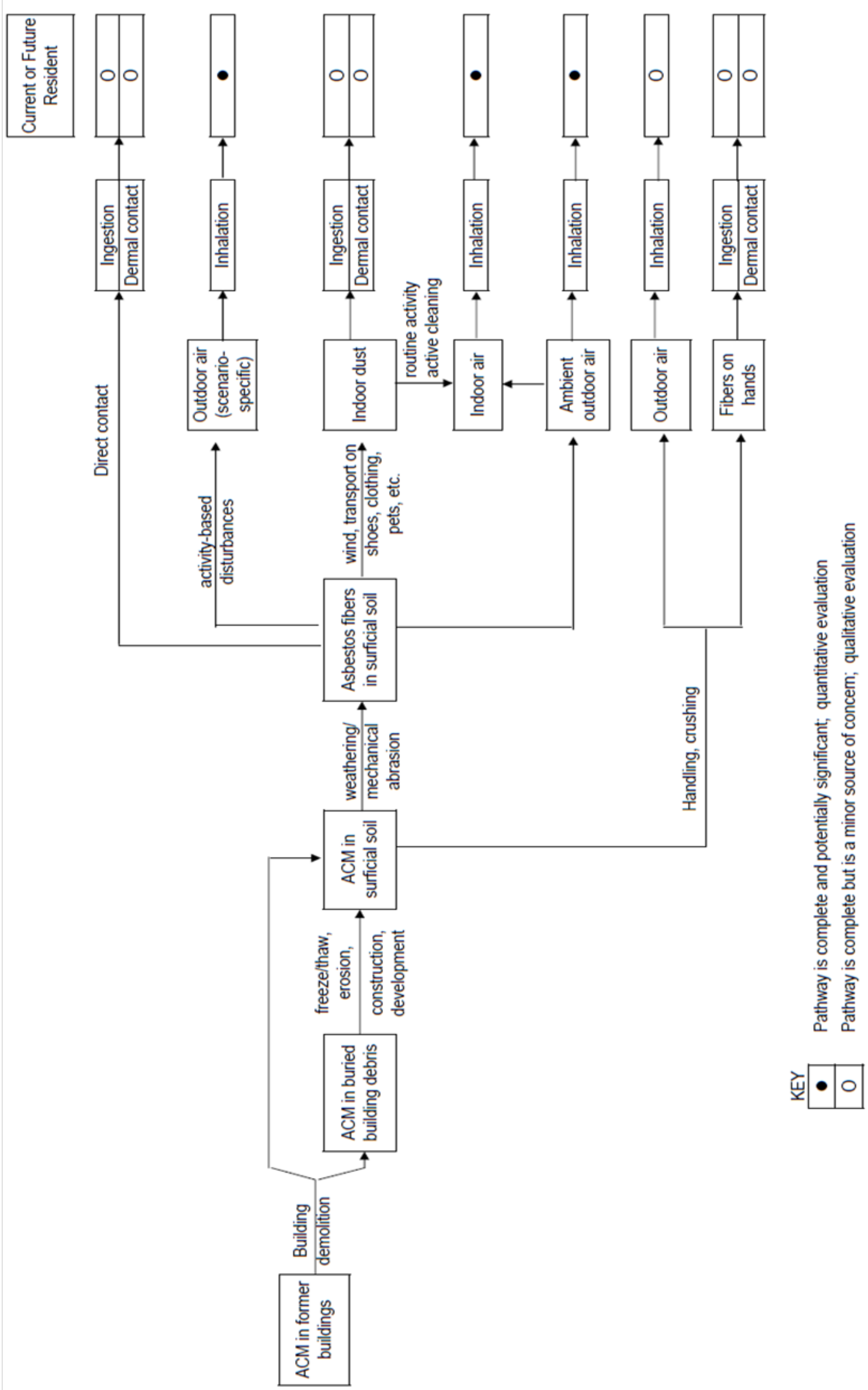
- Inhalation of fibers in indoor air

- Inhalation of fibers in outdoor (ambient) air

Inhalation exposure resulting from active soil disturbance is believed to be the most significant of these pathways.

Exhibit 5-3 is a conceptual site model that summarizes what is known about how current or future residents and workers might be exposed to asbestos fibers in air at OU1. While visible pieces of ACM that are at the surface are too large to become airborne or be inhaled, weathering and/or mechanical breakdown can release free asbestos fibers from the ACM into the soil. Pieces of ACM that are beneath the surface of the soil where they are not subject to disturbance would be of low concern if they were to stay in that location, but some pieces tend to move toward the surface because of freeze-thaw cycles and/or to erosion of the overlying cover. Construction and site development activities may also unearth significant amounts of buried ACM. Once at the surface, these pieces of ACM may undergo accelerated breakdown from weathering and/or mechanical forces which results in the release of free asbestos fibers into soil, as described above.

Exhibit 5-3. Conceptual Site Model for Exposure to Asbestos



Free asbestos fibers in surface soil may lead to human exposure by several pathways. For current or future residents, the pathways that are considered most likely to be of potential concern are described below:

- **Disturbance of Contaminated Outdoor Soil -** The most direct exposure for asbestos fibers in surface soil occurs when a person actively disturbs the soil, as this can cause free asbestos fibers in the soil to be released to air where they can be inhaled. Releases are likely to be highest and of greatest concern when the disturbance of the soil is vigorous (e.g., raking, mowing, weed-trimming, digging, riding an all-terrain vehicle, etc.), but might also occur to a lesser degree for less intense disturbances (e.g., walking or riding a bicycle across dry soil).

- **Disturbance of Contaminated Indoor Dust -** Exposure to free asbestos fibers in soil can occur when contaminated soil is tracked into the home on shoes or clothing. Once in the home, the soil becomes mixed into indoor dust, and a wide range of normal indoor living activities may disturb the dust and release asbestos fibers in indoor air. This would include vigorous activities (e.g., sweeping or dusting,) and intense activities (e.g., walking on carpets, playing with children or pets, or sitting down on furniture).

- **Inhalation of Ambient Air -** Exposure may occur when fibers are released by wind or mechanical forces from many different locations, all of which may add to a level of asbestos that is present in general (ambient) outdoor air. Thus, simply breathing outdoor air, even in the absence of actively disturbing any contaminated soil, might lead to asbestos exposure of area residents. In addition, outdoor air exchanges with indoor air, potentially leading to exposure while inside the home as well as outside.

- **Direct Handling of ACM -** Exposure may occur if pieces of ACM are picked up and handled releasing fibers of asbestos to the air where they can be inhaled. Fibers may also adhere to skin or clothing, which could lead to inhalation exposure if the fibers were subsequently released to the air.

For excavation or construction workers, the primary pathways of concern are inhalation of asbestos in outdoor air that occur when surface or subsurface soil is disturbed by excavation or other work-related activities, and also by handling pieces of ACM.

For residents, data are available for quantifying exposure and risk from disturbance of surface soil, indoor air and ambient air, and the remainder of this section describes how the exposures and risks may be estimated. Data are not presently available to allow a meaningful quantitative evaluation of risks from direct handling of pieces of ACM, or of exposure and risks to excavation/construction workers from disturbances of ACM in subsurface soil. These pathways that cannot be evaluated quantitatively are a source of uncertainty.

5.2.2 Non-Asbestos Conceptual Site Model

5.2.2.1 Sources of Non-Asbestos Contamination

Arsenic is found near the location of the former power plant on OU1. The former power plant used coal as its primary source of fuel. Coal is known to contain low levels of metals such as arsenic and arsenic could have accumulated as a byproduct of coal combustion during the operation of the former power plant.

VOCs are present at OU1 because of past onsite releases of dry cleaning solvents, solvents used for parts cleaning and/or degreasers, or other chemicals in the vicinity of the former power plant, maintenance shop, laundry building, OTI maintenance shop, paint shops, and service station. The disposal practices used in these areas may have consisted of dumping the solvents or other chemicals onto the ground and possible storage of leaking solvent containers in the areas of concern.

Other than small quantities of household chemicals used and stored by area residents, there are no significant sources of VOC solvents or other chemicals remaining at OU1. VOCs typically volatilize rapidly when exposed to air. VOCs found in a subsurface setting may degrade through abiotic and biotic processes.

5.2.2. 2 Migration Routes and Exposure Pathways

Contaminant migration can occur in several ways depending on the characteristics of the compound or element and the associated media. Potential mechanisms for transport of surface contaminants to the environment include transport in air or windblown particles, non-infiltrating surface water, which includes accumulation in or dissolution from sediment and dust, and infiltration of water though the subsurface and subsequent deposition in soil profiles. The presence of arsenic above background levels in the subsurface at the former power plant could be attributed to these transport mechanisms from the source at the surface.

Groundwater flow and fluctuation is typically the primary means by which contaminants migrate in the subsurface. However it is unlikely that residents are exposed to contaminated groundwater for the reasons discussed in Section 5.2.4.1.

Migration specific to VOCs can also result from volatilization of contaminants contained in soil. VOCs can partition to soil gas from contaminated soils via diffusion processes in the vadose zone. The soil gas can then migrate because of barometric pumping. Contaminant vapors may be found in outdoor and indoor settings. Contaminants in the surface soils can be transported across the site or indoors on clothes, shoes, and pets as a result of contact with the contaminants. Surface soil erosion due to surface water movement may transport contaminants across the site.

Contamination in the subsurface at the site is transported vertically by gravity and laterally by following preferential pathways in soil. Since groundwater is not a significant factor at the site because of its depth, the magnitude of the vertical and lateral extent of contamination will be based primarily on the volume of the releases in the areas of concern. VOCs in the subsurface can migrate to the surface in soil gas and the rate of migration is influenced by the soil type and depth and magnitude of contamination. Atmospheric pressure can also affect the migration of soil gas to the surface. As atmospheric pressure rises, the rate of soil gas migrating to the surface decreases and, as the pressure lowers, soil gas rises at a faster rate. The presence of VOCs in near-surface soils can result in migration of VOCs via a vapor intrusion pathway into residential homes.

Exhibit 5-4 presents a site conceptual model showing the exposure pathways by which non-asbestos chemicals may migrate from onsite sources into other environmental media, and the scenarios by which current or future onsite residents and workers might reasonably be exposed. However, not all of these potential exposure routes are likely to be of equal concern. Exposure scenarios that are considered to be complete and potentially significant are shown in Exhibit 5-4 by boxes containing a solid black circle. Boxes with an open circle show pathways that are judged to be complete but are likely to contribute only occasional or minor exposures. The following sections present a more detailed description of exposure scenarios that may occur at the site.

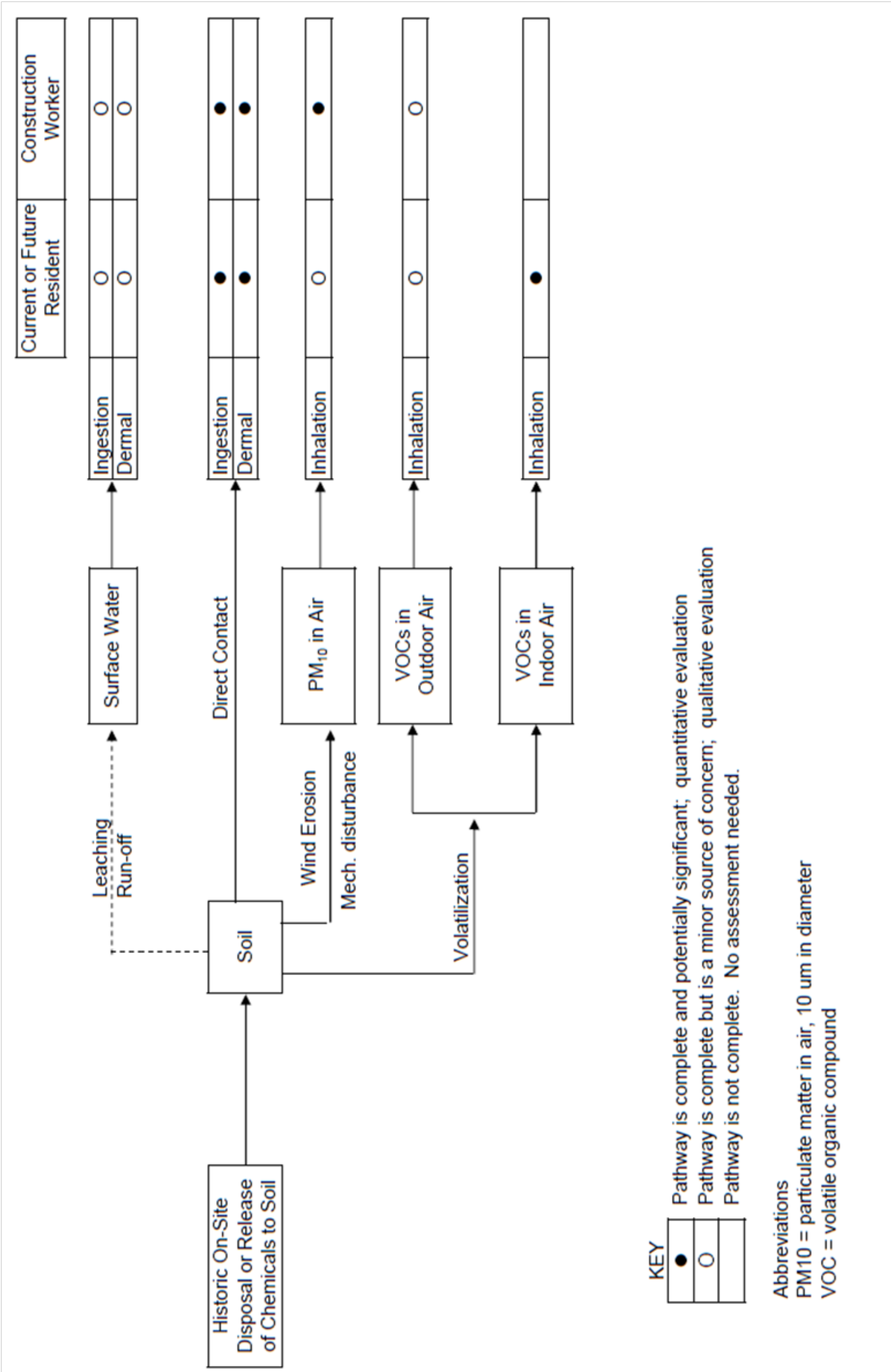
- **Exposure to Surface Water -** Contaminants in soil may run off or leach into surface water following rain or snowmelt events. Exposures may occur when skin contacts the water while working outdoors; and, under some circumstances, exposures may occur when small amounts of the water are ingested. However, because there are no permanent surface water bodies at OU1, and because human contact with surface water runoff is expected to occur only infrequently, this exposure pathway is considered to be minor and is not evaluated quantitatively.

- **Direct Contact with Soil –** Exposure may occur when small amounts of soil that adhere to hands during indoor or outdoor activities are ingested. Soil may also adhere to skin while working outdoors, and some chemicals, especially organic chemicals, can be absorbed across the skin from the soil into the body. Therefore, both ingestion and dermal contact with surface soil are considered to be complete and potentially significant exposure pathways for residents and workers, and are evaluated quantitatively.

- **Inhalation of Airborne Particulate Matter -** Particles of contaminated surface soil may become suspended in air by wind or mechanical disturbance. For residents, unless airborne concentrations of soil particles are extremely high, the amount of soil inhaled from air is typically a minor source of exposure when compared to soil ingestion. Therefore, this pathway is not evaluated quantitatively for residents. For workers who are actively engaged in construction or soil excavation activities, levels of soil particles in air are likely to be higher than for the residential scenario, so inhalation of soil particles in air by workers is evaluated quantitatively.

- **Inhalation of Volatile Organic Chemicals -** VOCs that are present in soil tend to migrate upward through the soil where they may either be released into outdoor air or may penetrate into buildings through crawl spaces or cracks in the foundation. Exposures may occur when those particles are inhaled. Releases to outdoor air are usually of low concern because the vapors are rapidly dispersed. Additionally, none of the VOCs detected in soil at OU1 approach or exceed ODEQ screening levels for residential or worker exposure to VOCs in outdoor air (ODEQ 2007). Therefore, exposure of residents and workers to VOCs in outdoor air is judged to be sufficiently small that quantitative evaluation is not needed. In contrast, vapors that penetrate buildings may tend to accumulate over time, leading to indoor air concentrations that might be of concern. Therefore, exposure of residents to VOCs in indoor air is evaluated quantitatively.

Exhibit 5-4. Conceptual Site Model for Exposure to Non-Asbestos



5.2.3 Affected Media

Affected media include soil and air. Additional detail regarding the COCs observed in each of the affected media is provided below.

ACM is present at OU1 as both dispersed material scattered widely across the 125-acre OU and concentrated material in burial areas with depths ranging from 4 inches bgs to 10 feet bgs. The total amount of buried material in these locations across OU1 has been estimated to be approximately 76,064 cy. MAG and AirCell are randomly distributed in most areas containing ACM. The specific location of surficial MAG or AirCell follows no predictable pattern. Although some of the ACM areas are near still-visible floor slabs, many of the burial areas do not appear to be connected to any specific historic building location. Surficial ACM is present at some, but not all, burial areas. Thus it cannot reliably be used as an indicator of burial.

There are a number of areas where no ACM (buried or surficial) has been observed. There are also areas where the presence of ACM could not be investigated. These are areas where access was not granted or areas where steep and heavily vegetated slopes make safe access impossible.

Asbestos fibers have been observed in both indoor and outdoor ambient air as well as personal and stationary air samples collected near soil disturbances. Asbestos fibers have also been observed in soil. ABS sampling showed elevated concentrations of asbestos fibers in outdoor air when soil is disturbed, even when surficial ACM has been removed and the soil is determined to be non-detect using PLM analysis for free asbestos fibers. However, the PLM analysis method for the measurement of free asbestos fibers present in soil has not been well developed. In general, values lower than about 1 percent are highly uncertain. Free amosite asbestos fibers have only been observed rarely at the site indicating that free amosite fibers are not detected at a high frequency in surface soils at the site at sensitivities evaluated. ACM has been observed to make up between 0.01 and 11 percent by weight of soil at the site.

Non-ACM COPCs at OU1 that exceeded human health screening levels SLs in soil include:

- Arsenic
- Lead
- PCBs
- Mercury
- 1,2- DCA
- Benzene
- Chloroform
- cis-1,2-DCE
- PCE
- TCE

Levels of these human health COPCs, with the exception of dermal contact and ingestion of arsenic in soil at the former power plant, do not pose a risk to human health and, thus, do not require remediation. Non-asbestos COPCs are discussed in further detail in Section 7 – Summary of Site Risks.

5.2.4 Groundwater and Surface Water

5.2.4.1 Groundwater

Based on the contaminant information presented in Section 2 and the site geology and hydrogeology presented in Section 5.1, it is unlikely that groundwater beneath OU1 has been impacted from contaminants of interest (COIs) in soils at OU1. The rationale provided in the following bullets form the basis for that conclusion:

- **Low Concentrations of Non-Asbestos COIs Detected in Soil –** Based on the information presented in the RI regarding nature and extent of contaminant releases, detections of non-asbestos COIs were below the comparison criterion (EPA Region 6 SLs from the residents soil table), with the exception of the following COIs at their maximum concentrations in soil: inorganics (arsenic at 27 mg/kg; lead at 1,190 mg/kg; mercury at 3.7 mg/kg), VOCs (benzene at 0.014J mg/kg; chloroform at 0.12 mg/kg; cis-1,2-DCE at 0.019 mg/kg; PCE at 0.018 mg/kg; 1,2-DCA at 0.62 mg/kg, TCE at 0.075 mg/kg), and PCBs (Aroclor 1260 at 7.27 mg/kg). These COIs were detected at specific locations of limited extent as discussed in the following bullet.

- **Limited Extent of Non-Asbestos COI Releases in Soil -** The non-asbestos COIs detected in soil were released from specific locations of localized extent within the former MRB. Although significant disturbance of site soils occurred during demolition of the former MRB, data collected during the RI indicate that areas of non-asbestos COI releases were not disturbed from their original release locations and have a limited horizontal extent. Specifically the RI identified the former power plant, maintenance shop, laundry building, OTI maintenance shop, paint shops, and service station as the primary facilities from which releases of non-asbestos COIs occurred.

  Data collected during the RI also indicate that the vertical extent of these releases was limited. The deepest detections of non-asbestos COIs above EPA Region 6 soil screening levels (SSLs) were approximately 10 feet bgs. Groundwater was not encountered in soil borings or test pits during subsurface sampling. PCBs and lead were excavated during previous removal actions; confirmation soil samples taken after excavation indicated the vertical extent of these COIs were limited to depths of approximately 3 feet bgs for both contaminants, respectively.

- **Significant Duration from Initial Releases of Non-Asbestos COIs in Soil –** Based on the historical information presented in the RI, the initial releases of non-asbestos COIs likely occurred more than 50 years ago, beginning in 1944 when the MRB facilities were constructed. The significant duration from the initial releases have allowed for natural attenuation of certain COIs in soil, specifically VOCs, to occur through mechanisms such as volatilization, biodegradation, etc.

- **Limited Ability of Certain Non-Asbestos COIs in Soil to Migrate to Groundwater –** Several of the non-asbestos COIs (particularly PCBs and inorganics) tend to sorb to soil particles and do not readily leach to groundwater. For instance, the National Academy of Sciences (1980) indicated lead is relatively insoluble and immobile in soil except where it exists as organic complexes or in acidic conditions, neither of which occurs or is expected to occur at OU1. The migration of inorganic COIs and PCBs to groundwater through the subsurface soil matrix is further retarded by the presence of organic material in surface soils and significant amount of clays in subsurface soils which have relatively high cation exchange capacities as discussed in the last bullet.

A comparison of the non-asbestos COIs that exceed the comparison criteria as indicated in the first bullet were made to EPA's generic SSLs for a residential scenario/migration to groundwater as indicated in Exhibit A-1, Appendix A of EPA's Supplemental Guidance For Developing Soil Screening Levels For Superfund Sites (EPA 2002). The SSLs that include a dilution attenuation factor of 20 were assumed because of the known presence of subsurface conditions that would favor attenuation of the COIs before their entry into a receptor well. Based on that comparison, the following COIs were not present at concentrations that would have allowed migration and impacts to groundwater: arsenic, benzene, chloroform, cis-1,2-DCE, and PCE.

- **Limited Vertical Extent of Asbestos Releases in Soil-** The asbestos in soil was released from demolition of ACM associated with the former MRB. Although this resulted in significant horizontal dispersion of asbestos in site soils at OU1, data collected during the RI indicate that the vertical extent of those releases was limited. The deepest asbestos was detected in subsurface burial piles was approximately 10 feet bgs.

- **Semi-Arid Conditions –** As discussed in the RI and Section 5.1.2, the site is located in a climate zone characterized by a vast area of high desert prairie punctuated by a number of mountain ranges and isolated peaks. Most of this region receives relatively low amounts of precipitation. Klamath Falls has received an average of 13.95 inches of precipitation annually from 1971 to 2000, with most precipitation falling in January and December (OCS 2005).

- **Significant Depth to Usable Aquifers –** Hydrogeological information directly beneath the site is limited. However based on available literature reported in the preliminary assessment and RI and well logs from drinking water wells located approximately a mile from the site, it is likely that the depth to useable groundwater beneath OU1 is several hundred feet bgs. The logs for wells KLAM_11009 and L42727 reported depths of first encountered groundwater at 334 and 518 feet bgs, respectively.

- **Significant Thicknesses of Low Permeability Geological Materials Above Useable Aquifers that Limit Contamination Migration -** Based on available literature reported in the RI and well logs from drinking water wells located approximately a mile from the site, it is likely that the geological materials (soils and rock) beneath the site but above useable groundwater consist of relatively low permeability materials such as clay and claystone with significant thicknesses. The log for well KLAM_11009 reported approximately 225 feet of clay and claystone above the depth at which groundwater was first encountered (334 feet bgs). The log for well L42727 reported approximately 428 feet of clay and claystone above the depth at which groundwater was first encountered (518 feet bgs). The low permeability of these subsurface geological materials retards the downward migration of contaminants within the vadose zone. This is especially important with respect to migration of asbestos fibers as they only migrate within the interstitial connected pores of unconsolidated materials; clays have low permeability due to lack of connectivity between pores.

In addition to the physical property of low permeability, clays tend to have additional properties that retard contaminant migration such as high cation exchange capacity.

- **Semi-Confined Conditions within Usable Aquifers –** The differences in groundwater elevations between depth to first encountered groundwater and SWL for wells KLAM 11009 and L42727 are significant (over 100 feet). This suggests that the aquifer commonly used as a drinking water source is semi-confined, which would further limit the potential for downward migration of contamination into the aquifer because of an upward hydraulic gradient.

The residents at OU1 (with the exception of the Wirths) are serviced by the public water supply originating in Klamath Falls. Although the Wirths do use groundwater adjacent to OU1, as discussed in Section 5.1.7, their well is screened in a deeper interval than the first occurrence of groundwater useable for drinking water. The human health risk assessment did not include use of groundwater as an exposure pathway and thus did not evaluate exposure to groundwater.

During the remedial design planning stages, groundwater sampling from existing water wells adjacent and downgradient of OU1 will be conducted to confirm that groundwater has not been impacted from COIs in soils at OU1.

5.2.4.2 Surface Water

There are no permanent surface water bodies at OU1, and because human contact with surface water runoff is expected to occur only infrequently, this exposure pathway is considered to be minor and is not evaluated quantitatively in the risk assessment and FS.

During the remedial design planning stages, sediment sampling downgradient of the landfill will be conducted, given limited existence of surface water, to determine if contaminant transport has occurred and if so, whether there is a risk posed to ecological receptors.

5.2.5 Populations of Concern

Receptors are groups of humans (or other organisms) that could be impacted by site contaminants via one of the exposure pathways. Potential human receptors at OU1 include current and future residents, and excavation and construction workers. The exposure route of chief concern for these receptors is inhalation (breathing) of asbestos fibers in air and dermal contact and ingestion of arsenic in soil.

Section 6 - Current and Potential Future Land and Resource Uses

6.1 Land Use

The current and anticipated future land uses for OU1 are an important consideration for the development of remedial alternatives that are protective of human health and the environment. The current land use is residential, and it is expected the future land use will remain residential.

OU1 is comprised of a mixture of privately owned properties and properties held in receivership. The site contains 39 single-family homes (21 of the homes are privately owned and 18 homes held by the Receiver are vacant), one occupied apartment building with four units, eight undeveloped vacant lots held by the Receiver, two privately held undeveloped vacant lots, part of a property that is used as a gravel pit, a warehouse, and a memorial park.

The selected remedy employs the use of caps to contain contamination and prevent direct contact, as such caps are one of the primary methods to mitigate or limit the liberation of asbestos. However, certain activities (e.g., off-road vehicle use) can compromise caps. To limit such activities, ICs or engineered controls are often used to preserve the integrity of the caps and to limit potential exposure risks. The selected remedy specifies the use of such controls. Land uses or activities that would compromise the remedy are considered unacceptable.

6.2 Groundwater Use

The beneficial use of groundwater in the vicinity of the site is as potential drinking water; however, as explained in Section 5.2.4.1, EPA has determined there is no likelihood of any impacts to groundwater from this site, and no need to evaluate or take any remedial action.

6.3 Surface Water Use

OU1 does not address surface water contamination. EPA does not consider surface water to be a viable pathway for exposure to asbestos at OU1. Surface water is not currently used as source of drinking water or irrigation water at the site because of public water supply from offsite sources. However, an ephemeral stream is present through the area of the landfill and sediment contamination within the streambed will be assessed during remedial design to determine if there is impact to this stream from the former landfill. Given the limited flow in the ephemeral stream, recreational use does not occur.

There are no indications that groundwater or surface water at OU1 has been impacted by site contamination. EPA will perform sampling of groundwater and surface water on and near OU1 to confirm that there are no impacts to these media.

Section 7 - Summary of Site Risks

The RI report contains a human health and ecological risk assessment for OU1. The risk assessment uses available data to estimate the risks to human health and ecological receptors at OU1. Methods used to evaluate human health and ecological risk are in accord with EPA guidelines for evaluating risks at Superfund sites, including recent guidance that has been specifically developed to support evaluations of human exposure and risk from asbestos. Detailed explanations of the steps used to conduct the risk assessment are provided in the RI report, including background information, the basis for concern, the exposure model, a toxicity assessment, quantification of exposure and risk, and a listing of uncertainties.

7.1 Exposure Assessment

7.1.1 Asbestos Conceptual Site Model

While visible pieces of ACM at the ground surface are too large to become airborne or be inhaled, weathering and/or mechanical breakdown can release free asbestos fibers from the ACM into the soil. Pieces of ACM that are beneath the surface of the soil where they are not subject to disturbance would be of low concern if they were to stay in that location, but some pieces tend to move toward the surface because of freeze-thaw cycles and/or to erosion of the overlying cover. Construction and site development activities may also unearth significant amounts of buried ACM. Once at the surface, these pieces of ACM may undergo breakdown from weathering and/or mechanical forces which results in the release of free asbestos fibers into soil, as described above.

Free asbestos fibers in surface soil may lead to human exposure by several pathways. For current or future residents, the pathways considered most likely to be of potential concern are:

- **Disturbance of Contaminated Outdoor Soil.** The most direct exposure pathway for asbestos fibers in surface soil occurs when a person actively disturbs the soil, as this can cause free asbestos fibers in the soil to be released to air where they can be inhaled. Releases are likely to be highest and of greatest concern when the soil disturbance is vigorous (e.g., raking, mowing, weed-trimming, digging, riding an all-terrain vehicle, etc.), but might also occur to a lesser degree for less intense disturbances (e.g., walking or riding a bicycle across dry soil).

- **Disturbance of Contaminated Indoor Dust**. Exposure to free asbestos fibers may also occur when contaminated soil is tracked into the home on shoes or clothing. Once in the home, asbestos fibers may settle and mix with other indoor dust. A wide range of normal indoor living activities may disturb the dust and release asbestos fibers to indoor air. These activities would include vigorous activities (e.g., sweeping or dusting) and also less intense activities (e.g., walking on carpets, playing with children or pets, or sitting down on furniture).

- **Inhalation of Ambient Air**. When sources of asbestos are wide-spread in an area, exposures may occur from releases caused by wind or mechanical forces from many different locations, all of which may add to a level of asbestos that is present in general (ambient) outdoor air. Thus, simply breathing outdoor air, even in the absence of actively disturbing any contaminated soil, might lead to asbestos exposure of area residents. In addition, outdoor air exchanges with indoor air, potentially leading to exposure while inside the home as well as outside.

- **Direct Handling of ACM**. Exposures may occur if pieces of ACM are picked up and handled, releasing fibers of asbestos to air which can be inhaled. Fibers may also adhere to the skin or clothing, which could result in inhalation exposure if the fibers were subsequently released to the air.

For excavation or construction workers, the primary pathways of concern are inhalation of asbestos in outdoor air that occurs when surface or subsurface soil is disturbed by excavation or other work-related activities, and also by handling pieces of ACM.

7.1.2 Non-Asbestos Conceptual Site Model

Exposure pathways by which non-asbestos chemicals may migrate from onsite sources into other environmental media, and the scenarios by which current or future onsite residents and workers might reasonably be exposed are discussed in this section.

- **Exposure to Surface Water -** Contaminants in soil may run off or leach into surface water following rain or snowmelt events. Exposure may occur when skin contacts the water while working outdoors, and might, under some circumstances, occur when small amounts of the water are ingested. However, because there are no permanent surface water bodies at OU1, and because human contact with surface water runoff is expected to occur only infrequently, this exposure pathway is considered to be minor and is not evaluated quantitatively.

- **Direct Contact with Soil** – Exposure may occur when small amounts of soil that adhere to hands during indoor or outdoor activities are ingested. Soil may also adhere to skin while working outdoors, and some chemicals, especially organic chemicals, can be absorbed across the skin from the soil into the body. Therefore, both ingestion and dermal contact with surface soil are considered to be complete and potentially significant exposure pathways for residents and excavation or construction workers, and are evaluated quantitatively.

- **Inhalation of Airborne Particulate Matter -** Particles of contaminated surface soil may become suspended in air by wind or mechanical disturbance, and exposures may occur when those particles are inhaled. Unless airborne concentrations of soil particles are extremely high, for residents the amount of soil inhaled from air is typically a minor source of exposure when compared to soil ingestion. Therefore, this pathway is not evaluated quantitatively for residents. For workers who are actively engaged in construction or soil excavation activities, levels of soil particles in air are likely to be higher than for the residential scenario, so inhalation of soil particles in air by workers is evaluated quantitatively.

- **Inhalation of Volatile Organic Chemicals** - VOCs that are present in soil tend to migrate upward through the soil where they may either be released into outdoor air or may penetrate into buildings through crawl spaces or cracks in the foundation. Releases to outdoor air are usually of low concern because the vapors are rapidly dispersed. Additionally, none of the VOCs detected in soil at OU1 approach or exceed ODEQ screening levels for residential or worker exposure to VOCs in outdoor air (ODEQ 2007). Therefore, exposure of residents and workers to VOCs in outdoor air is judged to be sufficiently small that quantitative evaluation is not needed. In contrast, vapors that penetrate into buildings may tend to accumulate over time, leading to indoor air concentrations that might be of concern. Therefore, exposure of residents to VOCs in indoor air is evaluated quantitatively.

Based on the evaluations above, the following pathways are judged to be of sufficient potential concern to warrant quantitative risk evaluation:

Residents	Construction Workers
Dermal contact with soil	Dermal contact with soil
Inhalation of VOCs in indoor air	Incidental ingestion of soil
Incidental ingestion of soil	Inhalation of dust in outdoor air

Other exposure pathways are judged to be sufficiently minor that further quantitative evaluation is not warranted.

7.1.3 Quantification of Exposure (Asbestos)

EPA has not developed a quantitative procedure for evaluating non-cancer risks for asbestos, but has developed a method for quantification of cancer risk (Integrated Risk Information System [IRIS] 2007). The basic equation is:

$$Risk = C \cdot UR \cdot TWF$$

where:

Risk = risk of dying from a cancer that results as a consequence of the site-related exposure.

C = concentration of asbestos fibers in air (f/cc).

UR = lifetime unit risk (f/cc)-1. This factor quantifies the risk of developing lung cancer or mesothelioma per unit concentration of asbestos in air following continuous lifetime exposure.

TWF = time weighting factor. This factor accounts for less-than-continuous lifetime exposure during the exposure interval, and is given by:

$$TWF = ET/24 \cdot EF/365 \cdot ED/70$$

where:

ET = exposure time (hours per day)
EF = exposure frequency (days per year)
ED = exposure duration (years)

In the past, the most common method for estimating the concentration of asbestos in air was phase contrast microscopy (PCM), and the units of concentration employed in the current EPA approach for estimating cancer risks (IRIS 2007) are PCM f/cc. During a PCM analysis, a particle is counted as a fiber if it is more than 5 microns (μm) long, and has an aspect ratio (length/width) of at least 3:1. However, PCM does not distinguish between different types of asbestos, or even between asbestos and non-asbestos particles. In addition, PCM cannot detect fibers that are thinner than about 0.25 µm. Because of these limitations, most analyses for asbestos are now conducted using TEM. TEM utilizes a high energy electron beam rather than a beam of light to irradiate the sample, and this allows operation at higher magnification (typically about 15,000 to 20,000x) and hence visualization of structures much smaller than can been seen under light microscopy.

In addition, most TEM instruments are fitted with devices that make it possible to distinguish organic fibers from mineral fibers, and also allows for distinguishing between different types of mineral fibers. All of the results for asbestos in air presented in this assessment are based on TEM analyses. However, it is required that all concentration values used to calculate risks using Equation 3-1 be expressed in the same units as the unit risk factor. As noted above, the unit risk value currently recommended by EPA is expressed in terms of PCM f/cc. Thus, when employing the data from a TEM analysis, it is necessary to utilize only those structures that meet the counting rules for PCM (thickness ≥ 0.25 µm and ≤ 3 µm, length > 5 µm, aspect ratio ≥ 3:1). For convenience, these are referred to as PCME fibers.

Analytical results for asbestos in air are reported in terms of the number of asbestos structures observed divided by the volume of air that passed through the portion of the filter that was examined:

$$C = N / V$$

where:

C = Concentration (f/cc)
N = Number of fibers observed during the analysis (f)
V = Volume of air that passed through the area of filter examined (cc)

For convenience, 1/V is referred to as sensitivity (S), and the equation for computing concentration is often written as:

$$C = N \cdot S$$

For risk assessment purposes, estimates of human exposure to asbestos are based on the average concentration in air that occurs over the exposure scenario being evaluated. For analytes other than asbestos, one approach EPA suggests is that when computing the mean of a set of samples, "non-detects" (i.e., samples whose concentration is below the detection limit of the analytical instrument) be evaluated by assigning a surrogate value of half the detection limit (EPA 1989). By analogy, it is sometimes supposed that non-detects for asbestos (i.e., samples where the observed count is zero) should be evaluated by assigning a value equal to half the sensitivity. However, the analytical sensitivity in microscopic analyses is not analogous to a detection limit in a wet chemistry analysis, and use of half the sensitivity as a surrogate for asbestos non-detects may lead to a substantial overestimate of the true mean of a group of samples. Rather, the mean of a set of microscopy sample results is computed by treating non-detects as zero.

For example, consider the case where the true concentration is 0.001 S/cc, and the sensitivity is 0.010 S/cc. If this sample were analyzed 10 times, the expected result would be that 9 of the 10 analyses would yield a count of zero, and one of the samples would yield a count of 1, which would correspond to a concentration estimate of 0.010 S/cc (10-times the truth). When averaged, the mean is 0.001 S/cc, which is the expected value. If half the sensitivity was assigned to the 9 non-detects, the resulting average would be 0.055 S/cc, nearly six times higher than the correct value. This approach for computing the average of multiple sample results derived using microscopic counting methods has been reviewed and validated by EPA as part of the rulemaking process for microbial contamination in drinking water (EPA 1999).

7.1.4 Quantification of Exposure (Non-Asbestos)

The amount of a chemical that is ingested, inhaled, or taken up across the skin is referred to as ″intake″ or "″dose.″ Exposure is quantified using an equation of the following general form:

$$DI = C \cdot \frac{IR}{BW} \cdot \frac{EF \cdot ED}{AT}$$

where:

DI = daily intake of chemical (milligrams of chemical per kilogram of body weight per day).

C = concentration of the chemical in the contaminated environmental medium (soil, dust, air, etc.) to which the person is exposed. The units are milligrams of chemical per unit of environmental medium (e.g., mg/kg for soil, milligrams per cubic meter for air).

IR = Intake rate of the contaminated environmental medium. The units are kilograms per day for soil and cubic meters per day for air.

BW = body weight of the exposed person (kilograms).

EF = exposure frequency (days per year). This describes how often a person is likely to be exposed to the contaminated medium over the course of a typical year.

ED = exposure duration (years). This describes how long a person is likely to be exposed to the contaminated medium during their lifetime.

AT = averaging time (days). This term specifies the length of time over which the average dose is calculated. For residents, two different averaging times are usually considered:

Chronic exposure includes averaging times on the scale of years (typically ranging from 7 years to 70 years). This exposure duration is used when assessing the non-cancer risks from chemicals of concern.

Lifetime exposure employs an averaging time of 70 years. This exposure interval is selected when evaluating cancer risks.

Because some of these parameters are not constant but vary as a function of age, the intake equation is divided into two parts, accounting for differences in parameters between child and adult:

$$DI = C \cdot \left(\frac{IRc}{BWc} \cdot \frac{EFc \cdot EDc}{AT} + \frac{IRa}{BWa} \cdot \frac{EFa \cdot EDa}{AT} \right)$$

In this equation, the subscript "c" indicates values applicable to a child and the subscript "a" indicates values applicable to an adult.

For mathematical convenience, the general equation for calculating dose can be written as:

$$DI = C \cdot HIF$$

where:

HIF = human intake factor.

This term describes the average amount of an environmental medium contacted by the exposed person each day. The value of HIF is given by:

$$HIF = \left(\frac{IRc}{BWc} \cdot \frac{EFc \cdot EDc}{AT} + \frac{IRa}{BWa} \cdot \frac{EFa \cdot EDa}{AT} \right)$$

The units of HIF depend on the medium being evaluated (kilograms per kilogram per day for soil, cubic meters per kilogram per day for air).

A more recent approach for addressing inhalation exposures to VOCs was presented in the Addendum 1 to the Risk Assessment for the North Ridge Estates Site included as Appendix A to the RI report (CDM 2010a), exposure to volatile chemicals in air was evaluated using an approach based on the computation of the inhaled dose of VOCs, expressed in units of milligrams of VOC inhaled per kilogram body weight per day. EPA has determined that inhalation exposure to VOCs is more accurately calculated by computing the time weighted average exposure concentration:

$$EC = CA \cdot ET \cdot EF \cdot ED / AT$$

where:

EC	=	Average exposure concentration (micrograms per square meter)

CA = Concentration in inhaled air (micrograms per square meter)
ET = Exposure time (hours per day)
EF = Exposure frequency (days per year)
ED = Exposure duration (years)
AT = Averaging time (hours)

Note that the term $ET \cdot EF \cdot ED / AT$ is a dimensionless parameter that represents the fraction of full time that exposure occurs. For convenience, this fraction may be referred to as TWF (time weighting factor), and the equation above may be written as:

$$EC = CA \cdot TWF$$

In the Addendum, exposures to VOCs were computed in this way, both for the new data collected in 2008, and also for the data previously collected and evaluated in CDM (2010a) using the dose-based approach.

For every exposure pathway of potential concern, it is expected that there will be differences between individuals in the level of exposure at a specific location because of differences in intake rates, body weights, exposure frequencies and exposure durations. Thus, there is normally a wide range of average daily intakes between different members of an exposed population. Because of this, all daily intake calculations must specify what part of the range of doses is being estimated. Typically, attention is focused on intakes that are average or are otherwise near the central portion of the range, and on intakes that are near the upper end of the range (e.g., the 95th percentile). These two exposure estimates are referred to as central tendency exposure (CTE) and reasonable maximum exposure (RME), respectively.

The EPA has collected a wide variety of data and has performed a number of studies to help establish default values for most residential CTE and RME exposure parameters. The chief sources of these standard default values are the following documents:

- Risk Assessment Guidance for Superfund (RAGS). Volume I. Human Health Evaluation Manual (Part A). EPA 1989.

- Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." EPA 1991a.

- Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Draft. EPA 1993a.

- Exposure Factors Handbook. EPA 1997a.

The CTE and RME exposure parameters selected for evaluation of residents and the RME exposure parameters for construction workers are listed below in Exhibits 7-1 and 7-2, respectively.

Exhibit 7-1. Exposure Parameters for Residents

Scenario	Variable	Units	CTE	Source	RME	Source
General	Body weight as child	kg	15	[1,4]	15	[1]
	Body weight as adult	kg	70	[1,4]	70	[2]
	Exposure frequency as child	days/yr	350	[1,4]	350	[1]
	Exposure frequency as adult	days/yr	350	[1,4]	350	[1]
	Exposure duration as child	yrs	2	[4]	6	[1]
	Exposure duration as adult	yrs	7	[4]	24	[1]
	Exposure duration (total)	yrs	9	[6]	30	[1]
	Averaging time (noncancer)[a]	days	3,285		10,950	
	Averaging time (cancer)[b]	days	25,550		25,550	
Inhalation of Indoor Air	Inhalation rate (indoors) as child	m^3/day	8.3	[5]	10	[2]
	Inhalation rate (indoors) as adult	m^3/day	13	[5]	20	[1]
	HIF(noncancer)	m^3/kg-d	2.56E-01	[6]	3.47E-01	[6]
	HIF(cancer)	m^3/kg-d	3.30E-02	[6]	1.49E-01	[6]
Ingestion of Soil	Ingestion rate as child	mg/day	100	[1,4]	200	[1]
	Ingestion rate as adult	mg/day	50	[4]	100	[1]
	HIF(noncancer)	kg/kg-d	1.95E-06	[6]	3.65E-06	[6]
	HIF(cancer)	kg/kg-d	2.51E-07	[6]	1.57E-06	[6]
Dermal Absorption from Soil	Default skin surface area as child	cm^2/day	2800	[3]	2800	[3]
	Default adherence factor as child	mg/cm^2	0.04	[3]	0.2	[3]
	Default skin surface area as adult	cm^2/day	5700	[3]	5700	[3]
	Default adherence factor as adult	mg/cm^2	0.01	[3]	0.07	[3]
	HIF(noncancer)	kg/kg-d	2.20E-06	[6]	1.15E-05	[6]
	HIF(cancer)	kg/kg-d	2.83E-07	[6]	4.94E-06	[6]

Notes:

[a]Averaging time for cancer = 25,550 days (365 days * 70 yrs)

[b]Averaging time for noncancer = exposure duration (yrs) * 365 days.

Abbreviations:

HIF = Human Intake Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Sources:

[1] Exposure Factors, EPA 1991 (OSWER No. 9285.6-03).

[2] RAGS (Part A), EPA 1989 (EPA/540/1-89/002).

[3] U.S. Environmental Protection Agency. 2004. Part E, Supplemental Guidance for Dermal Risk Assessment.

[4] U.S. Environmental Protection Agency. 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. [DRAFT]. November 4, 1993.

[5] U.S. Environmental Protection Agency. 1997. Exposure Factors Handbook.

[6] Calculated Value

Exhibit 7-2. Exposure Parameters for Construction Workers

Pathway	Variable	Units	Value
General	Adult Body Weight	kg	70
	Exposure Frequency	days/yr	250
	Exposure Duration	yr	1
	Averaging Time (noncancer)	yr	1
	Averaging Time (cancer)	yr	70
Ingestion of soils	Soil Ingestion Rate	mg/day	330
	HIFnoncancer	kg/kg-d	3.23E-06
	HIFcancer	kg/kg-d	4.61E-08
Inhalation of dust	Inhalation Rate	m^3/day	7
	Particulate Emission Factor	kg/m^3	7.58E-10
	HIF(noncancer)	m^3/kg-d	6.85E-02
	HIF(cancer)	m^3/kg-d	9.78E-04
Dermal contact with soil	Skin surface area	cm^2	3300
	Adherence factor	mg/cm^2-day	0.3
	ABS	unitless	0.03
	HIF(noncancer)	kg/kg-d	9.69E-06
	HIF(cancer)	kg/kg-d	1.38E-07

All values are from ODEQ (2007)

Abbreviations:
HIF = Human Intake factor
ABS = Dermal absorption fraction

Quantification of dermal exposure to soil requires a chemical-specific parameter (ABSd) that characterizes the fraction of chemical on the skin that is absorbed into the body. Although data are limited, EPA (2004a) indicates a value of zero is reasonable for VOCs, since VOCs that are on the skin are likely to volatize to air before being absorbed. For metals, EPA (2004a) identifies a value of 0.03 for arsenic. Data are not sufficient for mercury, so a screening-level value of 0.1 was assumed based on professional judgment. This value is about 3 times higher than the value for arsenic, and it is considered likely that this value will tend to overestimate the true amount of mercury absorbed across the skin.

Because of the assumption of random exposure over an exposure area, risk from a chemical is related to the arithmetic mean concentration of that chemical averaged over the entire exposure area. Since the true arithmetic mean concentration cannot be calculated with certainty from a limited number of measurements, the EPA recommends that the 95 percent upper confidence limit (UCL) of the arithmetic mean at each exposure point be used when calculating exposure and risk at that location (EPA 1992a). If the 95 percent UCL exceeds the highest detected concentration, the highest detected value is used instead (EPA 1989). The approach that is most appropriate for computing the 95 percent UCL of a data set depends on a number of factors, including the number of data points available, the shape of the distribution of the values, and the degree of censoring (EPA 2006b). EPA has developed a software system referred to as ProUCL that computes the UCL for a data set by several different strategies, and then identifies which UCL is recommended. This system was used to compute UCLs for all locations evaluated at this site. When the data were insufficient to support the estimation of a reliable UCL, the maximum detected value was used instead.

For direct contact exposure pathways (ingestion and dermal contact), only surface soil samples were used to calculate EPCs. For vapor intrusion of VOCs into buildings, the EPC for soil was based on samples from all depths (0 to 10 feet). For soil gas, the EPC was based on all samples collected at a location (generally at a depth of about 5 feet). If a chemical was not detected in any sample at a location, the EPC for that chemical was assumed to be zero for that location. The EPCs in soil (mg/kg) and soil gas (micrograms per cubic meter) were entered into EPA's vapor intrusion software (EPA 2004b) in order to compute the EPC for indoor air milligrams per cubic meter associated with that EPC in soil or soil gas. Exhibit 7-3 summarizes the EPC for each COPC at OU1 specific for non-asbestos contaminants.

Exhibit 7-3. Summary of Chemicals of Potential Concern and Medium–Specific EPCs for Non-Asbestos Contaminants

Exposure medium	Exposure pathway	Units opf concentration	COPC	GAS STATION[a]		LANDFILL		LAUNDRY BUILDING		MAINTENANCE SHOP		OTI MAINTENANCE SHOP		PAINT SHOPS		POWER PLANT	
				DF	EPC	DF	EPC	DF	EPC	DF	EPC	DF	EPC	DF	EPC	DF	EPC
Soil	Ingestion, dermal contact	mg/kg	Arsenic	4/4	1.4E+00	3/3	1.4E+00	NA	NA	8/8	9.8E-01	2/3	1.5E+00	6/6	1.2E+00	8/8	1.7E+01
			Mercury	4/4	3.2E-02	3/3	4.8E-01	NA	NA	8/8	2.8E-02	1/3	8.4E-02	6/6	2.4E-02	8/8	3.7E+00
			1,2-Dichloroethane	0/1	0.0E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzene	0/1	0.0E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chloroform	0/1	0.0E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			cis-1,2-Dichloroethene	0/1	0.0E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Tetrachloroethene	1/1	1.0E-03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Trichloroethene	1/1	1.0E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indoor Air	VOC Intrusion From soil (0-10 feet)	mg/m3	1,2-Dichloroethane	0/9	0.0E+00	1/3	9.6E-03	1/14	8.4E-02	2/15	3.0E-03	2/16	1.4E-01	0/6	0.0E+00	0/14	0.0E+00
			Benzene	0/9	0.0E+00	0/3	0.0E+00	0/14	0.0E+00	2/15	2.9E-03	0/16	0.0E+00	0/6	0.0E+00	1/14	1.1E-02
			Chloroform	0/9	0.0E+00	0/3	0.0E+00	1/14	4.2E-02	0/15	0.0E+00	1/16	8.8E-02	0/6	0.0E+00	0/14	0.0E+00
			cis-1,2-Dichloroethene	0/9	0.0E+00	1/3	4.1E-04	0/14	0.0E+00	2/15	5.8E-04	1/16	1.3E-02	0/6	0.0E+00	1/14	1.8E-03
			Tetrachloroethene	1/9	1.1E-03	1/3	3.2E-04	3/14	7.8E-04	1/15	2.1E-02	1/16	4.8E-04	0/6	0.0E+00	2/14	5.6E-04
			Trichloroethene	2/9	7.3E-03	1/3	5.4E-03	3/14	4.6E-02	4/15	1.9E-03	2/16	5.0E-02	2/6	6.1E-04	4/14	1.9E-03
	VOC Intrusion From Soil Gas	mg/m3	Benzene	6/6	2.2E-03	NA	NA	4/4	2.1E-03	3/3	3.3E-03	4/4	3.6E-03	NA	NA	4/4	3.3E-03
			1,2-Dichloroethane	NA	NA	NA	NA	0/4	0.0E+00	1/3	1.5E-03	NA	NA	NA	NA	NA	NA
			Trichloroethene	NA	NA	NA	NA	1/4	2.7E-03	2/3	3.3E-04	2/4	2.0E-04	NA	NA	1/4	1.4E-04
			Tetrachloroethene	1/6	4.1E-04	NA	NA	4/4	7.8E-02	2/3	5.5E-04	NA	NA	NA	NA	3/4	2.5E-04
	Total VOCs in indoor air (direct measurment)	mg/m3	1,2-Dichloroethane	0/1	0.0E+00	NA	NA	NA	NA	NA	NA	1/1	1.0E-03	NA	NA	NA	NA
				1/1	5.4E-04												
			Benzene	1/1	3.3E-03	NA	NA	1/1	1.4E-03	NA	NA	1/1	4.9E-04	NA	NA	NA	NA
				1/1	4.9E-04												
			cis-1,2-Dichloroethene	0/1	0.0E+00	NA	NA	NA	NA	NA	NA	0/1	0.0E+00	NA	NA	NA	NA
				1/1	2.4E-04												
			Tetrachloroethene	0/1	0.0E+00	NA	NA	1/1	1.4E-04	NA	NA	1/1	2.1E-04	NA	NA	NA	NA
				1/1	4.8E-04												
			Trichloroethene	0/1	0.0E+00	NA	NA	0/1	0.0E+00	NA	NA	1/1	2.7E-04	NA	NA	NA	NA
				1/1	4.4E-04												

Notes:
See Appendix A for the raw data and Appendix B for UCL calculations

[a] Two locations were tested for indoor air at the Gas Station

Abbreviations:
DF = Detection Frequency
EPC = Exposure Point Concentration
NA = Not analyzed
COPC = Chemical of potential concern
VOC = Volatile organic chemical

7.2 Toxicity Assessment

Toxicity assessments review and summarize the potential for each COPC to cause adverse effects in exposed populations. Toxic effects generally depend on the inherent toxicity of the chemical or substance and the magnitude, frequency, and duration of exposure pathways. A toxicity assessment identifies what adverse health effects a chemical causes and how the appearance of these adverse effects depends on the magnitude, frequency, and duration of exposure. Toxicity assessment is usually divided into two parts: non-cancer effects and cancer effects.

The adverse health effects of asbestos exposure in humans have been the subject of a large number of studies and publications. The following section provides a brief summary of the main types of adverse health effects that have been observed in humans who have been exposed to asbestos. Sources for more detailed reviews of the literature are provided in the OU1 RI (CDM 2010a).

7.2.1 Asbestos Non-Cancer Effects

7.2.1.1 Asbestosis

Asbestosis is a disease of the lung that is characterized by the gradual formation of scar tissue in the lung parenchyma. Initially the scarring may be minor and localized within the basal areas, but as the disease develops, the lungs may develop extensive diffuse alveolar and interstitial fibrosis. Buildup of scar tissue in the lung parenchyma results in a loss of normal elasticity in the lung which can lead to the progressive loss of lung function. People with asbestosis tend to have increased difficulty breathing that is often accompanied by coughing or rales. In severe cases, impaired respiratory function can lead to death. Asbestosis generally takes a long time to develop, with a latency period from 10 to 20 years.

7.2.1.2 Pleural Abnormalities

Exposure to asbestos may induce several types of abnormality in the pleura (the membrane surrounding the lungs):

- Pleural effusions are areas where excess fluid accumulates in the pleural space. Most pleural effusions last several months, although they may be recurrent.

- Pleural plaques are acellular collagenous deposits, often with calcification. Pleural plaques are the most common manifestations of asbestos exposure.

- Diffuse pleural thickening is a non-circumscribed fibrous thickening of the visceral pleura with areas of adherence to the parietal pleura. Diffuse thickening may be extensive and cover a whole lobe or even an entire lung.

Pleural abnormalities are generally asymptomatic, although rarely they may be associated with decreased ventilatory capacity, fever, and pain. Severe effects are rare, although severe cases of pleural thickening that led to death have been reported. The latency period for pleural abnormalities is usually about 10 to 40 years, although pleural effusions may occasionally develop as early as one year after first exposure. Specific references for these effects are cited in the OU1 RI (CDM 2010a).

7.2.2 Asbestos Cancer Effects

Many epidemiological studies have reported increased mortality from cancer in asbestos workers, especially from lung cancer and mesothelioma. Based on these findings, and supported by extensive carcinogenicity data from animal studies, EPA has classified asbestos as a known human carcinogen.

7.2.2.1 Lung Cancer

Exposure to asbestos is associated with increased risk of developing all major histological types of lung carcinoma (adenocarcinoma, squamous cell carcinoma, and oat-cell carcinoma). The latency period for lung cancer generally ranges from about 10 to 40 years. Early stages are generally asymptomatic, but as the disease develops, patients may experience coughing, shortness of breath, fatigue, and chest pain. Most lung cancer cases result in death. The risk of developing lung cancer from asbestos exposure is substantially higher in smokers than in non-smokers.

7.2.2.2 Mesothelioma

Mesothelioma is a tumor of the thin membrane that covers and protects the internal organs of the body including the lungs and chest cavity (pleura), and the abdominal cavity (peritoneum). Exposure to asbestos is associated with increased risk of developing mesothelioma. The latency period for mesothelioma is typically around 20 to 40 years and, by the time symptoms appear, the disease is most often rapidly fatal.

7.2.2.3 Other Cancers

The RI reports that limited evidence exists to suggest that exposure to asbestos may also increase the risk of cancer in several other tissues, including the gastrointestinal tract, the larynx and pharynx, and the kidney (http://www.atsdr.cdc.gov/asbestos/asbestos/health_effects/).

7.2.3 Non-Asbestos Non-Cancer Effects

Essentially all chemicals can cause adverse health effects if given at high enough doses. However, when the dose is sufficiently low, typically no adverse effect is observed. Thus, in characterizing the non-cancer effects of a chemical, the key parameter is the threshold dose at which an adverse effect first becomes evident. Doses below the threshold are considered to be safe, while doses above the threshold are likely to cause an effect. The threshold dose is typically estimated from toxicological data (derived from studies of humans and/or animals) by finding the highest dose that does not produce an observable adverse effect, and the lowest dose which does produce an effect. These are referred to as the no observed adverse effect level (NOAEL) and the lowest observed adverse effect level (LOAEL), respectively. The threshold is presumed to lie in the interval between the NOAEL and the LOAEL. However, in order to be conservative (health protective), non-cancer risk evaluations are not based directly on the threshold exposure level, but on a value referred to as the reference dose (RfD). The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

The RfD is derived from the NOAEL (or the LOAEL if a reliable NOAEL is not available) by dividing by an uncertainty factor. If the data are derived from human studies, and if the observations are considered to be very reliable, the uncertainty factor may be as small as 1.0. However, the uncertainty factor is normally at least 10, and can be much higher if the data are limited. The effect of dividing the NOAEL or the LOAEL by an uncertainty factor is to ensure that the RfD is not higher than the threshold level for adverse effects. Thus, there is always a margin of safety built into an RfD, and doses equal to or less than the RfD are nearly certain to be without any risk of adverse effect. Doses higher than the RfD may carry some risk, but because of the margin of safety, a dose above the RfD does not mean that an effect will necessarily occur.

7.2.4 Non-Asbestos Cancer Effects

For cancer effects, the toxicity assessment process has two components. The first is a qualitative evaluation of the weight of evidence that the chemical does or does not cause cancer in humans. Typically, this evaluation is performed by the EPA, using the system summarized in Exhibit 7-4.

Exhibit 7-4. Weight of Evidence Evaluation

WOE	Meaning	Description
A	Known human carcinogen	Sufficient evidence of cancer in humans.
B1	Probable human carcinogen	Suggestive evidence of cancer incidence in humans.
B2	Probable human carcinogen	Sufficient evidence of cancer in animals, but lack of data or insufficient data in humans.
C	Possible human carcinogen	Suggestive evidence of carcinogenicity in animals

For chemicals which are classified in Group A, B1, B2, or C, the second part of the toxicity assessment is to describe the carcinogenic potency of the chemical. This is done by quantifying how the number of cancers observed in exposed animals or humans increases as the dose increases. Typically, it is assumed that the dose response curve for cancer has no threshold, arising from the origin and increasing linearly until high doses are reached. Thus, the most convenient descriptor of cancer potency is the slope of the dose-response curve at low doses (where the slope is still linear). This is referred to as the slope factor, which has dimensions of risk of cancer per unit dose.

Estimating the cancer slope factor is often complicated by the fact that observable increases in cancer incidence usually occur only at relatively high doses, frequently in the part of the dose-response curve that is no longer linear. Thus, it is necessary to use mathematical models to extrapolate from the observed high dose data to the desired (but unmeasurable) slope at low dose. In order to account for the uncertainty in this extrapolation process, EPA typically chooses to employ the upper 95th confidence limit of the slope as the slope factor. That is, there is a 95 percent probability that the true cancer potency is lower than the value chosen for the slope factor. This approach ensures that there is a margin of safety in cancer as well as non-cancer risk estimates.

7.2.5 Toxicity Values

7.2.5.1 Asbestos Toxicity Values

All forms of asbestos that have been assessed to date have been shown to increase the risk of both cancer and non-cancer effects in exposed people (Agency for Toxic Substances and Disease Registry [ATSDR] 2001). Inhalation exposure has been clearly and repeatedly demonstrated to increase the risk of both cancer effects (lung cancer, mesothelioma) and non-cancer effects (asbestosis) in exposed workers. EPA quantitatively assesses the risk of cancer posed by inhalation exposures to asbestos using the inhalation unit risk of 0.23 per f/cc (www.epa.gov/iris/subst/0371.htm). Risks of lung cancer are believed to be multiplicative with the risk from smoking or other lung carcinogens. Currently, there is no RfC for the non-cancer effects from the types of asbestos present at the site.

The health effects from ingestion of asbestos are less clear (ATSDR 2001). Some studies have reported elevated death rates from cancer of the esophagus, stomach, and intestines in populations exposed to asbestos in drinking water, but it is not certain that asbestos is responsible for the elevated cancer rates (ATSDR 2001). Animals given high doses of asbestos in food did not get more fatal cancers than usual. Based on this, most scientists have focused their attention on the cancer and non-cancer effects following inhalation exposure to asbestos. There are a number of studies which suggest that the risk of disease from inhalation exposure to asbestos depends in part on mineral type (chrysotile *vs.* amphibole) and on the dimensions (length, width) of the particles inhaled. The exact mechanisms by which mineral type and fiber dimension influence toxicity are not known with certainty, but particle size likely influences the location in the lung where inhaled particles become deposited, and mineral type likely influences how long the particles remain in the lung. Fiber length may be especially important because particles that are short may be fully engulfed and cleared by lung macrophages, while long fibers may be attacked but are not usually cleared by lung macrophages. This situation (often referred to as frustrated phagocytosis) may result in the release of a variety of toxic substances from the macrophages that may cause local cell injury.

7.2.5.2 Non-Asbestos Toxicity Values

EPA-recommended toxicity values (RfDs and slope factors) are available from several sources, including EPA's online database referred to as IRIS. Provisional Peer Reviewed Toxicity Values, EPA's National Center for Environmental Assessment, and others. In some cases, a value is available for one exposure route (e.g., oral), but not for another route (e.g., inhalation), and route-to-route extrapolation may be used to estimate a toxicity value. Exhibit 7-5 summarizes the toxicity values used for evaluation of human health risks from quantitative COPCs at OU1. When the OU1 risk assessment was being written, EPA used the toxicity database maintained by EPA Region 6 (EPA 2007a). Since the risk assessment has been completed, the Region 6 toxicity database has been replaced by the Regional Screening tables (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm).

Exhibit 7-5. Non-Asbestos Toxicity Factors

		Noncancer				Cancer				
		Oral Exposure		Inhalation Exposure			Oral Exposure		Inhalation Exposure	
Index	Analyte	RfD mg/kg-d	Source	RfC (mg/m3)	Source	WOE Category	SFo $(mg/kg\text{-}d)^{-1}$	Source	IUR $(ug/m3)^{-1}$	Source
1	Arsenic	3.0E-04	i			A	1.50E+00	i	1.51E+01	i
2	Mercury	3.0E-04	i							
3	1,2-Dichloroethane	2.0E-02	n	2.4E+00	a	B2	9.10E-02	i	2.60E-05	i
4	Benzene	4.0E-03	i	3.0E-02	i	A	5.50E-02	i	7.80E-06	i
5	Chloroform	1.0E-02	i	9.8E-02	a	B2	(a)	i	2.30E-05	i
6	cis-1,2-Dichloroethene	1.0E-02	p							
7	Tetrachloroethene	1.0E-02	i	2.7E-01	a	NA	5.40E-01	o	5.90E-06	c
8	Trichloroethene	3.0E-04	n	1.30E-02	ny	NA	4.00E-01	n	2.00E-05	c*

Source: USEPA 2008c. Regional Screening Tables. Maintained by Oak Ridge National Laboratory. September 12, 2008.
*Based on CalEPA iUR of 2.0E-06 (USEPA 2008c), multiplied by a factor of 10 to account for uncertainty in extrapolation from animals to humans (Wroble 2008)

Abbreviations:
a = agency for toxic substances and disease registry (ATSDR)
c = California EPA
i = Integrated Risk Information System (IRIS)
p = Provisional Peer Reviewed Toxicity Value (PPRTV)
n = National Center for Environmental Assessment (NCEA)
ny = New York Department of Health (2006)
o = Other Documents
RfD = Oral Reference Dose
RfC = Reference Concentration
SF = Oral Slope Factor
IUR = Inhalation Unit Risk
WOE = Weight of Evidence
NA = Not assigned by the IRIS program

7.3 Characterization of Asbestos Risk

7.3.1 Risk from Disturbance of Outdoor Soil

Collection of air samples near active soil disturbances is referred to as ABS. In this type of study, a personal air monitor is worn by an individual engaged in a soil disturbance activity in order to measure the concentration of asbestos that occurs in the breathing zone of that individual. Concentration values of asbestos observed with the personal air monitor are generally higher than observed using stationary monitors set up near the activity, and these concentrations are considered to be the most relevant type of sample for assessing inhalation exposure from soil disturbance scenarios. Residents may disturb soil in their yard under a wide variety of circumstances. At OU1, ABS data have been collected following several different types of soil disturbance:

- Raking the soil with a metal-tined rake
- Weed trimming with a power trimmer
- Digging in the soil with shovel and pail (similar to a child's play)
- Rototilling

At most of the locations evaluated, the risk levels under current site conditions - averaged across all types of disturbance scenarios - range from 1E-05 to 8E-05. These risk levels fall within EPA's acceptable excess cancer risk range of 1E-06 and 1E-04, but exceed ODEQ's acceptable risk threshold of 1E-06. At one property, risk levels from active soil disturbance are approximately 1E-03, which exceeds EPA's and ODEQ's acceptable range. As noted above, the high risk at this location is associated with the presence of relatively high levels of visible MAG insulation in surface soil. This indicates that MAG insulation, because of its high friability and high content of PCME fibers, should be considered to be a source of concern under current site conditions. A similar conclusion was reached previously by Berman (2004). Although not specifically targeted in the ABS sampling program, it is considered likely that the same conclusion applies to locations with surficial AirCell insulation as well, since AirCell is also readily friable. Future risks to residents at the site may approach or exceed EPA's usual maximum risk level of 1E-04 because of continuing transport of ACM from the subsurface to surface soil and continuing weathering and/or mechanical breakdown of ACM at the surface to yield free asbestos fibers in soil. Risks for workers were generally lower than risks to residents and are described further in Section 7.5.1.

Review of the results related to site-specific ABS reveals the following main conclusions:

- Disturbance of soil by these types of activities results in the release of substantial numbers of total asbestos fibers into breathing zone air, although in most cases the fibers are either too short (< 5 µm) or too thin (< 0.25 µm) to be counted as PCME fibers.

- At most locations, the predominant fiber type that is released during ABS is chrysotile. This is consistent with the fact that chrysotile is the predominant form of asbestos in most onsite ACM materials. However, at one location, amosite fibers are also released in substantial numbers and a relatively high fraction of the fibers are PCME fibers. This location was selected for study specifically because MAG insulation was known to be present in relatively high levels at the surface. As explained in Section 1.2.2, MAG contains both chrysotile and amosite asbestos. The high levels of amosite fibers observed in the air at this location support the conclusion that MAG is of greater current risk than most other forms of ACM because it is more highly friable. AirCell is another type of ACM that is more friable than other types present on site. Thus, fibers are more easily released to air from MAG and AirCell than from other ACM types.

- At three locations, the raking scenario was performed at areas with and without the removal of visible ACM at the surface. In all cases, there was little difference between areas with and without prior ACM pickup on the levels of total asbestos fibers released to air. This suggests that most of the fibers observed in air were derived from asbestos that had already been released from the ACM into soil, and/or that after ACM was removed from the surface, new ACM was quickly re-exposed from shallow sub-surface soil at the onset of the raking activity.

Conceptually, levels of asbestos fibers in ABS air are related to the level of dust (soil particles) released into the air by the activity. However, at OU1, very little correlation between dust levels (measured using a Real-time Air Monitor) and asbestos levels could be detected. This is likely because the amount of asbestos released depends not only on the amount of soil released, but also on the level and friability of asbestos in the soil.

7.3.2 Risk from Indoor Air

Contractors for MBK collected indoor air samples using stationary air monitors placed in 22 different homes at OU1 (Berman 2003). Each sample was analyzed by TEM using ISO 10312 counting rules (ISO 1995) at an average analytical sensitivity of about 0.0001 f/cc. Four additional samples were collected by EPA in 2006 and analyzed in a similar fashion. Only two PCME fibers were observed in this set of 26 indoor air samples, corresponding to a detection frequency of only 4 percent. When detected, the concentration was 0.0001 PCME f/cc, and, when averaged across all samples, the concentration is about 7.7E-06 PCME f/cc.

Under current site conditions, risks to residents from indoor air are estimated to be 7E-07. This risk level is below EPA and ODEQ acceptable risk ranges. This risk level could increase above EPAs and ODEQ's acceptable risk range in the future if actions are not taken to limit the up-migration, weathering and breakdown of ACM in soil.

7.3.3 Risk for Ambient Air

For the purposes of this assessment, ambient air samples are defined as any outdoor sample collected within OU1 boundary that is not in the immediate proximity of any known EPA cleanup activity or soil disturbance test. The first round of ambient air samples was collected in 2003 (E&E 2005). At that time, six ambient air monitoring locations were established. During August and September of 2003, 13 samples were collected from each of the six stations (about three per week). Analytical results are available for 74 of the 78 samples. Additional ambient air samples were collected from these same six monitoring stations during April 2004 (two samples per station) and June to September 2005 (three samples per month for a total of 16 samples per station).

All samples were analyzed by TEM. The initial rounds used Yamate Method II counting rules (Yamate et al. 1984), while more recent samples used ISO 10312 counting rules (ISO 1995). Analytical sensitivity in the initial rounds was only about 0.001 f/cc, but lower sensitivities of 0.0001 f/cc were achieved in the later rounds.

One or more PCME fibers were detected in 23 out of 204 ambient air samples (12 percent). The average concentration of PCME fibers, combined across all stations and all sampling events, is 3.8E-05 PCME f/cc. Several different types of asbestos fibers were observed in ambient air samples, including chrysotile and amosite (these are the fiber types present in onsite ACM), as well as actinolite, tremolite, and winchite. None of these latter fiber types are known to be present in onsite ACM, and the occurrence of these fiber types in ambient air may represent releases from naturally occurring mineral bodies in the region.

Under current site conditions, risks to residents from ambient air are estimated to be 2E-07. This risk level is below EPA and ODEQ acceptable risk ranges. This risk level could increase above EPAs and ODEQ's acceptable risk range in the future if actions are not taken to limit the up-migration, weathering and breakdown of ACM in soil. Note that the need for a remedy at the site is based on soil disturbing activities as described in Section 7.3.1.

7.4 Characterization of Non-Asbestos Risk

The following summarizes the findings of the BLRA related to human exposures for current and future residential land uses.

7.4.1 Risks from Direct Contact with Soil

Soil samples from OU1 were analyzed for a total of 150 different non-asbestos chemicals to determine what non-asbestos contamination, if any, might be found at the site. Only 10 of those chemicals were identified in which the maximum detected concentration exceeded human health SLs in soil. Those 10 chemicals were retained as COPCs for further evaluation of risks to residents at OU1. The 10 chemicals are:

- Arsenic
- Lead
- PCBs
- Mercury
- 1,2- DCA
- Benzene
- Chloroform
- cis-1,2- DCE
- PCE
- TCE

A risk characterization was conducted for these COPCs, except for lead and PCBs; (please see discussion of removal actions for lead and PCBs below) in the OU1 BLRA. Risk characterization is defined by the potential for non-cancer effects and excess lifetime cancer risks. To assess potential for non-cancer effects, the non-cancer HQ was estimated. If the HQ is less than or equal to 1, it is believed that non-cancer effects of potential concern will not occur. For potential cancer effects the excess lifetime cancer risk was calculated.

In general, the EPA considers estimates of cancer risk that are less than 1E-06 to be so small as to be negligible, and excess cancer risks at or above 1E-04 (or a hazard index = 1 or above) to be sufficiently large to warrant some sort of response action. Excess cancer risks that range between 1E-06 and 1E-04 are generally considered to be acceptable (EPA 1991b), although this is evaluated on a case by case basis. The State of Oregon defines acceptable risk level for exposures of humans to a single carcinogen to be a lifetime excess cancer risk of one in one million (1E-06) for an individual at an upper-bound exposure.

Based on the risk characterization conducted in the OU1 BLRA, risks from direct contact with the eight non-asbestos COPCs (that is, all COPCs excluding lead and PCBs) in soil appear to be below a level of concern to current and future residents and workers at OU1, with the exception of arsenic at the former power plant. No remediation is required for any of the COPCs listed above except for arsenic. Only arsenic was retained as a non-asbestos COC for OU1.

Arsenic

Arsenic appears to pose a residential carcinogenic risk for soil ingestion and dermal contact at the former power plant. This risk is within EPA's acceptable risk range of 1E-06 (1 in 1 million carcinogenic risk) to 1E-04 (1 in 10,000), but exceeds ODEQ's threshold of 1E-06. The data set for arsenic in the area of the former power plant is limited and the EPC is elevated as compared with typical background soil levels for Oregon. Therefore, arsenic was retained as a COC for the OU1 site. Arsenic contamination is discussed further in Section 7.5.3.

Lead

Two removal actions focused specifically on lead-contaminated soils occurred in 2004 and 2008. Confirmation sampling conducted in 2008 following interim removal actions and all sample results were below the Region 6 SL of 400 mg/kg. Therefore, lead was not retained as a COC.

PCBs

Two removal actions were conducted in 2008 and 2009 as a result of PCB contamination discovered at the (b) (6) (Parcel B), (b) (6) (Parcel AM), and the warehouse property. Confirmation sampling conducted in 2008 and 2009 indicated that all sample results were below the Region 6 SL of 0.22 mg/kg. Therefore, PCBs were not retained as a COC.

Mercury

Mercury was initially retained as a COPC during the BLRA as a result of the maximum detection concentration exceeding the Region 6 SL. However, the risks associated with mercury are non-carcinogenic and therefore, a hazard index was calculated. Results from the BLRA indicate that the RME non-cancer hazard for all COPCs, including mercury, at all locations were below a level of concern for non-cancer (hazard index ≤ 1) (CDM 2010a). Therefore, mercury was not retained as a COC.

VOCs

As described in the BLRA, COPCs for the vapor intrusion pathway identified from the 2006 soil data included the following: 1,2- DCA; benzene; chloroform; cis-1,2- DCE; PCE; and TCE. Additional sampling was performed in 2007 and again in 2008 in attempt to clarify the potential risks posed by VOCs at OU1. No additional chemicals were identified from the 2007 or the 2008 data. A brief description of the risks posed by VOCs at the site is provided in Section 7.4.2. For additional details, please refer to the 2008 BLRA Addendum.

In general, risks from VOCs to current and future residents and workers at OU1 appear to be below a level of concern or are the result of sources, unrelated to site releases. Therefore, VOCs were not retained as COCs for the NRE site, OU1.

7.4.2 Risks from VOC Vapor Intrusion

Based on the original 2006 soil VOC data, a potential concern for intrusion of VOCs from soil into indoor air of homes was determined. Based on a mathematical model to predict concentrations in indoor air based on concentration values measured in soil, risks from DCA, TCE, and chloroform were determined to be of potential concern in several locations (gas station, landfill, laundry, MRB maintenance shop, OTI maintenance shop, power plant). Except for one location (the location of the former laundry) none of these areas presently have buildings located above the contaminated soil. Thus these original risk estimates apply to previous (in the case of the laundry building) and hypothetical future residents of buildings constructed above the area of contamination. Because the risk calculations are based on predicted rather than measured indoor air concentrations, confidence in the predictions is medium to low.

In the 2008 BLRA Addendum, the EPCs used in the risk calculations for exposure to VOCs via the vapor intrusion pathway were the actual measured VOC concentrations from the 2008 air samples (living space indoor air, basement air, crawl space air, and ambient air). For sub-slab and soil gas samples, the EPCs were estimated using EPA's vapor intrusion software based on the 2008 sample data.

The 2006 soil VOC data was utilized to develop the original BLRA that evaluated the vapor intrusion pathway of VOCs. After the 2008 air sampling data was collected the BLRA was updated to further evaluate this pathway.

In general, risks from VOCs to current and future residents and workers at OU1 appear to be below a level of concern. Therefore, VOCs were not retained as COCs for the OU1 site.

7.4.2.1 Risks Based on VOC Measurements in Soil

For non-cancer effects, concentrations are predicted to be above a level of concern at three locations (the landfill, the laundry building, and the OTI maintenance shop). These non-cancer inhalation risks are driven by DCE, with smaller contributions from chloroform and TCE.

Based on the 2006 data, cancer risks exceed EPA's and ODEQ's usual level of concern for CTE and/or RME receptors at all locations except the paint shop. These elevated cancer risks from VOC inhalation are due to DCE, TCE, and sometimes chloroform.

In contrast to the 2006 data, based on the 2007 investigation (Parametrix 2007), no VOC detected in soil exceeded either COPC selection criteria (HQ > 0.1, cancer risk > 1E-06), and none of the COPCs identified based on the 2006 data were detected in any 2007 soil sample. The 2006 data set contains occasional cases where the concentration of one or more chemicals was substantially higher than most others in the 2006 data set as well as the data from 2007.

The individual high values in the 2006 data set seem to be potentially inconsistent with other data from 2006 as well as the 2007 data. The reason for this is unknown.

7.4.2.2 Risks Based on VOC Measurements in Soil Gas

Measurement of VOCs in soil gas (rather than soil) is often a more reliable technique for estimating risks from vapor intrusion because it eliminates the need to model the release and transport of VOCs through soil, and only requires the modeling of soil gas entry into the house. Non-cancer and cancer risks are below EPA's and ODEQ's usual level of concern for both CTE and RME residential scenarios at all locations.

7.4.2.3 Risks Based on VOC Measurements in Indoor Air

Although risks are higher than predicted based on the soil gas measurements, the values are still below EPA's usual level of concern for both non-cancer and cancer effects, but above ODEQ's level of concern for the gas station CTE, gas station RME, and OTI maintenance shop RME. The higher levels of risk based on measured indoor air concentrations are not unexpected, because direct measurement of VOCs in indoor air captures not only VOCs entering the home from vapor intrusion, but also VOCs released from a variety of consumer products that contain volatile solvents (e.g., marking pens, adhesives, cleaning fluids, etc.). Levels of VOCs observed in homes at OU1 do not appear to be higher than observed in indoor air of background homes across the United States (EPA 2008). Taken together, these data suggest that risks from VOC intrusion from soil gas are likely to be below EPA's and ODEQ's threshold of concern.

There are several data quality concerns regarding the 2007 data set, including a) relatively high detection limits for some chemicals in soil, b) problems encountered with field collection of soil gas samples, and c) occurrence of some VOCs in field blank samples. Moreover, as noted above, the basis for the apparent inconsistency between the 2007 and the 2006 soil data is not known. For these reasons, EPA collected additional data in 2008.

Based on the 2008 investigation, non-cancer risks from inhalation of VOCs in indoor air appear to be below a level of concern (HQ < 1) for current and future residents at OU1. The estimated excess cancer risks are within EPA's acceptable risk range, but at some locations exceed ODEQ's risk threshold of 1E-06. This finding is consistent with previous and updated findings based on data collected in 2007 and with most but not all of the samples collected in 2006. Based on the weight of evidence, it is concluded that the initial indication of concern identified based on the 2006 data was likely incorrect and that intrusion of VOCs from subsurface soil into indoor air appears to be minimal, if in fact this pathway is complete. Concentrations of VOCs in the 2008 air samples were also below the established background concentrations (see 2008 risk assessment addendum in Appendix A of the RI). This indicates that detected concentrations were likely a result of other indoor air sources such as household chemicals, plastics, and textiles.

7.5 Summary of Human Health Risk

7.5.1 Human Health Risks from Asbestos

The following summarizes the findings of the BLRA related to human exposures to asbestos for current and future residential land uses. Current or future residents at OU1 may be exposed to asbestos in air by three main pathways:

- Inhalation of fibers released during active soil disturbance activities
- Inhalation of fibers in indoor air
- Inhalation of fibers in outdoor (ambient) air

Exhibit 7-6 presents the risk characterization summary for asbestos for the estimated current and future risk to residents, construction workers, and excavation workers from the three exposure pathways.

Exhibit 7-6. Risk Characterization Summary - Asbestos

Scenario Timeframe: Current & Future
Receptor Population: Resident/Construction Worker/Excavation Worker
Receptor Age: Lifetime
Exposure Medium: Dust
Chemical of Concern: Asbestos

Receptor	Medium	Exposure Pathway	Carcinogenic Risk	
			Current - Inhalation	Future - Inhalation
Residents	Soil	Soil Disturbance – Poorly Friable ACM	3E-05	3E-03 to 3E-02
		Soil Disturbance – Easily Friable ACM (MAG & AirCell)	1E-03	2E-03 to 4E-03
	Air	Indoor Air	7E-07	7E-05 to 7E-04
		Ambient Air	2E-07	2E-05 to 2E-04
Construction Worker	Soil	Soil Disturbance – Poorly Friable ACM	4E-06	4E-04 to 4E-03
		Soil Disturbance – Easily Friable ACM (MAG & AirCell)	2E-04	4E-04 to 8E-04
Excavation Worker	Soil	Soil Disturbance – Poorly Friable ACM	1E-07	1E-05 to 1E-04
		Soil Disturbance – Easily Friable ACM (MAG & AirCell)	8E-06	2E-05 to 3E-05

Notes: ACM – asbestos containing material

In general, the EPA considers excess cancer risks that are below 1E-06 to be so small as to be negligible, and excess cancer risks at or above 1E-04 (or a hazard index = 1 or above) to be sufficiently large to warrant some sort of response action. Excess cancer risks that range between 1E-06 and 1E-04 are generally considered to be acceptable (EPA 1991b), although this is evaluated on a case by case basis. Once risks that warrant action have been identified, the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) calls for development of remediation goals (RGs). These RGs must be protective of human health and the environment and comply with ARARs, and use of the 1E-06 risk level as the point of departure for setting cleanup levels (CULs) where ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure. ARARs, including the State of Oregon's acceptable risk level for exposures of humans to a single carcinogen to be a lifetime excess cancer risk of one per one million (1E-06) for an individual at an upper-bound exposure (ORS 415.315, OAR 340-122-115 (2)(a)) are discussed later in this document.

Residents

- Risks to current and potential future residents from soil disturbances exceed EPA's acceptable risk range in cases where easily friable asbestos (e.g., MAG and AirCell insulation) is present. Risks to residents from indoor air and ambient air appear to be below EPA's acceptable risk ranges under current site conditions. Likewise risks from soil disturbances under current site conditions are below EPA acceptable risk range when poorly friable ACM is present.

- EPA risk limits from current soil disturbances are exceeded in cases where friable asbestos (e.g., MAG and AirCell insulation) is present.

Construction and Excavation Workers

No data have been collected to estimate the levels of asbestos that may occur in air as a consequence of construction- or excavation-related soil disturbance activities. Therefore, risks to workers from soil disturbances were estimated using the ABS air data gathered for residential exposure. These data were modified for construction and excavation worker exposure factors in a similar approach as for exposure of residents during active soil disturbances.

- As seen in Exhibit 7-6, at locations where only poorly friable ACM is present, risks to construction and excavation workers do not currently exceed the risk level of 1E-04 that EPA usually considers acceptable.

- Estimates of potential future risk to construction workers are expected to exceed EPA's risk range, while risks to excavation workers are likely to remain within or below EPA's acceptable risk range.

In the future, it is expected that risk levels from asbestos will increase because of continuing transport of ACM from the subsurface to surface soil and continuing breakdown of ACM at the surface to yield free asbestos fibers in soil. The time course of future increases in free asbestos levels in surface soil is not known, but is likely to require many years. Screening level calculations suggest the ultimate magnitude of the increase in free fibers (and hence in risk) is likely to be on the order of 100 to1000 fold. If so, then future risks for all of the three exposure pathways are likely to approach or exceed the level of 1E-04 that EPA considers to be the maximum excess lifetime cancer risk that is acceptable. In particular the soil disturbance pathway would be of special concern, with predicted future risks ranging into the 1E-03 to 1E-02 range.

If all or part of OU1 was converted to non-residential land uses, future risks to humans would be lower than if land use remained residential. However, it would likely continue to exceed EPA's acceptable cancer risk range, especially for land uses where regular soil disturbances continued to occur.

7.5.2 Uncertainties – Human Health Risks from Asbestos

It is important to emphasize that these quantitative estimates of risk are uncertain because of a number of factors including uncertainty in measured asbestos levels in air and soil under current site conditions, uncertainty in future exposure levels, and uncertainties in the best cancer risk model to use.

There are a number of uncertainties in the estimation of current and future exposures and risks from asbestos at OU1. In general, when data are limited or absent, the exposure and risk parameters selected are chosen in a way that is intentionally conservative. That is, the values selected are more likely to overestimate than underestimate actual risk. However, some assumptions and approaches used in risk assessment may tend to underestimate risks. It is important for risk managers and the public to keep these uncertainties in mind when interpreting the results of a risk assessment. The following sections review the main sources of uncertainty in the exposure and risk calculations for asbestos performed at this site.

Uncertainties in Asbestos Levels in Soil

Asbestos in soil at OU1 exists in a continuous range of particle sizes, ranging from large pieces of ACM to free fibers that have been released from the ACM. For risk assessment purposes, these forms may be conceptually divided into two categories: pieces of ACM that are too large to be inhaled, and free fibers that have been released and which can be inhaled. The amount of asbestos present in intact pieces of non-respirable ACM that is present at a specific area is relatively easy to measure using simple gravimetric techniques. (Note, however, that such measurements are generally based on ACM that is present at the surface and does not include ACM that is buried in the subsurface soil). Estimation of the total amount of ACM debris that is present across the entire site is more difficult. At present, values for the amount of non-respirable ACM present at the site are based on estimates of the total amount of ACM that was likely used in the construction of the original MRB. These estimates are uncertain, and might either overestimate or underestimate the actual amount of ACM at the site.

Methods used to measure the amount of free asbestos fibers that is present in soil have not been well developed. Soil methods may not be sensitive enough to measure low concentrations of asbestos in soil and may underestimate actual soil concentrations of asbestos.

Uncertainties in Measured Asbestos Levels in Air

The concentration of asbestos in an air sample is estimated from the analytical results by dividing the number of countable structures observed during the analysis by the volume of air drawn through the fraction of the filter that was examined. Because the number of structures observed in such an analysis is a random variable that is characterized by a Poisson distribution, there is uncertainty in the count and, hence, in the resultant concentration. When the observed count is low, the relative magnitude of the uncertainty bounds is relatively wide. Because most of the samples evaluated in this project have relatively low counts for PCME fibers, uncertainty in the concentration values of individual samples are relatively large, and true values might be either higher or lower.

Although ABS was conducted at several locations on properties where ACM was observed, it is important to recognize that this is a limited data set and may not fully characterize the true range of concentration values in air associated with soil disturbances. In particular, the measurements may not accurately reflect the levels that occur in air during excavation or construction activities. In addition, it is possible that ABS at locations without visible ACM would have resulted in lower air concentrations of asbestos fibers. However, ACM continues to emerge at the surface from buried ACM that remains on site, and this pathway provides for an ongoing source of asbestos, even in locations where it has been picked up or not yet been observed. It is also possible that residents who perform activities on their properties may preferentially do so in areas without ACM; if so, their exposures to asbestos may be lower.

Because no ABS data were available for construction or excavation workers, the ABS data collected to represent residents were used as a surrogate. It is possible that construction activities would result in greater soil disturbance and, hence, greater concentrations of fibers and greater exposure, so risks to workers might tend to be underestimated by this approach.

Uncertainty in Cancer Risk Models

The current model used by EPA for evaluating cancer risks from inhalation exposure to asbestos (USEPA 1986, IRIS 2007) is based on a lifetime unit risk factor that is derived by fitting available human epidemiological data to appropriate mathematical risk models. However, many of the human epidemiological studies provide only uncertain estimates of human exposure, so the unit risk value derived from the data is also uncertain. In accord with EPA practice, because human data were used to derive the value, the unit risk value recommended by EPA represents a best estimate of the true unit risk rather than an upper bound, and the actual unit risk could be either higher or lower.

Uncertainties from Non-Cancer Effects

At present, EPA has not developed an approach for evaluation of non-cancer risks from inhalation exposure to asbestos. For most chemicals that cause both cancer and non-cancer effects, if humans can be protected from unacceptable risk of cancer, then risks of non-cancer effects are usually below a level of concern. However, in the case of asbestos, it is possible this might not be true, since adverse non-cancer effects on the lungs have been observed in workers at relatively low exposure levels (e.g., Rohs et al. 2008).

Uncertainties from Exposure Pathways Not Evaluated

As discussed above, current and future residents and workers may be exposed to asbestos not only by inhalation, but also by ingestion. Toxicity data are sufficient to indicate that ingestion exposure might tend to increase the risk of tumors of the gastrointestinal system, but at present it is not possible to quantify the magnitude of this risk. However, the risk of gastrointestinal tumors is generally thought to be minor compared to the risk of lung tumors, so this omission is not believed to result in a significant underestimation of total risk.

Exposure of residents or workers from direct handling of pieces of ACM was not evaluated quantitatively in this assessment because no data have been collected on the levels of exposure that might occur during this type of activity. If such handling were to occur only rarely, and if the ACM were not readily friable, it is suspected that risks would likely not be excessive. However, risks from this activity might be of substantial concern if ACM was handled frequently, if the asbestos was readily friable (e.g., MAG or AirCell), or if the handling included treatments such as grinding or crushing that could release fibers to air.

CULs for contaminants of concern and the basis for those levels are typically included in the ROD. Normally, RGs would be developed by computing the concentrations of contaminants of concern that correspond to an excess cancer risk of 1E-06 for media that have exposure pathways to receptors. However, such a computation for asbestos in soil is not possible at present because of the high variability in the relationship between asbestos in soil and asbestos in air. Even if the computations were possible, the ability to measure asbestos in surface and subsurface soil is presently limited by the available technologies and methods. Non-cancer risks from inhalation of asbestos fibers from ACM have also been recognized, but there is no current methodology to quantify non-cancer risks for asbestos.

Overall, these uncertainties do not substantially alter the key conclusions that risks are likely to be much higher in the future if no steps are taken to prevent future migration and breakdown of ACM and release of fibers into surface soil.

7.5.3 Human Health Risks from Non-Asbestos Contaminants

Risks from direct contact with non-asbestos chemicals in soil appear to be below a level of concern to current and future residents and workers at OU1, with the exception of arsenic at the former power plant. The arsenic-contaminated soils at the former power plant present risks that are within EPA's acceptable risk range but exceed ODEQ's threshold for hypothetical future residents.

Exhibit 7-7 presents the risk characterization summary for arsenic, which has been retained as a COC for the OU1 site. The RME risks are below a level of concern for non-cancer hazard (hazard index ≤ 1) at all locations and were therefore not included in Exhibit 7-7.

Exhibit 7-7. Risk Characterization Summary - Arsenic

Scenario Timeframe: Current
Receptor Population: Residents/Construction Worker
Receptor Age: Lifetime
Exposure Medium: Soil
Chemical of Concern: Arsenic

Receptor	Medium	Location	Exposure Pathway	RME Carcinogenic Risk	
				Soil Ingestion	Dermal Contact
Residents	Soil	Former Gas Station*	Soil Disturbance	3E-06	3E-07
		Former Landfill*		3E-06	3E-07
		Former Laundry		NA	NA
		Former MRB Maintenance Shop*		2E-06	2E-07
		Former OTI Maintenance Shop*		4E-06	3E-07
		Former Paint Shops*		3E-06	3E-07
		Former Power Plant		4E-05	4E-06
Construction Worker	Soil	Former Power Plant	Soil Disturbance	1E-06	1E-07

Notes: * - EPC is lower as compared with typical background soil levels for Oregon

Estimates of background arsenic concentrations can vary widely. Shacklette and Boerngen (1984) cite an average of 5.1 mg/kg for Oregon Statewide, and ODEQ uses a default estimate of background arsenic of 7 mg/kg. At OU1, the overall background arsenic concentration in soil is uncertain, but may be in the range of 1 to 5 mg/kg.

Because the RME exposure point concentrations for arsenic are the same order of magnitude as likely background levels (except at the former power plant), risk estimates for hypothetical future residents are on the same order of magnitude as background. Almost all of the risk in excess of background is attributable to arsenic contamination found in the footprint of the former power plant. Therefore, arsenic was not considered a COC at the remaining locations (shown in Exhibit 7-7) for OU1.

Residents

Risks to residents from arsenic at the former power plant are at a level of 4E-05, and estimated background concentrations (assumed between 5 to 7 mg/kg) are exceeded. Estimated cancer risks are within EPA's acceptable cancer risk range of 1E-06 (one in one-million) to 1E-04 (one in ten thousand), but exceed ODEQ's threshold of 1E-06 for the RME scenarios for soil ingestion and dermal contact.

Construction Worker

Risks to the construction worker from exposure to arsenic in soil at the former power plant, calculated based on an EPC of 17 mg/kg, are summarized in Exhibit 7-7. This level of risk does not exceed EPA's acceptable risk range and ODEQ's acceptable risk level.

7.5.4 Uncertainties – Human Health Risks from Non-Asbestos Contaminants

Quantitative evaluation of the risks to humans from environmental contamination is frequently limited by uncertainty regarding a number of key data items, including: concentration levels in the environment; the true level of human contact with contaminated media; and the true dose-response curves for non-cancer and cancer effects in humans. This uncertainty is usually addressed by making assumptions or estimates for uncertain parameters based on whatever limited data are available. Because of these assumptions and estimates, the results of risk calculations are themselves uncertain, and it is important for risk managers and the public to keep this in mind when interpreting the results of a risk assessment. Additional details regarding uncertainties related to the non-asbestos risk assessment can be found in the BLRA and Addendum 1 of the BLRA (Appendix A of the RI [CDM 2010a]).

7.6 Ecological Risk

Because OU1 has been developed for human use, ecological habitat at the site is diminished compared to the surrounding undeveloped lands. Therefore, use of the site by wildlife receptors is likely to be reduced compared to what would be expected for undeveloped lands. Nevertheless, the site may be used by a variety of different classes of ecological receptors, including birds, mammals, plants, and soil-dwelling invertebrates.

7.6.1 Ecological Risks from Asbestos

At present, there are no methods established for deriving quantitative estimates of risk to ecological receptors from asbestos. However, the following qualitative conclusions are likely to apply:

- Wildlife receptors with large home ranges (most birds and most large mammals) are expected to be present at the site only intermittently, and consequently the average level of exposure to asbestos would tend to be low. In contrast, receptors that have small home ranges and that reside on the site are likely to have a relatively high but uncertain frequency of contact with ACM, and would likely have the highest relative potential risk. This would include, for example, small ground-dwelling mammals such as mice and voles, and birds with relatively small home ranges (e.g., robin).

- Based on the data derived from ABS studies, it is likely that, under current site conditions, risks are likely to be low in most areas (except where MAG or possibly AirCell is present). Exposures and risks to animals that burrow into the soil might tend to be higher, especially if the receptor actually chews on or digs through the ACM.

- In the future, if no action is taken to prevent release and breakdown of ACM at the surface, levels of free fibers would be higher, and exposure (both oral and inhalation) of small home range receptors would tend to increase. It is not known whether such future exposures would result in adverse effects on any populations of exposed receptors, but is not expected given that the organisms that occur on site are common throughout the area.

7.6.2 Uncertainties – Ecological Risks from Asbestos

Methods are not presently available to support quantitative evaluation of risks to ecological receptors from asbestos; therefore, based on this level of uncertainty, only a qualitative assessment can be derived at this time. As such, a remedial action objective (RAO) for asbestos based on ecological risk has not been developed.

7.6.3 Ecological Risks from Non-Asbestos Contaminants

Concentrations of several metals (arsenic, barium, cadmium, chromium, lead, and mercury) in soil exceed screening-level ecological benchmarks for one or more receptor groups, but none of the metals in site soils occur in concentration ranges higher than in background soils. On this basis, it is concluded that metals in site soils are not of significant ecological concern. Most organic compounds in site soils were below a level of concern at all locations, except for dichlorodiphenyldichloroethylene (DDE) and dichlorodiphenyltrichloroethane (DDT). Further analysis by EPA concluded that the depth at which the DDE and DDT were observed, and the limited area in which they were found, supported the conclusion that DDE and DDT did not pose a risk to ecological receptors at OU1. As such, an RAO for non-asbestos contaminants based on ecological risk has not been developed.

7.6.4 Uncertainties – Ecological Risks from Non-Asbestos Contaminants

Risk estimates to wildlife receptors based on screening level benchmark values are uncertain because site-specific and species-specific factors that may be important determinants of exposure and risk are not considered. Species-specific calculations that include measures of contaminant concentration not only in soil but also in food chain items would be needed in order to refine the risk evaluation.

7.7 Basis of Action

Based on the site-specific human health risk assessment, under current site conditions, ACM and asbestos in soil are likely to pose unacceptable risks to current and potential future human receptors exposed through inhalation of fibers released during active soil disturbance activities. In the future, it is expected that risk levels from asbestos will increase because of continuing transport of ACM from the subsurface to surface soil and continuing breakdown of ACM at the surface to yield free asbestos fibers in soil. The response actions selected for OU1 in this ROD are necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment. For OU1, the risk drivers for human health are asbestos (site-wide) and arsenic (in the power plant area).

Section 8 Remedial Action Objectives

8.1 Remedial Action Objectives

RAOs are the media- and source-specific goals developed by EPA to protect human health and the environment that all cleanup activities selected for OU1 are intended to accomplish. These objectives are typically expressed in terms of the contaminant, the medium of concern, and the exposure route and receptor to address each medium and pathway that poses an unacceptable risk. In addition to the narrative RAOs, the selected remedial action must meet the contaminant-specific RGs and CULs described in Section 8.2, below.

RAOs and RGs are typically developed by evaluating several sources of information, including results of the risk assessments and tentatively identified ARARs. These inputs provide the basis for determination of whether protection of human health and the environment is achieved for a remedial alternative.

EPA considers current and reasonably anticipated future uses of the site when determining RAOs. As described in Section 6, the current and anticipated future land uses for the site are an important consideration for the development of RAOs to ensure that remedial alternatives are protective of human health and the environment. The current and expected future land use of the site is residential.

The following risks warrant action at this site:

- Based on the site-specific human health risk assessment, under current site conditions, ACM and asbestos in soil is likely to pose unacceptable risks to human receptors exposed through inhalation of fibers released during active soil disturbance activities. Risks to residents from indoor air and ambient air appear to be below EPA's acceptable risk range and ODEQ's acceptable risk level. It is expected that any risk from potential future disturbances that would result in continued frost-heave processes, expose subsurface soil, or otherwise allow the continued break down of ACM at the surface, would be at least as high as and could be substantially higher than under current conditions.

- Risks to humans from non-asbestos chemicals at the site are below levels of concern, with the exception of potential risks from exposure to elevated levels of arsenic in soils at the former power plant. The RAOs for OU1 are:

    1. Prevent inhalation exposures by humans to asbestos fibers in soil above levels that pose an unacceptable risk for residential use.

    2. Prevent the migration of asbestos contamination by natural and man-made transport mechanisms from source locations to unimpacted locations and media.

    3. Prevent the potential for human inhalation and incidental ingestion exposure to soil in the vicinity of the former power plant contaminated with arsenic concentrations above levels that pose an unacceptable risk to human health.

Indoor air contingency: Under current conditions, risks to residents from indoor air are estimated to be 7E-07 (below EPA's risk range of 1E-06 to 1E-04 and ODEQ's risk level of 1E-06). Therefore, no remedial action is necessary inside homes at this time. After the excavation and capping components of the selected remedy have been performed, indoor air and dust will be sampled for asbestos in each OU1 residence. If the risk levels inside one or more residence exceed 1E-04, a contingency for indoor cleaning of the affected residence(s) will be invoked. If EPA determines the contingent action is necessary, the following RAO will pertain to the contingent action:

- Prevent inhalation exposures by humans to indoor air containing asbestos fibers above levels that pose an unacceptable risk for residential use.

8.2 Remediation Goals and Cleanup Levels

In conjunction with narrative remedial action objectives such as those established above, the NCP also calls for the ROD to establish final RGs, which are acceptable exposure levels that are protective of human health and the environment taking into account ARARs under federal environmental or state environmental or facility siting laws, if available, and other factors. Where possible, RGs are expressed as contaminant-specific CULs.

As described more fully elsewhere in this ROD, including Section 13.2.1, the ARARs section of the selected remedy, the State of Oregon has promulgated an acceptable risk level for exposures of humans to a carcinogen equal to a lifetime excess cancer risk of one per one million (1E-06) for an individual at an upper-bound exposure in statute and regulation (ORS 465.315, OAR 340-122-0115 (2)(a)). This is also the risk level the NCP says shall be used as the point of departure for determining RGs and CULs, for known or suspected carcinogens, once action has been determined to be warranted and when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure.

Asbestos and ACM at this site pose an exposure risk to human receptors through inhalation of asbestos fibers released during active soil disturbance activities. Current and potential future risks are unacceptable in areas where readily friable asbestos (e.g., MAG and/or AirCell) is present at the surface and future risks are likely to be unacceptable at any location where ACM is present and is allowed to undergo future breakdown to release free fibers to soil. Based on this, rather than establish a chemical-specific cleanup level, this ROD concludes that remedial action is needed for all locations with known ACM contamination to address current and future risks from asbestos, and the RAOs for asbestos contamination will be achieved through implementation of remedial measures in the selected remedy including excavation, consolidation, containment to the extent practicable in onsite repositories, capping, and ICs to break or eliminate the exposure pathways.

As explained above, interior cleaning is not required as part of the selected remedy. However, interior cleaning is included as a contingency, if (after remedy described in section 12 is completed) indoor sampling indicates that asbestos is present at levels that could pose a risk to residents. To ensure protectiveness of human health, three to five ambient air samples will be collected inside each residence. Each sample will be analyzed by TEM using ISO 10312 counting rules. Dust samples will also be collected using microvacuum consistent with ASTM D5755. Average air and dust concentrations for each home will be compared to site-specific criteria for asbestos as described in Appendix B. If the risk is determined to equal or exceed the 1E-04 level that triggers remedial action at the site, or indoor dust exceeds criteria established in Appendix B, indoor cleaning will be performed. The target cleanup goal will be established at the 1E-06 level required by the Oregon ARAR. Appendix B also includes methodology that will be used to evaluate the need for action and to guide such action if deemed necessary.

Arsenic contamination is found in soils on and near the former power plant and is co-located with asbestos-contaminated soils. Arsenic risk levels in these soils are within EPA's acceptable risk range of 1E-06 to 1E-04, but exceed ODEQ's risk threshold of 1E-06. Cleanup of asbestos in soils on and near the former power plant location will require EPA to excavate deeper than where arsenic contamination of concern has been found. Therefore, the RAOs for arsenic contaminated soils near the former power plant will be achieved by excavation and placement in a capped onsite repository as part of the site final remedy. The EPA will use the presence of asbestos rather than an arsenic cleanup level as a guide for how much soil needs to be excavated.

The arsenic concentrations in soil at the former power plant range between 0.5 mg/kg and 27.2 mg/kg. Using an exposure point concentration of 17 mg/kg, the excess lifetime cancer risk was determined to be 4E-05. While no arsenic cleanup level is needed, EPA has calculated the arsenic concentration in soil that would equate to a human health risk level of 1E-06 using residential exposure assumptions as 0.425mg/kg. However arsenic is a metalloid that also occurs naturally in soils developed over volcanic rocks, such as those that underlie and outcrop near the NRE site. Pursuant to EPA guidance, Role of Background in the CERCLA Cleanup Program, Office of Solid Waste and Emergency Response (OSWER) 9285.6-07P, acceptable exposure levels are not set below natural background levels.

A site-specific background study will be performed in late 2011 on properties near OU1. If study demonstrates that natural background is higher than 0.425 mg/kg, EPA will publish an explanation of significant differences (ESD) to change the allowable arsenic level to site-specific background.

Section 9 Description of Alternatives

This section describes the remedial alternatives developed and evaluated in the FS, including a brief explanation of the alternatives developed for OU1. It is organized into two subsections: a) common elements of alternatives, and b) description of remedy components, distinguishing features and expected outcomes for each alternative. The detailed evaluation and comparative analysis of alternatives described in this section is summarized in Section 10.

General response actions (GRAs), remedial technologies, and process options that were potentially useful to address the RAOs for contaminated media were identified and screened in accordance with the NCP. The purpose of this identification and screening process was to retain representative technologies and process options that can be assembled into remedial alternatives. To simplify FS evaluations and alternative descriptions, the contaminated media (debris and soil contaminated with asbestos and/or arsenic) were grouped together and defined as contaminated materials to simplify FS evaluations. The GRAs identified to address contaminated materials at the site included the following:

- No action
- Monitoring
- Land use controls
- Containment
- Removal, transport, and disposal
- Treatment

Remedial technologies and process options were identified for each of the GRAs and broadly evaluated using a two-step screening process. The first screening step evaluated overall technical implementability and suitability of the technology for treatment of sitewide contamination. Remedial technologies and process options that were retained from the first step were further evaluated for effectiveness, implementability, and relative cost.

The first screening step eliminated specific process options for biological treatment (vermiprocess and phytoremediation), physical and/or chemical treatment (chemical digestion, soil washing, and soil flushing), and thermal treatment (incineration) because of their lack of identified or demonstrated effectiveness or compatibility with the arsenic and ACM. The process options for all other GRAs as well as the remaining relevant treatment process options were retained for further screening.

The second screening step further eliminated process options based on low effectiveness, low implementability, and/or high cost. These included specific process options for surface source controls (in situ mixing), transport (hydraulic transport), physical and/or chemical treatment (in situ and ex situ stabilization/solidification and chemical decomposition), thermal treatment (in situ and ex situ vitrification), and thermal/chemical treatment (thermo-caustic dissolution).

The remedial technologies and process options retained after the two-step screening process and indicated in Exhibit 9-1 were used to assemble remedial alternatives that could comprehensively address human health and ecological risks posed by contaminated materials. Please note the information in brackets was added to correspond with the terminology used for the alternative descriptions in this ROD.

Exhibit 9-1. Retained Remedial Technologies and Process Options Used to Develop Remedial Alternatives

Remedial Technology	Process Option
Physical and/or Chemical Monitoring	– Non-Intrusive Visual Inspection (i.e., surficial inspection) – Intrusive Visual Inspection (i.e., inspection using excavations or boreholes) – Sample Collection and Analysis
Institutional Controls	– Governmental Controls, Proprietary Controls, and Informational Devices
Community Awareness Activities	– Informational and Educational Programs
Access Controls	– Posted Warnings and fencing
Surface Source Controls	– Water-Based Suppression – Chemical-Based Suppression – Negative Pressure Enclosure – Soil or Rock Exposure Barrier/Cover [Caps] – Asphalt or Concrete Exposure Barrier/Cover [Caps] – Geosynthetic Multi-Layer Exposure Barrier/Cover [Caps]
Removal [Excavation]	– Mechanical Excavation – Pneumatic Excavation (Vacuum Extraction/Pumping)
Transport	– Mechanical Transport (Hauling/Conveying) – Pneumatic Transport (Vacuum Extraction/Pumping)
Disposal	– Onsite Disposal – Offsite Disposal
Physical and/or Chemical Treatment	– Physical Separation/ Segregation – Size Reduction
Thermal/Chemical Treatment	– Thermo-Chemical Treatment

Remedial alternatives were assembled by combining the retained remedial technologies and process options from the technology screening process. Exhibit 9-2 provides a list of the major remedy components derived from retained remedial technologies/process options that were used to develop each remedial alternative. The fundamental site assumptions and factors were also considered during development of the remedial alternatives.

Exhibit 9-2. Remedy Components Used in Site Remedial Alternatives

Remedy Component Used	Remedial Alternative							
	1	2	3	4	5a	5b	6	7
Partial in-place containment of contaminated materials			•					
In-place containment of contaminated materials				•				
Removal and on-site consolidation/disposal of contaminated surface materials, future off-site disposal of contaminated surface materials at permitted facilities					•			
Removal and on-site consolidation/disposal of contaminated Surface materials						•		
Removal and offsite disposal of contaminated materials							•	
Offsite thermo-chemical treatment								•
Indoor air cleaning			•					
ICs and monitoring		•	•	•	•	•	•	•
5-year review	•	•	•	•	•	•	•	•

Shaded alternatives (2 and 7) were eliminated from consideration prior to detailed analysis

The FS initially identified and screened eight alternatives; Alternatives 2 and 7 were eliminated and not retained for further evaluation.

Alternative 2 (Interior Cleaning and Land Use Controls with Monitoring) was eliminated because it would not be entirely effective at protecting human health and the environment.

Alternative 7 (Excavation and Offsite Thermo-Chemical Treatment of Contaminated Materials at Permitted Facilities, Reuse of Treated Material, and Land Use Controls with Monitoring) was eliminated because of issues related to logistical and technical difficulties of implementing the treatment technology for the large volume of heterogeneous contaminated materials, the availability of the treatment technology, and excessively-high costs relative to other protective alternatives. A more detailed discussion of why treatment was determined to not be practical or viable for OU1 is provided in Section 13 of this ROD. Further explanations of the screening determinations for alternatives 1-7 can be found in the FS.

The remedial alternatives retained for detailed evaluation for OU1 and described below are:

- Alternative 1: No Action
- Alternative 3: Capping of Contaminated Materials on Private Parcels, Partial Capping of Contaminated Materials on Receivership Parcels, Interior Cleaning, and Land Use Controls with Monitoring
- Alternative 4: Capping of Contaminated Materials and Land Use Controls with Monitoring
- Alternative 5a: Excavation and Onsite Consolidation/Disposal of Contaminated Surface Materials, Future Excavation and Offsite Disposal of Contaminated Surface Materials at Permitted Facilities, and Land Use Controls with Monitoring
- Alternative 5b: Excavation and Onsite Consolidation/Disposal of Contaminated Materials, and Land Use Controls with Monitoring

- Alternative 6: Excavation and Offsite Disposal of Contaminated Materials at Permitted Facilities, and Land Use Controls with Monitoring

The following subsection provides general descriptions of the common elements and distinguishing features of all the remedial alternatives, followed by a subsection which gives a description of the remedy components and expected outcomes for each of the alternatives retained for detailed evaluation in the FS.

9.1 Common Elements and Distinguishing Features of Alternatives

Common elements and distinguishing features in how contaminated materials and the remaining contaminated soils at OU1 are addressed under remedial alternatives 1, 3, 4, 5a, 5b, and 6 are discussed below. These common elements and distinguishing features were derived from the retained remedial technologies and process options presented in Exhibit 9-1.

9.1.1 Caps

Caps are a common element of Alternatives 3, 4, 5a, 5b, and 6. The purpose of capping and degree of capping varies from alternative to alternative. Alternatives 3 and 4 use in situ capping to address contaminated materials within parcels. Alternatives 5a and 5b use capping at onsite consolidation areas after excavation of contaminated materials. All of the alternatives (except Alternative 3) include permanent capping of the existing onsite repository created during previous removal actions.

Where a remedial alternative provides for a cap, it would be created with a minimum thickness to provide protection from frost heave. The minimum thickness of the cap will be determined by EPA during remedial design considering the recommendations of the U.S. Army Corps of Engineers, Cold Regions Research Lab. The thickness and composition of the cap will prevent buried ACM from resurfacing and posing human health and ecological risks. Until this determination is made, EPA has used the Oregon Residential Specialty Code to estimate an average 24-inch frost depth for Klamath County. EPA assumes the cap will be a minimum of 24 inches thick, including 18 inches of subsoil and 6 inches of topsoil. Asphalt, concrete, or a rock cap may also be acceptable alternatives to a vegetated soil cap.

9.1.2 Offsite Disposal

Of the alternatives that include excavation of contaminated soils, Alternatives 5a and 6 are the only ones to use offsite disposal.

9.1.3 ICs, Access Controls, and Community Outreach

All remedial alternatives, with the exception of Alternative 1, require land-use controls such as Institutional Controls (ICs), access controls, and community outreach. ICs are legal or administrative mechanisms to discourage human contact with contaminated materials and encourage safe land uses. Specific IC instruments may include governmental controls (changes in local zoning, permits, codes, or regulations), proprietary controls (such as easements and covenants), and informational notices/devices (such as deed notices). ICs are briefly discussed in each alternative, except for Alternative 1. Consistent with expectations set out in the Superfund regulations and policies, none of the remedies rely exclusively on ICs to achieve protectiveness and ICs are considered in concert with other land use controls to be consistent with the concept of layering.

Access controls include appropriate warning and informational signs. Access controls are incorporated into all of the alternatives, except Alternative 1, for the existing and proposed onsite repositories and for properties with buried, undisturbed steam pipe (see Section 12.3.1.8).

Remedies will require long-term community education and outreach programs to ensure that all current and future owners of land on or near OU1 are aware of potential risks associated with exposure to contaminated materials, and to help these property owners know how to mitigate their risks in the future. This community awareness outreach may take the form of health consultations, pamphlet distribution, press releases, public meetings, publicly posted notices, and advisory signs in public areas to both inform the public of risk mitigation and new risk information.

The objectives of the ICs, access controls, and community outreach that will be conducted for this site are:

- Limit the unacceptable use of portions of the properties where asbestos contamination remains
- Protect capped areas on each parcel
- Protect the capped onsite repositories from activities that could damage or degrade the caps
- Inform residents, construction, and excavation workers of the presence and risks from exposure to contaminated materials remaining on site, and to help property owners know how to mitigate their risks in the future

All of the parcels within the boundary of OU1 will be subject to institutional and/or access controls. The following is the criteria used to determine the areas that require ICs and/or access controls:

- All areas where contaminated material has been capped
- All areas where contamination was in left in place (such as under building foundations, driveways, sidewalks, large trees and existing roads)
- Parcels where undisturbed, buried steam pipeline has been left in place (such as on Thicket Court)
- All onsite repositories

No resident will have control or responsibility for long-term maintenance on any portion of an onsite repository.

The type of controls that will be applied to each parcel will be determined during the OU1 Remedial Design. Specific types of controls that will likely be used include: governmental controls such as zoning and local permitting; proprietary property restrictions recorded with the deed such as Oregon's easement and equitable servitude, covenants, conditions, and restrictions established on receivership parcels; and informational notices/devices such as notices of environmental contamination.

Governmental controls may be established by Klamath County, Oregon. The Klamath County Board of Commissioners maintains jurisdiction over specific local land use decisions with legal authority to approve proposed changes in zoning that may be necessary to accommodate remedial alternatives and ensure the protectiveness of any selected remedy.

Land use restrictions may be effected by the use of an easement and equitable servitude on both privately owned and Receiver-managed parcels. An executed easement and equitable servitude will be filed with the county records and is intended to run with the land, so that any future owners will also take the property subject to the conditions of the instrument. Through such instruments, grantees may hold perpetual rights to enforce the conditions and restrictions of such instrument.

Land use restrictions may also be effected within the site through use of private Covenants, Conditions, and Restrictions (CC&Rs) that are recorded with the property deed. CC&Rs are commonly established for new residential subdivisions, and have already been established for residential parcels within the site, setting such requirements as minimum lot size. Once in place, CC&Rs are typically enforced by homeowners acting through a homeowners' association. Activities of homeowners' association are typically funded through assessment of maintenance fees upon homeowners subject to the CC&Rs.

Informational notices may take the form of a Notice of Environmental Contamination which ODEQ may issue unilaterally, consistent with ORS 465.200 et seq. Consistent with ORS 205.130(2), such notices may be presented by ODEQ to the county clerk for recording in the county records.

9.1.4 Buried Steam Pipe

Buried steam pipe, an unused remnant of the old MRB heating system, is present across much of OU1. This buried, asbestos-wrapped pipe is generally co-located with other ACM on the west side of Old Fort Road and was disturbed during construction of the NRE subdivision. As a result, the buried pipe will be addressed in the same way as other subsurface ACM on this portion of OU1. The unused, buried steam pipe east of Old Fort road (for example, along Thicket Court) will be left in place under all remedial alternatives and addressed through a combination of ICs and access controls. There is no evidence that the steam pipe, and its associated asbestos pipe wrap, have been disturbed along the Thicket Court portion of the NRE subdivision (except for ACM found on one property (the (b) (6) property), parcel BO).

9.1.5 Indoor Air Sampling and Cleaning

As explained in the OU1 FS, interior cleaning is not required for any alternative, other than Alternative 3, since all identified contaminated materials are either isolated beneath caps or excavation backfill and are not left exposed at the site. Although it is possible that residual contaminated materials could migrate to the surface over time through backfill, the small quantities of these materials would not likely contaminate indoor air to levels posing risks within residential structures.

9.1.6 Monitoring

For all alternatives monitoring (inspections and sampling) would be performed as necessary to complete risk evaluation updates and 5-year site reviews to evaluate whether adequate protection of human health and the environment is provided. All alternatives include monitoring of ambient air during construction to ensure protectiveness. All alternatives except Alternative 1 also include sampling of borrow sources. Inspections and sampling are a component of each alternative except the "no action" alternative.

9.1.7 Five-Year Reviews

For all alternatives, contaminated subsurface soil is left in place – either because it is not addressed (Alternative 1), is left in place below protective caps (Alternatives 3 and 4) or is left in backfilled excavations (Alternatives 5a, 5b, and 6). Therefore, unrestricted use of the OU1 is not allowed, and all alternatives require the use of 5-year site reviews.

9.2 Description of Remedy Components

The following subsections provide general descriptions and expected outcomes of each alternative retained for detailed evaluation in the FS. Complete descriptions of each of these retained alternatives and the results of the alternative screening that led to evaluation of these alternatives are provided in the FS (EPA 2010b).

9.2.1 Alternative 1 – No Action

- Estimated capital cost: $ 0
- Estimated 5-year review costs (first 30 years): $ 516,000
- Estimated present value cost: $ 186,000
- Estimated construction timeframe: None
- Estimated time to achieve RAOs: would not achieve RAOs

Alternative 1 would leave removal action activities previously performed in their current conditions. No new remedial action activities would be initiated at the site to address contaminated materials or otherwise mitigate the associated risks to human health and the environment. A "no action" alternative is required by the NCP to provide an environmental baseline against which impacts of the various remedial alternatives can be compared.

Five-year site reviews would be performed as required by the NCP to evaluate whether adequate protection of human health and the environment is provided since contaminated materials would remain at the site. Monitoring (consisting of non-intrusive visual inspections and sample collection with laboratory analysis) would be performed as necessary to complete the 5-year site reviews.

Summary of Major Remedial Components and Associated Quantities for Alternative 1: None (no further action taken)

Key ARARs:

- Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules

Expected outcomes:

- Exposure to asbestos would increase over time, exposure to arsenic would remain at former power plant.
- Land would not be available for any use.
- Vacant homes/buildings on site would fall into disrepair; would be subject to vandalism, mold and water damage, and possible rodent infestation. Homes/buildings would likely need to be taken down.

9.2.2 Alternative 3 – Capping of Contaminated Materials on Private Parcels, Partial Capping of Contaminated Materials on Receivership Parcels, Interior Cleaning, and Land Use Controls with Monitoring

- Estimated capital cost: $ 9,592,000
- Estimated annual O&M total cost (first 30 years): $ 892,00
- Interior cleaning and 5-year review costs (first 30 years): $3,426,000
- Estimated present value cost: $ 10,152,000
- Estimated construction timeframe: less than 1 year (privately owned parcels), additional time for all of OU1 varies depending on degree of coverage within receivership parcels.
- Estimated time to achieve RAOs: Minimum of 1 year (all of OU1) - varies depending on degree of coverage within receivership parcels.

Alternative 3 includes in-place containment (capping) of contaminated materials identified on privately owned parcels and a portion of the contaminated materials on receiver-managed parcels. The remainder of contaminated materials on parcels managed by the Receiver would be left exposed at the surface; however, land use controls would be implemented to restrict access and use of these parcels. This alternative leaves the existing onsite waste repository intact, but does not otherwise modify the interim cap on the repository since other areas of contaminated materials on receiver-managed parcels would be left exposed at the surface.

It is assumed that future land use of the capped portion of receiver-managed parcels could be for either residential or non-residential purposes and that the uses could vary based on the extent of cap construction. Determination of allowable future land uses beyond the current zoning is not considered. Current residential structures on receiver-managed parcels would be relocated or demolished.

Caps over contaminated materials would be constructed to the extent practicable. However, it may not be possible to construct frost-protective soil caps over contaminated materials directly adjacent to obstructions such as homes or structures, trees, subsurface utilities, and roads. A thin profile of clean soil backfill or another barrier material placed adjacent to caps coupled with land-use controls is assumed to address these situations.

Caps used to contain contaminated materials are assumed to be constructed from clean soil transported from offsite borrow areas tested to ensure that contamination is not present. The thickness of the caps would be designed to keep contaminated materials from migrating to the surface in the future through frost heave processes.

While asbestos fibers in indoor air do not pose a current risk, tracking in contamination from outside in the future is of particular concern under this alternative. This is because contaminated materials left exposed at OU1 would further degrade over time, and risks from contaminated indoor air could increase because of asbestos fibers tracked inside from exposed contaminated materials located outside the homes. Therefore this alternative includes interior cleaning on a periodic basis using vacuum extraction to remove asbestos fibers within residential structures on privately owned parcels.

Land-use controls would be implemented to protect capped areas as well as restrict access and use of contaminated areas, and provide awareness of risks from potential exposure to contaminated materials. Monitoring would consist of non-intrusive (surface) and intrusive (subsurface) visual inspections and sample collection with analysis to ensure that caps, interior cleanings, and land use controls are protective of human health and the environment. Five-year site reviews would be performed since contaminated materials left in place under caps would remain at the site.

Exhibit 9-3. Summary of Major Remedial Components and Associated Quantities for Alternative 3

Remedial Component	Unit	Estimated Quantity
Surface Area of Caps	Acres	53
Common Backfill Required to Construct Caps	Loose Cubic Yards	145,000
Topsoil Required to Construct Caps	Loose Cubic Yards	48,300
Privately Owned Parcels Potentially Requiring Periodic Interior Cleaning of Residential Structures	Each	24
Privately Owned Parcels Potentially Requiring Land Use Controls	Each	27
Receiver-Managed Parcels Potentially Requiring Land Use Controls	Each	29
Receiver-Managed Parcels Requiring Home Relocation or Removal	Each	18

Key Federal ARARs:

- Clean Air Act: National Emission Standard for Asbestos
  - Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations

Key State of Oregon ARARs:

- Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules
- Air Quality
  - General Emission Standards
  - Asbestos Emission Standards And Procedural Requirements
- Solid Waste Management
  - Land Disposal Sites Other Than Municipal Solid Waste Landfills

Expected outcomes:

- All privately owned parcels would be able to be safely occupied.
- The portion of receiver-managed parcels that are capped could be used for either residential or non-residential uses. If residential use is considered, the now vacant homes on receiver-managed parcels that are capped would be able to be safely reoccupied.
- Interior cleaning of occupied buildings would be performed - as indicated by testing – to ensure protectiveness to residents.

- The portion of receiver-managed parcels that are not capped would be left as is, and contaminated materials would remain exposed. Vacant homes on these parcels would fall into disrepair, and would likely need to be taken down.

- Because the cap would be installed on top of contaminated soils, there is a greater likelihood that property owners could be exposed to asbestos contamination. Property owners could disregard land use restrictions, and choose to make improvements on their land (such as installing fences and planting trees). If a property owner digs through a protective cap, he/she would be exposed to asbestos-contaminated soils.

- Not all portions of the site would have a frost-protective soil caps over contaminated materials, thus there is a greater chance of recontamination of the site because of frost heave. Contamination levels on the uncapped portions of the site would be expected to increase over time.

9.2.3 Alternative 4 – Capping of Contaminated Materials and Land Use Controls with Monitoring

- Estimated capital cost: $ 13,500,000

- Estimated annual O&M total cost (first 30 years): $ 1,064,000

- Five-year review costs (first 30 years): $360,000

- Estimated present value cost: $ 12,798,000

- Estimated construction timeframe: less than 1 year (privately owned parcels); 2 years (all of OU1)

- Estimated time to achieve RAOs: 2 years (all of OU1)

Alternative 4 includes in-place capping (covering) of contaminated materials identified on all parcels, regardless of whether they are privately owned or receiver-managed parcels. This alternative includes installation of a permanent cap over the existing onsite waste repository to ensure the interim cap installed in 2008 is protective.

It is assumed that future land use of the receiver-managed parcels would be residential. Current residential structures on receiver-managed parcels would be kept intact. Caps over contaminated materials would be constructed to the extent practicable. However, it may not be possible to construct frost-protective soil caps over contaminated materials directly adjacent to obstructions such as homes or structures, trees, subsurface utilities, and roads. A thin profile of clean soil backfill or another barrier material placed adjacent to caps coupled with land-use controls is assumed to address these situations.

Caps used to contain contaminated materials are assumed to be constructed from clean soil transported from offsite borrow areas tested to ensure that contamination is not present. The thickness of the caps would be designed to keep contaminated materials from migrating to the surface in the future through frost heave processes.

As explained in section 9.1.5: Indoor Air Sampling and Cleaning, above, interior sampling and cleaning would not be required for this alternative since all identified contaminated materials are isolated beneath caps at the site and not left exposed. Monitoring of ambient air would be required during construction to ensure protectiveness.

Land use controls would be implemented to protect and restrict use of capped areas, and provide awareness of risks from potential exposure to contaminated materials. Monitoring would consist of non-intrusive (surface) and intrusive (subsurface) visual inspections and sample collection with analysis to ensure that caps and land use controls are protective of human health and the environment. Five-year site reviews would be performed since contaminated materials left in place under caps would remain at the site.

Exhibit 9-4. Summary of Major Remedial Components and Associated Quantities for Alternative 4

Remedial Component	Unit	Estimated Quantity
Surface Area of Caps	Acres	88
Common Backfill Required to Construct Caps	Loose Cubic Yards	238,800
Topsoil Required to Construct Caps	Loose Cubic Yards	80,900
Privately Owned Parcels Potentially Requiring Land Use Controls	Each	27
Receiver-Managed Parcels Potentially Requiring Land Use Controls	Each	29

Key Federal ARARs:

- Clean Air Act: National Emission Standard for Asbestos
  - Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations

Key State of Oregon ARARs:

- Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules
- Air Quality
  - General Emission Standards
  - Asbestos Emission Standards And Procedural Requirements
- Solid Waste Management
  - Land Disposal Sites Other Than Municipal Solid Waste Landfills

Expected outcomes:

- All privately owned and receiver-managed parcels would be capped, and all homes would be safe to occupy. The warehouse could be safely used.

- Currently vacant homes/other buildings would be able to be safely reoccupied, so risk of vandalism is significantly reduced.

- Because the cap would be installed on top of contaminated soils, there is a likelihood that property owners could be exposed to asbestos contamination. Property owners could disregard land use restrictions, and choose to make improvements on their land (such as installing fences and planting trees). If a property owner digs through a protective cap, he/she would be exposed to asbestos-contaminated soils.

9.2.4 Alternative 5a - Excavation and Onsite Consolidation/Capping of Contaminated Surface Materials, Future Excavation and Offsite Disposal of Contaminated Surface Materials at Permitted Facilities, and Land Use Controls with Monitoring

- Estimated capital cost: $ 9,970,000

- Estimated annual O&M total cost (first 30 years): $ 3,304,000

- Five-year review costs (first 30 years): $360,000

- Estimated present value cost: $ 10,467,000

- Estimated construction timeframe: less than 1 year (privately owned parcels); 2 years (all of OU1)

- Estimated time to achieve RAOs: 2 years (all of OU1)

Alternative 5a includes excavation of contaminated surface materials (assumed to be within 2 feet bgs) identified on all parcels, regardless of whether they are privately owned or receiver-managed parcels. This alternative does not remove subsurface contaminated materials previously identified at the site (assumed to be greater than 2 feet bgs). This alternative includes installation of a permanent cap over the existing onsite waste repository to ensure the interim cap installed in 2008 is protective.

Excavation of contaminated surface materials would be conducted to the extent practicable. However, it may not be possible to fully excavate contaminated surface materials underneath or adjacent to obstructions such as homes or structures, trees, subsurface utilities, and roads. Thus residual contaminated materials may be left in soil underlying or adjacent to these obstructions. A thin profile of clean soil backfill or another barrier material placed in excavations coupled with land use controls are assumed to address these situations.

Excavated contaminated materials would be consolidated at onsite disposal locations specifically constructed to isolate wastes using caps. The caps would be designed to keep contaminated materials from migrating to the surface in the future through frost heave processes.

Clean soil would be used to backfill excavation areas. Clean soil is assumed to be transported from offsite borrow areas tested to ensure that contamination is not present. The backfill would be covered with topsoil and revegetated, or otherwise restored to match the surface conditions that previously existed. While the backfill would provide an initial exposure barrier to subsurface contaminated materials and asbestos fibers, it would not necessarily keep these materials in underlying or adjacent soil from migrating to the surface in the future through frost heave processes.

Because subsurface contaminated materials would not be removed and could potentially migrate to the surface over time, future excavation events (e.g., surface pick up of contaminated materials) would be performed on an as-needed basis. Contaminated materials excavated during these events are assumed to be transported offsite and placed within permitted offsite disposal facilities authorized by ODEQ to receive asbestos and other site COPCs.

It is assumed that future land use of the receiver-managed parcels would be residential and that current structures on receiver-managed parcels would be kept intact.

As explained in section 9.1.5: Indoor Air Sampling and Cleaning, above, interior cleaning would not be required for this alternative since all remaining contaminated materials are isolated beneath caps or excavation backfill and are not left exposed. Monitoring of ambient air would be required during construction to ensure protectiveness.

Land-use controls would be implemented to protect and restrict use of capped and backfilled areas, and provide awareness of risks from potential exposure to contaminated materials. Monitoring would consist of non-intrusive (surface) and intrusive (subsurface) visual inspections and sample collection with analysis to ensure that caps, excavation backfill, and land use controls are protective of human health and the environment. Five-year site reviews would be performed since contaminated materials left in place under caps and backfill would remain at the site.

Exhibit 9-5. Summary of Major Remedial Components and Associated Quantities for Alternative 5a

Remedial Component	Unit	Estimated Quantity
Area of Contaminated Surface Materials Initially Excavated	Acres	81
Volume of Contaminated Surface Materials Initially Excavated	Loose Cubic Yards	97,000
Common Backfill Required for Excavations	Loose Cubic Yards	31,500
Topsoil Required for Excavations	Loose Cubic Yards	69,500
Receiver-Managed Parcels Potentially Impacted by Onsite Disposal Locations	Parcel ID	5 parcels assumed to be the following: MBK-E, AG, and Y (Existing Repository); MBK-D, and L (Possible location of second onsite repository)
Surface Area of Onsite Disposal Locations	Acres	8
Common Backfill Required to Construct Caps for Onsite Disposal Locations	Loose Cubic Yards	50,700
Topsoil Required to Construct Caps for Onsite Disposal Locations	Loose Cubic Yards	6,600
Annual Weight of Contaminated Materials During Future Excavation - Years 1 through 10	Tons	11
Annual Weight of Contaminated Materials Assumed During Future Excavation - Years 11 through 20	Tons	7
Annual Weight of Contaminated Materials Assumed During Future Excavation - Years 21 through 30	Tons	3
One-Way Distance to Multiple Offsite Disposal Facilities (Weighted Average)	Miles	110
Privately Owned Parcels Potentially Requiring Land Use Controls	Each	27
Receiver-Managed Parcels Potentially Requiring Land Use Controls	Each	29

Key Federal ARARs:

- Clean Air Act: National Emission Standard for Asbestos
  - Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations

Key State of Oregon ARARs:

- Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules
- Air Quality
  - General Emission Standards

- Asbestos Emission Standards And Procedural Requirements

- Solid Waste Management
  - Municipal Solid Waste Landfills
  - Land Disposal Sites Other Than Municipal Solid Waste Landfills

Expected outcomes:

- Privately owned and receiver-managed parcels would have all detected contaminated surface materials excavated from the property and clean backfill placed. All homes would be safe to occupy. The warehouse could be safely used.
- Currently vacant homes/other buildings would be able to be safely reoccupied, so risk of vandalism is significantly reduced.
- Even though clean fill would be used to backfill excavation areas and would be revegetated, it would not necessarily keep asbestos containing materials in underlying or adjacent soil from migrating to the surface in the future through frost heave processes.
- Property owners could disregard land use restrictions and choose to make improvements on their land (such as installing fences and planting trees). If a property owner digs through clean fill, he/she could still be exposed to asbestos-contaminated soils. However, since up to 2 feet of contaminated soils would have been excavated before property is backfilled, the likelihood that property owners would be exposed to asbestos contamination in the future is reduced.
- Onsite repositories would need to be carefully monitored to ensure protectiveness. Repositories could be incorporated into residential land uses, such as for bike paths or walking trails.
- Disposal of future excavated materials in offsite permitted facilities ensure long-term protectiveness of site. However, transporting contaminated materials off site increases chance that asbestos contamination could inadvertently be spread off site (because of covers on truck beds coming loose, asbestos fibers clinging to truck tires and to the bottoms of work boots, etc.).

9.2.5 Alternative 5b – Excavation and Onsite Consolidation/Disposal of Contaminated Materials and Land Use Controls with Monitoring

- Estimated capital cost: $ 15,335,000
- Estimated annual O&M total cost (first 30 years): $ 1,050,000
- Five-year review costs (first 30 years): $360,000
- Estimated present value cost: $ 14,028,000

- Estimated construction timeframe: 1 year (privately owned parcels); 3 years (all of OU1)
- Estimated time to achieve RAOs: 3 years (all of OU1)

Alternative 5b includes excavation of surface and subsurface contaminated materials identified on all parcels, regardless of whether they are privately owned or receiver-managed parcels. This alternative includes installation of a permanent cap over the existing onsite waste repository to ensure the interim cap installed in 2008 is protective.

Excavation of contaminated surface materials would be conducted to the extent practicable. However, it may not be possible to fully excavate contaminated surface materials underneath or adjacent to obstructions such as homes or structures, trees, subsurface utilities, and roads. Thus residual contaminated materials may be left in soil underlying or adjacent to these obstructions. A thin profile of clean soil backfill or another barrier material placed in excavations coupled with land use controls are assumed to address these situations.

Excavated contaminated materials would be consolidated at onsite disposal locations specifically constructed to isolate wastes using caps. The caps would be designed to keep contaminated materials from migrating to the surface in the future through frost heave processes.

Clean soil would be used to backfill excavation areas. Clean soil is assumed to be transported from offsite borrow areas tested to ensure that contamination is not present. The backfill would be covered with topsoil and revegetated, or otherwise restored to match the surface conditions that previously existed. While the backfill would provide an initial exposure barrier to residual contaminated materials and asbestos fibers, it would not necessarily keep these materials in underlying or adjacent soil from migrating to the surface in the future through frost heave processes.

It is assumed that future land use of the receiver-managed parcels would be residential and that current structures on receiver-managed parcels would be kept intact.

As explained in section 9.1.5: Indoor Air Sampling and Cleaning, above, interior cleaning would not be required for this alternative since all remaining contaminated materials are isolated beneath caps or excavation backfill and are not left exposed. Monitoring of ambient air would be required during construction to ensure protectiveness.

Land-use controls would be implemented to protect and restrict use of capped and backfilled areas, and provide awareness of risks from potential exposure to contaminated materials. Monitoring would consist of non-intrusive (surface) and intrusive (subsurface) visual inspections and sample collection with analysis to ensure that caps, excavation backfill, and land use controls are protective of human health and the environment. Five-year site reviews would be performed since contaminated materials left in place under caps and backfill would remain at the site.

Exhibit 9-6. Summary of Major Remedial Components and Associated Quantities for Alternative 5b

Remedial Component	Unit	Estimated Quantity
Surface Area of Excavations	Acres	82
Volume of Contaminated Materials Excavated	Loose Cubic Yards	130,300
Common Backfill Required for Excavations	Loose Cubic Yards	63,700
Topsoil Required for Excavations	Loose Cubic Yards	70,600
Receiver-Managed Parcels Impacted by Onsite Disposal Locations	Parcel ID	5 parcels assumed to be the following: MBK-E, AG, and Y (Existing Repository); MBK-D, and L (Possible location of second onsite repository)
Surface Area of Onsite Disposal Locations	Acres	8
Common Backfill Required to Construct Caps for Onsite Disposal Locations	Loose Cubic Yards	59,200
Topsoil Required to Construct Caps for Onsite Disposal Locations	Loose Cubic Yards	6,700
Privately Owned Parcels Potentially Requiring Land Use Controls	Each	27
Receiver-Managed Parcels Potentially Requiring Land Use Controls	Each	29

Key Federal ARARs:

- Clean Air Act: National Emission Standard for Asbestos
    - Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations

Key State of Oregon ARARs:

- Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules
- Air Quality
    - General Emission Standards
    - Asbestos Emission Standards And Procedural Requirements
- Solid Waste Management
    - Land Disposal Sites Other Than Municipal Solid Waste Landfills

<u>Expected outcomes</u>:

- Privately owned and receiver-managed parcels would have all detected contaminated materials excavated from the property and clean backfill placed. All homes would be safe to occupy. The warehouse could be safely used.
- Currently vacant homes/other buildings would be able to be safely reoccupied, so risk of vandalism is significantly reduced.
- Even though clean fill would be used to backfill excavation areas and would be revegetated, it would not necessarily keep asbestos containing materials in underlying or adjacent soil from migrating to the surface in the future through frost heave processes.
- Property owners could disregard land use restrictions and choose to make improvements on their land (such as installing fences and planting trees). If a property owner digs through clean fill, he/she could still be exposed to residual asbestos contamination in soils. However, since contaminated materials would have been excavated before property is backfilled, the likelihood that property owners could be exposed to asbestos contamination in the future is reduced.
- Onsite repositories would need to be carefully monitored to ensure protectiveness. Repositories could be incorporated into residential land uses, such as for bike paths or walking trails.

9.2.6 Alternative 6 - Excavation and Offsite Disposal of Contaminated Materials at Permitted Facilities and Land Use Controls with Monitoring

- Estimated capital cost: $ 32,990,000
- Estimated annual O&M total cost (first 30 years): $ 1,050,000
- Five-year review costs (first 30 years): $360,000
- Estimated present value cost: $ 29,472,000
- Estimated construction timeframe: 1 to 2 years (privately owned parcels); 4 years (all of OU1)
- Estimated time to achieve RAOs: 4 years (all of OU1)

Alternative 6 includes excavation of surface and subsurface contaminated materials identified on all parcels, regardless of whether they are privately owned or receiver-managed parcels. This alternative includes installation of a permanent cap over the existing onsite waste repository to ensure the interim cap installed in 2008 is protective.

Excavation of contaminated surface materials would be conducted to the extent practicable. However, it may not be possible to fully excavate contaminated surface materials underneath or adjacent to obstructions such as homes or structures, trees, subsurface utilities, and roads. Thus residual contaminated materials may be left in soil underlying or adjacent to these obstructions.

A thin profile of clean soil backfill or another barrier material placed in excavations coupled with land use controls are assumed to address these situations. Removed contaminated materials would be transported offsite and placed within one or more permitted offsite disposal facilities specifically authorized by ODEQ to receive asbestos and other site COPCs.

Clean soil would be used to backfill excavation areas. Clean soil is assumed to be transported from offsite borrow areas tested to ensure that contamination is not present. The backfill would be covered with topsoil and revegetated, or otherwise restored to match the surface conditions that previously existed. While the backfill would provide an initial exposure barrier to residual contaminated materials and asbestos fibers, it would not necessarily keep these materials in underlying or adjacent soil from migrating to the surface in the future through frost heave processes.

It is assumed that future land use of the receiver-managed parcels would be residential and that current structures on receiver-managed parcels would be kept intact.

As explained in section 9.1.5: Indoor Air Sampling and Cleaning, above, interior cleaning would not be required for this alternative since all remaining contaminated materials are isolated beneath caps or excavation backfill and are not left exposed. Monitoring of ambient air would be required during construction to ensure protectiveness.

Land-use controls would be implemented to protect and restrict use of capped and backfilled areas, and provide awareness of risks from potential exposure to contaminated materials. Monitoring would consist of non-intrusive (surface) and intrusive (subsurface) visual inspections and sample collection with analysis to ensure that caps, excavation backfill, and land use controls are protective of human health and the environment. Five-year site reviews would be performed since contaminated materials left in place under caps and backfill would remain at the site.

Exhibit 9-7. Summary of Major Remedial Components and Associated Quantities for Alternative 6

Remedial Component	Unit	Estimated Quantity
Surface Area of Excavations	Acres	89
Volume of Contaminated Materials Excavated	Loose Cubic Yards	139,600
Estimated Weight of Contaminated Materials for Offsite Disposal	Tons	186,700
One-Way Distance to Multiple Offsite Disposal Facilities (Weighted Average)	Miles	110
Common Backfill Required for Excavations	Loose Cubic Yards	67,200
Topsoil Required for Excavations	Loose Cubic Yards	76,400
Privately Owned Parcels Potentially Requiring Land Use Controls	Each	27
Receiver-Managed Parcels Potentially Requiring Land Use Controls	Each	29

Key Federal ARARs:

- Clean Air Act: National Emission Standard for Asbestos
  - Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations

Key State of Oregon ARARs:

- Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules
- Air Quality
  - General Emission Standards
  - Asbestos Emission Standards And Procedural Requirements
- Solid Waste Management
  - Municipal Solid Waste Landfills
  - Land Disposal Sites Other Than Municipal Solid Waste Landfills

Expected outcomes:

- Privately owned and receiver-managed parcels would have all detected contaminated materials excavated from the property and clean backfill placed. All homes would be safe to occupy. The warehouse could be safely used.
- Currently vacant homes/other buildings would be able to be safely reoccupied, so risk of vandalism is significantly reduced.
- Even though clean fill would be used to backfill excavation areas and would be revegetated, it would not necessarily keep asbestos containing materials in underlying or adjacent soil from migrating to the surface in the future through frost heave processes.
- Property owners could disregard land use restrictions and choose to make improvements on their land (such as installing fences and planting trees). If a property owner digs through clean fill, he/she could still be exposed to asbestos-contaminated soils. However, since contaminated materials would have been excavated before property is backfilled, the likelihood that property owners could be exposed to asbestos contamination in the future is greatly reduced.
- The onsite repository would need to be carefully monitored to ensure protectiveness.
- Disposal of contaminated materials in offsite permitted facilities ensures long-term protectiveness of site. However, transporting contaminated materials off site increases chance that asbestos contamination could inadvertently be spread off site (because of covers on truck beds coming loose, asbestos fibers clinging to truck tires and to the bottoms of work boots, etc.).

Section 10 – Comparative Analysis of Alternatives

Each remedial alternative was screened in the FS to determine its overall effectiveness, implementability, and cost. Alternatives deemed to have lower than moderate effectiveness, lower than moderate implementability, and/or high cost were eliminated from further consideration.

Alternatives 2 and 7 were eliminated during this screening evaluation. Alternative 2 (Interior Cleaning and Land Use Controls with Monitoring) was eliminated because it would not be entirely effective at protecting human health and the environment. Alternative 7 (Excavation and Offsite Thermo-Chemical Treatment of Contaminated Materials at Permitted Facilities, Reuse of Treated Material, and Land Use Controls with Monitoring) was eliminated because of issues related to logistical and technical difficulties of implementing the treatment technology for the large volume of heterogeneous contaminated materials, the availability of the treatment technology, and excessively-high costs relative to other protective alternatives. Further explanations on those screening determinations can be found in the FS.

The remaining alternatives (1, 3, 4, 5a, 5b, and 6) were retained for detailed analysis in the FS against two **threshold criteria** and five **balancing criteria**.

Threshold Criteria:

The following two threshold criteria are the most important and must be satisfied by any alternative in order to be eligible for selection:

- ***Overall protection of human health and the environment*** requires that an alternative eliminates, reduces, or controls unacceptable threats to public health and the environment through ICs, engineering controls, treatment, and/or other remedial actions.

- ***Compliance with ARARs*** evaluates whether the alternative meets federal and state environmental and facility siting statutes that pertain to OU1 or whether a waiver is justified.

Balancing Criteria:

The following five balancing criteria are used to make comparisons and to identify the major tradeoffs between alternatives:

- ***Long-term effectiveness and permanence*** considers the ability of an alternative to maintain protection of human health and the environment over time.

- ***Reduction of toxicity, mobility, or volume through treatment*** evaluates an alternative's use of treatment to reduce a) the harmful effects of principal contaminants, b) the contaminant's ability to move in the environment, and c) the amount of contamination remaining after remedy implementation.

- ***Short-term effectiveness*** considers the length of time needed to implement an alternative and the risk the alternative poses to workers, residents, and the environment during implementation.

- ***Implementability*** considers the technical and administrative feasibility of implementing the alternative, including factors such as the availability of materials and services.

- ***Cost*** includes estimated capital and annual operations and maintenance costs, as well as present value cost. Present value cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates for detailed analysis of alternatives are expected to be accurate within a range of +50 to -30 percent of actual cost.

Exhibit 10-1 provides a comparative analysis of the remedial alternatives against the **threshold** and **balancing** criteria and highlights the key tradeoffs between them. Only significant comparative differences between alternatives are presented. A full discussion of the differences between alternatives can be found in Section 7 and Appendix G of the FS.

Modifying Criteria:

After the NRE site Proposed Plan was released in April 2010, EPA received formal comments from the state and community on the proposed plan and preferred alternative. With state and community input in hand, EPA was able to complete the final evaluation of the remedial alternatives using the following modifying criteria. These criteria can prompt modification of the preferred remedy that was presented in the Proposed Plan:

- ***State acceptance*** considers whether the state agrees with the EPA's analyses and recommendations, as described in the RI/FS and proposed plan.

- ***Community acceptance*** considers whether the local community agrees with the EPA's analyses and preferred alternative. Comments received on the proposed plan are an important indicator of community acceptance.

A discussion of how the **modifying** criteria affected the selected remedy is provided in Section 10.2.

10.1 Comparative Analysis of Remedial Alternatives Against Threshold and Balancing Criteria

Exhibit 10-1 Comparative Analysis of Alternatives - Threshold and Balancing Criteria Evaluations

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
Alternative Description	***No Action***	***Capping of Contaminated Materials on Private Parcels, Partial Capping of Contaminated Materials on Receivership Parcels, Interior Cleaning, and Land Use Controls with Monitoring***	***Capping of Contaminated Materials and Land Use Controls with Monitoring***	***Excavation and Onsite Consolidation/Disposal of Contaminated Surface Materials, Future Excavation and Offsite Disposal of Contaminated Surface Materials at Permitted Facilities, and Land Use Controls with Monitoring***	***Excavation and Onsite Consolidation/Disposal of Contaminated Materials, and Land Use Controls with Monitoring***	***Excavation and Offsite Disposal of Contaminated Materials at Permitted Facilities, and Land Use Controls with Monitoring***
Threshold Criteria						
Overall Protection of Human Health and the Environment						
Human Health Protection	No reduction of risk. Not protective of human health and does not meet RAOs.	Caps on a portion of site break exposure pathway. Capped areas are protective of human health and meets human health RAOs. Contaminated materials still remain beneath cap across a large extent of the site and could pose additional human	Caps across site break exposure pathway. Capped areas are protective of human health and meets human health RAOs for OU1. Contaminated materials still remain beneath cap across a large extent of the site and could pose human health	Contaminated subsurface materials would remain beneath a large extent of the site at deep disposal locations and beneath backfill placed in excavations. These materials could pose risks if the caps or backfill are compromised. Upward migration of subsurface contaminated materials through backfill to the surface may occur over	Since the majority of the contaminated materials are excavated and capped at onsite disposal locations protected by land use controls, long-term protection of human health is more certain across the site than alternatives that leave contaminated materials across a larger extent of the site. However, since exposure pathway must	Similar to Alternative 5b, except that contaminated materials are excavated and disposed of offsite rather than consolidated and disposed of on site. Since the majority of the contaminated materials are excavated and disposed of offsite, long-term

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
		health risks if the caps are compromised. Contaminated materials that remain exposed outside of capped areas pose human health risks through dispersal across the site. Uncapped areas are protective of human health in the short term and partially meet RAOs because area is fenced and humans are excluded from area.	risks if the caps are compromised.	time and pose additional risks. Since exposure pathway must be broken to ensure protectiveness and backfill does not necessarily prevent frost heave, this alternative does not ensure that human health RAOs for OU1 are met.	be broken to ensure protectiveness and backfill does not necessarily prevent frost heave, this alternative does not ensure that human health RAOs for OU1 are met.	protection of human health is more certain than Alternative 5b. However, since exposure pathway must be broken to ensure protectiveness and backfill does not necessarily prevent frost heave, this alternative does not ensure that human health RAOs for OU1 are met.

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
Ecological Protection	Not protective of ecological receptors.	Caps on a portion of site break exposure pathway. Capped areas are protective of ecological receptors. Contaminated materials still remain beneath cap across a large extent of the site and could pose additional ecological risks if the caps are compromised. Contaminated materials that remain exposed outside of capped areas pose ecological risks through dispersal across the site.	Caps mitigate the potential for direct contact exposures by animals to ACM and asbestos fibers in soil. Contaminated materials still remain beneath caps across a large extent of the site and could pose ecological risks if the caps are compromised.	Contaminated subsurface materials remain across a large extent of the site and beneath caps at disposal locations and backfill placed in excavations. These contaminated materials could pose risks if the caps or backfill are compromised. Upward migration of subsurface contaminated materials through backfill to the surface may occur over time and pose additional risks. Since exposure pathway must be broken to ensure protectiveness and backfill does not necessarily prevent frost heave, this alternative does not ensure that protectiveness for ecological receptors is achieved.	Since the majority of the contaminated materials are excavated and capped at onsite disposal locations protected by land use controls, long-term protection of ecological receptors is more certain across the site than alternatives that leave contaminated materials across a larger extent of the site. However, since exposure pathway must be broken to ensure protectiveness and backfill does not necessarily prevent frost heave, this alternative does not ensure that protectiveness for ecological receptors is achieved.	Similar to Alternative 5b, except that contaminated materials are excavated and disposed of offsite rather than consolidated and disposed of on site. Since the majority of the contaminated materials are excavated and disposed of offsite, long-term protection of ecological receptors is more certain than Alternative 5b. However, since exposure pathway must be broken to ensure protectiveness and backfill does not necessarily prevent frost heave, this alternative does not ensure that protectiveness for ecological receptors is achieved.

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
Compliance with ARARs						
Chemical Specific ARARs	No action would be taken to address contaminated materials and contaminated air that would likely exceed acceptable risk standards specified in Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules.	Caps placed over contaminated materials would physically break the exposure pathways to humans and most ecological receptors and eliminate discharges to air, thus meeting acceptable risk standards specified in Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules. Uncapped areas of contamination on receiver-managed parcels would not be physically addressed. Contaminated materials and contaminated air would likely exceed acceptable	Caps placed over contaminated materials would physically break the exposure pathways to humans and most ecological receptors and eliminate discharges to air, thus meeting acceptable risk standards specified in Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules.	Caps placed over consolidated contaminated materials would physically break the exposure pathways to human and most ecological receptors and eliminate discharges to air. These approaches would meet acceptable risk standards specified in Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules. Backfill placed over subsurface contaminated materials would initially break the exposure pathways to human and most ecological receptors and eliminate discharges to air. However, long-term compliance with acceptable risk standards specified in Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rule is less certain because of frost heave processes.	Same as Alternative 5a.	Same as Alternative 5a.

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
		risk standards specified in Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules.				
Location Specific ARARs	ARARs would not be triggered since no new remedial measures would be undertaken.	Addresses the location- specific ARARs through adherence of the ARARs during implementation of the remedial action.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Action-Specific ARARs	ARARs would not be triggered since no new remedial measures would be undertaken.	Addresses action-specific ARARs through adherence of the ARARs during implementation of the remedial action.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Other Criteria and Guidance	Other criteria and guidance would not be triggered since no new remedial measures would be undertaken.	Other identified criteria and guidance will be considered during implementation of the remedial action.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
Balancing Criteria						
Long-Term Effectiveness and Permanence						
Magnitude of Residual Risk	No additional cleanup measures are initiated and contaminated materials are left exposed. Existing risk will remain.	Risk is reduced in capped areas as long as cap is maintained. Contaminated materials that remain exposed outside of capped areas will continue to pose human health and ecological risks. Contaminated materials still remain beneath caps across a large extent of the site and could pose additional risks if the caps are compromised. Interior cleaning would not ensure protectiveness within the interior of residential structures since contaminated materials would continue to be	Risk is significantly reduced as long as cap is maintained. Contaminated materials still remain beneath caps and backfill across a large extent of the site and could pose risks if the caps and backfill are compromised. Long-term effectiveness and permanence is not as certain as for remedies that remove and consolidate contaminated materials for onsite and offsite disposal.	Contaminated materials still remain under caps at onsite disposal locations. Contaminated subsurface materials also remain across a large extent of the site beneath backfill placed in excavations. These materials could pose current and future human health and ecological risks if the caps on the onsite disposal locations are compromised or contaminated materials become exposed at the surface in backfilled excavations.	Since the majority of the contaminated materials are excavated and disposed of at onsite disposal locations protected by land use controls, long-term protection of human health and the environment is more certain across the site than alternatives that leave contaminated materials across a larger extent of the site.	Similar to Alternative 5b, except offsite rather than onsite disposal of excavated contaminated materials is performed.

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
		exposed and degrade and migrate from receiver-managed parcels and could be tracked into the structures.				
Adequacy and Reliability of Controls	No additional controls put in place. Contaminated materials left uncontrolled.	Caps on portions of OU1 adequately controls migration of and exposure to contaminated soil. There are inadequate controls on contaminated materials left exposed outside of capped areas. Long-term reliability of capped areas on site can be high, dependent on continued integrity of the caps and adherence to institutional and access controls. This is less certain on privately owned parcels. O&M activities would be periodically required to repair damage or erosion to the	Same as Alternative 3, except that all contaminated materials within OU1 are capped.	Same as Alternative 3 for capped areas of OU1. Initial excavation of surface contamination and future excavation of contaminated materials that emerge in the future presents a marginally adequate control. Future excavation of contaminated materials would be a periodic action requiring monitoring of the source areas for new migration of subsurface contaminated materials, especially during colder periods because of freeze thaw cycles. However, the volume of contaminated materials exposed at the surface should decrease over time.	Same as Alternative 3 for capped areas of OU1. Excavation of surface and subsurface contaminated materials with onsite consolidation, disposal, and backfilling with clean soil presents more adequate and reliable control than Alternative 5a.	Same as Alternative 3 for capped areas of OU1. Excavation of surface and subsurface contaminated materials with offsite disposal and backfilling with clean soil presents still more adequate and reliable control than 5b.

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
		caps and maintenance to warning signs. Reliance on ICs and access controls for long-term protectiveness and permanence would not be ensured since humans and ecological receptors could ignore them, especially on privately owned parcels. Legal enforcement of ICs may be necessary. Interior cleaning would not ensure protectiveness within interiors of residential structures since contaminated materials would continue to be exposed and degrade and migrate from receiver-managed parcels and could be tracked into the structures.				

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
Reduction of Toxicity, Mobility, or Volume through Treatment						
Treatment Process Used	No treatment; therefore, does not reduce toxicity, mobility, or volume of contaminants through treatment.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Amount Destroyed or Treated	N/A	N/A	N/A	N/A	N/A	N/A
Reduction of Toxicity, Mobility, or Volume	N/A	N/A	N/A	N/A	N/A	N/A
Irreversible Treatment	N/A	N/A	N/A	N/A	N/A	N/A
Type and Quantity of Residuals Remaining after Treatment	N/A	N/A	N/A	N/A	N/A	N/A
Short-Term Effectiveness						
Community Protection	Continued risk to community through no action. No additional cleanup measures are initiated and	Work area restrictions (such as exclusion zones) would be implemented during construction to reduce short-term	Similar to Alternative 3. However Alternative 4 involves significantly more surface disturbance of	Requires disturbance and consolidation of a large amount of contaminated materials across the site and large volumes of offsite borrow. These activities pose greater increased	Similar to Alternative 5a. While Alternative 5b involves initial excavation and consolidation of a larger volume of contaminated materials than Alternative 5a, the	Similar to Alternative 5b, offsite rather than onsite disposal of excavated contaminated materials is performed. Short-

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
	contaminated materials are left exposed. Thus, there are no short-term effectiveness issues for this alternative.	exposure risks to the community. Residents of privately owned parcels could be exposed to contaminated materials during implementation of the remedial action. Temporary relocation of residents from privately owned parcels may be required during construction of caps and interior cleaning. Trucks used to haul offsite borrow materials increases short-term risks to the community from increased traffic.	contaminated materials and larger number of haul trucks than Alternative 3.	short-term risks to workers and the community than surface disturbance activities under Alternative 4.	increase in initial short-term risks during excavation is offset by not requiring future excavation of contaminated materials as under Alternative 5a.	term impacts to workers and especially the community are potentially increased over alternatives that do not require offsite disposal because of truck traffic to the offsite disposal facilities.
Worker Protection	No risk to workers, as no action taken.	Protection required against inhalation of contaminated materials while walking or driving over site, and during earth moving and cap construction.	Same as Alternative 3.	Same as Alternative 3. Also, this Alternative involves excavation and relocation of contaminated materials which could pose short-term risks to workers from inhalation of asbestos fibers and non-asbestos COPC.	Same as Alternative 5a.	Same as Alternative 5a.

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
		Transport of clean borrow materials would pose short-term risks to workers from increased traffic.		Protective measures such as dust suppression and personal protective equipment would be used to address those risks.		
Environmental Impacts	Continued impact from existing conditions.	There could be some impact to the environment during remedial action because of emissions from heavy construction and hauling equipment. Water and chemical based suppression would be used for controlling contaminated materials and dust during construction. Development of offsite borrow areas could adversely impact the environment. Mitigation measures could include selection of easily accessible borrow locations and reclamation of	Same as Alternative 3.	Same as Alternative 3. This alternative would involve excavation of contaminated materials which could pose additional potential adverse impacts through dispersion of asbestos fibers or dust.	Same as Alternative 5a.	Same as Alternative 5a.

Alternative #	*Alternative 1*	*Alternative 3*	*Alternative 4*	*Alternative 5a*	*Alternative 5b*	*Alternative 6*
		borrow areas after use.				
Time Until Action is Complete	N/A	Estimated Construction timeframe = minimum of 1 year - varies depending on degree of coverage within receivership parcels.	Estimated Construction timeframe = 2 years.	Estimated Construction timeframe = 2 years. Future excavation of contaminated materials could occur over a long period of time.	Estimated Construction timeframe = 3 years. Since more contaminated materials (both surface and subsurface) would be removed under this Alternative, a longer period of time is needed to complete the work.	Estimated Construction timeframe = 4 years. Same as Alternative 5b, but contaminated materials would be disposed of offsite.
Implementability						
Ability to Construct and Operate	No action is taken other than 5-year site reviews. No construction or operation.	Easy to construct. Construction resources and materials needed to construct caps for this alternative should be available. ICs have been implemented in a similar manner on other contaminated residential sites in Oregon. Maintenance of the capped areas, especially on privately owned parcels, could provide difficulties in the future.	Similar to Alternative 3. However Alternative 4 requires capping a larger area of the site than Alternative 3 and requires a larger volume of borrow from offsite areas.	Excavation and onsite consolidation of contaminated materials could be difficult in areas of underground utilities, trees, roads, and near structures. This alternative requires less overall offsite borrow than Alternative 4, but additional logistical coordination is needed since both contaminated materials and offsite borrow will be transported simultaneously. Alternative 5a requires less initial excavation than Alternative 5b. However, there may be difficulties in performing periodic future excavations of	Similar to Alternative 5a. Alternative 5b requires more initial excavation than Alternative 5a, but does not have the difficulties in performing future excavations as for Alternative 5a.	Similar to Alternative 5b except offsite rather than onsite disposal of excavated contaminated materials is performed. Offsite disposal of large volumes of removed materials requires additional coordination with the offsite disposal facilities. Additional difficulties exist in obtaining the necessary approvals and the logistics of transporting large volumes of contaminated

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
		Interior cleaning has not been performed at this site and would require coordination with affected residents, but has been successfully performed at similar sites with asbestos contamination.		contaminated surface materials.		materials for long distances to offsite disposal facilities.
Ease of Doing More Action If Needed	No action taken.	Additional soil cover could be implemented with relative ease. Additional remedial action may be more difficult to implement on privately owned parcels.	Same as Alternative 3	Additional excavation and consolidation of surface materials at authorized onsite locations could be easily constructed. Additional remedial action may be more difficult to implement on privately owned parcels.	Additional excavation and consolidation of surface and subsurface contaminated materials from the site at authorized onsite locations could be easily constructed. Additional remedial action may be more difficult to implement on privately owned parcels.	Future excavation and offsite disposal of contaminated materials could easily be constructed. Additional remedial action may be more difficult to implement on privately owned parcels.

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
Ability to Monitor Effectiveness	No Monitoring.	Monitoring and maintenance and inspections will give notice of remedy failure before significant adverse impacts occur. Monitoring and maintenance of caps and ICs may be more difficult for privately owned parcels because of various degrees of contamination, types of ownership, and levels of occupancy.	Same as Alternative 3	Same as Alternative 3	Same as Alternative 3	Same as Alternative 3
Ability to Obtain Approvals and Coordinate with Other Agencies	No approvals necessary.	No approval for in-place capping of contaminated materials and interior cleanings needed. Regulatory approval for institutional and access controls should be obtainable. However, some difficulties may be encountered with regard to the types	Same as Alternative 3, except interior cleanings are not a remedy component.	Same as Alternative 4 with the following difference: Regulatory and facility approval for offsite disposal at permitted disposal facilities should be obtainable.	Same as Alternative 4	Same as Alternative 4. Also, Regulatory and facility approval for offsite disposal at permitted disposal facilities should be obtainable.

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
		of restrictions, especially on privately owned parcels. Development of offsite borrow sources for cover materials would require coordination and approval from the affected agency.				
Availability of Equipment Specialists, and Materials	None required.	No special equipment, material, or specialists required, except for asbestos monitoring. Asbestos monitoring equipment should be available.	Same as Alternative 3	Same as Alternative 3	Same as Alternative 3	Same as Alternative 3
Availability of Technologies	None required.	Cap technology readily available.	Same as Alternative 3	Same as Alternative 3	Same as Alternative 3	Same as Alternative 3

Alternative #	***Alternative 1***	***Alternative 3***	***Alternative 4***	***Alternative 5a***	***Alternative 5b***	***Alternative 6***
Alternative Cost (Dollars)						
Capital Cost	$0	$9,592,000	$13,500,000	$9,970,000	$15,335,000	$32,990,000
Annual O&M Total Cost (Years 0 through 30)	$0	$892,000	$ 1,064,000	$3,304,000	$1,050,000	$1,050,000
Periodic Cost	$516,000	$3,426,000	$360,000	$360,000	$360,000	$360,000
Present Value Cost [1]	$186,000	$10,152,000	$12,798,000	$10,467,000	$14,028,000	$29,472,000

N/A = Not applicable

[1] Present value cost for each alternative was calculated using a real discount rate of 7%.

10.2 Modifying Criteria Evaluation

10.2.1 State Acceptance

Representatives of ODEQ provided input in the RI, FS, proposed plan, and ROD through review of these documents. ODEQ also provided formal comments on the proposed plan during the comment period. The State of Oregon, through ODEQ, has submitted a letter to EPA concurring with the selected remedy in this ROD and supports EPA's preferred alternative for OU1. A copy of this concurrence letter is in Appendix D.

In their comments to EPA, ODEQ indicated that they supported EPA's proposed plan, including the preferred alternative detailed therein. ODEQ did provide several comments, which are addressed in the Responsiveness Summary (Part 3 of this ROD). They include:

1. A recommendation that the minimum capping standard (assumed to be 2 feet in the proposed plan) be modified to anticipate that site-specific constraints may preclude installation of full thickness of protective cap

2. A recommendation that EPA include more flexibility for field judgment in how cleanup will be conducted on parcels where "incidental" and "localized" contamination found on the site

3. A recommendation that EPA identify the parcels that are reasonably believed to be incidentally and locally contaminated within the site boundary

4. A list of those parcels on the site that ODEQ viewed as incidentally and locally contaminated. Also, ODEQ supported the idea of creating a soil management plan for the site.

EPA provided explanation and clarification for these comments in the Responsiveness Summary. Based on these comments (and those from the public), EPA has made a number of changes to the original proposal, described in Section 10.3.

10.2.2 Public Acceptance

Sixty three public comments were received from 16 citizens (via comment letters or during the Proposed Plan public hearing). While most individuals supported the proposed plan, each commenter raised one or more of the following seven issues or questions to EPA:

1. Why capping and/or excavation was needed at the site, and how much cap was required

2. What are the current and future exposure risks from asbestos contamination at the site

3. Suggestions about what areas of the site might be considered incidentally contaminated, or what EPA might do on parcels where extensive removal action has already been conducted by EPA

4. Concerns about what would happen to property owners if no funds are found to clean up the site, and statements of support for listing the NRE site to the NPL

5. Suggestions for how EPA might address the contamination at the site if very limited funding is available

6. Observations about how much money could be recovered from the sale of now vacant homes and how much the remedy is expected to cost

7. Requests for EPA's help in working with lending institutions when the contamination on the site is addressed, and statements of concern from property owners about property values and how bank view their properties

10.3 Modifications Made as a Result of Comment

Comments from the ODEQ and the general public were addressed through clarification and explanation. These can be found in Part 3 of this document, the Responsiveness Summary. Based on these written and oral comments, EPA has made a number of changes to the original proposal, including:

- **Excavation of Contamination.** More clarity has been provided in the selected remedy description about why excavation is needed, and under what conditions excavation might not be conducted further at OU1. This is discussed further in Section 12. In addition, more flexibility has been provided for site-specific determinations of how much contamination needs to be removed at specific incidentally or locally contaminated sites.

- **Capping.** More clarity has been provided in the selected remedy description about when caps may not be constructed to full minimum frost protective thickness, and what action will be taken if full thickness if a protective cap cannot be installed. This is discussed further in Section 12.

- **ICs.** Additional language has been added in the Institutional Control section of the selected remedy that EPA will help educate lenders and real estate agents about the long-term impacts of conducting remedial action at OU1. This is discussed further in Section 12.

- **Listing of NRE site to NPL.** On March 10, 2011, EPA proposed listing of NRE to NPL and finalized the listing on September 16, 2011. Now that the site has been added to the NPL, EPA expects that federal funds will be available to address most of the funding concerns raised by the public. This is discussed further in Section 15.

Section 11 - Principal Threat Wastes

Principal threat wastes are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present significant risk to human health or the environment should exposure occur. The ACM and asbestos-contaminated soil at OU1 is considered a principal threat waste. This material is the source for asbestos fibers and acts as a source for direct exposure when these materials are encountered. As such, the waste would present a significant risk to human health should exposure occur.

The NCP establishes an expectation that EPA will use treatment to address any principal threat waste. A range of treatment technologies for ACM and asbestos containing soils was evaluated and screened in the FS as described in Section 9. Likewise, a remedial alternative for OU1 employing treatment was evaluated and screened out in the FS as described in Section 9. Treatment was determined to not be practical nor viable for the reasons provided in Section 13.4.

The selected remedy will eliminate the exposure to the source materials by excavating the waste and consolidating it within onsite repositories and/or by in-place containment. The selected remedy also includes ICs along with monitoring to provide assurance that the integrity of the remedy will be protected and unacceptable exposures do not occur.

Section 12- Selected Remedy

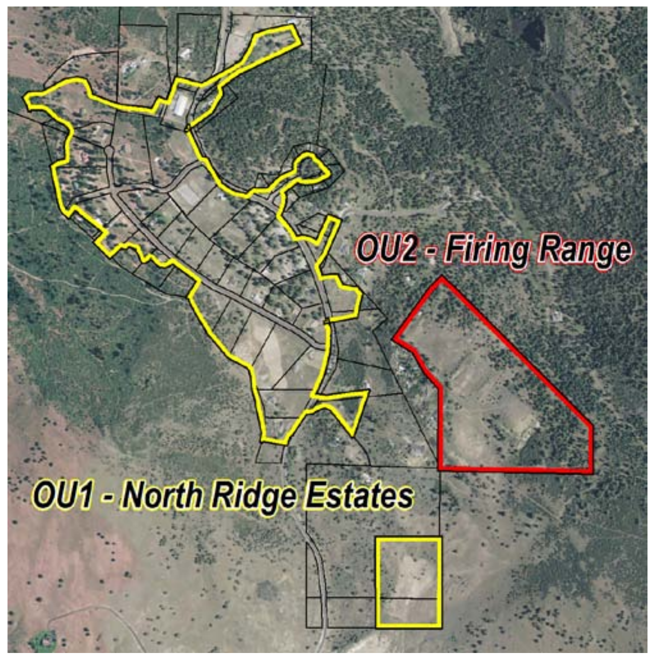
Based on consideration of the CERCLA requirements, the detailed analysis of remedial alternatives, state comments, and all public comments (see Part 3, Responsiveness Summary), EPA has determined that the preferred remedial alternative presented in the proposed plan for OU1 is in general the appropriate remedy for the site. The selected remedy for the cleanup of contaminated materials at OU1 is a combination of the following remedy components:

- Excavation of surface and subsurface soils with onsite disposal, as described in Alternative 5b (Excavation and Onsite Consolidation/Capping of Contaminated Materials, and Land Use Controls with Monitoring)

- Capping of parcels after soil excavation, as described in Alternative 4 (Capping of Contaminated Materials and Land Use Controls with Monitoring)

- Institutional Controls, Access Controls, and Community Outreach, as described in Section 9.1 (Common Elements and Distinguishing Features of all the Alternatives)

Exhibit 12-1. Areas to be Addressed in OU1 Remedy



The selected remedy also includes a contingency for Interior Cleaning, as described in Alternative 3 (Capping of Contaminated Materials on Private Parcels, Partial Capping of Contaminated Materials on Receivership Parcels, Interior Cleaning, and Land Use Controls with Monitoring). If indoor air sampling conducted inside residences after excavation and capping is completed shows risk that exceed 1E-04, or if indoor dust samples exceed site-specific criteria, indoor cleaning will be performed.

A description of the selected remedy is presented in the following subsections.

The yellow boundary lines on the site map, Exhibit 12-1, marks the outermost extent of where ACM has been detected or observed at OU1, and defines the outer boundary of OU1. This line represents the area where remediation will be conducted on the site, based on current information.

12.1 Short Description of the Selected Remedy

The selected remedy is an excavation and containment remedy that will be conducted across OU1. The selected remedy will provide protection of human health and the environment by eliminating exposure to ACM and asbestos-contaminated soils across OU1, and arsenic in soils at the former power plant area of OU1.

This selected remedy reduces the long-term risk of exposure to ACM and asbestos fibers by eliminating complete exposure pathways. This ensures that human receptors have no, or very limited, opportunities for inhalation of asbestos fibers from ACM in contaminated soil, thus reducing cancer risk and non-cancer hazard from asbestos exposure. The selected remedy also reduces risks to ecological receptors through control of ACM and contaminated soils using excavation, consolidation, and/or capping of contaminated materials at OU1.

The selected remedy includes the following components:

1. Excavate the majority of contaminated materials (in surface and subsurface soils) on privately owned and receiver-managed parcels.

2. Install a visible marker layer to denote the extent of contaminated material excavated on each parcel.

3. Cap remaining soils on the parcels with clean soils of sufficient thickness to break the soil-to-air exposure pathway associated with any residual ACM or asbestos fibers left in the soils. The caps will also keep ACM from migrating to the surface in the future through natural processes such as frost heave or erosion. Caps on OU1 will include 1) onsite repositories, 2) soil caps on parcels and 3) existing structures, such as buildings, driveways, and existing roads.

4. Consolidate and place all excavated contaminated material in one or more onsite ACM repositories.

5. Cap the onsite repositories with a barrier of clean soil of sufficient thickness to break the soil-to-air exposure pathway and keep contaminated materials from migrating to the surface in the future through natural processes such as frost heave or erosion. Access controls will be implemented as necessary to protect the repositories.

6. Apply ICs to the entire site to prevent disruption of residual contamination within parcels and consolidated material in the onsite repositories.

7. Maintenance with ongoing monitoring (inspections and sampling) will be conducted to provide assurance that capped areas are maintained and not damaged, exposure does not occur, and caps remain protective.

8. Contingency: The selected remedy includes a contingency for interior cleaning, if necessary. After excavation and capping are completed, indoor air and dust sampling will be conducted inside OU1 residences. If indoor air samples show risk that exceed 1E-04, or if indoor dust samples exceed site-specific criteria provided in Appendix B, EPA will invoke a post-ROD change (such as an explanation of significant differences or a Record of Decision Amendment). This post-ROD change will document EPA's determination that indoor cleaning is needed, will indicate which spaces will need to be cleaned, and will share information with the public about how indoor cleaning will be conducted**.**

While the NCP establishes an expectation that EPA will use treatment to address any principal threat waste, the use of treatment technologies for ACM and asbestos-containing soils at OU1 is not practical or viable based on the rationale presented and discussed in Section 13.4. Thus treatment was not chosen as a component of the selected remedy.

12.2 Rationale for the Selected Remedy

The selected remedy provides the best balance of tradeoffs among the alternatives and attains an equal or higher level of achievement of the threshold and balancing criteria than other site-wide alternatives that were evaluated for OU1. The selected remedy is a comprehensive cleanup of the entire OU1 that will protect human health and environment and complies with ARARs (described more fully in Section 13.2). It has long-term effectiveness and permanence because a) it reliably consolidates and contains contaminated materials, such as ACM and associated asbestos and arsenic contaminated soils, on site and b) provides a frost protective cap to break any exposure possible from ACM or asbestos fibers that might remain in the subsurface soils. The cap will be designed to prevent buried ACM from emerging on the ground surface because of frost heave or erosion. It achieves substantial risk reduction as it will reduce the contamination footprint by consolidating contaminated materials into well defined containment zones that will be kept separate from residential properties. The selected remedy is feasible, implementable, does not require offsite transport and disposal of untreated hazardous substances or contaminated materials and has long-term cost-effectiveness. Residual risks are effectively eliminated, mitigated, or managed under the selected remedy. Excavation and capping of asbestos contamination sources, and capping of remaining soils are remedy components that have been selected and performed at contaminated sites similar to NRE, OU1.

The selected remedy also includes requirements for ICs, monitoring (inspections and sampling), and maintenance of the caps preventing migration of and human exposure to contaminants of concern. With the creation of containment zones for most of the excavated contamination at the site, EPA and ODEQ will not need to rely strictly on ICs to ensure protectiveness for the site, especially for occupied parcels.

A plan to continue monitoring for, and sampling and analyses of, asbestos in soils will be developed during the RD process. This plan will be subject to continued re-evaluation as more is learned about asbestos risk management to ensure protectiveness of the remedy into the future. This will include re-evaluation of the long-term approach for asbestos sampling and analysis that will be conducted at the site based on possible improvements to the technology to detect ACM in air and in soils. EPA recognizes the importance of new information as knowledge about the effects of ACM grows through further investigation and the science expands on asbestos sampling and detection. EPA will review the protectiveness of the remedy at least every five years after the remedy has been initiated.

12.3 Detailed Description of the Selected Remedy

As discussed earlier, the selected remedy will eliminate the exposure to ACM, asbestos-containing soils, and arsenic in soils from the former power plant area, first, by removing the waste in surface and subsurface soils, and second, by capping the soils, thereby breaking the soil-to-air exposure pathway associated with contact with asbestos. The selected remedy will leave waste on site, so ICs and monitoring will provide assurance that the integrity of the remedy will be protected.

The selected remedy ensures that human receptors (residents and construction workers) have limited opportunities for inhalation of ACM and asbestos-contaminated materials, thus reducing cancer risk and non-cancer hazard from asbestos exposure. The selected remedy also ensures that human receptors are not exposed to arsenic contamination at the former power plant.

The selected remedy is also expected to reduce risks to ecological receptors. Ecological receptors most likely to be impacted by contact with ACM include animals that reside on the site (e.g., small ground-dwelling mammals such as mice and voles) and birds with relatively small home ranges (e.g., robin). Exposures and risks to animals that burrow into the soil might tend to be higher than to risks to other animals, especially if the receptor actually chews on or digs through the ACM. These risks will be reduced by excavating, consolidating, and placing a protective cap over the remaining contamination at the site.

The selected remedy will be implemented throughout OU1 of the NRE site. The boundary lines on the site map, above, mark the outermost extent of where ACM has been detected or observed at OU1. This line represents the area where remediation will be conducted on OU1, based on current information. Ongoing monitoring (inspections and sampling) will be conducted inside the OU1 boundary after remedial action is taken to ensure that no new ACM from OU1 emerges because of frost heave or erosion. In addition, monitoring will be conducted outside, but in near proximity to, the boundary of OU1 to ensure that no newly-indentified ACM from OU1 is found beyond the area that EPA has now defined as the boundary of OU1.

The remedy will build on work that has been done under past response actions. Although EPA does not anticipate any future modifications to the selected remedy, additional removal actions may be taken as necessary before site-wide remedial action begins to protect public health and the environment.

Because of the various types of property ownership as well as parcel-specific limitations and constraints, the degree of excavation performed at each parcel as well as the various types of IC, access controls, and monitoring protocols will be a parcel-specific decision.

Details of the selected remedy are provided in the following subsections. The descriptive information within each subsection is further presented in a “frequently asked questions” format to provide further clarification as to the basis for the description of the remedy components.

12.3.1 Excavation of Surface and Subsurface Contaminated Materials

The selected remedy will provide protection of human and ecological receptors through excavation of the majority of contaminated materials (surface and subsurface) from privately owned and receiver-managed parcels in OU1.

Contaminated materials will be excavated from the site and placed in one or more onsite containment areas. Contaminated materials will be excavated to no less than 2 feet from the ground surface. Excavation will continue until no contaminated materials are visible in the soil. If contamination is still visible, additional excavation will continue up to a depth of 4 feet.

The amount of material excavated from the site must be sufficient to accommodate installation of a frost protective cap to maintain existing grades. The depth of the cap that will be employed on the site as part of the remedy will be determined during the remedial design process.

EPA expects that not all of the contamination on the site will be excavated before the parcels are capped. EPA's RI has shown that there are areas on the site where contamination has been buried 10 feet deep. Please see below for discussion of why a maximum of 4 feet of contamination will be removed on most portions of the site.

12.3.1.1 Why Excavate Before Capping?

EPA's selected remedy assumes long-term residential use, and must provide long-term protectiveness to human health from the contamination found at the site. Leaving contamination in place and simply capping over the contamination will not provide long-term protection for the following reasons:

a. Asbestos contamination at OU1 will persist in those soils. The risk levels from the ACM in the soils at OU1 are expected to greatly increase over time because of continuing transport of ACM from the subsurface to surface soils, and continuing breakdown of ACM at the surface to yield free asbestos fibers in soils.

b. Property owners could dig beneath caps and barriers on their parcels. It is possible that a future OU1 homeowner may decide to put in a tree or dig a fence post, and not fully understand the risk of breathing in the asbestos fibers he/she may release in digging these holes.

c. All caps degrade and break down over time without maintenance, and can be accelerated through damage from natural or human activities. Damage to caps may not be readily apparent between inspections. Unacceptable exposures to ACM may occur between when damage occurs and when actions are taken to re-establish cap integrity.

Given the risk that asbestos contamination poses to human health and the long-term persistence of asbestos in the soils, EPA must take the extra precaution to excavate as much contamination at OU1 as possible and consolidate it within repositories to limit the chance of future exposure of contaminated materials within a parcel. Capping the remaining soils is an additional protective measure to ensure what is left in the soils does not come to the surface in the future and pose risks.

12.3.1.2 Why Remove Contaminated Materials Between 2 Feet and 4 Feet?

As described in EPA's Proposed Plan for the NRE site, OU1, the 2 foot minimum depth was established because:

- Based on soil boring data taken from the site, much of the ACM contamination is located within 2 feet of the ground surface.

- It would facilitate the proper construction of a frost protective cap over remaining soils to match surrounding grades and structures.

The 4-foot maximum depth was proposed because:

- Based on soil boring data taken from the site, ACM contamination below 4 feet of the ground surface is not commonly found and is limited to specific locations.
- Excavations deeper than 4 feet may undermine structure foundations.
- Excavations dug deeper than 4 feet require measures for worker protection such as special sloping or shoring of the excavations.
- The likelihood of residents digging through 4 feet of material and exposing buried contaminated materials during routine activities is extremely remote.
- Most utility lines and other subsurface structures that may require future access are installed no deeper than 4 feet.
- It is presumed that most animals would not dig below 4 feet bgs.

12.3.1.3 Excavation May Be Less than 2 Feet and More than 4 Feet under Certain Conditions

It may be necessary to excavate less than 2 feet, or deeper than 4 feet on a parcel-specific basis. This determination will be based on horizontal and vertical features or conditions that cause excavation to be damaging, difficult or costly. These features include, but are not limited to, the presence of adjacent parcel boundaries, bedrock, structures, utilities and trees. Structures are considered to be homes, pavement (such as roadways and sidewalks), and other permanent objects such as warehouses or garages. During the remedial design process, EPA will provide specific remediation guidelines for excavation up to these structures on a parcel-specific basis, including how much material can be removed next to a home or garage without compromising the integrity of that existing structure yet still provide protectiveness.

<u>Example where excavation could be less than 2 feet:</u>

An example of an area on the site that is not expected to have additional excavation is the steep slope on the north side of the apartment building on parcel BM. (See map of site showing parcel designations below and in Appendix A.) In 2008, EPA conducted a removal action on this parcel and excavated large quantities of contaminated materials from the slope north of the apartments. EPA cannot, however, be certain that all ACM has been removed from this portion of the property. Further excavation of the slope could undermine the structural integrity of the apartment buildings. Therefore, EPA expects that remedial action on this portion of parcel BM will include the installation of a frost protective cap or retaining wall to ensure that the apartment residents are not exposed to any contaminated materials left in the soils on that steep slope.

<u>Example where excavation could be deeper than 4 feet:</u>

As reported in Section 7 of this ROD, risks from disturbing soils containing ACM and risks from arsenic in soil at the former power plant are above a current level of concern for construction workers at OU1. To protect construction workers from the risk of exposure to these contaminants, protective utility corridors created from clean backfilled soils will be excavated on parcels, as needed. These corridors will normally be excavated to a depth of 4 feet, but it may be necessary to excavate deeper than 4 feet on a parcel especially in the case of gravity systems such as storm or sanitary sewer systems, or other utilities where greater depth is a requirement. Protective corridors will enable utility and construction workers to safely excavate and work in clearly marked areas zones of OU1, so repairs may be made to water, electric or other service lines without the risks associated with asbestos and arsenic exposures. The location and depth of utility corridors will be made on a parcel-specific basis.

12.3.1.4 Existing Wastewater Treatment Systems

If existing septic tanks, lines, or drain fields are disturbed or removed as part of the excavation of contaminated materials on each parcel, a parcel specific determination will be made to determine if septic systems will be repaired or replaced. This decision will be based on the degree of system disturbance, extent and depth of contaminated materials in the vicinity of the septic system, and whether the parcel is currently occupied or fit for occupancy.

12.3.1.5 Future Wastewater Treatment Systems

In the future, property developers, the NRE Receiver, or other entities may propose the installation of a wastewater treatment system on OU1 parcels containing ACM or asbestos-contaminated soil. Implementation of the selected remedy at OU1 will result in caps placed over soils remaining after excavation of ACM and contaminated soil. If a proposed wastewater treatment system is permitted under state and local regulations for a parcel containing caps, the caps on that parcel and adjoining parcels must be protected so they are not compromised during installation, operation, and maintenance of the wastewater treatment system. EPA will not plan to construct any wastewater treatment structure to support future development or future occupation of un-occupied properties.

<u>Note about possible onsite community septic system</u> **-** The NRE Receiver has done some investigation into the possibility of creating a community waste water treatment system for OU1. While EPA’s remedial action will not include the creation of a community waste water treatment system for OU1, the utility corridors EPA will install as part of the selected remedy for OU1 may be used to support a possible community system in the future.

12.3.1.6 How Much Cleanup is Needed After an EPA Removal Action Conducted on a Parcel?

As reported in Section 2 of the ROD, EPA conducted several removal actions at OU1. During these actions, large amounts of contamination were excavated from many parcels at OU1. On some parcels much more than 2 feet of contamination have been removed and no visible ACM remains on portions of some properties. During the remedial design process, EPA will make a parcel-specific determination on whether additional soil must be excavated from portions of each parcel prior to capping using the following criteria:

1. EPA will review all site-specific records and photos of past removal actions to evaluate exactly how much contaminated material has been removed and precisely what actions were taken on each parcel, including how much material was excavated around existing structures, along roads and driveways, trees, and near septic drainfields.

2. EPA will carefully compare the documented work completed on each parcel against the remedial design for each parcel on the site, considering the extent of contamination identified in the RI for each parcel.

3. If any step of the parcel-specific remedial design has not been taken, then that work will be done during remedial action. If records do not exist to clearly demonstrate that a certain action was completed, EPA will assume that the work was not done.

The end result of this comparison, and completion of any missing actions described in the remedial design for each parcel, is that all OU1 parcels will be required to ensure protectiveness before work can be deemed complete at OU1.

12.3.1.7 Incidental and/or Localized Contamination

During EPA's investigation of OU1, EPA noted several properties where incidental and localized contamination have been found.

- By using the term incidental contamination, EPA means very limited quantities of non-friable asbestos (e.g., no MAG or Air Cell) contamination have been found on a location, and found only once at any location on a parcel. An example of incidental contamination is the asbestos found on the BK parcel, known as the (b) (6) property. EPA found just one piece of CAB right next to the (b) (6) driveway when walking the parcel. ACM was found only once on this property in all the years EPA has conducted investigations at OU1.

- By using the term localized contamination, EPA means non-friable asbestos (e.g., no MAG or Air Cell) contamination has been found only once in an isolated area, far removed from any other contamination found on OU1. An example of localized contamination is the asbestos contamination found on parcel BI, known as the (b) (6) property. Several pieces of CAB were found on the (b) (6) driveway right on the boundary between parcels BI and BJ. The nearest location where additional ACM is found is on parcel BJ, approximately 300 feet away. The contamination was found on the (b) (6) property, BI only one time in the years EPA has conducted investigations at OU1.

EPA does not believe that any portion of the site where MAG and/or AirCell has been found could be considered incidentally or locally contaminated. Since MAG and AirCell are friable forms of ACM, very little disturbance of these materials can release asbestos fibers into the air, and lead to contamination of nearby soils.

EPA believes that conducting excavation to a minimum of two feet across the entire affected parcel as well as the installation of a minimum two foot cap following excavation may be disproportionate to the risk posed to human health and the environment in areas where incidentally and localized contamination have been found on the site. During the remedial design process, EPA will make parcel-specific determinations of the horizontal extent of the remedy that will be conducted on each of the parcels.

As an example of how incidentally or localized contamination might be addressed in remedial design, the (b) (6) driveway contamination (described above) on the boundary between parcels BI and BJ would be excavated to a depth of 2 feet and capped. This change in the proposed plan would permit EPA to remove 5 to 10 feet of soils horizontally radiating from the point where the ACM was found. EPA would NOT excavate the 350 feet of uncontaminated soils between the contamination found on BI and BJ. Since this 350-foot clean area is inside the boundary of OU1, not excavating and capping this portion of the site is a departure from the remedy presented in the proposed plan.

Of course, when EPA conducts its remedial action on parcels BI and BJ, it is possible that EPA will find more contamination buried under the ground that has never been detected. Any additional contamination that is found on any parcel at the site will be excavated and capped as described in this Section. These areas would be monitored (inspected and sampled) carefully to ensure that no new ACM emerges after the remedy is implemented.

The following parcels are those where incidental and localized contamination have been located by EPA so far on OU1: (b) (6) parcel: BK; (b) (6) parcel BI; and on parcel AR, only along driveway leading to residence on parcel AR and east of driveway to parcel BK. [Area west of driveway to parcel BK contains MAG and/or AirCell, so this portion of site must be fully excavated and capped.] During the remedial design process and remedial action at the site, it is possible that other incidental and localized contamination locations may be identified.

12.3.1.8 Buried Steam Pipe

Buried steam pipe, a no longer used remnant of the old MRB heating system, is present across much of OU1. This buried asbestos-wrapped pipe is generally co-located with other ACM on the west side of Old Fort Road and was disturbed during construction of the NRE residential subdivision. As a result, the buried pipe will be addressed in the same way as other subsurface ACM on this portion of the site.

SPECIAL CONDITIONS FOR PROPERTIES WITH BURIED, *UNDISTURBED* STEAM PIPE:

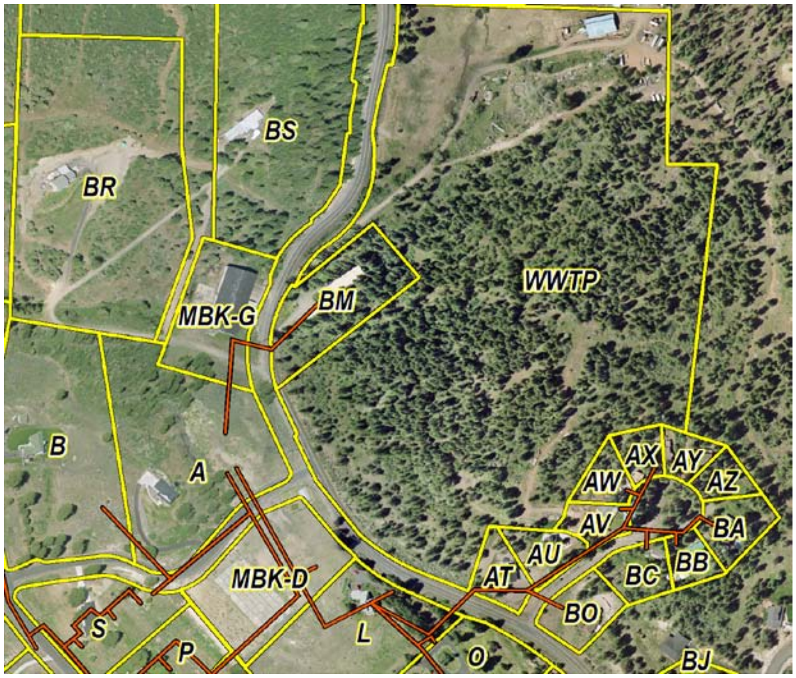
Thicket Court:

Privately held properties along Thicket Court have steam pipe associated with the old MRB heating system buried beneath the ground. No ACM has been found at or near the surface on any of the following ten properties: AT, AU, AV, AW, AX, AY, AZ, BA, BB, and BC. With the exception the one property identified at BO shown in Exhibit 12-2, there is no evidence that the steam pipe, and its associated asbestos pipe wrap, have ever been disturbed on the properties on Thicket Court. Because the ACM contained in the steam pipe wrap remains deeply buried under the surface of the ground, the ACM in that wrap poses no discernable risk to human health and the environment.

As long as the steam pipe and wrap remains undisturbed, the buried steam pipe on Thicket court parcels (except parcel BO) will be left in place and no excavation or capping will be conducted. To ensure that this buried pipe and its associated asbestos pipe wrap remain undisturbed, these 10 properties will be addressed through a combination of ICs and access controls.

Undisturbed steam pipe along Old Fort Road:

Exhibit 12-2. Steam Pipe Associated with Old Fort Road



Buried, undisturbed steam pipe associated with the old MRB heating system is also known to exist along Old Fort Road, on parcels MBK-G and BM as indicated on Exhibit 12-2. Although not shown, it is suspected that buried, undisturbed steam pipe that may have served buildings at the WWTP may also extend north of the currently indicated alignment on parcels BS and WWTP. There is no evidence that the steam pipe, and its associated asbestos pipe wrap, have ever been disturbed. Because the ACM contained in the steam pipe wrap remains deeply buried under the surface of the ground and a portion is located under Old Fort Road, the ACM in that wrap poses no discernable risk to human health and the environment.

Unless the soils around this steam pipe are disturbed during excavation of contamination on parcel WWTP, this steam pipe and wrap will be left in place and no excavation or capping will be conducted. The portion of the steam pipe that runs under Old Fort Road will be left in place as well. To ensure that this buried pipe and its associated asbestos pipe wrap remain undisturbed, the parcels where this steam pipe is found will be addressed through a combination of ICs and access controls.

12.3.2 Installation of a Visible Marker Layer to Denote the Extent of Excavation on Each Parcel

After excavation of contaminated materials is complete, a visible, durable marker layer will be placed before backfilling or capping. This visible layer will mark the extent of excavation, and where contaminated materials have been left in place.

Parcel specific maps will be created showing areas where deeply buried contamination has not been excavated. These maps will be used to inform residents and define where property specific ICs and careful monitoring will be instituted for these areas on each parcel.

12.3.3 Capping of Properties After Soil Excavation

12.3.3.1 Capping Rationale and Requirements

After contaminated materials have been excavated from individual parcels, the parcels will be backfilled and capped with clean soil. Caps on OU1 will include 1) onsite repositories, 2) soil caps on parcels and 3) existing structures, such as buildings, driveways, and existing roads.

Asphalt, concrete, or a rock cap may also be an acceptable backfill and cap material. If a soil cap is used, the cap will be seeded to minimize erosion.

<u>Why must we create a cap on the site?</u>

The site will be capped to ensure long-term protectiveness from asbestos containing materials that may remain in the soils, and to meet ARARs. The cap will prevent inhalation exposures by humans to asbestos fibers in soil that exceed the target cancer risk specified by ODEQ of 1E-06 (one in one million), will mitigate the potential for direct contact exposures by ecological receptors, and will mitigate the potential for human inhalation and incidental ingestion exposures to concentrations of arsenic in soil that exceed acceptable levels for protection of human health and the environment.

Because individual friable asbestos fibers are so small that they cannot been seen with the naked eye, EPA cannot simply excavate visible contamination from the site to ensure protectiveness. Friable asbestos (MAG and AirCell) and other currently non-friable forms of asbestos contamination has been spread all over the site (because of improper disposal of asbestos containing materials), so EPA cannot simply excavate those portions of the site where friable ACM were originally used on the MRB. Asbestos contamination may be found almost anywhere within the OU1, and therefore, all of the site must be remediated.

Even after EPA completes the excavation of the contaminated materials on each parcel, described in 12.3.1 above, there is a possibility that the excavation will not remove all the asbestos fibers and/or contamination on those parcels. Asbestos fibers that might remain in the soils might still pose a risk to human health and ecological receptors. A cap is required to break the soil-to-air exposure pathway associated with any remaining ACM fibers left in the soils. In addition, capping will ensure that no additional buried ACM will rise to the surface of the ground through frost heave, erosion, or other transport mechanisms.

<u>Backfill:</u>

Clean backfill will be applied to the excavations prior to capping in those areas where deeper excavations and utility corridors have been created. This backfill will provide additional vertical separation over remaining soils that may be contaminated, ensure a smooth transition for the cap, re-establish grades and provide positive drainage from all structures.

<u>Cap Thickness:</u>

The cap will be constructed to ensure protectiveness as indicated by the RAOs. After contaminated materials are capped, the mechanisms that could cause a cap breach (aside from intentional intrusive disturbances) are frost heave processes and erosion.

The cap will be created with a minimum thickness to provide protection from frost heave. EPA will determine the minimum thickness of the cap as part of the remedial design process after considering the recommendations of the U.S. Army Corps of Engineers, Cold Regions Research Lab. The thickness and composition of the cap will prevent buried ACM from resurfacing and posing human health and ecological risks.

Erosion of caps will be minimized by proper grading of the cap to allow positive surface drainage, and the establishment of vegetation or other appropriate surface materials.

The thickness of caps is based on ARARs as well as performance requirements indicated in the RAOs in Section 8.1 to ensure protectiveness. The primary federal ARAR governing cover construction at OU1 is the National Emission Standards for Hazardous Air Pollutants (NESHAP), National Emission Standard for Asbestos (specifically the standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations) implemented under the Clean Air Act. This ARAR (identified as a relevant and appropriate ARAR) requires a minimum cap thickness of 6 inches for a vegetative cap, 9 inches for a rock cap, or 2 feet for a compacted non-vegetative cap (40 Code of Federal Regulations [CFR] 61.151(a)). The regulation also allows alternative control methods as approved by the EPA administrator (40 CFR 61.151(d)). Caps will be designed and constructed to comply with the substantive requirements of this ARAR.

The primary State of Oregon ARAR cover construction at OU1 is OAR 340-248-0280 (Friable Asbestos Disposal Requirements). This ARAR (identified as a relevant and appropriate ARAR) requires a minimum cover thickness of 24 inches for a vegetative cap and 27 inches for a rock cap (OAR 340-248-0280(11)(a) through (b)). The regulation also allows alternative control methods as approved by ODEQ (OAR 340-248-0280(12)). Caps will be designed and constructed to comply with the substantive requirements of this ARAR.

For the purposes of estimating costs for the cap in this ROD, EPA has used the Oregon Residential Specialty Code to determine frost depth for Klamath County. Based on this indicated frost depth, EPA has assumed the cap will be a minimum of 24 feet thick, including 18 inches of subsoil and 6 inches of topsoil. This thickness is expected to achieve the RAOs for protectiveness as well as meet the minimum thicknesses of soil caps indicated in the NESHAP standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations, 40 CFR 61.151(a) as well as the friable asbestos disposal requirements in OAR 340-248-0280(11)(a) through (b)).

<u>Cap thickness might not be 2 feet in all capped areas:</u>

It may be necessary to provide a cap that measures less than the minimum thickness of the cap described above, on specific areas of the site. In addition, it may not be possible to construct frost-protective caps over contaminated materials directly adjacent to obstructions such as homes or structures, trees, subsurface utilities, and roads. During the remedial design process, and possibly during remedial action at the site, EPA will determine the appropriate thickness of the cap based on horizontal and vertical features or conditions that may limit the thickness of the cap. During the remedial design process, EPA will provide parcel-specific remediation guidelines for the cap, including what type of cap material will be used on each parcel. If a thinner cap is used, that cap must still ensure long-term protectiveness and meet ARARs. An example of a thinner, but equally protective would be one made of concrete. Compliance with the ARARs previously identified for caps will be met for alternative capping configurations through the approval process indicated in 40 CFR 61.151(d) and OAR 340-248-0280(12).

12.3.3.2 Sources and Sampling of Backfill and Capping Materials

Backfill and capping materials will be obtained from borrow sources from properties adjacent to or nearby OU1 to the extent practical. If nearby borrow sources do not provide adequate quantities of backfill or capping materials, or are determined to be unsuitable sources of backfill and capping materials for any other reason, then borrow source areas will be found further off site. It was assumed during development of the selected remedy that approximately one half of the total amount of backfill and capping soils needed to complete remediation at OU1will be obtained from one or more borrow locations adjacent to OU1. However, borrow locations near OU1 will be used to the extent possible to reduce costs of the remedy and impacts to the community through offsite transportation of borrow.

The most promising borrow location is the receiver-managed parcel H. This prospective borrow location is outside the OU1 boundary, and EPA has found no ACM contamination on this portion of the property. Only a small portion of the 90-acre parcel H was contaminated by ACM or other contaminated materials associated with OU1. The small, contaminated portion of parcel H is included in the OU1 site footprint. The potential borrow source for backfill and capping material on parcel H is uphill, generally upwind, and of sufficient distance from OU1 to be isolated from the effects of the demolition that occurred at the former MRB. Any soils that are excavated from parcel H will be analyzed to ensure that the soils are not contaminated, and suitable for use as backfill or capping material on OU1.

Other sources of borrow soils that will be used to complete backfill and capping of OU1 are assumed to be from offsite locations further away from OU1. Potential offsite sources of borrow soils will be analyzed to ensure they are not contaminated prior to use as backfill or capping material for OU1.

Sampling and analyses of possible backfill and capping soils will be conducted as part of the remedial design for OU1.

12.3.4 Consolidation of Excavated Contaminated Materials within Onsite ACM Repositories

All excavated contaminated materials from the site will be consolidated and placed into one or more onsite ACM repositories, similar to the ACM repository EPA created as part of the 2008 removal action, located on the southeast portion of OU1.

The repositories will permanently contain asbestos and arsenic contaminated soils and debris, removed from each parcel on OU1. Exhibit 12-3 shows the existing repository which is the grassy area in the foreground just behind the signs and fencing and in front of the hillside with trees.

Exhibit 12-3. Existing Repository

12.3.5 Capping of Onsite Repositories for Contaminated Materials

The onsite repositories will be capped with clean soils breaking the soil-to-air exposure pathway, and keeping contaminated materials from migrating to the surface in the future through frost heave, erosion, or other transport mechanisms. The onsite repositories will be capped with the minimum thickness of material as described in 12.3.3.1. The height, pitch, slope, location(s), and depth of cap used to cover the repositories, and any plantings that will be used to stabilize and protect the repository slopes and top from erosion and wear will be determined as part of the remedial design for OU1. Compliance with ARARs for cap construction was discussed in Section 12.3.3.1.

The cap will be monitored to ensure that it remains in good condition, and continues to be protective of human health and the environment. ICs and access controls will be put into place to ensure the long-term integrity of the cap.

The onsite repositories may also be designed for alternative uses where practicable, such as a paved bike trail that extends through OU1.

During the remedial design process, EPA may include a provision for an onsite, long-term, asbestos repository that could be used if asbestos contamination is found on or around the NRE site in the future. This asbestos containment repository could be operated as separate containment cells within one of the constructed ACM repositories. So, each time any new ACM is found on the site, that new contamination would be excavated, permanently placed in the containment cell, and then the contamination in that cell would be permanently capped.

EPA expects that after remediation is complete on OU1, areas where any onsite repositories have been created will be re-platted and subject to land use restrictions (e.g., through easement and equitable servitudes) to prevent future land use inconsistent with the waste repository as designed and constructed. EPA will not re-plat these parcels until after the remedy is complete, because the exact boundaries of the onsite repositories may change during the remedial action at OU1. Parcels containing onsite repositories will be managed and protected in perpetuity by the NRE long-term site management (LTSM) program (discussed later in section 12.3.6 of this ROD).

The cap on the temporary onsite repository created on the southeast portion of OU1 during EPA's September/October 2008 response action will also be completed as part of this final remedy. ICs, access controls, and operation and maintenance will be established for each onsite repository to ensure its continued integrity and protectiveness.

12.3.6 Institutional Controls

ICs are non-engineered, legal or administrative instruments established to discourage human contact with contaminated materials, encourage safe land uses, and to limit activities that could compromise the integrity of the remedy.

ICs are considered an integral part of the remedy for the site. ICs for OU1 will be crafted during remedial design and applied across the entire OU1 during remedial action. ICs may vary from parcel to parcel based on the type of ownership and types of contaminated materials remaining on each parcel. Consistent with expectations set out in the Superfund regulations and policies, the selected remedy does not rely exclusively on ICs to achieve protectiveness; ICs are considered in concert with other land use controls to be consistent with the concept of layering.

ICs will be used to minimize risks posed to human and ecological receptors from ACM in soils that remain under the cap, and also to ensure that caps are not damaged. The controls may allow residential, commercial, and recreational land use, but will limit uses that might damage the caps, liners and onsite repositories created under the OU1 remedy.

The selected remedy employs the use of caps to contain contamination and prevent direct contact. Because certain activities (e.g., off-road vehicle use) can compromise caps, ICs or engineered controls (posted warnings and fencing) will be used to limit those activities thereby preserving the integrity of the caps and limiting potential exposure.

EPA anticipates that as part of the final remedy for OU1, and to ensure protectiveness to human health and the environment, an LTSM program will be established for OU1. This LTSM program could take the form of a Homeowners Association or could be managed by a Trustee. The LTSM program will ensure that all ICs established for the site will be adhered to. EPA will work closely with the ODEQ, Klamath County, and OU1 residents during the remedial design and remedial action processes to establish an effective LTSM program for the site.

EPA anticipates that the ICs will include proprietary restrictions (specifically including deed notices, easements, and equitable servitudes consistent with Oregon law), and informational controls such as community awareness programs (e.g., ads, handouts, and contractor training). If engineered controls are needed, they would likely include posted warnings and fencing. The need for engineering controls will be evaluated in the remedial design process. Again, EPA will work closely with the ODEQ and Klamath County in the remedial design process to ensure that the controls selected will be implementable and will achieve the desired results.

<u>Specific considerations for use of ICs and community awareness activities:</u>

- ICs must be established to ensure long-term protectiveness on properties on OU1. OU1 parcels will be managed and protected in perpetuity by the NRE LTSM program.
- ICs must be established to ensure long-term protectiveness on parcels where onsite repositories have been created. Parcels containing onsite repositories will be managed and protected in perpetuity by the NRE LTSM program.
- Informational devices (e.g., Notices of Environmental Contamination) will be permanently attached to property records to notify future OU1 property owners that asbestos contamination is buried under protective caps at the site.
- A local one-call utility locate service could add "known areas of subsurface asbestos at OU1" to their database of underground hazards using information provided by EPA. Advice on how to address the contamination, if disturbance is required, would be obtained from the NRE LTSM program.
- During the remedial design process, EPA will create a best management practices guide that will address the measures EPA will take to prevent re-contamination of areas that have been excavated and capped. The Guide will also describe the measures EPA will employ to keep contamination from migrating on to roads and off site while remediation is being conducted. The Guide will also provide useful information for any construction worker that disturbs soils at the site, indentifying the types of personal protection equipment the worker must use, the training he/she must have, and licensing requirements the worker must meet before conducting work at OU1. Please see Section 12.4 for more information about the Best Management Practices Guide.
- Creation of long-term community education and outreach program to ensure that all current and future owners of land on or near OU1 are aware of potential risks associated with exposure to contaminated materials, and to help these property owners know how to mitigate their risks in the future. Education and outreach may include handouts, fact sheets, brochures and training classes that will support community awareness programs, contractor training, and education of lenders and real estate agents about residual risks and safe uses of remediated properties within OU1. Specific details about these informational materials will be developed in the remedial design process.

<u>Specific IC instruments to be considered for the OU1 Remedial Action:</u>

The type of controls that will be applied to each parcel will be determined during the OU1 Remedial Design. There are four categories of institutional controls: governmental controls, proprietary controls, enforcement tools, and informational devices. The specific controls that will likely be employed at OU1 include:

Governmental Controls

Government Controls are those controls using the regulatory authority of a governmental entity to impose restrictions on citizens or sites under its jurisdiction. Generally, EPA must turn to state or local governments to establish controls of this type. Typically these controls include changes in local zoning, permits, codes, or regulations;

At the NRE site, OU1, Governmental controls may be established by Klamath County, Oregon to provide a means for regulating land uses and/or restrict activities that could adversely affect the selected remedy. The Klamath County Board of Commissioners maintains jurisdiction over specific local land use decisions with legal authority to approve proposed changes in zoning that may be necessary to accommodate remedial alternatives and ensure the protectiveness of any selected remedy.

Proprietary controls

Proprietary controls are private contractual mechanisms contained in a deed or other document transferring a piece of property, used to restrict or affect the use of property. Proprietary controls involve the placement of restrictions on land through the use of easements, equitable servitudes, and covenants.

An **easement** is a certain right to use the real property of another without possessing it. Easements are helpful for providing pathways across two or more pieces of property, such as right-of-way (easements of way) and easements of support (pertaining to excavations).

An **equitable servitude** is a term used in the law of real property to describe a non-possessory interest in land that operates much like a covenant running with the land.

Proprietary controls provide for an orderly transfer of land usage, such as when open space lands may be proposed for onsite repositories. Proprietary controls also provide for the proper transfer of ownership so that land restrictions are clear when ownership changes. The controls may allow residential and recreational land use as indicated by local zoning, but will limit uses that might create an exposure pathway or damage the remedy. As an example, with these controls, no resident will necessarily have control or responsibility for long-term maintenance on any portion of an onsite repository.

Easement and equitable servitude may be used on both privately owned and Receiver managed parcels on OU1. An executed easement and equitable servitude could be filed with the county records and run with the land, so that any future owners would also take the property subject to the conditions of the instrument. Through such instruments, grantees, including ODEQ, may hold perpetual rights to enforce the conditions and restrictions of such instrument.

Land use restrictions may also be effected within the site through use of private CC&Rs that are recorded with the property deed. CC&Rs are commonly established for new residential subdivisions, and have already been established for residential parcels within the site, setting such requirements as minimum lot size. At the request of EPA, the NRE Receiver, the NRE LTSM program or another entity could propose to amend the CC&Rs for the NRE subdivision to incorporate selected land use restrictions necessary to protect human health from exposure to remaining ACM. Proposed amendments to the CC&Rs may be facilitated through the NRE Receiver's majority ownership of parcels within the subdivision. Once in place, CC&Rs are typically enforced by homeowners acting through a homeowners' association. Activities of homeowners' association are typically funded through assessment of maintenance fees upon homeowners subject to the CC&Rs. This self-enforcing mechanism may provide enhanced reliability.

Enforcement Tools

Enforcement tools are mechanisms to administrative orders or consent decrees, available to EPA under CERCLA and Resource Conservation and Recovery Act that can be used to restrict the use of land. Enforcement authority can be used to either (1) prohibit a party from using land in certain ways or from carrying out certain activities at a specified property, or (2) require a settling party to put in place some other form of control, such as a proprietary control.

Informational Devices

Informational devices are tools that provide public information that can help limit use of reclaimed areas to acceptable activities. These devices **(**such as state registries of contaminated properties, deed notices, and advisories**)** coupled with community awareness activities guide behavior to avoid exposures that may exceed health-based levels.

Informational notices may take the form of a notice of environmental contamination which ODEQ may issue unilaterally; consistent with ORS 465.200 et seq. Consistent with ORS 205.130(2), such notices may be presented by ODEQ to the county clerk for recording in the county records. Future notices for parcels within the site would be coordinated, as appropriate, with ATSDR and the Oregon Environmental Health Assessment Program.

12.3.7 Maintenance and Monitoring

Long-term O&M and ongoing monitoring (inspections and sampling) will be required to maintain the integrity of the engineered controls, and to provide assurance that the cap is not damaged and remains protective.

12.3.7.1 Inspections

Ongoing inspections [walking the site] will be conducted inside the boundary of OU1 after remedial action to ensure that no new ACM emerges. As described in 12.3.1, under incidental and localized contamination, there may be a few areas within the site boundary that will not be excavated or capped. These areas will be carefully inspected to ensure that no new ACM emerges after the remedy is implemented. In addition, monitoring will be conducted outside, but in near proximity to, the OU1 boundary to ensure that no new ACM is found beyond the area that EPA has now defined as the site. The location, frequency, and types of inspection will be developed further during remedial design.

If unacceptable exposures are identified, EPA (or the ODEQ, if exposure identified after remedial action is completed at OU1) will take action as necessary to ensure that the soil-to-air pathway is broken. Actions may include additional excavation, improving caps, and/or strengthening ICs.

12.3.7.2 Sampling

Regular sampling will be conducted on OU1. Sampling will be conducted on the outside edge of the capped areas to ensure that no contamination emerges in areas where no ACM or contaminated materials have been detected to date. The location, frequency, and types of sampling will be developed further during remedial design.

Sampling will be conducted of indoor air and dust after excavation and capping has been completed on each parcel. Please see 12.3.8 Contingency for Interior Cleaning of Occupied Buildings if Necessary after Excavation and Capping for more information about this sampling.

12.3.7.3 Ongoing Review of Asbestos-Related Sampling and Monitoring Used to Measure Protectiveness of the Site

The science around sampling, analyses, and risk assessment for asbestos contamination is developing rapidly. New sampling techniques and protocols may be developed in the future that could change the sampling, operation and maintenance plans we will be put in place for the site. More sensitive and precise analytical methods may refine the decisions we have presented in this ROD.

The sampling in the selected remedy will be subject to continued re-evaluation, as we learn more about asbestos, to ensure protectiveness of the remedy into the future. This will include re-evaluation of long-term sampling that will be conducted at the site based on possible improvements to the technology to detect ACM in air and in soils. EPA will review the protectiveness of the remedy at least every five years after the remedy has been initiated.

12.3.8 Contingency for Interior Cleaning of Occupied Buildings if Necessary after Excavation and Capping

The selected remedy includes a contingency for Interior Cleaning, if necessary. Under current conditions, risks to residents from indoor air are estimated to be 7E-07 (below EPA's risk range of 1E-06 to 1E-04 and ODEQ's risk level of 1E-06). Therefore, no remedial action is necessary inside OU1 homes at this time.

After excavation and backfill/capping has been completed on each parcel, indoor air and dust sampling will be conducted to ensure that indoor air remains protective of human health.

Indoor air sampling: Three to five ambient air samples will be collected using stationary air monitors placed inside each OU1 residence. Each sample will be analyzed by TEM using ISO 10312 counting rules (ISO 1995). If indoor air sampling results show risks in any residence that exceed 1E-04, then indoor cleaning will be conducted in that residence.

Indoor dust sampling: To provide an extra measure of protectiveness, for buildings where analyses of indoor air samples indicate risks below 1E-04, dust samples will be taken in OU1 residences to identify residual reservoirs of asbestos fibers that could pose unacceptable risks.

Dust samples may be collected using microvacuum consistent with ASTM D5755. Average dust concentrations for each home will be compared to site-specific criteria for asbestos as described in Appendix B.

If indoor air risk is determined to equal or exceed the 1E-04 level that triggers remedial action at the site, or indoor dust exceeds criteria established in Appendix B, indoor cleaning will be performed. The target cleanup goal will be established at the 1E-06 level required by the Oregon ARAR. Appendix B also includes the methodology that will be used to evaluate the need for action and to guide such action if deemed necessary.

If implementation of the contingency is necessary based on this sampling of indoor spaces after soil remediation is completed, EPA will make a post-ROD change and document it appropriately, such as by publishing an explanation of significant differences to reflect this determination. This post–ROD change will indicate which residence(s) will need to be cleaned, and will share information with the public about how indoor cleaning will be conducted.

Final results from indoor air and dust sampling will be documented, and that record will be placed in the North Ridge Estates, OU1, site file.

Interior cleaning, if needed, will require temporary relocation of any residents occupying the structure because of the disturbance of asbestos fibers created by the cleaning.

12.4 Other Site-Specific Issues That Will Be Addressed in the Remedial Design Process

National Historic Preservation Act (NHPA):

- In the National Historic Preservation Act (NHPA), Congress established a comprehensive program to preserve the historical and cultural foundations of the nation as a living part of community life. Section 106 of the NHPA requires consideration of historic preservation in all federal projects. Section 106 requires federal agencies to consider the effects of projects they carry out, approve, or fund on historic properties. The NRE site, OU1, is a property that could be considered historic, as the MRB was created over 50 years ago.

- Many of the foundations and other support structures of the MRB are still found on OU1. During the remedial design process, EPA will work with the Oregon State Historic Preservation Officer to make a determination what action will need to be taken to comply with substantive requirements of Section 106 of the NHPA as well as substantive portions of applicable State of Oregon statutes and regulations analogous to the NHPA (contained within ORS 358 and OAR 736-050 and 736-051 as indicated in Appendix C).

Addressing asbestos contamination from tree roots:

- Remediation around tree roots at this site will pose a significant challenge, as contaminated materials are often bound up in the roots of trees. EPA expects that during remedial action, some of the smaller trees will be removed. However, some “heirloom” trees have stood on OU1 for decades, and add an esthetic to OU1 residents and may not be above contamination because of their age relative to the construction of the MRB. During the remedial design process, EPA will define how cleanup will be conducted on and around tree roots, as well as define which trees will be taken out and which will remain.

Warehouse located on parcel MBK-G:

- In the past, large quantities of contaminated materials were piled on and adjacent to the north side of the warehouse on parcel MBK-G. This pile of contaminated materials contained significant quantities of ACM, including friable MAG and AirCell. EPA observed bicycle tracks in this waste pile, and understood that people could be exposed to unacceptable levels of ACM at this location. EPA installed structural support measures and covered the site with rock to stabilize this pile to mitigate exposure risks from the ACM in the contaminated materials until a final remedy could be implemented at OU1. Drainage at this site is very poor, and water running on and through this pile of contaminated materials will pose an ongoing threat to stability of this pile of contaminated materials. Since there is so much contamination now stored in this location, EPA will consider during the remedial design process whether to create a permanent waste repository at this location that will address drainage and stability issues on the parcel, or move the contamination within this pile to another onsite repository.

- The siding on the existing warehouse is made of ACM and is degrading. In addition, the condition of the building may not merit repair of structure to ensure that it is safe to use in the future. During the remedial design process, EPA will consider what actions should be taken on the warehouse to ensure that the siding is not an additional source of future contamination at the site. Options EPA might consider are: removal of siding, covering the siding, and demolition of the entire building.

Remnants of MRB waste water treatment plant on private land:

Several structures associated with the MRE waste water treatment plant are still found on a privately owned parcel, WWTP. During the remedial design process, EPA will define how the ACM contamination found in, on, beneath and around these structures will be addressed. Since these structures are on private land, as part of the remedial design process, EPA will work with the property owner to define how EPA will conduct remediation on that portion of the site.

Sequencing work:

EPA estimates that the cleanup of contamination at the site will take a minimum of three construction field seasons (typically May – October) to complete, once initiated, assuming no significant delays. This will necessitate EPA working on some parcels and leaving adjacent properties untouched until the next field season. To ensure that those properties that have been capped are not re-contaminated by ACM on adjacent properties, careful planning and protective measures will be taken during the phased cleanup process. Actions that will likely be taken could include isolating capped properties from adjacent contaminated properties by access controls such as exclusion fencing, plastic barrier walls and posting signs on properties warning trespassers to keep off parcels to ensure ACM or asbestos fibers are not tracked from contaminated areas to those that have been capped.

Best Management Practices:

During the remedial design process, EPA will create a best management practices guide that will address the measures EPA will take to prevent re-contamination of areas that have been excavated and capped, and keeping contamination from migrating on to roads and off site while remediation is being conducted. Examples of measures that will likely be included in the "Best Management Practices" guide are: 1. requiring the use of specialized trucks with covered tops to move all contaminated materials; 2. washing truck tires before leaving OU1, and 3. using water-based dust suppression to prevent asbestos fibers from becoming airborne.

In addition, the best management practices guide will stipulate that any workers engaged directly in asbestos collection, excavation, transporting, capping, and otherwise handling asbestos-contaminated materials will be property trained, equipped, and otherwise prepared for such work, consistent with ARARs and applicable health and safety requirements.

Clean and Green Policy:

To the extent practicable, the remedial action at OU1 will be carried out consistent with the following three practices:

1. Use renewable energy and energy conservation and efficiency approaches, including Energy Star equipment, to the maximum extent practicable

2. Use cleaner fuels, diesel emissions controls and retrofits, and emission reduction strategies

3. Use environmental management system practices such as reducing the use of paper by moving to fully electronic transmittal of project documents and implementation of waste reduction and recycling programs at all work site

12.5 No Treatment to Address Principal Threat Waste Used at OU1:

While the NCP establishes an expectation that EPA will use treatment to address any principal threat waste, the use of treatment technologies for ACM and asbestos-containing soils at OU1 would not be practical or viable for the reasons stated in Sections 9 and 13.4. Thus treatment was not chosen as a component of the selected remedy.

12.6 Estimated Cost of the Selected Remedy

The present value cost of the Selected Remedy (a combination of remedy components from Alternatives 3, 5b, and 4) is approximately $20,356,000. The estimated capital costs are $21,830,000 and O&M and 5-year review costs (for the first 30 years) are $2,757,000. The construction timeframe is estimated to be 3 construction seasons (May to October), assuming no substantial delays after initiation. Exhibit 12-3 presents the cost estimate summary for the selected remedy, including the present value analysis on a year by year basis assuming a real discount rate of 7 percent.

12.7 Expected Outcomes of the Selected Remedy

The selected remedy will prevent exposure to ACM and contaminated materials through a combination of excavation and containment. Risks to human health from inhalation of contaminated materials will be eliminated or greatly reduced. Exposure to contaminated media that must remain on site will be controlled by use of caps, ICs, and access controls.

The selected remedy for OU1 will allow the site to continue to be used for residential purposes. EPA expects that the remedial action on OU1 will take approximately 3 construction seasons (May - October). After remedial action is completed, the remainder of the site not currently occupied will be ready for residential use.

As explained in Section 7 of this ROD, current and potential future risks are unacceptable in areas where readily friable asbestos (e.g., MAG and/or AirCell) is present at the surface and future risks are likely to be unacceptable at any location where ACM is present and is allowed to undergo future breakdown to release free fibers to soil. Based on this, it is concluded that remedial action is needed for all locations with known ACM contamination to address current and future risks from asbestos, and the RAOs for asbestos contamination will have to be achieved through implementation of remedial measures that break the exposure pathways The acceptable level of asbestos in air for soil disturbing pathways is 0.0002 f/cc. For long-term residential exposure on site (e.g., quiescent or routine activities), the acceptable level of asbestos in air is 0.000006 f/cc. These acceptable levels are based on an excess lifetime cancer risk of 1E-06 (See Section 8.2 and Appendix B).

Since arsenic at the former power plant is co-located with soils that are contaminated with asbestos fibers, all arsenic contaminated soils at the former power plant will be excavated and placed in a capped onsite repository as part of the site final remedy. The RAOs for arsenic contamination will be achieved through excavation of contaminated soils, and placing them in an onsite capped repository. The current cleanup level for arsenic in soil is 0.425 mg/kg (see Section 8.2 and Appendix B).

After contaminated materials are excavated from the NRE site and the site is capped, the soil-to-air exposure pathway will be broken. No final CULs for asbestos or arsenic will apply.

The remedial action will result in a significantly reduced risk to ecological receptors to the extent any such risk exists. Installation of the protective cap, and ongoing inspections and maintenance of the cap will greatly diminish the chances of any animal or bird from coming into contact with ACM, or any other contaminated material at the site.

After the remedy is completed, and after indoor air and dust samples demonstrate no unacceptable risk from exposure to asbestos in living spaces, the 18 currently vacant homes on OU1 should be safe from asbestos hazards and open to occupying again. Since homes now stand vacant, EPA expects the change to the community will be substantial. Property values will be expected to increase, and property taxes will be expected to be paid once again.

12.8 Performance Standards

As reported in Section 7 of the ROD, current analytical capabilities are insufficient to adequately characterize concentrations of asbestos in soil at OU1. Additionally, there is not an established relationship between concentrations of asbestos in soils and concentrations of asbestos in air. Based on this, this remedial action is needed for all locations with known ACM and asbestos contamination on the site to address current and future risks from asbestos and will have to be achieved through implementation of remedial measures that will break the exposure pathway.

12.9 Environmental Justice

In 1994, Executive Order 12898, Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations, became effective. The purpose of the Executive Order is to ensure that environmental actions or decisions do not result in disproportionately high and adverse human health or environmental effects by ensuring that the analysis of these effects includes the examination of secondary effects, cultural concerns, and cumulative impacts/effects.

Achieving environmental protection for all communities is a fundamental part of EPA’s mission. However, because of the remote location of the site, a formal environmental justice evaluation was not warranted.

Exhibit 12-4. Cost Estimate Summary for Selected Remedy

Year[1]	Capital Costs (Land Use Controls)	Capital Costs (Earthwork)	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[2]	Present Value[3]
0	$0	$0	$0	$0	$0	$0
1	$1,062,000	$6,922,667	$26,000	$0	$8,010,667	$7,486,769
2	$0	$6,922,667	$26,000	$0	$6,948,667	$6,068,965
3	$0	$6,922,667	$26,000	$169,000	$7,117,667	$5,810,151
4	$0	$0	$36,000	$0	$36,000	$27,464
5	$0	$0	$36,000	$369,000	$405,000	$288,765
6	$0	$0	$36,000	$0	$36,000	$23,987
7	$0	$0	$36,000	$0	$36,000	$22,417
8	$0	$0	$36,000	$0	$36,000	$20,952
9	$0	$0	$36,000	$0	$36,000	$19,580
10	$0	$0	$36,000	$369,000	$405,000	$205,862
11	$0	$0	$36,000	$0	$36,000	$17,104
12	$0	$0	$36,000	$0	$36,000	$15,984
13	$0	$0	$36,000	$0	$36,000	$14,940
14	$0	$0	$36,000	$0	$36,000	$13,961
15	$0	$0	$36,000	$200,000	$236,000	$85,526
16	$0	$0	$36,000	$0	$36,000	$12,193
17	$0	$0	$36,000	$0	$36,000	$11,398
18	$0	$0	$36,000	$0	$36,000	$10,652
19	$0	$0	$36,000	$0	$36,000	$9,954
20	$0	$0	$36,000	$200,000	$236,000	$60,982
21	$0	$0	$36,000	$0	$36,000	$8,694
22	$0	$0	$36,000	$0	$36,000	$8,125
23	$0	$0	$36,000	$0	$36,000	$7,592
24	$0	$0	$36,000	$0	$36,000	$7,096
25	$0	$0	$36,000	$200,000	$236,000	$43,471
26	$0	$0	$36,000	$0	$36,000	$6,199
27	$0	$0	$36,000	$0	$36,000	$5,792
28	$0	$0	$36,000	$0	$36,000	$5,414
29	$0	$0	$36,000	$0	$36,000	$5,062
30	$0	$0	$36,000	$200,000	$236,000	$31,010
TOTALS:	$1,062,000	$20,768,000	$1,050,000	$1,707,000	$24,587,000	
TOTAL PRESENT VALUE OF SELECTED ALTERNATIVE (a combination of Alternatives 3, 4 and 5b)						**$20,356,000**

Notes:
[1] Duration is assumed to be 31 years (Years 0 through 30) for present value analysis.
[2] Total annual expenditure is the total cost per year with no discounting.
[3] Present value is the total cost per year including a 7.0 percent real discount factor for that year.
[4] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from present value cost. Costs presented are expected to have accuracy between -30 to +50 percent of actual costs, based on the scope. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation and remedy selection.

Section 13 Statutory Determinations

Under CERCLA Section 121 and the NCP, EPA must select a remedy that is protective of human health and the environment, complies with or appropriately waives ARARs, is cost effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that include treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the selected remedy meets these statutory requirements.

13.1 Protection of Human Health and the Environment

The selected remedy includes components to address human health and environmental risks at OU1 associated with asbestos and arsenic at the former power plant area. Unacceptable human health or environmental risks will be addressed. The selected remedy will be monitored and maintained through comprehensive programs using ICs, access controls, monitoring, and maintenance. There are no short-term threats associated with the selected remedy that cannot be readily controlled through applicable health and safety requirements, monitoring, and standard asbestos-related construction practices. In addition, no adverse cross-media impacts are expected from the selected remedy.

The selected remedy will protect human health and the environment through consolidation and capping to break a complete exposure pathway for inhalation at OU1. Capping will effectively isolate ACM and asbestos in soils and will prevent human and environmental exposures. Protection will be maintained via comprehensive O&M measures, including monitoring (including inspections and sampling). ICs and access controls will be implemented to ensure that the remedy is not disturbed inappropriately.

13.2 Compliance with ARARs

ARARs are determined based on analysis of which requirements are applicable or relevant and appropriate to the distinctive set of circumstances and actions contemplated at a specific site. The NCP requires that ARARs be attained during the implementation and at completion of the remedial action. A summary of federal and state ARARs for the OU1 ROD is attached as Appendix C. The selected remedy would address the chemical-, location-, and action-specific ARARs described in Appendix C through adherence of those ARARs during implementation of the remedial action. As summarized in Section 10.1, there is a potential for ACM contamination to be released if the site is not excavated and then fully capped. When the site is excavated and capped as described in Section 12, EPA has determined that the selected remedy meets ARARs while providing the greatest protection to human health and the environment from exposure to asbestos and arsenic contamination found at the site. Exhibit 13-1 presents the evaluation criteria considerations and the justification for this determination.

Exhibit 13-1. Evaluation of Compliance with ARARs for Selected Remedy

Evaluation Criteria Considerations for Compliance with ARARs	Justification for Rating
Compliance with Chemical-Specific ARARs	• Excavation of contaminated soil and onsite disposal, coupled with capping excavations and onsite disposal locations would physically address contaminant sources and prevent discharges of asbestos fibers to air, thus meeting visible emissions requirements of NESHAP and chemical-specific ARARs for air. • ICs and engineered controls alone do not physically address migration of site contamination; presence of unaddressed contaminated soil may not be compliant with NESHAP and could cause exceedances of chemical-specific ARARs in air. However it is expected that all areas of contaminated soil would be capped under this remedy, and would then be compliant with NESHAP and meet chemical-specific ARARs.
Compliance with Location-Specific ARARs	• Addressed during implementation of the remedial action. • The National Historic Preservation Act will be met by the selected remedy through consultation with the historical preservation agencies in remedial design and implementation of remedial action consistent with the outcome of that consultation.
Compliance with Action-Specific ARARs	• Addressed during implementation of the remedial action. • EPA has determined that the cap and signage requirements specified under NESHAP (40 CFR 61.151) and the friable asbestos disposal requirements in OAR 340-248-0280 are relevant and appropriate ARARs for the site. The selected remedy would be in compliance with these ARAR as indicated under 40 CFR 61.151(a) ,40 CFR 61.151(b),and OAR 340-248-0280(11)(a) and (b) respectively. Modifications to these requirements would be allowed with approval as indicated in 40 CFR 61.151(c) and OAR 340-248-0280(12).

13.2.1 ARARs Affecting Protectiveness Determinations

The provisions of the following ARARs were identified as significantly affecting protectiveness determinations for the selected remedy identified in this ROD.

The Oregon Environmental Cleanup Law (ORS 465.200 through ORS 465.900) and the Oregon Hazardous Substance Remedial Action Rules (OAR 340-122) provide the state's regulatory framework for the determination of removal and remedial action necessary to assure protection of the present and future public health, safety and welfare, and the environment in the event of a release or threat of a release of a hazardous substance. These state laws and regulations have been identified as applicable ARARs and thus compliance with the substantive requirements of these laws and regulations is required.

CERCLA and the NCP form the federal laws and regulations under which a response is performed in the event of a release or threat of a release of a hazardous substance from an abandoned site.

Generally the substantive portions of the Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules provide standards similar to those within CERCLA and the NCP. However there are a few major differences that fundamentally affect the determination of protectiveness.

Specifically, the NCP indicates the following regarding carcinogens:

- For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 1E-04 and 1E-06 using information on the relationship between dose and response. The 1E-06 risk level shall be used as the point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure. (Section 300.430(e)(2)(i)(A)(2)).

The Oregon Hazardous Substance Remedial Action Rules indicate the following:

- "Acceptable risk level for human exposure to individual carcinogens" means for deterministic risk assessments, a lifetime excess cancer risk of less than or equal to one per one million (1E-06) for an individual at an upper-bound exposure (OAR 340-122-0115(2)(a).

This is a significant difference in determining protectiveness for remediation of the primary carcinogen identified at the site (asbestos) since many of the analytical techniques relied on for determination of risks from asbestos exposure have poor sensitivity at low concentrations of asbestos fibers that pose risks at these levels. This issue is discussed further in Section 3.4.1.

The issue of background concentrations of COPCs that are naturally occurring is another aspect of the Oregon Hazardous Substance Remedial Action Rules that affects the development of a PRG. Specifically the Standards section within OAR 340-122-0040(2)(a) through (c) states:

- In the event of a release of a hazardous substance, remedial actions shall be implemented to achieve:

  (a) Acceptable risk levels defined in OAR 340-122-0115, as demonstrated by a residual risk assessment;

  (b) Numeric cleanup standards developed as part of an approved generic remedy identified or developed by the Department (ODEQ) under OAR 340-122-0047, if applicable; or

  (c) For areas where hazardous substances occur naturally, the background level of the hazardous substances, if higher than those levels specified in subsections (2)(a) through (2)(b) of this rule.

Arsenic is a COC but is also naturally occurring element within soils near the site. Thus, the determination of the CUL for arsenic is not solely based on the determination of risk, but also whether that risk represents concentrations of arsenic above background concentrations for the site.

The issue of background may also affect determinations of protectiveness for forms of asbestos that may be naturally occurring at the site (those not associated with chrysotile and amosite forms of asbestos in ACM that was used in construction of the former MRB).

13.2.2 Contaminant Sources

No permits will be necessary to implement a remedial action within the site boundary in accordance with Section 121(e) of CERCLA; however, the substantive requirements of any permits will be followed.

13.2.3 Surface Water and Groundwater

No surface water or groundwater ARARs apply to selected remedy for OU1.

13.2.4 Other ARARs

One location-specific ARAR that is applicable to OU1 is the National Historic Preservation Act and the analogous State of Oregon statutes and regulations designed to encourage historic, archeological, and antiquities preservation (contained within ORS 358 and OAR 736-050 and 736-051 as indicated in Appendix C). These ARARs will be met by the selected remedy through consultation with the historical preservation agencies in remedial design and implementation of remedial action consistent with the outcome of that consultation.

Federal and state standards for particulate matter1 are both contaminant and action-specific ARARs at OU1. These standards are applicable to releases of particulate matter during remediation. EPA anticipates that these ARARs can be met through the implementation of appropriate standard operating procedures and monitoring.

13.3 Cost Effectiveness

In EPA's judgment, the selected remedy is cost effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost effective if its costs are proportional to its overall effectiveness" [NCP §300.430(f)(1)(ii)(D)]. This was determined by evaluating the overall effectiveness of the selected remedy and comparing that effectiveness to the overall costs. Effectiveness was evaluated by examining how the remedy meets three criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness. Overall effectiveness of the remedial alternatives was then compared to costs to determine cost effectiveness. The relationship of the overall effectiveness of the selected remedy was determined to be proportional to its cost and hence this remedy represents a reasonable value for the cost to be incurred.

Often, more than one cleanup alternative is cost effective, but Superfund does not mandate the selection of the most cost-effective cleanup alternative. This is because the most cost-effective remedy does not always provide the best balance of tradeoffs with respect to remedy selection criteria. In addition, the most cost-effective cleanup alternative is not necessarily the least-costly alternative that is both protective of human health and the environment *and* ARAR-compliant.

For OU1, net present value costs for each alternative were compared in the FS, and a range of costs for each alternative was developed that represents the range and possible scope of actions.

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[1] Oregon State Clean Air Act and NESHAPs 40 CFR 50.6.

The cost of the selected remedy is expected to have a present value cost of $20,356,000. EPA believes that the selected remedy achieves an appropriate balance between cost effectiveness and adequate protectiveness.

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

This determination looks at whether the selected remedy provides the best balance of trade-offs among the alternatives with respect to the balancing criteria set forth in NCP §300.430(f)(1)(i)(B), such that it represents the maximum extent to which permanence and treatment can be practicably utilized at OU1 of the NRE site. NCP §300.430(f)(1)(ii)(E) provides that the balancing shall emphasize the factors of "long-term effectiveness" and "reduction of toxicity, mobility, or volume through treatment," and shall consider the preference for treatment and bias against offsite disposal. The modifying criteria were also considered in making this determination.

Of the alternatives evaluated that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria. The selected remedy also represents the maximum extent to which permanent solutions and treatment technologies can be practically utilized in a cost-effective manner at OU1. Although the NCP establishes an expectation that EPA will use treatment to address any principal threat waste, a range of treatment technologies for ACM and asbestos containing soils was evaluated and screened in the FS as described in Section 9. Likewise, a remedial alternative for OU1 employing treatment was evaluated and screened out in the FS as described in Section 9. Treatment was determined to not be practical or viable for the following reasons:

- **Uncertainty Regarding Long-Term Effectiveness and Permanence of Treatment Technology**. Data and studies provided by treatment vendors indicate that ACM can be successfully treated to an amorphous, inert form as long as the asbestos contamination is subjected to sufficient residence time within the treatment unit. However, there is significant uncertainty regarding how residence time may vary depending on the heterogeneity of the ACM both in bulk materials and a soil matrix, and changes in the moisture content of soil. In addition, it is unclear whether sufficient residence time would be possible to allow treatment through the full thickness of the materials and yet treat all of the materials in a reasonable timeframe (estimated minimum time required for treatment is over 10,000 working days). Thus, it is possible that untreated asbestos could potentially exist within the treated materials and become exposed if treated materials were further broken down or weathered. A study provided by the treatment vendor indicated that treated material could exhibit particle breakdown if exposed to construction operations which are likely under the remedial measures contemplated for the site.

- **Difficult implementation.** Thermo-chemical treatment of ACM asbestos is significantly more difficult to implement than the other evaluated remedial measures. The heterogeneity of the contaminated materials at the site also could complicate the treatment process. Segregation and size reduction of ACM (such as long lengths of steam pipe wrap) may be required to facilitate treatment. The volumes of ACM and contaminated soil at the site that would require treatment (approximately 189,000 cubic yards assumed to be 257,000 tons) are generally several orders of magnitude greater than the capacity of the treatment unit (up to 25 tons per day) and thus would require a significant period of time to implement (estimated to be over 10,000 working days). There are also a number of potential issues regarding meeting the substantive requirements of regulations for implementation of treatment. These regulatory issues include allowable air emissions from the treatment unit and use/disposition of treated materials.

- **Limited availability.** There are relatively few vendors within the U.S. that are capable of providing thermo-chemical treatment, and relatively few treatment units in existence within the U.S. Thermo-chemical treatment units are not currently located within the state of Oregon. It is not known whether these vendors and units would be available to treat contaminated materials at OU1 when the remedy is implemented.

- **Inaccessible contaminated materials**. Contaminated materials at the site will be excavated to the extent practicable. The RI determined that contaminated materials exist directly under permanent structures and infrastructure within OU1 such as roadways and homes or at depths that require specialized measures for excavation without damage to nearby structures. Excavation of contaminated materials under or directly adjacent to these permanent structures is not practical without the risk of damage to these structures and significant associated costs of repair or replacement. It may be possible - during the remedial design process - to determine that the structural integrity of specific roadways and homes at OU1 would not be compromised by excavating the soils immediately adjacent to these locations. However, these determinations would be made on a case-by-case basis. In addition, it is unlikely these determinations could be performed throughout OU1 because of changes in soil conditions and topography throughout the NRE site, OU1.

  Since thermo-chemical treatment it is an ex situ process, treatment of inaccessible ACM and asbestos-contaminated soil would not be possible and would still require measures such as containment.

- **Ongoing need for land use controls, monitoring, and 5-year reviews**. Because of the inaccessibility of contaminated materials as previously described, subsurface contaminated materials will likely remain at depth at OU1. Treatment of excavated ACM and asbestos-contaminated soil would not negate the need for land use controls to prevent human contact with the contaminated materials in the subsurface, ongoing monitoring (including inspections and sampling), and 5-year site reviews. Thus treatment does not gain efficiencies or savings in terms of long-term protectiveness. As noted above, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment. Subsequent five year site reviews will also be performed since contamination posing risks will continue to remain in the subsurface regardless of the remedy selected for the site.

- **High cost relative to protectiveness**. Thermo-chemical treatment of asbestos wastes is significantly more expensive than the selected remedy, which provides protection of human health and the environment through consolidation and containment of ACM and asbestos-contaminated soil in onsite ACM repositories. Both approaches require excavation and relocation of these contaminated materials with capping of remaining soils in excavated areas to prevent exposure to any remaining asbestos contamination. However the present value cost to implement treatment of ACM and asbestos-contaminated soil is approximately $174 million; that cost is $154 million higher than the present value cost for implementing the selected remedy.

Protection and long-term effectiveness are achieved through maintenance, monitoring, and ICs following remedial action. The selected remedy is expected to provide short-term effectiveness with a low level of risk to the community, cleanup workers, and the environment. It is also highly implementable and cost-effective.

13.5 Preference for Treatment as a Principal Element

Treatment does not constitute a major component of the remedy for OU1 and the selected remedy does not satisfy the statutory preference for treatment as a principal element because the extraordinary volume of materials, and complexity of the site make treatment impracticable. The 125-acre area is estimated to contain 189,000 cy of ACM, contaminated debris, and soils contaminated predominantly with asbestos (a small volume of arsenic-contaminated soil also exists in the locale of the former power plant). These contaminated materials will be excavated and consolidated as part of the selected remedy. Approximately two thirds of those materials are at the surface or near-surface, and approximately one third of those materials are in deeper burial locations. In addition to the extraordinary volume, treatment is not practicable at this site because of the complexity and heterogeneity of the contaminated materials at the site, with ACM present in bulk form, in particles and fibers within the soil matrix, and fibers potentially entrained in fractures of subsurface bedrock.

13.6 Five-Year Reviews

Because the selected remedy results in contaminants remaining on site (although under caps) above levels that allow for unlimited use and unrestricted exposure, five-year reviews will be conducted pursuant to CERCLA §121(c) and NCP §300.430(f)(5)(iii)(C). EPA shall conduct a review of remedial actions no less often than each five years after the initiation of such remedial action to assure that the remedy is, or will be, protective of human health and the environment.

The 5-year reviews will include any additional information related to human health or ecological risk that is developed during the period covered by the review. If unacceptable exposures to asbestos contamination are identified, EPA may take action as necessary to ensure that the soil-to-air exposure pathway to asbestos contamination is broken. Actions may include additional excavation and disposal, installing or improving caps, and/or strengthening ICs and access controls.

Section 14 Documentation of Significant Changes from Preferred Alternative of Proposed Plan

The proposed plan for OU1 was released for public comment in April 2010. It identified components of several alternatives as the preferred alternative for OU1:

1) Excavation of surface and subsurface soils from Alternative 5b

2) Capping of properties after soil excavation from Alternative 4

3) Institutional Controls, Access Controls, and Community Outreach, from all the Alternatives

4) A contingency for Interior Cleaning as from Alternative 3

This preferred alternative is described herein as the selected remedy. EPA reviewed all written and verbal comments submitted during the comment period. These comments are provided in the Responsiveness Summary (Part 3 of the ROD). It was determined that no significant changes to the remedy as originally identified in the proposed plan were necessary or appropriate.

The following points of clarification were made concerning the selected remedy for OU1 in this ROD:

- **Excavation of Contaminated Materials.** More clarity has been provided in the selected remedy about why excavation of contaminated materials is needed, and under what conditions excavation of contaminated materials might not be conducted further at OU1. In addition, more flexibility has been provided for site-specific determinations of how much contamination needs to be removed at specific incidentally or locally contaminated sites.

- **Capping.** More clarity has been provided in the selected remedy about when caps may not be constructed to the full minimum frost protective thickness, and what action(s) will be taken if the full thickness of a protective cap cannot be installed.

- **ICs.** Additional language has been added in the Institutional Control section of the selected remedy stating that EPA will help educate lenders and real estate agents about the long-term impacts of conducting remedial action at OU1.

- **Listing of NRE Site to NPL.** On March 10, 2011, EPA proposed listing of NRE to NPL, and final listed the site on September 16, 2011. Now that the site is listed, NRE will become eligible for federal funds that can be used to clean up OU1 as described in Selected Remedy, Section 12 of the ROD, potentially addressing most of the funding concerns raised by the public for remediation of the site.

Section 15 Listing of North Ridge Estates to NPL

The NRE site includes areas affected by asbestos-related releases or threatened releases within approximately 422 acres. Specifically, these areas include the 125 acres of the former MRB location and the approximately 46 acres of the Kingsley Firing Range, identified as OU1 and OU2, respectively. The NRE site may not be limited to these areas or releases. Until the CERCLA site investigation process has been completed for OU2 and a remedial action (if any) selected for OU2, EPA can neither estimate the extent of the release, nor describe all the areas of the site.

As stated previously, the NRE site has been divided into OUs:

- ***OU1*** is the focus on this ROD. OU1 encompasses the footprint of the former MRB and includes all areas where ACM and/or asbestos have been observed and/or detected with the exception of the former firing range. OU1 is estimated to include approximately 125 acres. Appendix A shows the footprint of the OU1 site boundary and parcel ownership (either privately owned or receiver-managed).

- ***OU2*** includes the area of the former firing range and is estimated to include approximately 46 acres.

On August 31, 2010, Oregon Governor Kulongoski sent a letter to EPA nominating the NRE site for placement on NPL consistent with the state's authority under CERCLA Section 105(c). The State of Oregon used its one-time nomination to bring forward this site for listing.

On March 10, 2011, EPA proposed listing the NRE site to the NPL and sought comments on that proposed listing through May 9, 2011. EPA received no negative comments on the proposed listing during the public comment period.

The NRE site was final listed to the NPL on September 16, 2011. Now that the site is final listed on the NPL, NRE will become eligible for federal funds that can be used to clean up OU1 as described in Selected Remedy, Section 12 of the ROD, and EPA should be able to address most of the funding concerns raised by the public for remediation of the site. EPA's next step will be to create a remedial design for remedial (cleanup) work that will be conducted at OU1. The remedial design will provide a detailed, parcel-specific, plan for how for the final remedy will be conducted at OU1.

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RECORD OF DECISION

FOR

NORTH RIDGE ESTATES SITE

OPERABLE UNIT 1

KLAMATH COUNTY, OREGON

Part 3
Responsiveness Summary

Section 1 Introduction

This section responds to comments received on the proposed plan for OU1 of the NRE site. The Proposed Plan was available for public comment from April 2, 2010 through May 10, 2010. A public meeting was held to take spoken comments on April 8, 2010 and an open house was held on April 9, 2010 to allow individuals to pose additional comments and concerns. Sixteen individuals or groups submitted a total of 63 comments.

Some commenters stated either support or opposition for the EPA Preferred Alternative, and several made suggestions to add to or modify the proposed plan. Most commenters requested clarification or asked questions on topics including cost, methods of work, use of volunteers, effectiveness, and ease of implementation. A number of commenters raised parcel specific questions. Each substantive comment (or a synopsis of each) is numbered and italicized below, followed by EPA's response.

Section 2 Responses to Specific Comments

1) ***Comment****. With reference to the "proposed plan to address environmental cleanup of asbestos-contaminated soil and debris at Operable Unit 1 of the NRE site located near Klamath Falls, Oregon," herewith I now vote that Remedial Alternative 5b "Excavation and onsite consolidation/disposal of contaminated materials," is satisfactorily adequate for asbestos remediation of the NRE site.*

EPA Response. Excavation and onsite consolidation/capping of contaminated materials at the site are important components of the final remedy for Operable Unit (OU) #1 of the NRE site. However, capping of the site is also needed to ensure long-term protectiveness from asbestos containing materials and microscopic asbestos fibers that may remain in the soils and potentially migrate to the surface in the future. Capping is also required to meet risk reduction standards in State of Oregon ARARs. Please see Section 12.3.3 of the ROD for more information about why capping in addition to excavation and consolidation is required for the site.

2) ***Comment****. Providing a large excavated pit, at a suitable location on the NRE site, for containment of some of the asbestos containing materials from the NRE site, plus minimal excavation collection of and periodic manual collection of asbestos containing building materials from the NRE site, with all asbestos containing materials so collected being buried in the large excavated NRE site onsite pit that I have here aforestated, should be adequate asbestos remediation for the NRE site.*

EPA Response. The ROD evaluated an alternative (5a) that included an initial excavation of contaminated materials at the surface and consolidation at an onsite repository, coupled with future periodic pickup of contaminated materials that would migrate to the surface over time. Although the alternative could address larger asbestos containing materials, it would fail to ensure protection of human health from potential exposure to microscopic asbestos fibers remaining in the soils that pose the largest health risks. Alternative 5a also would not meet the risk reduction standards in State of Oregon ARARs. Please see response to comment #1, above, and section 12.3.1 in the ROD for more information about excavation of contamination at OU1.

3) **Comment.** *An onsite NRE site temporary asbestos collection facility, where volunteers may deposit asbestos containing material(s) that the volunteers have collected from the NRE site, appears to me practical and worthy for visitors and/or residents of the NRE site, providing that the facility both may be restricted to NRE site asbestos containing materials only, and the facility is regularly monitored and serviced.*

EPA Response. Because of the risks associated with disturbing ACM at the site, as described in Section 7 of the ROD, EPA does not support volunteers collecting, transporting, or managing asbestos containing materials, because they could potentially inhale or ingest dangerous concentrations of asbestos fibers.

Even if properly trained and licensed personnel performed collection of larger asbestos containing materials, collecting ACM on OU1 without capping the remaining surface soils with clean soil would not be considered protective to human health nor would it meet the risk reduction standards in State of Oregon ARARs. As discussed in the response to Comment 1, microscopic asbestos fibers may remain in surface soils and pose unacceptable human health risks.

Properties on OU1 will be excavated and then a visible marker will be placed on the ground before a cap is installed. A restriction will be will be put in place that any digging of soils that will lie beneath that visible marker on properties where excavation has been completed must be done by a licensed asbestos abatement contractor.

In addition, EPA will create a best management practices guide that will stipulate that any workers engaged directly in asbestos collection, excavation, transporting, capping, and otherwise handling asbestos-contaminated materials will be property trained, equipped, and otherwise prepared for such work, consistent with ARARs and applicable health and safety requirements. Operation and maintenance of an onsite, long-term, asbestos collection facility must managed by individuals who are trained in and licensed to handle asbestos containing materials.

4) **Comment**. *I support the EPA proposed plan. I understand that each property will be individually assessed and treated accordingly. The theory is sound. Remove the potentially contaminated material, put down a barrier and top with clean soil. It is simple but certainly not easy or inexpensive. If the EPA is to fulfill its mission to protect people and the environment, a solution must be implemented. I believe there will be a stigma associated with this subdivision for many years to come.*

EPA Response. Thank you for your input. Your comment has been noted.

5) **Comment**. *I find the removal of the top layer of ACM and depositing it on site with protective sheeting and capping OK*

EPA Response. Thank you for your input. Your comment has been noted.

6) **Comment**. *After ACM removal, the laying down of a protective 'sheet' of material and then backfilling with clean fill, then soil is a good remedy and even though will not guarantee that*

somewhere down the road some remote pieces of asbestos siding will show up, this method will provide a safety margin that is totally acceptable.

EPA Response. EPA agrees that excavation of most of the contaminated materials on each parcel, laying down a visible marker layer, and then covering each parcel with a frost protective cap will prevent exposure to contamination contained beneath the caps.

Since ACM could still be present on some buildings, it is possible that one or more pieces of asbestos siding or other ACM may show up on or near the site even after contaminated materials are removed to an onsite repository and the site is capped. As described n the Summary of Site Risks, Section 7, in the ROD, even this level of exposure to asbestos may pose an unacceptable risk to human health and the environment. Therefore, EPA has included in the selected remedy a requirement that the site be monitored (inspected and sampled) on a regular basis to look for any new ACM that may appear. Should any new ACM appear, EPA anticipates it will be cleaned up as described in Section 12 of the ROD. EPA will also perform 5-year site reviews to ensure protectiveness of the remedy over time since contaminated materials would remain beneath caps at the site.

7) ***Comment.*** *I think the plan as it is written is fine for the area around the homes, but there are a lot of areas that don't need t have soil removed. It would be far better to pack and cover these areas with asphalt. For example, around the warehouse you would be moving more dirt around that would just make it more dangerous than just sealing it in where it is. There are also many areas that can just have cloth laid down and then bring in fill to cover it. This would not only be safer but much less expensive.*

EPA Response. EPA agrees that there are areas on the site where an asphalt cover could provide <u>short-term</u> protection to human health and the environment. The discussion of cap (page 8 in EPA's Proposed Plan) provides an option for the use of asphalt, concrete or rock as acceptable cap materials.

However, EPA's selected remedy is designed for <u>long-term</u> residential use, and must provide long-term protectiveness to human health from the contamination found at the site. Please see discussion of why excavation must be conducted before capping in Section 12.3.1 of the ROD.

Also, more information about how EPA expects to address the warehouse will be developed during the remedial design process in Section 12.4 of the ROD.

8) ***Comment****. ODEQ notes that selection of the preferred remedial alternative as currently described in the Plan may have unintended consequences for remedy implementation on specific parcels that are believed to be incidentally or locally contaminated with ACM, and/or which have extenuating physical constraints that may limit conformance with the Plan's excavation and/or capping standards. ODEQ acknowledges that this second condition of physical constraints is already contemplated by the current Plan with respect to the excavation standard, which states: "A determination to stop excavation will be made on a parcel-specific basis and will be based on horizontal and vertical features or conditions that cause excavation to be damaging, difficult or costly ... " ODEQ presumes that this element of the Plan would allow for an exception to the two foot minimum excavation standard, but notes that these same physical constraints may also reasonably*

limit capacity to meet the minimum capping standard. As such, ODEQ recommends that this element of the Plan be further modified to anticipate that site-specific physical constraints may also preclude installation of the required minimum two foot thick cap following excavation.

EPA Response. EPA agrees that site-specific physical constraints may preclude installation of a two foot protective cap following excavation, and has included language in Section 12.3.1 of the Selected Remedy in the ROD to address this situation.

9) ***Comment***. *The excavation standard of the current preferred alternative requires a minimum two foot to a maximum four foot vertical excavation on all parcels and the capping standard specifies a minimum two foot thickness, subject to input from the U.S. Army Corps of Engineers, Cold Regions Research laboratory. These requirements would strictly apply to every parcel within the NRE site boundary with any documented ACM, irrespective of degree, location, or type of ACM present. If selected without modification, this remedial approach would literally require both the wholesale excavation to a minimum of two feet across the entire affected parcel as well as the installation of a minimum two foot cap following excavation. For parcels that are known to be extensively contaminated, the excavation and capping standards in the current Plan makes sense and ODEQ fully supports the application of these standards, as practicable. We also agree with the provision to excavate deeper than four feet, based upon field judgment and discretion, if necessary. However, for parcels that are impacted by incidental or localized contamination, the strict application of the excavation and capping standards seem excessive and disproportionate. Instead, ODEQ advocates that USEPA modify this particular element of the preferred remedy to accommodate more flexibility for field judgment based upon historical observations and realtime, implementation observations of the extent and magnitude of contamination. This modification would require expansion of exception criteria already contemplated in the Plan.*

EPA Response. EPA agrees that there are a few areas on the site where incidental and localized contamination have been found, and agrees that conducting wholesale excavation inside the entire site boundary may be excessive and disproportionate to the risk posed to human health and the environment by this incidental and localized contamination. Please see Section 12.3.1.7 in the ROD for additional information on this topic.

10) ***Comment***. *ODEQ agrees that literal conformance with the excavation and capping standards is appropriate for parcels with significant and reappearing ACM, where site-specific physical setting does not reasonably prohibit conformance with these standards. In contrast, ODEQ believes that parcel and/or portions of parcels within the site boundary that have been essentially devoid of ACM during the approximately seven years of extensive field observations, should have remedial options available such as limited removal and/or capping, monitoring, and reporting. Given the extensive site investigations and contaminant removals completed at NRE to date, most of the individual parcels or locales within parcels falling into the incidentally or locally contaminated category are generally known. ODEQ recognizes that there is remaining uncertainty associated with concluding that a given parcel is only incidentally or locally contaminated by inference to visual ACM presence or absence at the surface. Therefore, we advocate the discretion for alternatives to the excavation and capping standards as the exception and not the rule.*

EPA Response. EPA agrees, please see response to comment #9, above.

11) ***Comment***. *ODEQ recognizes that the Plan identifies a preferred remedial alternative that would be considered protective for the entire facility, which at NRE comprises approximately 125 acres. As such, the Plan does not detail how the selected remedy will be implemented on individual parcels. ODEQ understands that USEPA currently intends to provide additional guidance for cleanup of individual NRE parcels subsequent to selection of a preferred remedy, and we acknowledge that decisions about individual parcel cleanups will generally be identified after the preferred remedial action is selected. Accordingly, ODEQ believes that the Soil Management Plan (SMP) would be an appropriate document to identify specific locales within individual parcels that may be subject to excavation and/or capping exceptions.*

EPA Response. This comment was submitted to EPA before the NRE site was proposed as an addition to NPL, making it eligible for federal funding to clean up the contamination.

Before EPA proposed listing the NRE site to the National Priorities List (NPL), we discussed developing a Soil Management Plan (SMP) for the site. The SMP would have been a general guide to homeowners or other interested parties on how private parties could address the contamination on the site. The SMP would have been created if no federal cleanup funds were available to EPA to clean up the NRE site, OU1. Before we listed the site to the NPL, EPA did not expect to have the funds necessary to provide detailed description or cost estimates for the cleanup for each parcel in the OU1 footprint.

Now that the site is listed, EPA's next step is to create a remedial design for cleanup work at OU1. The remedial design will provide a detailed, parcel-specific, plan for how for the final remedy will be conducted on the site, including detailed cost estimates for all work described, and will fulfill the intent of the suggested soil management plan.

Please see discussion in Section 15 of the ROD, regarding EPA's listing of the NRE site to the NPL.

12) ***Comment***. *ODEQ recommends that USEPA revise the Plan to identify expanded excavation and capping exception criteria that could be used at specific locales within the NRE footprint. In order to further specify where these exceptions can be considered, ODEQ recommends that USEPA identify specific locations that are reasonably believed to be incidentally and/or locally contaminated within the current site boundary and stipulate these locales in the SMP. Specific parcels that ODEQ believes may be incidentally and/or locally contaminated include, but may not be limited to: BJ*(b) (6)*); AK*(b) (6)*; B*(b) (6)*; A (*(b) (6)*); 0 (Parade Grounds); N (Parade Grounds); AR*(b) (6)*; BP*(b) (6) *BK (*(b) (6)*; AS*(b) (6)*; AL*(b) (6)*; AI (*(b) (6)*; H*(b) (6)*; and, AQ*(b) (6)*. In addition, ODEQ believes that similar field discretion may also be warranted on parcels that have been subject to prior interim removals, such as BM*(b) (6)*; M (*(b) (6)*); and/or, other similar parcels/locales where USEPA has completed robust interim excavation of contaminated materials.*

EPA Response. EPA agrees that the ROD should identify the parcels that are reasonably considered those that have incidental or localized contamination. These designations have been provided in section 12.3.1.7 in the ROD.

EPA does not agree that <u>all</u> the parcels listed by the commenter can be considered incidentally and/or locally contaminated within the OU1 boundary (as defined in Section 12 of the ROD for the following reasons:

- Parcels A (b) (6), B (b) (6), H (b) (6), AK (b) (6), AR (b) (6), AS (b) (6), BJ (b) (6), and BP (b) (6) were found to be contaminated with MAG and/or AirCell asbestos contamination. As explained in 12.3.1.7 in the ROD, any portion of the site where MAG and/or AirCell has been found cannot be considered incidentally or locally contaminated. Since MAG and AirCell are friable forms of ACM, very little disturbance of these materials can release asbestos fibers into the air, and lead to contamination of nearby soils.

- Parcels A (b) (6), B (b) (6), H (b) (6), AK (b) (6), AS(b) (6)), AQ (b) (6)), AR (b) (6)), BJ (b) (6)) and BP (b) (6) had recurring evidence of ACM. That is, additional ACM was discovered after EPA conducted asbestos abatement on each of these parcels. EPA expects that the recurring emergence of asbestos contamination on these properties was probably due to frost heave bringing buried ACM to the ground surface. EPA has limited the use of the terms incidentally and/or locally contaminated areas to those areas where contamination have been found only once at any location.

- Parcels O (Parade Grounds) and N (Parade Grounds) are surrounded by properties that have been shown to have extensive MAG and/or AirCell contamination and that MAG and/or AirCell has been disturbed in the past. While EPA has not detected ACM on the parade ground portions of these properties, EPA cannot demonstrate that these parcels have not been contaminated with asbestos fibers. Unless significant, detailed (and costly) sampling on these parcels is conducted, EPA cannot ensure that these parcels would be protective to human health and the environment without excavation and capping of these parcels.

- AL (b) (6)) does not appear to have had MAG/AirCell; however, in 2008 MAG/AirCell was flagged directly on the apparent southeastern boundary line with MBK-E. Contamination and may be present on Lindell if property boundary changes following survey work. MAG/AirCell was historically present on AI (b) (6)).

Please see discussion in Section 12.3.1.7 of the ROD for a discussion of how EPA expects to address remediation on properties, such as BM (b) (6)) and M ((b) (6)), where EPA has already conducted removal actions.

13) ***Comment***. *Expansion of Plan exception criteria for excavation and capping standards would potentially facilitate prioritization of remedial actions within the NRE site boundary and within individual parcels. Increased flexibility for field judgment during implementation of the selected remedy would allow incidentally or locally contaminated properties to be more quickly restored to reuse without compromising protectiveness of the selected remedy or incurring additional cost for*

unnecessary work. In areas where USEPA may consider exception{s) to excavation and/or capping standards, ODEQ believes that protectiveness determinations would necessarily rely more heavily on monitoring, site inspection, and ICs elements of the remedy. Expanded exception criteria that are explicitly cited in the Plan would inform remedial design and remedial action scoping decisions on individual parcels. The development of expanded exception criteria to excavation and capping standards would allow areas within NRE that have no documented visual evidence of ACM to be managed in a different manner than areas with documented ACM, which would result in efficiencies not available in the current Plan.

EPA Response. Please see response to comments #9 and #12, above. EPA agrees that because of parcel-specific incidental and localized contamination determinations, there may be a few areas within the site boundary that will not be excavated or capped. These areas will be carefully inspected to ensure that no new ACM emerges after the remedy is implemented, as explained in 12.3.1.7 of the ROD.

14) ***Comment***. *I have read the Proposed Plan and support the Preferred Alternative to clean-up NRE, with one suggested change. According to the Preferred Alternative, all land within the OU1 boundaries would be treated according to Alternative 5B and Alternative 4 (excavation, backfill and recapping). On areas within the OU1 map outline that show incidental contamination, I think only the areas where contamination is shown to be or has been found should be treated by the excavation and recapping. In other words, the isolated areas found should be isolated for treatment, as well. The land areas between such locations where contaminants/materials have NOT been found should be left as is. For instance, two of my bare lots (Lots BJ and AK) are partially within the OU1 outline because of materials found in two isolated spots (a few pieces of surface debris on Lot BJ, building debris on and beneath the surface of Lot AK). However, the areas on these lots where materials were found are approximately 350 feet apart. It would not be appropriate to remove and recap the entire length and width between the two locations, as no contaminants/materials exist or have been found in that space.*

EPA Response. EPA agrees, please see response to comment #9, above.

Please note that the RI for OU1 currently shows that parcels BI, BJ, and AK are contaminated with ACM. Existing county records showing parcel boundaries on OU1 have been shown to not always be accurate. So, as part of EPA's remedial design process, survey work will be conducted to more precisely locate property boundaries. EPA will compare those boundaries to the GPS locations taken when ACM was found on the parcels during EPA's investigation.

15) ***Comment***. *Removing all the uncontaminated areas between marked contaminant locations on my properties and throughout the OU1 map would be unnecessarily disruptive and costly. Removal and recapping of specific spots where contamination was not contiguous would achieve the RG while saving a lot of money and unnecessary land disturbance. There should be some individual solutions allowed for individual situations throughout the site.*

EPA Response. EPA agrees, please see response to comment #9, above.

16) ***Comment***. *I believe that your minimum of 2' of ACM removal for all areas is excessive. In addition, your maximum of 4' may not be enough for some areas. I would suggest that the depth of the ACM*

removal be monitored during the removal process and only go as deep "as needed"... some areas might not need any removal, some may need more than 4 feet to get to the bottom of the debris.

EPA Response. Please see Section 12.3.1 in the ROD for discussion about why EPA expects to remove no less than 2 feet of soil on most portions of OU1.

Also, based on soil boring data collected at the site, it is clear that EPA will not be able to "get to the bottom of the debris" by excavating just 4 feet of contaminated soils. There are some locations on the site where contamination is reported to be as deep as 10 feet. EPA's Section 12.3.1 in the ROD provides a discussion about why a 4 foot maximum depth will be implemented at OU1.

In the OU1 ROD, EPA made a provision for the possible need to excavate more than 4 feet on a parcel, given unexpected site conditions. EPA agrees that this determination should be made on a parcel-specific basis.

17) ***Comment**. ODEQ also recommends a format revision to the Plan section titled Description of the Preferred Alternative. This section begins with three bullets (in order): Interior cleaning; Excavation of surface and subsurface soils; and, Capping of properties after soil excavation. We note however, that the narrative that follows these bullets does not align with the order of these three main elements. Specifically, the narrative mostly addresses excavation; includes only one paragraph related to capping (inserted in the middle); and, addresses interior cleaning last. ODEQ recommends reformatting this section for readability purposes. In addition, we recommend that USEPA consider an expanded narrative in this section for the capping element. Specifically, the reader would otherwise have to refer to other sections in the current Plan (i.e., page 10 - Alternative 4 and/or page 8 -- #2 minimum cap thickness) to access more information about the capping element of the Plan.*

EPA Response. The Selected Remedy has been organized as suggested. However, Interior Cleaning has been listed at the end of the description of the Selected Remedy, as this is a contingent action. Also, more information has been provided on capping Section 12 of the ROD, as suggested by the commenter.

18) ***Comment**. Certainly much of the asbestos containing piping of the NRE site is most likely secure and stable enough now, that it should remain buried as it currently is.*

EPA Response. EPA agrees that there are parcels on OU1 where buried steam pipe, a no longer used remnant of the old MRB heating system, presents no human health or ecological risk. In many areas – especially along Thicket Court - there is no evidence that the steam pipe, and its associated asbestos pipe wrap, have been disturbed. As long as the steam pipe and wrap remains undisturbed, the buried steam pipe will be left in place and no excavation or capping will be conducted. Please see Section 12.3.1.8 of the ROD for a discussion of how EPA expects to address buried steam pipe on OU1.

19) ***Comment**. The primary United States of America asbestos health hazard, appears to me to have been suffered of the miners and asbestos fiber workers, who inhaled and/or ingested asbestos fibers while originally acquiring the asbestos fibers and/or forming the asbestos fibers into human-industrially*

manufactured products. Asbestos fibers were selected for inclusion in manufactured products, because the fibers were fire resistant and very durable. Many of the asbestos fiber products produced over 50 years ago, are currently quite stable and providing safe, sturdy, wear-resistant service.

EPA Response. As long as asbestos containing products remain intact and sealed, there is little chance that they would present an unacceptable risk of exposure to asbestos fibers.

However, if the products are disturbed, broken up into smaller pieces or otherwise misused, asbestos fibers may be released to the air, posing an unacceptable risk to human health. Improper disposal of ACM containing building materials once used in the MRB, has led to an unacceptable risk of exposure to asbestos fibers at the site. The RI and Section 5.2 of the ROD explain more fully how the improper disposal of ACM has led to this unacceptable risk at OU1.

20) ***Comment****. $20,000,000 is an excessive investment for asbestos remediation of the NRE site. Excavation collection of and periodic manual collection of asbestos containing building materials from the NRE site, plus NRE site onsite burial of all asbestos materials so collected, shouldn't exceed $4,000,000, because most of the NRE site asbestos contamination is low risk material, and the NRE site asbestos remediation benefit doesn't justify greater financial investment than $4,000,000.*

EPA Response. Section 7 of the attached ROD confirms that the asbestos contamination found at OU1, if left unaddressed poses current and future unacceptable risks to human health and the environment.

EPA is required to follow a regulatory process in evaluating possible remedial alternatives for a contaminated site. Please see Section 10, Comparative Analysis of Alternatives, in the ROD for a discussion of the criteria EPA must use in this evaluation as prescribed by CERCLA. The selected remedy for OU1 must protect human health and the environment from exposure to unacceptable risks from asbestos and arsenic contamination and meet all ARARs. The selected remedy for OU1 is designed to protect the current and anticipated residential use at the site.

Cost is one of the criteria EPA used to evaluate and compare the remedial alternatives for the site. However, the value of the existing properties and how much can be recovered from the resale of those properties is not part of the evaluation as prescribed by CERCLA.

As explained in response to comment #2, above, manual collection of pieces of asbestos contamination at the site will not address the asbestos fibers in the soil. Also, as explained in response to comment #3, above, collection, excavation, transporting, capping, and otherwise handling materials that lie beneath the visible marker on properties marking where excavation has been conducted must be conducted by individuals who are trained in and licensed to handle asbestos containing materials.

21) *I have read the article in the local newspaper and have noted some of the comments of the other members of the public during the meeting at OTI on April 8, 2010.*

   a. ***Comment****. Dan Silver was quoted as saying that the potential value of the land after cleanup would be in the $10 million dollar range. Compared to a potential cleanup cost of $20 million that certainly doesn't lend itself to making good* *financial sense. However, the figure Silver quoted is current value and I could argue that after the cleanup, some decades down the road, the value of the property might equal the cleanup cost and eventually exceed that. Often the cost of doing business doesn't make financial sense in the short term, but in this case, we're talking about the long-term benefits. In addition, people living at these properties will no doubt improve them, increasing the value. Our experience living here has shown us that there is indeed a demand for these properties from local citizens.*

EPA Response. Thank you for input. Your comment has been noted. Also, please see response to comment #20, above.

b. ***Comment***. *Some other comments were that it makes more sense to simply buy out the current residents and fence the entire area and prevent public entrance. In the short term, that probably makes more financial sense as buying out the residents wouldn't come close to the cost of cleanup. My wife and I would be open to this option providing that the amount of the buyout was sufficient to compensate us for the fair market value as if it were cleaned up, including the improvements already made. This dollar amount would have to be negotiated in some way because current market conditions may not reflect the potential value of the property in the future. In addition, we would need to be compensated for the nearly 10 years of anguish we have endured during this process.*

EPA Response. Whether the site is used for a park or for residential use, EPA's Risk Assessment (part of the RI written for OU1) has documented that the short and long-term risk from the ACM is too great to leave the site as is.

Currently, if all of OU1 was fenced off and no one disturbed the contaminated soils within the fenced in area, the risk to nearby residents from windblown dust is acceptable. However, EPA must ensure that trespassers who ignore fencing and warning signs are also protected. The current risks of exposure are unacceptable to people who might disturb soil in a fenced off area by walking, running, riding bikes and all-terrain vehicles, etc.

The long-term risk to human health from the fenced area may cause unacceptable risks to nearby residents. In the future, the act of the wind blowing over the fenced area may be enough to expose nearby residents to unacceptable levels of asbestos in ambient air.

Please see Section 15 of the ROD for information on EPA's final listing of the NRE site to the NPL, and how listing makes the site eligible for federal funding to conduct remedial action (clean up) on NRE site.

22) *Comment.* *I would ask that the EPA commit to work with local officials and lending institutions in an effort to educate them about the safety of the area after the remediation plan has been implemented.*

EPA Response. Community awareness activities are an integral part of the land use controls within the Selected Remedy for OU1. The community awareness activities for the site include informational programs. EPA will make sure to stress that the OU1 community awareness activities include education programs, handouts, and brochures prepared for lenders and real estate agents discussing the long-term implications associated with a completed remedial action at OU1.

23) ***Comment***. *Innocent people have had their lives turned upside down. I have had the good fortune to meet outstanding, professional and compassionate people from many government agencies during this ordeal. Here is my question; do these agencies have the same character as the people who work for them? Will these agencies walk away from the people in the area or will they find a way to make this happen?*

EPA Response. As discussed in Section 15 of the ROD, the State of Oregon brought forward the NRE site for listing on the NPL on August 31, 2010. On March 10, 2011, EPA proposed listing the NRE site, and final listed the site on September 16, 2011. The State of Oregon used a one-time nomination to bring forward this site for listing. These actions by ODEQ and EPA reflect both ODEQ and EPA's concern for the health and welfare of the NRE community.

24) ***Comment***. *Whatever is decided by EPA, the current residents within the boundaries of the OU-1 area must be treated fairly, as they chose to live here in good faith prior to the discovery of the asbestos problem and have withstood many, many tests to that faith during this process. In our own case, we have consistently stood behind EPA and have helped in any way possible. We might be the only ally EPA has left in the area.*

EPA Response. EPA appreciates how difficult living on the NRE site has been for the residents of OU1 since asbestos contamination was found on your properties.

Please see discussion in Section 15 of the ROD, regarding EPA's listing of the NRE site to the NPL.

25) ***Comment.*** *I understand the EPA's mission is to protect people and the environment, not to preserve property value. The people who purchased property in the NRE subdivision did so without knowing the truth. As one of those people, I did nothing wrong. I invested money, time, sweat and blood to make a home for my family. My children grew up in this subdivision. I frequently wonder if their health is at risk because of my decision to build this home. My children did nothing to deserve this uncertainty. This has been a long and tortuous process. Lives have been affected in ways you will never understand.*

EPA Response. EPA appreciates how difficult living on the NRE site has been for the residents of OU1 since asbestos contamination was found on your properties.

Please see discussion in Section 15 of the ROD, regarding EPA's listing of the NRE site to the NPL.

26) ***Comment***. *Action must be taken to remove the asbestos problem in NRE. It will not fix itself, it will not just go away as some would like, and fencing/razor wiring/abandoning this 125-acre mountainous site is unrealistic and offers no remedy. Therefore, I also strongly support North Ridge as Oregon's one-time Superfund site selection. Being on the Superfund site appears to be the only way the Preferred Alternative for cleanup at NRE can be fully achieved. As far as the stigma of being on the Superfund List, it can't be any worse than having this 125-acre neighborhood labeled as*

asbestos-contaminated and unusable, as it is now. That designation affects not only NRE properties, but others in the vicinity. Klamath Falls should be known as a clean and healthy place to live and raise families; I urge Oregon authorities to place NRE on the slope factor list so this blight on Klamath County will be remedied.

EPA Response. Thank you for your comment. Also, please see response to comment #23 above.

27) ***Comment**. Any plan that provides an acceptable cleanup for this site is welcome, as long as the result is the issuance of the 'No Further Action Required' documentation that restores the value of the property as best as possible and allows the owners normal financing options as well as returning to valid county tax roles. As I have maintained in our informal conversations, guaranteeing 100% cleanup of asbestos fibers can never happen. The question is how close to 100% is acceptable and my opinion is that as long as the effort has been made to get the stuff as best as possible; that is good enough. Once the proposed plan has been accomplished I would suggest that the area is as clean (or cleaner) than many metropolitan areas where millions of people live and work on a daily basis.*

EPA Response. EPA's completion of the remedial action described in Section 12 of the ROD will result in a final action for the area included within OU1. Once the action is complete, EPA anticipates that most of the currently vacant homes on the site will be able to be re-occupied. Most importantly, the site will be protective to human health and the environment.

28) ***Comment**. I have concerns about how to remove the ACM around the trees, specifically the Ponderosa pines. Ponderosa pine root systems are fairly intolerant of disturbance and must be protected in some way. I have thought that mechanical ACM removal around the trees within a 5' radius, and then a pressure water 'spray' to the trunk of the tree makes sense. Some trees might be better off being removed completely, depending upon the condition of the tree itself.*

EPA Response. EPA agrees that cleanup of contamination around tree roots is a significant challenge. We also agree that the removal of some smaller trees on the site makes a lot of sense. However, taking out all the trees on the site is not EPA's intent. The remedial design will provide a detailed discussion of what trees will be removed from the site, and how EPA will cleanup around those trees that will be left standing on the site.

29) ***Comment**. Another option that hasn't been mentioned is to finish the cleanup effort at the sites that have been started (i.e.,* (b) (6) [redacted]*, and others) using the methods in the proposed plan, then issue the "No Further Action Required" documents for those property's so that the owners can be made whole and then fence the other contaminated properties to prevent public access. That would allow the current residents, such as ourselves, to now be able to stay, sell, refinance, or continue with the lives we set out to enjoy nearly 10 years ago when this all started. Granted, there is the potential for asbestos fibers from neighboring properties to become airborne through wind action, but I believe that to be exceptionally minimal.*

EPA Response. EPA's selected remedy is designed for long-term residential use of the area identified as OU1, and must provide long-term protectiveness to human health. EPA does not agree that leaving contamination in some areas and fencing them off would provide long-term protection to any resident living near the NRE site – especially those that live immediately adjacent to properties that are littered with friable asbestos (MAG or AirCell).

The commenter is correct in their understanding that, currently, the risk from exposure to airborne asbestos from contamination on neighboring properties is minimal (as long as the soil in that fenced area is not disturbed).

30) ***Comment.*** *I notice that when they took the dirt off of our property, they only went down one foot and brought back dirt, and when they took that material they put it up on the side of the hill up there, and if I am not mistaken after they got it all cleaned up they put this fabric on it, and then they put a couple of feet of dirt on top of that. So, right now they are only covering the contaminated material by just two feet of dirt right now with that material, and so I would like to suggest if that is the case why would we have to take up two feet of dirt if we can pretend that this is the contaminated area that is going to be there because the one on the hill up there is now safe. So why couldn't it be everywhere safe if it was just material was being brought in at least two feet of dirt to cover that entire area. We have one giant contaminated area that has been covered.*

EPA Response. The removal action taken by EPA on the commenter's property, parcel N, was an interim measure to remove as much visible contamination as possible from that parcel, and to minimize the risk to residents from exposure to ACM in contaminated soils. Without conducting extensive testing at the site, EPA must assume that asbestos fibers remain in the soils where removal actions have been conducted.

Please see Section 12.3.1 in the ROD for a discussion about why EPA expects to remove no less than 2 feet of soil on most portions of OU1 before capping.

Also, please see discussion in Section 12.3.1.6 of the ROD for a discussion of how EPA expects to address remediation on properties where removal action has already been conducted.

31. ***Comment.*** *It says here that they would excavate. The area would be backfilled, graded and capped with clean material. We didn't get clean material. We got dirt from the hill. That was 10 to 12 feet underground by the time it came to our property, and they piled a big pile of it on my neighbor's yard, and then we did some other work up there. They had a backhoe come up, and he was digging what I would call good dirt out, and he put a little pile of good dirt next to this big pile of clean dirt. There was a big work of difference. So I was going to suggest if they are going to save any of the homes up there and bring back any clean dirt to them, that they do find some other place to get the clean dirt outside of 10 to 12 feet underground somewhere.*

EPA Response. When EPA conducted its removal action on the commenter's property, parcel N, the material used for backfill was obtained from a borrow source located just outside the OU1 site boundary. Before the borrow source soils were used as backfill on parcel N, they were analyzed to ensure that the soils were not contaminated.

Section 12 in the ROD describes how OU1 will be capped and graded with materials excavated from offsite borrow sources. These borrow sources may be located nearby or adjacent to the OU1 site, and others may be located further away from OU1. Any soils that are excavated from borrow sources that will be used as cap or backfill material at OU1will be analyzed to ensure that the soils are not contaminated, and are suitable for use as backfill or capping. Please see section 12.3.3.2 for more information about sources and prior sampling of backfill and capping materials.

32. ***Comment.*** *Once this gets started and the money comes in, roughly how many years would it take to finish it up*

EPA Response. It is not possible to estimate the exact time of construction completion at this time, but EPA should have a better estimate once the remedial design work is completed following this ROD.

EPA proposed listing the NRE site to the NPL on March 10, 2011, and final listed the site on September 16, 2011. Now that the site is listed, NRE is eligible for federal funds that can be used to implement the remedy described in Selected Remedy, Section 12 of the ROD.

33. ***Comment.*** *The warehouse would need to be covered with metal to keep people from breaking any more of the siding off, causing further problems.*

EPA Response. EPA will consider what actions should be taken on the warehouse to ensure that the siding is not an additional source of asbestos contamination at the site. Options we might consider are: removal of siding, covering the siding, and even removal of the entire building (depending on its current condition). EPA will prepare a detailed plan for the cleanup of the warehouse property as part of our remedial design.

34) ***Comment****. Our property has barely any contamination on it and was one of the first properties cleaned up. It is contained in a small area at the way bottom of the property. If the plan requires we go down 2 to 4 feet on the whole 5 acres that would bankrupt us. Our lot is on a stiff incline and the excavation and replacement of dirt would be extremely expensive. What I am asking is that the property that only has a small amount of contamination should be addressed in only those areas only. I would like to ask for an extension so that I could receive documentation of the cleanup that the EPA has done on my property to see if any more clean-up would be necessary for my small spot. This has really got me scared at what this would do to our financial situation. With the economy the way it is we could not survive this. I am asking the board to please look at my situation carefully and consider just the areas that are of concern of contamination.*

EPA Response. The ROD describes the remedy for the NRE, OU1. The site is now eligible for federal funds to clean up the contamination on the site.

The property mentioned in this comment is parcel AS. Not all of parcel AS is contaminated. Only those portions of this parcel that are contaminated will need to be remediated. EPA and its contractors have inspected the AS property several times and have only found contamination on the northern portion of the parcel. The OU1 property boundary shown in Exhibit 12-1 includes only that portion of the parcel that is known to be contaminated. Only the portions of properties *within* the OU1 boundary will be excavated, and capped. Properties just *outside* the OU1 boundary will be monitored for the emergence of any new ACM exposed through frost heave, erosion, or other transport mechanisms.

EPA has excavated contamination from parcel AS as part of our removal actions conducted at OU1 in order to mitigate exposure threats from the ACM on the site until a final remedy can be implemented on the site. None of EPA's removal actions conducted to date were able to completely remove all the ACM on any property, including parcel AS, as asbestos fibers too small to be seen by the naked eye may remain in the soils. This is why each property within the OU1 site boundary will be excavated and then capped during EPA's remedial action to ensure that human and ecological receptors are protected from long-term exposure to asbestos.

35) ***Comment***. *I purchased the 2.24 acre parcel with the five-unit apartment complex from MBK in February of 1997. The MBK holdings were subdivided in 1990. This parcel was part of the subdivision but was located on the east side of Old Fort Road and was not part of the main portion of NRE. I was unaware of any problems from contamination at the time of purchase. It has been a long and painful process since the EPA investigation began in 2003. I was not informed by EPA of the degree of contamination on my parcel until I made inquiries after I received the listing letter proposing to add the parcel to the DEQ's Confirmed Release List (CRL) in November of 2007. I surmise from what I have learned that the apartments located on the east side of Old Fort Road were the Brig for the Marine Recuperation Barracks. The basic building is constructed from cinder blocks. I assume that the debris located on the north sloping slide of the building are the materials removed from the building during renovation from the brig to the five-unit apartment building. This parcel is zoned residential but the apartments were grandfathered in by Klamath County prior to my acquisition. It now seems that EPA's dealing with this parcel was an afterthought until I received the CRL listed and voiced my concerns.*

EPA Response. Parcel BM, and other parcels on the east side of Old Fort Road, have been subject to significant investigation for asbestos contamination.

In 2005, EPA conducted an investigation of the superficial ACM on properties east and west of Old Fort Road. Superficial ACM was visually observed in the area surrounding the apartments on property BM. In 2006, EPA conducted another investigation of the surficial ACM on properties east and west of Old Fort Road. More ACM was found on property BM. In 2005 and 2009 MAG and AirCell debris was found on parcel BM. Even though EPA conducted several investigations on parcel BM between 2005 and 2009, EPA did not understand the full extent of the contamination at parcel BM until we conducted our removal action on that parcel in the fall of 2008, and removed large quantities of asbestos-contaminated materials mostly from the steep slope just north of the apartment building.

36) ***Comment***. *In October 2008, excavation work was done on the north slope of the apartments to remove subsurface contamination. Kathy Parker, on-scene coordinator, explained in the email dated October 25, 2008, (INCL 1) the excavation area and the various depth levels needed to get to the bottom of the debris. Also, note para 2.6.2.1, apartments, from the Remedial Investigation Report dated January 2010. Kathy's email dated October 22, 2008, (INCL 1) outlines the planned work. It can be noted that the excavators went down at three depths of 12 inches, 24 inches, and 60 inches, (INCL 2), to get to the bottom of the debris. It seems that this area would be deemed to be clean since the various depths were excavated to reach the bottom of the debris. Please note that in some areas the depth excavated was only 12 inches to reach the bottom. I feel this should be acceptable even though the Proposed Plan recommends a depth of 24 inches. I strongly suggest that this be considered in the Soil Management Plan for the apartments, parcel #3509- 015AO-00307.*

EPA Response. EPA agrees with the commenter. Please see language in Section 12.3.1.6 regarding how remedy will be conducted on parcels where removal action has been conducted.

37) ***Comment***. *If it is true the homes are worth $9 to $12 million and the project is costing $20 million. Suggestions:*

   a. ***Comment***. *#1 Sell the houses to be moved or torn down & hauled off.*

EPA Response. As discussed in response to comment #20 above, EPA is required to follow a regulatory process in evaluating possible remedial alternatives for a contaminated site. The value of the existing properties and how much can be recovered from the resale of those properties is not part of this evaluation.

The selected remedy for OU1 is designed to protect human health and the environment from exposure to unacceptable risks from asbestos and arsenic contamination. Selling or tearing down the 18 vacant homes on OU1 will not address the current or future risk of exposure to asbestos contamination to those people who now live or work around the site.

Please see Section 15 of the ROD for information about EPA's adding the NRE site to NPL. Now that the site is listed, NRE is eligible for federal funds that can be used to conduct a remedial action on the site. When remedial action is conducted on the site, the 18 homes could be occupied once again (depending on the condition of the homes at that time).

If, for some reason, the site is not listed to the NPL, and no funds are found to address the contamination at the site, EPA anticipates that the homes will eventually need to be torn down or relocated to prevent the homes from becoming threats to public safety.

   b. ***Comment***. *#2 Bulldoze them down & haul the rubble off. It looks to me as either of the above options the contaminated ground would need to be sealed & covered with top soil. What would this cost?*

EPA Response. Please see response to tearing down homes and hauling rubble off in comment #37a above.

EPA agrees that even if the homes are taken down, OU1 would still need to be capped.

EPA evaluated the "capping only" alternative while conducting the Feasibility Study for OU1. Alternative #4, Capping of Contaminated Materials and Land Use Controls with Monitoring, was estimated to cost $12,798,000, but was not deemed as protective to human health and the selected remedy. Please see Section 10, Comparative Analysis of Alternatives, in the ROD for a table showing the significant differences between alternatives evaluated for the site.

   c. ***Comment***. *#3 Please just don't leave it as is & just fence it off! I still think all of the above is a waste of some beautiful homes. But as I asked all of them at the very first meeting of the area homeowners, I can't believe you people don't want to live here and save your houses and this nice housing area! Most of them didn't.*

EPA Response. Your comment has been noted. Also, please see response to comment 37a above about the final listing of the NRE site to NPL.

Now that the site is listed, NRE is eligible for federal funds that can be used for the remedy described in Selected Remedy, Section 12 of the ROD. EPA intends to use federal funding to implement the selected remedy described in Section 12, and does not intend to leave the site as is, and just fence it off.

d. ***Comment***. *#4 is my favorite an idea that I stated at that same meeting years ago, I would love to look down on a 9-HOLE GOLF COURSE. So sell the whole thing to someone, whom will either move the homes, tear them down for salvage or bulldoze them down and haul off waste. Then seal the ground & put 2 to 3 feet of topsoil on and build this 9 HOLE GOLF COURSE!*

EPA Response. During the FS process, EPA considered many alternatives for how OU1 might be remediated (cleaned up) and re-used. Alternative #3 detailed in the FS, and summarized in Sections 9 and 10 of the ROD, provided that receiver-managed parcels on OU1 could be used for other than residential use, such as the creation of a golf course.

To create a golf course at the site, the 18 now vacant homes would need to be taken down or moved off site, and the contamination on the site would still need to excavated and capped to ensure long-term protectiveness at the site. In addition, the creation of a golf course would involve additional earth moving to create proper contours for the golf course, extensive plantings and very high water use.

The creation of a golf course is beyond the scope of EPA's charge to protect human health and the environment. A golf course would be a more expensive alternative than the selected remedy described in Section 12 of the ROD and it would also be less implementable, given that no party has been identified to develop and maintain the property as a golf course.

38) ***Comment***. *I propose that the Soil Management Plan provide estimated costs for clean-up for each occupied parcel.*

EPA Response. Please see response to comment #11, above.

39) ***Comment***. *I feel that whatever is done on the occupied properties should leave them without the stigma of contamination since banks will not lend and value will be decreased. If this cannot be done, it may be best to buy out the existing willing owners, fence off the properties, and deal with the situation when money is available for clean-up. This is especially true for properties on the east side of Old Fort Road.*

EPA Response. EPA and state agencies have successfully remediated thousands of other contaminated sites across the county. After remediation (clean up) has been completed, these sites have been brought back to productive use, and private homeowners have been able to move on with their lives.

As discussed in Section 15 of the ROD, EPA has added the NRE site to the NPL, and the NRE site is now eligible for funds to conduct remedial action on the site and bring this site back to residential use.

40) ***Comment***. *I suggest that ODEQ continue to pursue all avenues, to include the Oregon Legislators and the possibility of being placed on the NPL, to clean up this site and deem it acceptable for lending and keeping property levels from being devalued.*

EPA Response. The NRE site was final listed to NPL on September 16, 2011. Please see discussion in Section 15 of the ROD, regarding EPA's listing of the NRE site to the NPL.

41) ***Comment.*** *EPA is proposing a procedure that, according to my figures, is going to move 500,000 yards of material, and somehow you are going to contain the product you are trying to protect us from. I live less than a mile away, and in jest I would say I will monitor the air when you do that so when it blows downwind I can come back and visit you with my lawyer.*

EPA Response. EPA will use approaches that are in full compliance with National Emissions Standards for Hazardous Air Pollutants (NESHAP) and the Occupational Safety and Health Administration's Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations and will minimize the release of fibers into the air, such as wetting materials before and during handling, covering loads, and monitoring the air during remedial activities.

EPA has monitored the air immediately outside work zones during all removal activities at OU1, and has confirmed that air quality outside work zones was protective of human health.

42) ***Comment.*** *It is absolutely absurd not to consider Obama's cap and trade or in this case cap and fill, not move the material layer. You must have a barrier that you can lay on the ground one foot or 2,000 yards to cover this site per acre, and you as you dig this out you are going to create 25% more volume.*

EPA Response. Please see response to comment #7, above, for discussion of why material needs to be excavated from the site before a cap installed. EPA did consider the expansion of excavated materials after they are removed for volume calculations within the Feasibility Study (FS).

During the FS process, EPA considered many alternatives for how OU1 might be remediated (cleaned up) and re-used. Alternative #4 provided an option for only capping and monitoring the site. Please see the FS for a detailed evaluation of the alternatives considered, and Section 10 of the ROD, for a comparison of the significant differences between the alternatives considered.

43) ***Comment.*** *Pay off the current owners, put a good fence down the main Old Fork Road and close off the property or make an environmental park.*

EPA Response. Whether the site is used for a park or for residential use, EPA's Risk Assessment (part of the RI written for OU1), has demonstrated that the short and long-term risk the ACM poses is too great to leave the site as is.

Please see the response to Comment #21 for additional information.

The long-term risk to human health from the fenced area may cause unacceptable risks to nearby residents. In the future, the act of the wind blowing over the fenced area may be enough to expose nearby residents to unacceptable levels of asbestos in ambient air or to transport pieces of ACM or asbestos fibers to locations where people could contact them.

44) ***Comment.*** *It seems like everything has primarily been disturbed already, and it seems like it would make a lot more sense to simply cover it and not disturb it further.*

EPA Response. Please see response to comment #7 above.

45) ***Comment.*** *It seems like it would be best to simply cover this over, buy the homes out, cover it over, don't disturb it anymore and put a fence around it.*

EPA Response. Please see response to comment #43, above. Also, please see section 12.3.1 in the ROD for why excavation is needed at OU1. If EPA could assure restricted access to OU1 in perpetuity, taking down the homes, capping the property, and fencing might be a viable option for the site, at least for the short term. However, EPA's remedy is designed to make OU1 protective for short and long-term residential use. With residential use, simply covering the contamination will not ensure protectiveness for the homeowners who will live in nearby homes.

46) ***Comment.*** *If I was EPA, and if I looked at our United States government, who is broke, you are never going to get the money. I don't even know why we talk about the possibility.*

EPA Response. Please see discussion in Section 15 of the ROD, regarding EPA's proposed listing of the NRE site to the NPL.

47) ***Comment.*** *The banks are not going to loan on this property. I have great working relationship with Bend ODEQ who has done enormous amounts to help us on site work, but you have spent $9 million. You have tried the original developers of the property. You have taken their money. It is gone. And I think you have absolutely nothing to show for it.*

EPA Response. Of the $11 million recovered from the developers of the NRE residential subdivision, and other parties involved at the site, $8.5 million was used to buy out and relocate property owners who were living on top of the widespread contamination found at OU1. These families, including children under the age of 18, are now protected from immediate health risks from asbestos fibers.

EPA conducted several removal actions to mitigate the release of friable asbestos at OU1, and to remove tons of contaminated soils and debris from occupied home and those properties immediately adjacent to those homes. EPA has also created a repository for that contaminated soil, and capped that repository so it would cause no additional threat to human health and the environment.

EPA has also conducted a detailed study of the contamination at the site to determine the nature and extent of the contamination at OU1, and the risks associated with that contamination. The conclusion of that study is documented in this Record of Decision.

Finally, EPA has final listed the NRE site to the NPL. Please see Section 15 of the ROD, for more information about EPA's listing of the NRE site.

48) ***Comment.*** *You have a great map of engineering. You have all these particular sites where you can say it is here, but you are going to remove it, and somehow you are going to do so and not affect the environment. I am blown away by that analogy.*

EPA Response. Please see response to comment #41 above.

49) ***Comment.*** *If you proceed and get a waiver on prevailing or Davis Bacon wages, you will take 15 to 35 percent off the cost of the work you are anticipating doing. That will be one way, at least, justifying to save $6 million off the top, and you will have a line-up of bidders to do it.*

EPA Response. Pursuant to the 1931 Davis-Bacon Act, Title 40 U.S.C. 276(a), EPA must pay the prevailing wage rates to all labors and mechanics on federal or federally assisted construction contracts. No waiver is available for this requirement.

50) ***Comment.*** *Take a very hard look at the potential value of this property which in no way will see that $8 million figure. You apparently are not aware of the economic situation of this state which is virtually broke, also.*

EPA Response. Please see response to comment #20.

51) ***Comment.*** **[Part #1]** *Is it approximately 2% of MAG that is the one in one thousand parts?* **[Part #2]** *In 60 years it remains below EPA standards. Primarily why do you think it will change now given the removal of the original buildings and the reconfiguration and rebuilding of the site?*

EPA Response to part #1 of comment: As summarized in Section 7 of the ROD, the current risk from exposure to the easily friable asbestos at the site (MAG and AirCell) is 1E-03 (or, one in one thousand). While MAG and AirCell constituted only a small percentage of the construction material used to build the MRB, the MAG and AirCell have been improperly disposed of on and in the soils over much of OU1. Because these asbestos containing materials are very friable (i.e., easily crumble), they have degraded and continue to release asbestos fibers into OU1 soils, too small to be seen by the naked eye. So, while the MAG and AirCell originally represented just a small fraction of the ACM used on the site, it currently poses the greatest risk to human health and the environment at OU1.

EPA response to part #2 of comment: If the Marine Barracks buildings were still in use and the asbestos containing building materials in them were still intact, EPA might not be concerned about human health risks at OU1. The risk of asbestos exposure at OU1 has been caused by the demolition and improper disposal of ACM into the soils and subsoils at OU1.

Please see the RI and Risk Assessment for OU1 for much more detail about what caused the problem at the site, and the current and future risks posed by the ACM at the site.

52) ***Comment.*** *I don't know if I understand. You said this is a culmination of seven years of what but not how, and I was wondering how you came to a determination of $21 million if you don't know how it is going to be done.*

EPA Response. EPA's Proposed Plan proposed what cleanup work needs to be done, but did not determine how the work will be funded.

Please note that the NRE site has been final listed to the NPL, as discussed in Section 15 of the ROD. The site is now eligible for federal funding to conduct the remedial action (clean up) on the site.

53) ***Comment.*** *How much has been spent already by the U.S. and the State of Oregon today is $9 million EPA, or is it ODEQ and EPA?*

EPA Response. As of this writing, EPA has spent $9,878,258.16 on our work on OU1. Of this, more than $3 million came from potentially responsible parties for the site. ODEQ has spent a total of $557,342.04.

54) ***Comment.*** *How often do you see asbestos coming to the surface in areas that haven't been disturbed by the road building or home building in the area?*

EPA Response. No new roads or homes have been built on OU1 since the late 1990s. However, EPA has documented observations of new ACM coming up to the surface at OU1 every year since 2003, when EPA became involved in the emergency removal and investigation of contamination at the site.

55) ***Comment.*** *How many buildings in your estimation are still in existence in Oregon that have has similar construction in the era of asbestos that we talked about earlier? You said when they weren't disturbed that essentially there is no problem, but how many have been remodeled, and what are we looking at in the future for the State of Oregon for buildings to have asbestos mitigation?*

EPA Response. Because of the recognized health hazards of asbestos, EPA is concerned about all potential human exposures to asbestos. Because of these hazards, there are regulations in place, including 40 CFR Part 61, to ensure that all major remodeling activities are carried out properly and safely. Compliance with these regulations, in existence since the 1970s, might have prevented the contamination at OU1 and the need for the cleanup described in this ROD.

56) ***Comment.*** *What geologic material is the asbestos found i[n]? Is it unconsolidated dirt? You mentioned that there are fine particles that have gone into the bedrock and fissures and cracks?*

EPA Response. The asbestos at the site has been buried and mixed with the soils and sub-soils that the old Marine Barracks were built upon. Please see Section 2,Site Background and History, in the ROD, for more information about how the asbestos contamination was distributed over the site.

More information about the Geology of OU1 can be found in the January 18, 2010, NRE RI Report, pages 3-2 and 3-3.

57) **Comment.** *How do you know that some of this hasn't already been transported with runoff since it is one of the higher areas in the basin either into Plum Valley or down into the Klamath basin, and have you checked that?*

EPA Response. EPA has conducted a full investigation the nature and extent of the contamination found at OU1. The maps provided in our January 19, 2010, RI report show GPS locations of areas where ACM and arsenic (and other) contamination were found at the site. EPA has no evidence that the ACM has migrated any further than the site boundary provided in the RI report, but will continue to monitor the site and the boundary to watch for the emergence of any new ACM exposed through frost heave, erosion, or other transport mechanisms.

58) **Comment.** *Where would you propose to put the dirt that is removed, and what is the containment system comprised of?*

EPA Response. As described in the Proposed Plan and the Selected Remedy in the ROD, EPA would create one or more onsite repositories on OU1, similar to the existing ACM repository EPA created in September 2008, located in the southwest portion of OU1 (the majority of the repository is located on OU1 parcel AG.) The repositories will permanently contain asbestos and arsenic contaminated soils and debris removed from each parcel on OU1. The repositories will be graded and covered with a frost protective cap. EPA will define the specific requirements for these onsite containment areas as part of the remedial design process.

59) **Comment.** *Is there a possibility that Klamath County will be forced to pay for the cleanup? If there is no money in the state or federal coffers for it, is there going to be some sort of enforcement of Klamath County doing it?*

EPA Response. In general, EPA cannot comment on prospective enforcement matters. However, EPA notes that this site has already been subject to significant enforcement activity, resulting in the 2006 settlement, and has been proposed for NPL listing, putting the site on a path to federal funding.

60) **Comment.** *What is the chance after cleanup that further conditions will be placed on the site, and who would be responsible for these costs if you do everything you think is right and all of a sudden more of this stuff comes up that you weren't anticipating?*

EPA Response. EPA expects that we will need to place conditions on the site, called long-term institutional controls (ICs), monitoring and access controls to the site to provide protection of human health to the extent possible and to maintain the remedy's long-term protectiveness. The remedial design will better define how these restrictions will be managed.

In addition to regular site monitoring, EPA will carefully evaluate the effectiveness of the cleanup every five years and will make adjustments to the ROD for any new or unanticipated conditions with an Explanation of Significant Differences.

61) **Comment**. *In regards to the parcel labeled BP This area was not part of the NRE, but was an area contaminated by the contractors of the original Marine Barracks and Hospital ,who illegally dumped*

their building wastes on areas BP and BQ. As owners of the BP area, we would like to thank you for the cleanup. While this particular area of the piece would hardly be buildable sites because of its rocky nature and the natural drainage that traverses the area, at least it will not be an eyesore nuisance for any possibility of future development. We would appreciate any official acknowledgement of your clean-up. The adjacent areas were never built on or contaminated.

EPA Response. EPA conducted an extensive removal action on the properties identified in this comment in the fall of 2008, but clean up is not complete. Additional contamination remains on the BP and BQ properties and the properties still need to be capped to be in full compliance with the final remedy for OU1.

The definition of "site" (under CERCLA) is any area where hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located. Since asbestos of the type found at OU1 has come to be located on parcels BP and BQ, these parcels have been included in OU1 and will be remediated in the same way as the rest of the properties at OU1.

62) ***Comment.*** **[Part #1]** *Looking at page 5 of this handout, it says on the second column: "Risks from soil disturbances at most locations are within EPA's acceptable risk range of 1 in 10,000 to 1 in a million." That is a 100-fold range.* **[Part #2]** *And the later in the same column it says "The magnitude of the increase in free fibers (and hence the risk) is likely to be on the order of 100 to 1,000 fold. That is, again, a 100-fold range". In the science that I have been associated with, that is a pretty broad range, and I wonder if you have done any studies on the statistical confidence of your assertions that your plan will make any difference and any studies of the statistical confidence that if you do nothing disease caused by asbestos will happen because those ranges in a scientific paper are just unacceptable, but I realize this is not a scientific paper, but that kind of research to me is way over the top. We need more specific, and perhaps you are being constrained by legislative congressional action. When you start talking about 100-fold ranges, scientifically that is usually pretty absurd.*

EPA Response to part #1 of comment: As explained in Section 7 of the ROD, EPA normally conducts investigations on contaminants that fall within or greater than our acceptable risk range. In general, EPA considers excess cancer risks that are below 1E-06 to be so small as to be negligible, and risks above 1E-04 to be sufficiently large that some sort of response action is desirable. Excess cancer risks that range between 1E-04 and 1E-06 are generally considered to be acceptable (EPA 1991b), although this is evaluated on a case by case basis. EPA must meet the state ARAR of 1E-06 for our cleanup of asbestos at OU1.

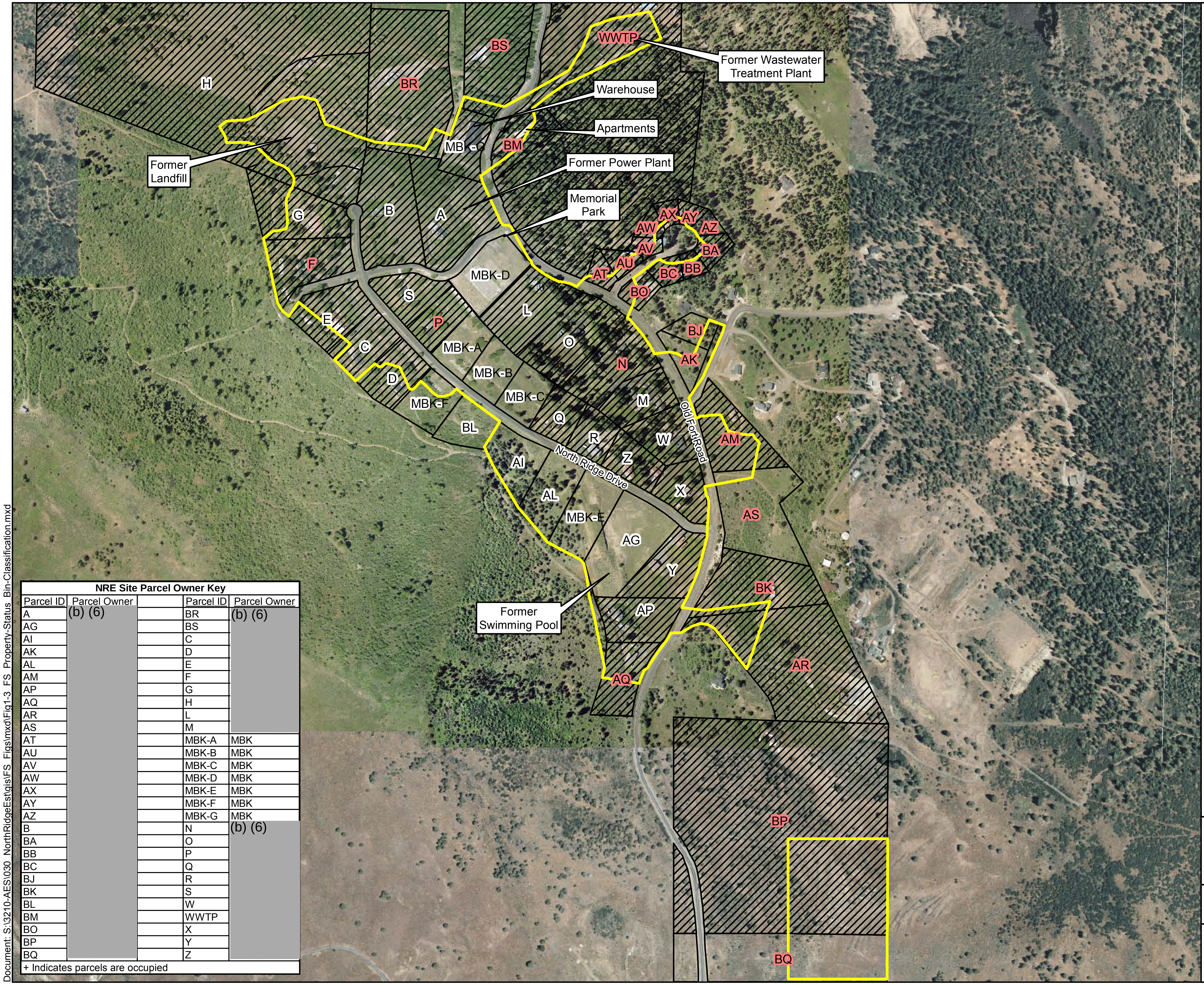
EPA Response to part #2 of comment: Please see EPA's Risk Assessment for OU1 which provides detailed explanations of the steps used to conduct the risk assessment, including: background information, the basis for concern, the exposure model, a toxicity assessment, quantification of exposure and risk, and a listing of uncertainties. The increase in free fibers in the future was based on field observations of various types of ACM weathering at the site and additional lab studies that showed the extent to which fibers could be released from ACM when materials are crushed. Some of this crushing activity has occurred on site when construction and grading activities were conducted. Additionally, children had been reported to pick up and break apart pieces of ACM to use as a chalk-like material. Given the field and laboratory observations of the breakdown of ACM, EPA estimated that increased releases of fibers of 100 to 1,000 fold in the future were possible.

63) ***Comment.*** *I hope and wish that EPA and ODEQ together will take strong consideration of how the property values will be affected through the cleanup as well. Our primary concern for NRE is human health first, but also all the residents up there have a strong interest in their property values and how they are affected. Currently, the majority of the tests that I have been – that I have seen air monitoring and all that, the risk assessments are quite low and less disturbing into the MAG insulation, that sort of thing. So my – I would like to make comment that whatever is proposed it – if we do a $50 million cleanup up there, but yet the residents cannot be in a position to sell their homes, because a bank will not lend money on them, it would be a very – money not spent wisely. Also, I would like to make comment. I don't know if it is EPA's or DEQ's position, but the banks, I think, have a very strong stigma about the area up there and are adamant, you know, that it is a disaster, but I think EPA and ODEQ are in a position that could be very effective. If a cleanup is done and you feel confident that it is in a position that is very livable and could be – money could be lent with institution controls, this and that, that it could be a workable situation. I think you guys could be a very big influence on how banks look at that property.*

EPA Response. EPA understands the Commenter's concerns about property values and how banks may view this property. As mentioned above, the NRE site has been proposed to the NPL. If listed, the site will become eligible for federal funds to clean up the contamination on the site. EPA and state agencies have successfully remediated thousands of other contaminated sites across the county. After the cleanup has been completed, these sites have been brought back to productive use, and private homeowners have been able to move on with their lives. Recognizing concerns that some parties may have regarding lending on or purchasing of properties subject to cleanup requirements, the Superfund law was amended in 1996 and 2002 specifically to provide liability protections to lenders and prospective purchasers who abide by certain conditions.

Appendix A

Parcel Status Map



NRE Site Parcel Owner Key

Parcel ID	Parcel Owner	Parcel ID	Parcel Owner
A	(b) (6)	BR	(b) (6)
AG		BS	
AI		C	
AK		D	
AL		E	
AM		F	
AP		G	
AQ		H	
AR		L	
AS		M	
AT		MBK-A	MBK
AU		MBK-B	MBK
AV		MBK-C	MBK
AW		MBK-D	MBK
AX		MBK-E	MBK
AY		MBK-F	MBK
AZ		MBK-G	MBK
B		N	(b) (6)
BA		O	
BB		P	
BC		Q	
BJ		R	
BK		S	
BL		W	
BM		WWTP	
BO		X	
BP		Y	
BQ		Z	

+ Indicates parcels are occupied

Legend

OU1 - North Ridge Estates

Developed Parcels

Undeveloped Parcels

A Receivership - 29 parcels

A Private Ownership - 27 parcels

N

0 300 600 900 1,200 1,500

Feet

1 inch = 600 feet

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon
South FIPS

Data Source(s):
May 2005 Aerial Photo

March 2010

This product is for informational purposes and may not have been prepared for legal, engineering or surveying purposes. Users of this information should review or consult the primary data and information source to ascertain the usability of this information.

Parcel Status Map

Figure A-1

CDM

Document: S:\3210-AES\030 NorthRidgeEst\gis\FS Figs\mxd\Fig1-3 FS Property-Status Bin-Classification.mxd

Appendix B

How to Sample Indoor Air and Dust

Appendix B – How to sample indoor air and dust

The selected remedy includes a contingency for Interior Cleaning, if necessary. Under current conditions, risks to residents from indoor air are estimated to be 7E-07 (below EPA's risk range of 1E-06 to 1E-04 and ODEQ's risk level of 1E-06). Therefore, no remedial action is necessary inside homes at this time.

After excavation and backfill/capping has been completed on each parcel, indoor air and dust sampling will be conducted to ensure that indoor air remains protective of human health.

For indoor air sampling, three to five ambient air samples will be collected using stationary air monitors placed inside each OU1 residence. Each sample will be analyzed by TEM using ISO 10312 counting rules (ISO 1995). If indoor air sampling results show risks in any residence that exceed 1E-04, then indoor cleaning will be conducted in that residence.

For indoor dust sampling, dust samples will be taken in OU1 residences to identify residual reservoirs of asbestos fibers that could pose unacceptable risks. This is being done to provide an extra measure of protectiveness, for buildings where analyses of indoor air samples indicate risks below 1E-04. Dust samples will be collected using a microvacuum consistent with ASTM D5755. Average dust concentrations for each home will be compared to site-specific criteria for asbestos as described below.

If indoor air risk is determined to equal or exceed the 1E-04 level that triggers remedial action at OU1, or indoor dust exceeds criteria established in this Appendix, indoor cleaning will be performed. The target cleanup goal will be established at the 1E-06 level required by the Oregon ARAR.

If implementation of the contingency is determined to be necessary based on this sampling of indoor spaces after soil remediation is completed, EPA will make a post-ROD change and document it appropriately, such as by publishing an explanation of significant differences to reflect this determination. This post–ROD change will indicate which residence(s) will need to be cleaned, and will share information with the public about how indoor cleaning will be conducted.

Final results from indoor air and dust sampling will be documented, and that record will be placed in the North Ridge Estates, OU1, site file.

Interior cleaning, if needed, will require temporary relocation of any residents occupying the structure because of the disturbance of asbestos fibers created by the cleaning.

Final results from this aggressive indoor air sampling will be documented, and that record will be placed in the North Ridge Estates, OU1, site file.

<u>Cleanup Levels for Asbestos</u>

Ambient air samples are used to assess long-term ongoing exposures that may occur at the site. As such, ambient air samples collected to ensure that risks are acceptable should be compared to the criteria presented below:

A risk-based air action level for asbestos in air may be calculated by rearranging the standard risk equation to compute the concentration of asbestos in air that corresponds to a specified risk level for a specified exposure scenario of concern as follows:

Action Level for Asbestos in Air (f/cc) = Target Risk

[IURLTL • TWF]

Using the standard Superfund residential exposure scenario (EPA, 1989), a cleanup level for asbestos in air can be calculated using the time weighting factor for Baseline Residential

Exposures (TWF = 350/365), the age 0-30 IURLTL (Table E-4, http://www.epa.gov/superfund/health/contaminants/asbestos/pdfs/framework_asbestos_guidance.pdf), along with the target risk levels of 1x10-6:

Air Cleanup Level for Baseline Residential Asbestos Exposures (f/cc)

= 1x10-6 ÷ [0.17 (f/cc)-1 • 0.96]

= 0.000006 f/cc

For indoor dust samples, any PCME fibers detected in dust samples at a concentration greater than 200 s/cm2 will be assumed to indicate the presence of asbestos in the home that could pose a risk to human health. Samples collected in 2007 in several homes within the former base footprint found no PCME asbestos fibers above the analytical sensitivity of about 200 s/cm2.

Appendix C

Summary of Compliance with Federal and State Applicable or Relevant and Appropriate Requirementes

Summary of Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered Information (TBCs) North Ridge Estates (NRE) Site

Statutes, Regulations, Standards, or Requirements	Citations or References	ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
National Historic Preservation Act (NHPA) National Register of Historic Places Determinations of eligibility for inclusion in the National Register of Historic Places Protection of historic properties Requirements for environmental information documents and third-party agreements for EPA actions subject to NEPA	16 United States Code (U.S.C). 470 36 Code of Federal Regulations (CFR) 60 36 CFR 63, 36 CFR 800 40 CFR 6.301(b)	Applicable	This statute and implementing regulations require federal agencies to take into account the effect of this response action upon any district, site, building, structure, or object that is included in or eligible for the National Register of Historic Places (generally, 50 years old or older).	If cultural resources on or eligible for the national register are present, it will be necessary to determine if there will be an adverse effect and, if so, how the effect may be minimized or mitigated, in consultation with the appropriate State Historic Preservation Office. The unauthorized removal of archaeological resources from public or Indian lands is prohibited without a permit and any archaeological investigations at a site must be conducted by a professional archaeologist.		✓	
Archaeological and Historic Preservation Act Requirements for environmental information documents and third-party agreements for EPA actions subject to NEPA Protection of archaeological resources	16 U.S.C. 469 40 CFR 6.301(c) 43 CFR 7	Applicable	This statute and implementing regulations establish requirements for the evaluation and preservation of historical and archaeological data, which may be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.			✓	

Statutes, Regulations, Standards, or Requirements	Citations or References	ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
Fish and Wildlife Coordination Act Responsible official requirements Rules implementing the Fish and Wildlife Conservation Act of 1980	16 U.S.C. 661 et seq., 40 CFR 6.302(g) 50 CFR 83	Applicable	This statute and implementing regulations require coordination with federal and state agencies for federally funded projects to ensure that any modification of any stream or other water body affected by any action authorized or funded by the federal agency provides for adequate protection of fish and wildlife resources.	If the remedial action involves activities that affect wildlife and/or non-game fish, federal agencies must first consult with the USFWS and the relevant state agency with jurisdiction over wildlife resources.		✓	
Endangered Species Act (ESA) Responsible official requirements Endangered and threatened wildlife and plants Interagency cooperation-Endangered Species Act of 1973, as amended	16 U.S.C. 1531 40 CFR 6.302(h) 50 CFR 17 50 CFR 402	Applicable	This statute and implementing regulations provide that federal activities not jeopardize the continued existence of any threatened or endangered species. ESA Section 7 requires consultation with the United States Fish and Wildlife Service (USFWS) to identify the possible presence of protected species and mitigate potential impacts on such species.	If threatened or endangered species are identified within the remedial areas, activities must be designed to conserve the species and their habitat. To date no threatened or endangered species have been identified in the area of the site.		✓	
Migratory Bird Treaty Act List of Migratory Birds	16 U.S.C. 703, et seq. 50 CFR 10.13	Relevant and Appropriate	Makes it unlawful to “hunt, take, capture, kill,” or take other various actions adversely affected a broad range of migratory birds, without the prior approval of the Department of the Interior.	The selected remedial actions will be carried out in a manner to avoid adversely affecting migratory bird species, including individual birds or their nests.		✓	
Clean Air Act National Emission Standard for Asbestos	42 U.S.C. 7401, et seq. 40 CFR 61, Subpart M	Applicable	National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Asbestos	The selected remedial actions will be carried out in a manner that will comply with all the National Emission Standard for Asbestos as required under NESHAP.	✓		✓

Statutes, Regulations, Standards, or Requirements	Citations or References	ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
Standard for demolition and renovation	40 CFR 61.145 (c)	Relevant and Appropriate	This requirement establishes detailed standards and specifications for demolition and renovation. The regulation provides detailed procedures for controlling asbestos release during demolition of a building containing “regulated-asbestos containing material (RACM)”.	Applicable to building demolitions that will occur as part of the removal if certain threshold volumes of RACM are disturbed. The dust control portions of the regulations are relevant and appropriate for soil disturbance activities and for asbestos contaminated material that does not meet the strict definition of RACM.			✓
Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations	40 CFR 61.150	Relevant and Appropriate	Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations. This regulation provides detailed procedures for processing, handling, and transporting asbestos containing waste material generated during building demolition and renovation (among other sources).	Applicable to RACM generated by building demolitions that will occur as part of the remedial action. Relevant and appropriate for soil disturbance activities and for asbestos contaminated material that does not meet the strict definition of RACM.			✓
Standard for waste disposal for asbestos mills	40 CFR 61.149	Relevant and Appropriate	Detailed procedures and specifications for handling and disposal of asbestos containing waste material generated by an asbestos mill.	Requirements under this regulation are considered relevant and appropriate to the asbestos containing material (ACM) disposal. It is not applicable because the facilities do not meet the regulatory definition of an asbestos mill.			✓
Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations	40 CFR 61.151	Relevant and Appropriate	Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations. Provides requirements for covering, revegetation, and signage at facilities where RACM will be left in place.	Requirements under this regulation are considered relevant and appropriate to asbestos containing soils and/or debris left in place. It is not applicable because the facilities that are part of this remedial do not meet the facility definitions in the regulation.			✓

Statutes, Regulations, Standards, or Requirements	Citations or References	ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
Occupational Safety and Health Act related regulations- asbestos (construction industry) non-mandatory guidance	29 CFR 1926.1101 - Appendices B, F, and H through K	To Be Considered	Provides non-mandatory guidance on safety and health procedures as well as sampling and analysis procedures for occupational exposures to asbestos by construction workers covered by the Occupational Safety and Health Act.	No Comments.	✓		✓
United States District Court, District of Oregon. consent decree in the matter of Burns v. MBK v. United States	No. 03-30210-H0, Relating to the North Ridge Estates Site (January 20, 2006)	To Be Considered	Provides the consent decree between Burns, MBK, and the United States Department of Justice. The consent decree includes legal rulings and agreements regarding establishment of the NRE receivership.	This information may be useful in determining legal status of the NRE receivership and may provide information useful in selection of a remedy.		✓	✓
Institutional Controls: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls at Superfund and Resource Conservation and Recovery Act Corrective Action Cleanups	EPA 540-F-00-005, OSWER 9355.0-74FS-P, September 29, 2000	To Be Considered	Provides guidance for selection or approval of institutional controls as part or all of a remedy.	No Comments.		✓	✓
Memorandum to Superfund National Policy Managers, Regions 1-10- clarifying cleanup goals and identification of new assessment tools for evaluating asbestos at Superfund cleanups	Cook, Michael B. August 10, 2004, Office of Superfund Remediation and Technology Innovation, EPA	To Be Considered	This memorandum provides EPA national policy for assessing and evaluating asbestos at Superfund sites.	This information may be useful for determining appropriate monitoring and inspection techniques for asbestos at the site.	✓		✓
U.S. Environmental Protection Agency Region 10 Superfund, RCRA, LUST, and Brownfields Clean and Green Policy	EPA Region 10, August 13, 2009	To Be Considered	Describes the policy developed by EPA Region 10 to enhance the environmental benefits of federal cleanup programs by promoting technologies and practices that are sustainable.	This information may be useful for determining appropriate means and methods for conducting remediation at the site in a sustainable manner.			✓

Statutes, Regulations, Standards, or Requirements	Citations or References	ARAR Determination	Description	Comment	Chemical -Specific	Location -Specific	Action-Specific
State of Oregon ARARs and TBCs							
Indian Graves And Protected Objects Historic Property Historic Preservation Plan Preservation Of Property Of Historic Significance Oregon Property Management Program For Historic Sites And Properties Archaeological Objects And Sites	Oregon Revised Statutes (ORS) 97.740-97.750 ORS 358.475 ORS 358.612 ORS 358.622 ORS 358.635 ORS 358.680 ORS 358.905	Applicable	Governs Oregon Historical Preservation. Analogous to Federal Historic Preservation Act (36 CFR; Parts 60 and 61).	Substantive requirements would be applicable for on site actions.		✓	
Historical Preservation Officer Archaeological Permits	Oregon Administrative Rules (OAR) OAR 736-050 OAR 736-051						
Archaeological Sites and Historical Material	ORS 390.235	Relevant and Appropriate	Regulates excavation or alteration of an archaeological site on public lands or removal from public lands any material of an archaeological, historical, prehistorical, or anthropological nature.	Although no public lands currently exist at NRE, this statute may be relevant and appropriate to activities conducted on properties with similar land uses such as a common use or park area.		✓	

Statutes, Regulations, Standards, or Requirements	Citations or References	ARAR Determination	Description	Comment	Chemical -Specific	Location -Specific	Action-Specific
State of Oregon ARARs and TBCs							
Air Quality General Emission Standards	ORS 468A OAR 340-226-0100	Relevant and Appropriate	This requirement states that highest and best practicable treatment and control of air contaminant emissions must in every case be provided so as to maintain overall air quality at the highest possible levels and to maintain contaminant concentrations, visibility reduction, odors, soiling and other deleterious factors at the lowest possible levels.	No Comments.		✓	
Air Quality Visible Emissions and Nuisance Requirements	ORS 468A OAR 340-208-0200 OAR 340-208 -0210	Relevant and Appropriate	This requirement establishes detailed standards and specifications which prohibit any handling, transporting, or storage of materials, or use of a road, or any equipment to be operated, without taking reasonable precautions to prevent particulate matter from becoming airborne. These are rules for "special control areas" or other areas where fugitive emissions may cause a nuisance and control measures are practicable.	No Comments.		✓	
Air Quality Noise Control Regulations	ORS 468A OAR 340-035-0035	Relevant and Appropriate	Sets noise standards for equipment, facilities, operations, or activities including the storage or disposal of waste products.	No Comments.		✓	
Air Quality Asbestos Emission Standards And Procedural Requirements	ORS 468A OAR 340-248-0270 OAR 340-248-0280 OAR 340-248-0290	Relevant and Appropriate	This requirement establishes detailed standards and specifications for any situation where a potential for exposure to asbestos fibers exists. Provides standards for asbestos abatement work and friable and non-friable asbestos disposal requirements.	Substantive requirements may be relevant and appropriate to the removal, handling, and on-site packaging, storing, transport, or disposal of friable/non-friable ACM.		✓	

Statutes, Regulations, Standards, or Requirements	Citations or References	ARAR Determination	Description	Comment	Chemical -Specific	Location -Specific	Action-Specific
State of Oregon ARARs and TBCs							
Storage, Treatment And Disposal Of Hazardous Waste And PCB Hazardous Waste Management System: General Identification And Listing Of Hazardous Waste	ORS 465.225 ORS 466.005 OAR 340-100 OAR 340-101	Relevant and Appropriate	Regulations under this act establish a regulatory structure for the generation, transportation, treatment, storage, and disposal of hazardous wastes.	At this time, it is not anticipated that material meeting the regulatory definition of hazardous waste will be disturbed or encountered.			✓
Solid Waste Management Solid Waste: General Provisions	ORS 459 OAR 340-093	Applicable	Governs the management of solid wastes, including the permitting of disposal sites.	This ARAR is applicable to the off-site management of contaminated materials. Substantive requirements would be applicable for management or disposal of any ACM which occurs on site.			✓
Solid Waste Management Solid Waste: Municipal Solid Waste Landfills	ORS 459 OAR 340-094	Applicable	Governs the management of solid wastes at municipal solid waste landfills.	This ARAR is applicable to the off-site management of contaminated materials. Substantive requirements would be relevant and appropriate for management or disposal of any ACM which occurs on site.			✓
Solid Waste Management Solid Waste: Land Disposal Sites Other Than Municipal Solid Waste Landfills	ORS 459 OAR 340-095	Applicable	Governs the management of solid wastes at land disposal sites other than municipal solid waste landfills.	This ARAR is applicable to the off-site management of contaminated materials. Substantive requirements would be applicable for management or disposal of any ACM which occurs on site.			✓

Statutes, Regulations, Standards, or Requirements	Citations or References	ARAR Determination	Description	Comment	Chemical -Specific	Location -Specific	Action-Specific
State of Oregon ARARs and TBCs							
Oil Storage Tanks Hazardous Substance Remedial Action Rules	ORS 465.200-ORS 465.455 ORS 466.706 ORS 466.835 OAR 340-122	Applicable	Governs the regulation of underground storage tanks (USTs) to protect the public health, safety, welfare, and the environment.	UST possibly still buried at parcels AL and MBK-E (Former Oregon Technical Institute gas station).			✓
Removal or Remedial Action/ Oregon Environmental Cleanup Law Hazardous Substance Remedial Action Rules	ORS 465.200 ORS 465.900 OAR 340-122	Applicable	Standards for degree of cleanup required. Establishes acceptable risk levels for human health at 1E-06 for individual carcinogens, 1E-05 for multiple carcinogens, and Hazard Index of 1.0 for non-carcinogens. Identifies selection of remedial action by balancing factors: effectiveness, implementability, long term reliability, short term implementation risk, and cost reasonableness. Allows waiver of state and local permits so long as substantive requirements are met.	Substantive requirements may be applicable to remedy selection.	✓		✓

Statues, Regulations, Standards, or Requirements	Citations or References	ARAR Determination	Description	Comment	Chemical -Specific	Location-Specific	Action-Specific
State of Oregon ARARs							
Rules For The Administration Of The Oregon Safe Employment Act General Occupational Safety And Health Rules Construction	OAR 437-001 OAR 437-002 OAR 437-003	To Be Considered	Analogous to the federal Occupational Safety and Health Administration codes and contains health and safety requirement that must be met during implementation of any remedial action. These standards are intended to protect construction and utility workers at the site. Contains health and safety training requirements for onsite workers and permissible exposure limits for contaminants when conducting work at a site.	Worker protection standards are not environmental requirements, but should be considered to ensure site safety.			✓
Final Guidance, Consideration of Land Use In Environmental Remedial Actions	Oregon Department of Environmental Quality (Oregon DEQ), July 1998	To Be Considered	Describes how to make a land use determination for use in a risk assessment and in the remedy selection process.	No Comments.		✓	✓
Guidance for identification of Hot Spots.	Oregon DEQ, April 1998	To Be Considered	Describes procedures for delineating "hot spots" in water and other environmental media.	No Comments.		✓	✓
Final, Guidance for Use of Institutional Controls	Oregon DEQ, April 1998	To Be Considered	Guidance for selection or approval of institutional controls as part or all of a remedy.	No Comments.			✓
Klamath County Landuse Zoning (Draft Map), Township 38 S Range 09 E	Klamath County, Oregon, Planning Division and Management Information Systems Department, November 2007.	To Be Considered	Provides the current land use zoning for Klamath County.	No Comments		✓	

Appendix D

State Letter of Concurrence on ROD

Oregon
John A. Kitzhaber, MD, Governor

Department of Environmental Quality
Headquarters
811 SW Sixth Avenue
Portland, OR 97204-1390
(503) 229-5696
FAX (503) 229-6124
TTY 711

September 16, 2011

Dennis McLerran, Regional Administrator
Office of Environmental Cleanup
U. S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle WA 98102

RE: State Concurrence on the North Ridge Estates Record of Decision for Operable Unit 1

Dear Mr. McLerran:

The Oregon Department of Environmental Quality (DEQ) has reviewed the U. S. Environmental Protection Agency (EPA) Region 10 proposed Record of Decision for Operable Unit 1/Final Remedial Action at the North Ridge Estates. North Ridge Estates is a residential subdivision located in Klamath Falls, Oregon that is impacted by legacy asbestos contamination. On August 31, 2010, Governor Theodore R. Kulongoski requested that North Ridge Estates be placed on the National Priorities List (NPL). DEQ recommended the nomination to the NPL because it recognized that these unsafe and blighted areas due to legacy asbestos contamination would not likely be restored without superfund status.

DEQ believes that EPA's remedy decision complies with state laws that are applicable or relevant and appropriate to the site, and will provide for remedial action that is protective of human health and the environment. Pursuant to CERCLA and 40 CFR § 300.515(e), I am pleased to advise you that the State of Oregon, by and through DEQ, concurs with EPA's Record of Decision.

Since DEQ's initial referral of this project to EPA in 2003, DEQ has worked in close collaboration with EPA Region 10 on all aspects of the North Ridge Estates project to advance both the EPA's and the DEQ's objectives for selection of a permanent, protective remedy. DEQ looks forward to providing support for future EPA efforts to finalize the design of, and implementation of, the remedy selected in the EPA ROD, which DEQ believes will result in environmental restoration of affected properties within Operable Unit 1.

DEQ acknowledges and appreciates the fact that EPA has utilized its Superfund Technical Assessment and Response Team (START) program to implement response actions at North Ridge Estates. DEQ believes that these actions have resulted in significant reductions in the volume and toxicity of residual asbestos contamination and have successfully mitigated unacceptable risk to current residents across multiple parcels at this facility. DEQ continues to advocate for EPA's use of the START authority in the future to further mitigate unacceptable exposure risk to current residents, consistent with remedial action objectives selected in the Record of Decision for Operable Unit 1.

From a broader, longer-term perspective, DEQ believes it is imperative that the North Ridge Estates Receiver remain solvent. The receivership is important for maintenance of existing property assets and for implementation of the remedy. Specifically, the Record of Decision for Operable Unit 1 relies upon institutional controls and the Receivership appears to be the logical and appropriate legal entity to facilitate and implement these controls in several specific circumstances. Although the specific institutional controls that will be needed will probably not be completely established until after the RA/RD is completed, as one example, onsite repositories designed to consolidate excavated asbestos containing materials are presently constructed on Receivership-controlled properties, and these repositories are expected to be expanded in the future. These repositories will be subject to institutional controls, as will several other parcels whose fee titles are currently held by the Receiver.

DEQ appreciates and respects the tireless work to protect human health and the environment and the enormous resources EPA has, and will continue to, deploy at North Ridge Estates. DEQ looks forward to a similar constructive approach with EPA and other federal agencies to cleanup of Operable Unit 2 (Kingsley Firing Range Annex) of the NPL site.

The appropriate DEQ contact is Mr. Cliff Walkey, who can be reached at (541) 633-2003.

Sincerely,

Dick Pedersen

Dick Pedersen, Director

C: Dan Opalski, EPA Region 10 Director of Environmental Cleanup
Denise Baker-Kircher, EPA Region 10 Environmental Cleanup
Clifford Villa, EPA Region 10 Office of Regional Counsel
Richard Whitman, Interim Natural Resources Advisor to Governor Kitzhaber
Linda Hayes-Gorman, DEQ Eastern Region Administrator
Wendy Wiles, DEQ Land Quality Administrator
Jeff Christensen, DEQ
Sheila Monroe, DEQ
Kurt Burkholder, Oregon Department of Justice