North Ridge Estates Site, Operable Unit 1

U.S. EPA, Region 10 – Seattle, Washington **April 2010**

Proposed Plan for Public Comment

Introduction

The public is invited to review and comment on this proposed plan to address environmental cleanup of asbestos contaminated soil and debris at **Operable Unit** 1 (**OU1**) of the North Ridge Estates (NRE) Site located near Klamath Falls, Oregon. **OU1** includes all portions of the site outlined in *Exhibit 1* (see fold-out map at end of document) excluding the Kingsley Firing Range (OU2).

The NRE Site is comprised of a mixture of **privately-owned** properties and properties held in receivership (*please see Section 3 for more info on receivership*). The site contains: 39 single-family homes (18 of which are vacant), one 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. This document is issued by the U. S. Environmental Protection Agency (EPA), in consultation with the Oregon Department of Environmental Quality (DEQ).

NRE is not currently a **Superfund** site (listed on the **National Priorities List [NPL]**), and, therefore, EPA and DEQ have no clear path at this time for how cleanup for this site will be funded. This proposed plan is written in anticipation that funding will be found to address contamination at the site. Given the current funding challenge, it may be that cleanup of the site will be conducted in stages, and choices will need to be made about which parcels will be cleaned up first with limited funding.

This proposed plan provides an overview of the site history, site contamination and risk; summarizes the remedial alternatives EPA is considering; and details EPA's preferred remedial alternative and supporting rationale.

Issuance of this proposed plan starts the public comment period, which will end on May 10, 2010. At the end of that period, EPA will review and consider all comments provided. Based on that consideration, EPA may select the preferred cleanup alternative, modify it, select another response action, or develop other alternatives, if public comment warrants or if new material is presented.

Information on how to provide your comments or questions to EPA is provided on page 16, along with details on where you can get more information and attend a public meeting. To help you better understand the plan, page 17 provides a list of commonly used environmental terms that appear in **BOLD** throughout this proposed plan.

Understanding NRE Site Documents

The **remedial investigation (RI)** and **feasibility study (FS)** for **OU1** were completed in January 2010 and March 2010 using data collected since 2003. These documents were prepared concurrently, as data collected in the **RI** influenced development of remedial alternatives in the **FS**. The **RI** characterizes the site conditions, determines the nature and extent of the contamination at the site, and assesses risk to human health and the environment. The **FS** identifies, develops, screens, and evaluates remedial alternatives to address risks to human health and the environment from soil contaminated with asbestos and **asbestos-containing material (ACM)** and a small area of arsenic in the vicinity of the former power plant.

The **FS** process generally follows the steps below:

- Identify **remedial action objectives** (**RAOs**)
- Identify and screen potential remedial technologies that will satisfy these **RAOs**
- Assemble remedial alternatives that can provide protection of human health and the environment from the retained remedial technologies
- Screen the alternatives based on effectiveness, implementability, and cost
- For alternatives that make it through the screening process, conduct a detailed analysis against seven of nine evaluation criteria (the two threshold criteria and the five primary balancing criteria) and a comparison between alternatives

After the **FS** is finalized, a preferred alternative for the site is presented to the public in a proposed plan (this document). The proposed plan briefly summarizes the alternatives studied in the detailed analysis phase of the **RI/FS** and, highlights the key factors that led to identifying the preferred alternative. The 30-day public comment period allows the State of Oregon (through DEQ) and the community to provide comment on the preferred alternative.

This proposed plan is required to fulfill the requirements of Section 117(a) of the **Comprehensive Environmental Response, Compensation and Liability Act (CERCLA),** and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 CFR 300.430(f) (2).

Site Background

NRE is a residential subdivision located approximately three miles north of Klamath Falls, in Klamath County, Oregon. The site is contaminated with **ACM** resulting from the demolition of approximately eighty 1940s era military barracks buildings. **OU1** of the NRE Site is located on Old Fort Road and North Ridge Drive and encompasses an area of approximately 125 acres.

Marine Recuperation Barracks (1944 to 1946)

The site was originally developed in 1944 to create a facility to treat Marines suffering from tropical diseases contracted during WWII. The base was active from April 1944 until February 1946. The entire 745 acres were declared surplus property by the Navy in March 1946.

The Marine Recuperation Barracks (MRB) was composed of 82 buildings, including 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, bachelor's quarters, central power plant, library, and 30 barracks. Most of the buildings were constructed between Old Fort Road and the present day North Ridge Drive. Many of the materials used for improvements on the site contained asbestos, such as siding, roofing, floor tiles and steam pipe insulation.

Oregon Technology Institute (1947 to 1964)

The State of Oregon acquired the property in October 1947 to be used for the Oregon Technology Institute (OTI) [now known as the Oregon Institute of Technology]. During OTI's occupancy of the site, six structures were demolished. 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. In addition, two new buildings were constructed adjacent to the maintenance garage during OTI occupancy. OTI moved from the site in May 1964, having added seven new buildings and having acquired 40 additional acres of land.

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.

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. It is reported that while this partnership owned the site, the owners stripped

the vacant buildings of salvageable materials such as equipment, furnishings, copper, and wood. At least 22 buildings were demolished during the time this partnership owned the property.

MBK Ownership (1977 to 2006)

In December 1977, the property was purchased by MBK partnership for development. In 1993, Klamath County approved subdivision plans and construction of homes began later that year. MBK sold properties in the subdivision from 1994 until 2002.
EPA conducted a series of emergency removals between 2003 and 2005 to reduce the volume of friable asbestos that had reached the surface due to frost heave and erosion. While large amounts of **ACM** were removed each year, the removals could not permanently eliminate unacceptable risks to residents of the site. Residents were temporarily relocated from the site for three months in 2005.

Receivership (2006 to present)

In January 2006, a federal **consent decree** was approved with parties including the developer, the homeowners, the Department of Justice and EPA. The majority 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** mentioned above, the NRE Site is comprised of a mixture of **privately-owned** properties and **receiver-managed parcels.**

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 on-site repositories, and reducing the amount of friable **ACM** at the surface, new **ACM** surfaced each year due to frost heave and erosion. The removals were not able to permanently eliminate unacceptable risks at the affected properties.

Site Characteristics

NRE is located in South Central Oregon in a high desert area (elevation of 4,500 feet above sea level) in Klamath County, Oregon. Vegetation in the area is sparse, with some scattered ponderosa pines, juniper, and sagebrush. Soil is volcanic and rocky in places. The climate is relatively dry, with an average annual rainfall of 13.2 inches.

Oregon's High Plateau, a region bordered by the Cascades on the west and several minor mountain ranges on the south and east, comprises much of Klamath County and parts of Lake and Deschutes Counties. Due to generally high elevations, the Plateau has cool temperatures and receives a significant amount of snow.

Frost is encountered from October through May and the average daily minimum temperature stays below freezing from November through March. The resulting freezing and thawing of the soil has contributed significantly to annual resurfacing of buried **ACM** across the 125-acre site.

Conceptual Site Model

The conceptual site model (CSM) describes how contaminants enter the environment, how they are transported, and how human and animal **exposure** occurs. It also provides a framework for assessing risks from contaminants, developing remedial strategies, determining source control requirements, and methods to address unacceptable risks. **ACM** is the dominant environmental concern at the site.

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 cement asbestos board (CAB) used on exterior and interior walls, asphalt-asbestos roofing material, vinyl asbestos floor tiles (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.

Estimated amounts of **ACM** used in the construction of the MRB are shown in *Exhibit 2*. EPA estimates that 96% of these building materials still remain buried in the soils on the NRE Site. When the buildings associated with the old military barracks were demolished, these building materials mixed into surface and subsurface soils, creating approximately 119,000 cubic yards of **ACM**, contaminated debris, and **ACM**-contaminated soils.

Exhibit 2. 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**

Other non-**ACM** contamination sources were investigated for the NRE Site. In a few instances, contamination from non-asbestos chemicals such as polychlorinated biphenyls (PCBs) from former electrical transformers and lead from lead-based paint or leaded gasoline were discovered and removed during previous removal actions. Risks from all non-asbestos chemicals on the NRE Site now appear to be below a level of concern, except for a small area of arsenic in the vicinity of the former power plant.

The arsenic contamination is co-located with asbestos contamination in surface soil and actions taken to cleanup asbestos contamination will also address the arsenic. Because of this, arsenic will not be discussed separately in this proposed plan. All ecological risks from non-**ACM** contamination within surface soils in close proximity to the former power plant are below a level of concern.

Migration Routes and Exposure Pathways

The **exposure** route of chief concern for asbestos is inhalation of asbestos fibers. People at the 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.

Scope and Role of this Proposed Plan

Descriptions of OU1 and OU2

This proposed plan identifies the preferred alternative for the clean-up of asbestos-contaminated soil and debris for **OU1** at the NRE Site. **OU1** includes all portions of the site except Kingsley Firing Range. The Kingsley Firing Range (OU2) was not investigated due to the suspected presence of unexploded ordnance (UXO). The presence or absence of **ACM** and other contamination at Kingsley Firing Range must be investigated separately, before a proposed plan can be presented for that portion of the site.

Principal Threat Waste

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 friable types of **ACM** (MAG and AirCell) and **ACM** contaminated soil at **OU1** are considered a principal threat waste. This material acts as a source for direct **exposure** when these materials are encountered. As such, the waste presents a significant risk to human health should **exposure** occur.

The preferred alternative will eliminate the **exposure** to the source materials, first by removing the waste in surface and subsurface soils and second, by **capping** the soils, thereby breaking the **exposure pathway** associated with contact with ACM. **Institutional controls (ICs)** and **monitoring** will provide assurance that the integrity of the remedy will be protected. While the NCP establishes an expectation that EPA will use treatment to address any principal threat waste, the use for treatment technologies for **ACM** and asbestos-containing soils is cost prohibitive for the site.

The NRE Site is not a Superfund Site; currently no funding is available to conduct cleanup on the site. Since, the NRE Site is not currently listed on the **NPL**, EPA and DEQ have no clear timeline for implementing cleanup or path for funding the cleanup. This proposed plan is written in anticipation that funding will be found to address contamination at the site. Given the current funding challenge, it may be that cleanup will be conducted in stages, and choices will need to be made about which parcels will be cleaned up first with limited funding.

Compliance with EPA's *Clean and Green* Policy

EPA will comply with the August 13, 2009 US EPA, Region 10 *Clean and Green Policy* for all work conducted on the NRE Site.

Summary of Site Risks

The **RI** report contains a human health risk assessment for **OU1**. The risk assessment uses available data to estimate the health risks to people who may breathe asbestos in air, either now or in the future, based on the conditions that currently exist within **OU1**. The methods used to evaluate human health risks from asbestos are in accordance with current EPA guidelines for evaluating risks at **Superfund** sites.

The **RI** report contains detailed explanations of the steps used to conduct the risk assessment for **OU1**. This proposed plan provides a very brief summary of the conclusions of the risk assessment.

Risks Posed by Asbestos Contaminants

*Under current site conditions, r*isks to residents from indoor air and ambient air appear to be below EPA and DEQ acceptable risk ranges. Risks from soil disturbances at most locations are within EPA's acceptable risk range of one-in-ten-thousand to one-in-a-million, but above DEQ's limit of one-in-a-million. EPA and DEQ risk limits are exceeded when soil is disturbed and when friable asbestos, such as MAG insulation, is present.

The relatively low level of risk under current site conditions is likely due to the fact that much of the **ACM** in soil has not yet emerged at the surface, and most **ACM** that is at the surface has not yet broken down to release free fibers into soil.

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. Screening level calculations suggest the magnitude of the increase in free fibers (and hence in risk) is likely to be on the order of 100 to 1,000 fold. If so, then future risks for all of the three exposure pathways are likely to approach or exceed the level of 1E-06 that DEQ considers to be the maximum excess 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.

It is important to emphasize that these quantitative estimates of risk are uncertain due to a number of factors. These factors include 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. However, these uncertainties do not substantially alter the key conclusions that risks are likely to be low (below EPA and DEQ's acceptable risk ranges) under current site conditions except when MAG and AirCell insulation are present, and that risks are likely to be much higher in the future if no steps are taken to prevent future release and breakdown of **ACM** in surface soil.

Risks Posed by Non-Asbestos Contaminants

Risks from non-asbestos chemicals to current and future residents at the NRE Site appear to be below a level of concern. Risks from non-asbestos chemicals to construction workers at the site appear to be below a level of concern, except for arsenic in soil at the former power plant.

Remedial Action Objectives

Remedial Action Objectives (**RAOs**) are goals developed by EPA to protect human health and animals from exposure to asbestos from **ACM** and asbestos contaminated soils at the NRE Site. In addition, the **RAOs** protect construction workers from exposure to arsenic from contaminated soils in the vicinity of the former power plant. The **RAOs**, shown in *Exhibit 3,* are the overarching goals that all cleanup activities selected for **OU1** should meet.

The preferred alternative will effectively remove, stabilize, and contain the asbestos and arsenic contaminated soil on site so that:

1. Potential human exposure through direct contact and /or incidental ingestion exposures are minimized.

2. Potential releases of respirable asbestos to ambient air and migration of contaminants are controlled and below concentrations that would create unacceptable risks (as defined by **ARAR** federal and state requirements) to people who live on and off the North Ridge Estates site.

The soil cleanup levels are concentrations of asbestos and arsenic established to reduce the risks posed to humans at the site down to or below the target human cancer risk of 10^{-6}(one-in-a-million) and non-cancer hazard quotient of 1 required by the Oregon Hazardous Substance Remedial Action Rules.

Exhibit 3: RAOs for OU1

- Mitigate the potential for direct contact, inhalation and exposures by humans and animals to asbestos fibers in soil and indoor air that exceed the target cancer risk specified by Oregon DEQ of 1E-06 (one in one million).
- Control the migration of asbestos contamination by natural and man-made transport mechanisms to prevent the spread of contamination from source locations to unimpacted locations and media.
- Mitigate the potential for human inhalation and ingestion exposures to concentrations of arsenic in soil that exceed protective levels.

EPA considers current and future use of the site when determining **RAOs**. The **RAOs** for the NRE Site were based on future residential land use.

In evaluating potential future activities at the site, the final condition of the remediated area must be considered. For each of the alternatives evaluated, **land use controls** such as **ICs** would be implemented to provide continued protection to human health and the environment. **ICs** are actions, such as restrictive covenants, zoning ordinances, easements, deed restrictions, and building permits, that help minimize the potential for human **exposure** to contamination by ensuring appropriate land or resource use.

Summary of Remedial Action Alternatives

EPA's alternative development process began with identification of all potential cleanup methods that were protective of human health and the environment. A number of proven remedial technologies and process options were used to develop remedial alternatives for clean up. The remedial alternatives initially screened during the **FS** consisted of varying combinations of those technologies and process options to create remedy components (*Exhibit 4*).

The main differences in the use of various remedy components in the remedial alternatives relate to the following:

- Is the contaminated soil left in place and only **land use controls** and **monitoring** applied on the property (Alternative 2)?

- Is all of the contaminated soil across **OU1 capped** or is only part of the contaminated soil **capped** (Alternatives 3 and 4)?
- Is contaminated soil across **OU1 capped** in place (Alternatives 3 and 4) or removed (Alternatives 5a, 5b, 6)?
- Is the removed contaminated soil disposed of on site or at an off-site permitted location (Alternatives 5a, 5b, 6)?
- Is the soil treated and returned to **OU1** (Alternative 7)?

Exhibit 4: Remedy Components Used in Site Remedial Alternatives

Remedy Component Used	Remedial Alternative							
	1	2	3	4	5a	5b	6	7
Partial in-place capping of **contaminated materials**			●					
In-place capping of **contaminated materials**				●				
Excavation and on-site consolidation/disposal of contaminated surface materials, future excavation and off-site disposal of contaminated surface materials at permitted facilities					●			
Excavation and on-site consolidation/disposal of **contaminated materials**						●		
Excavation and offsite disposal of **contaminated materials**							●	
Offsite thermo-chemical treatment								●
Interior cleaning of houses			●					
ICs and **monitoring**		●	●	●	●	●	●	●
5-year review	●	●	●	●	●	●	●	●

Shaded alternatives were eliminated from consideration prior to detailed analysis.

Eight alternatives, shown in *Exhibit 4,* were evaluated in the **FS** to determine their ability to provide protection to human health and the environment through overall effectiveness, implementability, and cost. Alternatives 2 and 7 were deemed to have lower than moderate effectiveness or implementability and/or high cost were eliminated from further consideration.

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 (thermo-chemical treatment) was eliminated because of issues related to the availability of the technology, applicability to this medium, and excessively-high costs relative to other protective alternatives. Further explanations on those determinations can be found in the **FS**.

Remedial Alternatives Retained for Detailed Evaluation

Six remedial alternatives were retained for detailed analysis and are discussed below.

Common Elements

There are many common elements among the alternatives retained for evaluation. Seven elements common to two or more of the alternatives are described below:

1. All remedial alternatives require **land use controls,** such as **ICs**, **community awareness** activities, and **access controls**.

   ICs are legal or administrative controls such as land use restrictions, deed restrictions, easements, codes, or covenants used to limit the unacceptable use of portions of the property where asbestos contamination remains. **ICs** are briefly discussed in each alternative, except in Alternative 1. **ICs** would also include informational devices. Consistent with expectations set out in the **Superfund** regulations, none of the remedies rely exclusively on **ICs** to achieve protectiveness.

   Access controls would be implemented at the site to warn of dangers from **contaminated materials** by installing appropriate warning and informational signs. **Access controls** are incorporated into most of the remedies listed below, as well.

   Remedies will require long-term community education and outreach programs to ensure that all current and future owners of land on or near the site 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.

2. Where a remedial alternative provides for a **cap**, either in-place or at on-site consolidation areas, 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 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. For the purposes of calculating costs in the **FS** and for this proposed plan, 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.

3. Buried steam pipe, a no longer used remnant of the old MRB heating system, is present across much of the NRE Site. 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 the site. The no longer used, 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 property BO on the attached site location map).

4. **Monitoring** (inspections and air sampling) would be performed as necessary to complete risk evaluation updates and the five-year site reviews to evaluate whether adequate protection of human health and the environment is provided. Inspections and sampling are a component of each alternative except the "no action" alternative.

5. Long-term operation and maintenance (O&M) would be implemented as necessary to maintain and/or replace caps and **access controls**. Long-term review and maintenance of **ICs** will be enforced.

6. The potential exists for recontamination of areas that would be remediated under any of the alternatives described below. Possible ways the site could be recontaminated include:

   - If a property has been **capped** (Alternative 4), a property owner could dig through the **cap**, and re-expose the **ACM** or contaminated soil beneath.
   - If a property has had only surface soil removed (Alternative 5a), additional **ACM** could emerge due to frost heave or erosion.
   - If all visible **ACM** has been removed from a property (Alternative 5b), new contamination could be re-introduced onto the property by someone driving a vehicle over the "clean" site with tires contaminated with **ACM** from other parcels on NRE.
   - If clean up of the site is conducted incrementally, recontamination could be reintroduced to clean parcels by storms or by airborne dust created by nearby trucks and earth movers.

   Recontamination would be addressed using **access controls** to the degree practical or periodic maintenance where **access controls** are not sufficient to address the problem. In addition, the potential for recontamination will be addressed through best management practices and through community education.

7. Costs for the alternatives listed below are rounded up to the nearest thousand. These costs are presented for purposes of comparing one alternative to another and are not developed with

the level of detail necessary to be estimated completion costs.

Description of Alternatives

Alternative 1 – No Action
Est. Capital Costs: None
Five-year Review Costs (first 30 years): $516,000
Est. Construction Timeframe: None
Est. Total Alternative Cost (Present Value): $186,000

Alternative 1 would leave **contaminated materials** at the site in their current condition and no additional cleanup action would be performed. Regulations governing the **Superfund** program require that the "no action" alternative be evaluated to establish an environmental baseline for comparison with other alternatives.

Five-year site reviews would be performed as required by law to evaluate whether adequate protection of human health and the environment is provided. **Monitoring** would only be performed as necessary to support the five-year site reviews. Risks posed by the **contaminated materials** at the site are expected to increase over time. This alternative is not protective of human health or the environment and does not comply with the **RAOs.**

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
Est. Capital Costs: $9,592,000
Est. O&M Costs (first 30 years): $892,000
Interior Cleaning and Five-year Review Costs (first 30 years): $3,426,000
Est. Construction Timeframe: 1 Year
Est. Total Alternative Cost (Present Value): $10,152,000

Alternative 3 provides protection of human health and the environment through in-place **capping** (covering) of all **contaminated materials** identified on **privately-owned** parcels and on a portion of **receiver-managed parcels**. The **cap** would be designed to break any potential exposure pathway by preventing human and animal exposure to **contaminated materials** in surface soils and keeping **contaminated materials** from migrating to the surface in the future through frost heave processes.

The capped portion of **receiver-managed parcels** could be converted to either residential or non-residential use, depending on zoning requirements, and this use could vary based on the degree of coverage. Depending on the future use, some homes might be removed.

Only part of the **contaminated materials** identified on **receiver-managed parcels** would be **capped** (assumed in the **FS** to be 50 percent of identified **contaminated materials** for cost purposes). The existing on-site waste repository constructed by EPA would also be **capped**. The remaining portion of receiver-managed parcels would be left un**capped**, and **contaminated materials** would remain exposed.

The soils that will be used to create the **caps** will be obtained, in part, from an uncontaminated area on the NRE Site (currently held in receivership). The remainder, if needed, will be obtained from an off-site borrow source further from the site..

Access controls, such as warning and informational signs, would be installed around un**capped** areas and the existing on-site **ACM** repository to alert people that areas remaining un**capped** pose a current risk to human health and the environment.

Interior cleaning of occupied buildings would be performed on a periodic basis as indicated by testing. While the *current risk* of exposure to indoor air appears to be below EPA and DEQ acceptable risk ranges, EPA proposes that indoor spaces be cleaned – especially after on-site excavation has been completed on each parcel. EPA is aware that steps must be taken to ensure protectiveness for current and future NRE residents inside their homes. Interior cleaning may be required on a regular basis if un**capped contaminated materials** remain at the site, contingent upon periodic testing of indoor air and/or dust.

Additional provisions of this alternative include:

- **Land use controls**, consisting of a combination of **ICs** and **community awareness** activities, would be used to protect **capped** areas as well as provide

awareness of risks from potential exposure to **contaminated materials**.

- Long-term **O&M** would preserve the integrity of caps and the existing on-site waste repository.
- **Monitoring** (inspections, sampling**)** and **five-year site reviews** would be performed to ensure adequate protection to human health and the environment.

Alternative 4 – Capping of Contaminated Materials and Land Use Controls with Monitoring
Est. Capital Costs: $13,500,000
Est. O&M Costs (first 30 years): $1,064,000
Five-year Review Costs (first 30 years): $360,000
Est. Construction Timeframe: 2 Years
Est. Total Alternative Cost (Present Value): $12,798,000

Alternative 4 provides protection of human health and the environment through in-place **capping** (covering) of **contaminated materials** identified on **privately-owned** and **receiver-managed parcels** and the existing **ACM** repository located in the southeast portion of the NRE Site. The **caps** would be designed to break any potential exposure pathway by preventing human and animal exposure to **contaminated materials** in surface soils and keeping **contaminated materials** from migrating to the surface in the future through frost heave processes. The soils that will be used to create the **caps** will be obtained, in part, from an uncontaminated area on the NRE Site (currently held in receivership). The remainder, if needed, will be obtained from an off-site borrow source further from the site.

Additional provisions of this alternative include:

- **Land use controls**, consisting of a combination of **ICs**, **community awareness** activities, and **access controls**, would be used to protect capped areas as well as provide awareness of risks from potential exposure to **contaminated materials**.
- Evaluation of the suitability of borrow material prior to use.
- Long-term **O&M** would preserve the integrity of caps and the existing on-site waste repository.
- **Monitoring** (inspections, sampling**)** and **five-year site reviews** would be performed to ensure adequate protection of human health and the environment.

Alternative 5(a) - Excavation and On-site Consolidation/Capping of Contaminated Surface Materials, Future Excavation and Offsite Disposal of Contaminated Surface Materials at Permitted Facilities, and Land Use Controls with Monitoring
Est. Capital Costs: $9,970,000
Est. O&M Costs (first 30 years): $3,304,000
Five-year Review Costs (first 30 years): $360,000
Est. Construction Timeframe: 2 Years
Est. Total Alternative Cost (Present Value): $10,467,000

Alternative 5a provides protection of human health through partial excavation of **contaminated materials** within **OU1**. The contamination would be excavated to a depth of no more than 2 feet from ground surface, on all **privately-owned** and **receiver-managed parcels** in **OU1**. This material would be consolidated and placed in one or more on-site **ACM** repositories, similar to the existing **ACM** repository located in the southeast portion of the NRE Site. The on-site repositories would be **capped** and protected with **ICs** and access-related **engineering controls**. **ACM** would remain in subsurface soils (soils deeper than 2 feet from ground surface).

Excavations would be backfilled to existing grade under this alternative. Clean backfill soil will be obtained, in part, from an uncontaminated area on the NRE Site (currently held in receivership). The remainder, if needed, will be obtained from an off-site borrow source further from the site.

Monitoring (inspection and sampling) would be conducted to ensure that all visible **ACM** within 2 feet of the ground surface has been excavated before backfilling with uncontaminated soil. Any new **ACM** appearing at the surface in the future will be excavated on a regular basis and sent for off-site disposal at a facility permitted for disposal of **ACM**.

Additional provisions of this alternative include:

- **Land use controls**, consisting of a combination of **ICs**, **community awareness** activities, and **access controls,** would be implemented, as necessary, to

maintain the integrity of backfilled areas and provide awareness of risks from potential exposure to **contaminated materials**.
- Evaluation of the suitability of borrow material prior to use.
- Long-term **O&M** would preserve the integrity of caps and the existing and newly constructed on-site waste repository.
- **Monitoring** (inspections and sampling) and **five-year site reviews** would be performed to ensure adequate protection to human health and the environment.

Alternative 5(b) – Excavation and On-site Consolidation/Disposal of Contaminated Materials, and Land Use Controls with Monitoring
Est. Capital Costs: $15,335,000
Est. O&M Costs (first 30 years): $1,050,000
Five-year Review Costs (first 30 years): $360,000
Est. Construction Timeframe: 3 Years
Est. Total Alternative Cost (Present Value): $14,028,000

Alternative 5b provides protection of human health through excavation of all identified **contaminated materials** (surface and subsurface) and associated soils from both **privately-owned** and **receiver-managed parcels**.

The scope and protectiveness of Alternative 5b are higher than Alternative 5a above, as more **contaminated materials** are excavated, and the likelihood of human or animal exposure to **ACM** in surface soils is reduced. In addition, this deeper, more comprehensive excavation on all NRE properties would provide uncontaminated zones to mitigate potential future risks to workers installing underground utilities or conducting other excavation work.

Monitoring (inspection and sampling) would be conducted to ensure that all visible **ACM** has been removed before backfilling the excavations. All excavations would be backfilled to existing grade under this alternative. Clean backfill soil will be obtained, in part, from an uncontaminated area on the NRE Site (currently held in receivership). The remainder, if needed, will be obtained from an off-site borrow source further from the site.

All excavated contaminated materials would be consolidated and placed in one or more on-site **ACM** repositories, similar to the existing **ACM** repository located in the southeast portion of the NRE Site. The on-site repositories would be **capped** and protected with **ICs** and **access controls**.

Additional provisions of this alternative include:

- **Land use controls**, consisting of a combination of **ICs**, **community awareness** activities, and **access controls,** would be implemented as necessary to maintain the integrity of backfilled areas and provide awareness of risks from potential exposure to **contaminated materials**.
- Evaluation of the suitability of borrow material prior to use.
- Long-term **O&M** would maintain the integrity of covers and the existing and newly constructed on-site waste repository.
- **Monitoring** (inspections and sampling) and **five-year site reviews** would be performed to ensure adequate protection to human health and the environment.

Alternative 6 - Excavation and Offsite Disposal of Contaminated Materials at Permitted Facilities, and Land Use Controls with Monitoring
Est. Capital Costs: $32,990,000
Est. O&M Costs (first 30 years): $1,050,000
Five-year Review Costs (first 30 years): $360,000
Est. Construction Timeframe: 4 Years
Est. Total Alternative Cost (Present Value): $29,472,000

Alternative 6 provides protection for human health and the environment through excavation of all identified **contaminated materials** (surface and subsurface) and associated soils from both **privately-owned** and **receiver-managed parcels**.

As in 5b above, the scope and protectiveness of Alternative 6 are higher than Alternative 5a, as more **contaminated materials** are excavated, and the likelihood of human or animal exposure to **ACM** in surface soils is reduced. In addition, this deeper, more

comprehensive excavation on all NRE properties would provide uncontaminated zones to mitigate potential future risks to workers installing underground utilities or conducting other excavation. All excavated **contaminated material** will be transported off-site for disposal at one or more facilities permitted for disposal of ACM.

Monitoring (inspection and sampling) would be conducted to ensure that all visible **ACM** has been removed before backfilling with uncontaminated soil. All excavations would be backfilled to existing grade under this alternative. Clean backfill soil will be obtained, in part, from an uncontaminated area on the NRE Site (currently held in receivership). The remainder, if needed, will be obtained from an off-site borrow source further from the site.

Additional provisions of this alternative include:

- **Land use controls** (consisting of a combination of **ICs**, **community awareness** activities, and **access controls**) would be implemented as necessary to maintain the integrity of backfilled areas and provide awareness of risks from potential exposure to **contaminated materials**.
- Evaluation of the suitability of borrow material prior to use.
- Long-term **O&M** would maintain the integrity of covers and the existing on-site waste repository.
- **Monitoring** (inspections and sampling) and **five-year site reviews** would be performed to ensure adequate protection to human health and the environment

Evaluation of Alternatives

Many options were considered for cleaning up the NRE Site. Federal law and the NCP require that alternatives be evaluated using nine criteria, which are grouped into three categories (shown in Exhibit 5). To be eligible for selection, an alternative must meet the two threshold criteria (overall protection of human health and the environment and compliance with **applicable or relevant and appropriate Requirements** (**ARARs**).

The five balancing criteria weigh tradeoffs among alternatives; a low rating on one balancing criterion can be compensated by a high rating on another. The two modifying criteria are generally considered after the public comment period during selection of the final remedy.

Three key ARARs significantly affected EPA's evaluation of the Remedial Alternatives listed above:

1. The Oregon Hazardous Substance Remedial Action Rules (OAR 340-122-0115(2)(a) defines "acceptable risk level for human exposure to individual carcinogens" as a lifetime excess cancer risk of less than or equal to one per one million (1 E-06) for an individual at an upper-bound exposure.

2. The Oregon Hazardous Substance Remedial Action Rules (OAR 340-122-0040(2)(c)) affect the development of the PRG for arsenic. Because of this rule, the determination of a PRG 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.

3. The Oregon Revised Statute (ORS 459) governs the management of solid wastes at land disposal sites other than municipal solid waste landfills. Substantive requirements would be applicable for any management and disposal of **ACM** in an on-site repository.

The NRE site **ARARs** are discussed in more depth in Section 3 of the FS, and a list of **ARARs** for NRE is provided in Appendix B of the FS.

In General, Alternatives 3, 4, 5a, 5b and 6 are expected to comply with the chemical-, location, and action-specific **ARARs** identified in the FS. No key **ARARs** significantly differ between these alternatives. In addition, Alternatives 3, 4, 5a, 5b and 6 are not expected to require **ARAR** waivers pursuant to NCP 300.430(f) 2(iv).

Exhibit 5. Evaluation Criteria for Remedial Alternatives

Evaluation Criteria		
THRESHOLD CRITERIA	**Overall protection of human health and the environment**	Determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through **ICs, engineering controls**, treatment, or other remedial actions.
	Compliance with ARARs	Evaluates whether the alternative meets Federal, State, and Tribal environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.
BALANCING CRITERIA	**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 are expected to be accurate within a range of +50 to -30 percent.
MODIFYING CRITERIA	**State/Support Agency 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.

Exhibit 6 presents a summary of EPA's analysis of the six remedial alternatives described above against the threshold and balancing criteria. The remedial alternatives for the site are summarized in the left hand column. Each of the alternatives is given a rating for each evaluation criterion, as well as a brief narrative describing the findings of our analysis. The **FS** provides a detailed description of how the comparison of alternatives was made.

The remedial alternatives developed in the **FS** are not mutually exclusive choices; the preferred alternative was developed using a combination of the alternatives presented in the **FS**. The preferred alternative described in this plan may be a modified, based on new information or public comments. Consistent with the **NCP**, the remedial alternatives have been developed to a conceptual planning level of detail and may require additional data collection to further define the problem and refine the action.

Description of the Preferred Alternative

EPA's preferred alternative for cleanup of **contaminated materials** at **OU1** is a combination of remedy components from three alternatives:

- **Interior cleaning**, as described in Alternative 3, (***Capping*** *of* ***Contaminated Materials*** *on* ***Private Parcels****, Partial* ***Capping*** *of* ***Contaminated Materials*** *on* ***Receiver-Managed Parcels****, Interior Cleaning, and* ***Land Use Controls*** *with* ***Monitoring***)
- **Excavation of surface and subsurface soils**, as described in Alternative 5b (*Excavation and On-site Consolidation/****Capping*** *of* ***Contaminated Materials****, and* ***Land Use Controls*** *with* ***Monitoring***).
- **Capping of properties after soil excavation**, as described in Alternative 4 (***Capping*** *of* ***Contaminated Materials*** *and* ***Land Use Controls*** *with* ***Monitoring***)

This preferred alternative would provide protection of human health and the environment through excavation of the majority of **contaminated materials** (surface and subsurface) from all **privately-owned** and **receiver-managed parcels** in **OU1.**

Contaminated materials would be excavated to no less than 2 feet from ground surface. If contamination is still visible, additional excavation will continue up to a depth of 4 feet. In addition, utility corridors will be

excavated on parcels, as needed, up to a depth of 4 feet. Utility corridors will be created on a parcel-specific basis depending on the extent and depth of **contaminated materials** at a parcel. It may be necessary to excavate deeper than 4 feet on a parcel, given unexpected site conditions. This determination will be made on a parcel-specific basis, as well.

If septic 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 new septic lines will be replaced. This decision will be based on the extent and depth of **contaminated materials** and whether the parcel is currently occupied.

Backfill will be applied to the excavations prior to capping (especially over deeper excavations and over utility corridors) as needed to make a smooth transition for the **cap**, to reestablish grades, and to provide positive drainage from all structures.

Privately-owned and **receiver-managed parcels** would then be **capped**. This **cap** will break any potential exposure pathway from **contaminated materials** that may still exist below the surface and will keep **contaminated materials** from migrating to the surface in the future through frost heave processes.

All excavated contaminated material would be consolidated and placed in one or more on-site **ACM** repositories, similar to the existing **ACM** repository located in the southeast portion of the NRE Site. The on-site repositories would be **capped** and protected with **ICs** and **access controls**.

A 2-foot minimum excavation depth is proposed because:

- It would facilitate the proper construction of a 2-foot protective **cap**.
- Based on soil boring data taken from the site, much of the **ACM** contamination is located within 2 feet of the ground surface.

A 4-foot maximum excavation depth is proposed because:

- Most utility lines and other subsurface structures are installed no deeper than 4 feet.
- 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 excavation holes.
- The likelihood of residents digging through 4-feet of material and exposing buried **contaminated materials** is extremely remote. **ICs** will be put into place to assure that the **cap** remains intact and no buried **contaminated materials** left on site are exposed.

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. These features include, but are not limited to, 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.

Ten privately-held properties along Thicket Court have steam pipe associated with the old MRB heating system buried under them. With the exception of the property identified at BO in the attached site map, there is no evidence that the steam pipe, and its associated asbestos pipe wrap beneath Thicket Court have ever been disturbed. No **ACM** has been found at or near the surface of these properties. For the purposes of this preferred alternative, the buried steam pipe on Thicket Court parcels will be left in place and no excavation or **capping** will be conducted, except on property BO. To ensure that this buried pipe, and its associated asbestos pipe wrap, remains undisturbed, these properties will be addressed through a combination of **ICs** and **access controls**.

The current risk of exposure to asbestos in indoor air appears to be below EPA and DEQ acceptable risk ranges. However, interior cleaning of occupied buildings may be performed after excavation has been completed on each parcel, if necessary, as indicated by indoor air testing.

Long-term O&M would be required to maintain the integrity of the capped and backfilled areas. **ICs** would be used to provide protection of human health to the extent possible and to maintain the remedy's long-term protectiveness. **Monitoring** (inspections and sampling) and **five-year site reviews** would continue to evaluate effectiveness of the remedy. Long-term O&M, **ICs**, **monitoring**, **access controls,** and five-year site reviews are key components of this preferred alternative, and must be implemented along with excavation, backfill, and **capping** to ensure long term protectiveness**.**

The preferred alternative was identified over other alternatives for reasons including the following:

1. This alternative would protect human health and the environment and comply with ARARs.

2. It would have greater long-term effectiveness and permanence compared to any of the other alternatives evaluated because:

    - To the greatest possible extent, it removes **contaminated materials,** such as **ACM** and associated asbestos and arsenic contaminated soils.
    - A frost protective **cap** would be installed to break any exposure possible from **ACM** that might remain in the subsurface soils. The **cap** will be designed to prevent buried **ACM** from emerging on the ground surface due to frost heave or erosion.

3. It would reduce the contamination footprint by consolidating **contaminated materials** into well defined containment zones that would be kept separate from residential properties.

4. With the creation of containment zones for most of the contamination at the site, EPA and DEQ will not need to rely strictly on **ICs** to ensure protectiveness for the site, especially for occupied parcels.

The preferred alternative would be implemented throughout the NRE Site. However, due to 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 **ICs, access controls,** and **monitoring** protocols will be a parcel-specific decision. If a parcel-specific decision was made to leave some amount of **contaminated materials** in place, **capping** and **ICs** would be required over that area.

Est. Capital Costs: $21,830,000
Est. O&M Costs (first 30 years): $1,050,000
Interior Cleaning and Five-year Review Costs (first 30 years): $1,707,000
Est. Construction Timeframe: 3 Years
Est. Total Alternative Cost (Present Value): $20,356,000

Implementation Details

- During construction, water-or chemical-based suppression would be used to prevent **ACM** from becoming airborne.
- Specialized trucks (with covered tops) would transport excavated contaminated material from NRE properties to one or more on-site **ACM** repositories.
- A geotextile or plastic barrier would be placed on the ground surface before placing clean fill and **cap** materials in temporary on-site storage areas to prevent possible contamination
- Temporary gravel access roads would be constructed to limit contaminated soil disturbance during excavation
- Clean soil that will be used for **capping** and for backfill of excavations would be tested before use
- A visible marker layer would be placed at the bottom of an excavated area prior to backfill and capping to denote the boundary between native and backfilled material.

Opportunities for Public Involvement

Public Meeting

EPA will hold a public meeting to explain the proposed plan, the preferred cleanup alternative for NRE Site, and all the alternatives presented in the **FS**. We encourage you to attend. It's a great opportunity to learn more about the details.

North Ridge Estates Site
Public Comment Meeting

Thursday, April 8, 2010
6:30 to 9:00 pm
Mt. Mazama Room
OIT College Union
3201 Campus Drive
Klamath Falls

If you like, you can provide your comment orally at the public meeting, and the meeting stenographer will record it.

Contacts

If you have questions or need additional help, please feel free to contact the following representatives:

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425 NE Bellevue Dr., Suite 110
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Walkey.cliff@deq.state.or.us

Written and E-Mailed Comments

The public comment period runs from April 2 to May 10, 2010. During that time, you may submit a comment in writing (by mail, email, or at the public meeting). The mailing address for written comments is:

Denise Baker-Kircher
US EPA Region 10
1200 Sixth Ave., Suite 900,
Mailstop ECL - 115
Seattle, WA 98101
E-mail: baker.denise@epa.gov

EPA will respond in writing to all significant public comments. A final Record of Decision may then be prepared by EPA to describe the selected remedial action.

Comments must be received by May 10, 2010

Documents

The site file, which contains the complete public record for the site, is available for public viewing at:

US EPA Region 10 Records Center
1200 6th Avenue, 7th Floor
Seattle, WA 98101
(206) 553-4494*

The Administrative Record, which contains the documents that provide the basis for selecting the final cleanup alternative, will be available for viewing at:

Klamath Falls Library
126 S 3rd Street
Klamath Falls, OR 97601
(541) 882-8894

** Please call for the most current information on office hours.*

Useful Terms

Understanding environmental cleanup can be daunting for the average person. The following are definitions of commonly used terms at the NRE Site to aid your understanding of this document.

- ***Access controls-*** Access controls include posting warning and informational signs on the site.
- ***Asbestos-containing materials (ACM)*** Any cement asbestos board, roofing, tile, steam pipe or other material at NRE Site that is known to contain asbestos.
- ***Applicable or relevant and appropriate requirements (ARARs) -*** the Federal and State environmental or facility siting laws that a preferred alternative will meet. These requirements may vary among sites and alternatives.
- ***Cap or capping*** - An engineered barrier that prevents upward migration of **ACM** from below ground to the surface. A **cap** is generally constructed in layers such as gravel, rock or soil and is covered with vegetation after it is completed. Cover is another term for a **cap**.
- ***Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).*** A federal law designed to clean up abandoned hazardous waste sites.
- ***Community awareness activities*** Includes community education and outreach programs used to inform the community of potential risks associated with exposure to **contaminated materials** and how to mitigate future risks.
- ***Consent decree*** - A legal document, approved by a judge, that formalizes an agreement between EPA and one or more potentially responsible parties (PRPs) in resolution of liability under the **Superfund** statute or other applicable law. A consent decree is subject to a public comment period prior to its approval by a judge, and is enforceable as a final judgment by a court.
- ***Contaminated materials*** - Media (debris, soil, etc.) that contain contaminants that pose risks to humans and the environment. **Contaminated materials** currently identified at the NRE Site are **ACM** debris, associated soils impacted by asbestos fibers, and arsenic-contaminated soils in the vicinity of the former power plant. Surface **contaminated materials** are found at depths of 2 feet or less from ground surface. Subsurface **contaminated materials** are found at depths greater than 2 feet from ground surface.
- ***Engineered controls.*** **Engineering controls** are physical controls, such as fencing, used to help preserve the integrity of the remedy.
- ***Exposure -*** The amount of pollutant present in a given environment that represents a potential health threat to people and animals.
- ***Exposure pathway -*** The path from sources of pollutants to people and animals.
- ***Feasibility study (FS) -*** The mechanism for development, screening, and detailed evaluation of alternative remedial actions. The **FS** is conducted concurrently with the RI.
- ***Five-year review -*** 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 five years to ensure protection of human health and the environment.
- ***Institutional controls (ICs) –*** Mechanisms to discourage human contact with **contaminated materials** and encourage safe land uses. **ICs** may be governmental controls (like zoning or deed notices), proprietary controls (like covenants, conditions, and restrictions), and informational devices (like public notices).
- ***Land use controls*** - A combination of **ICs**, community awareness activities, and access controls. Land use controls are generally used to protect remedy components, restrict access and use of contaminated areas, and provide awareness of risks from potential exposure to **contaminated materials**.
- ***Monitoring*** – Ongoing visual inspection (either surface or subsurface) and/or collection and analysis of samples taken from property. This information is collected to help gauge the effectiveness of a clean-up action.
- ***National Priorities List (NPL) -*** EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under **Superfund**. A site must be on the **NPL** to receive money for remedial action.
- ***Operable unit (OU) -*** A designation based on geography or other characteristics that defines a specific area of a site and enables the **Superfund** process to move forward in different areas at different times, speeding up the overall cleanup process.
- ***Operation and maintenance (O&M) -*** Activities conducted after a **Superfund** site action is completed to ensure that the action is effective for the long-term.
- ***Present value -*** The present value (of a sum payable in the future) calculated by deducting interest that will accrue between the current and future date.
- ***Privately-owned properties.*** Properties on the NRE Site where title belongs to individual or business interests.
- ***Receiver-managed parcels.*** Properties on the NRE Site where title is held by the receiver for EPA.
- ***Remedial action objectives (RAOs).*** Specific goals for protecting human health and the environment developed by evaluating ARARs and the results of the RI, including the risk assessment.
- ***Remedial investigation (RI) -*** The investigation phase of the **Superfund** process that determines the nature and extent of contamination and assesses the risk to human health and the environment.
- ***Superfund -*** The federal program that funds and carries out EPA solid waste emergency and long-term removal and remedial activities. These activities include establishing the **NPL**, investigating sites for inclusion, determining priority, and conducting and/or supervising cleanup and other actions.

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Exhibit 6. Summary of Comparative Analysis of Alternatives

Remedial Alternative	Description	Threshold Criteria		Balancing Criteria					
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost (Dollars)	
1	No Action	⓿ Not protective of human health and the environment and does not meet PRAOs.	⓿ Not compliant with chemical-specific ARARs. Specifically, the risk standards in the Oregon Hazardous Substance Remedial Action Rules for asbestos are exceeded because exposure to contamination is not addressed.	⓿ No additional cleanup measures are initiated and contaminated materials are left exposed.	⓿ No treatment; therefore, does not reduce toxicity, mobility, or volume of contaminants through treatment.	⓿ No additional cleanup measures are initiated and contaminated materials are left exposed. Thus there are no short-term effectiveness issues for this alternative.	⓿ No action is taken other than 5-year site reviews. Since no new remedial action is taken, this alternative has no implementability issues.	$	$186,000
3	Capping of Contaminated Materials on Private Parcels, Partial Capping of Contaminated Materials on Receivership Parcels, Interior Cleaning, and Land Use Controls with Monitoring	❷ Contaminated materials that remain exposed outside of capped areas pose human health and ecological risks through dispersal across the site. Contaminated materials also still remain beneath covers across a large extent of the site and could pose additional risks if the covers are compromised.	❸ Addresses the location- and action-specific ARARs through adherence of the ARARs during implementation of the remedial action. This alternative leaves contaminated materials exposed at the site. Thus compliance with the chemical-specific ARARs is questionable.	❷ Contaminated materials that remain exposed outside of capped areas pose human health and ecological risks through dispersal across the site. Contaminated materials also still remain beneath covers across a large extent of the site and could pose additional risks if the covers are compromised.	⓿ No treatment; therefore, does not reduce toxicity, mobility, or volume of contaminants through treatment.	❹ Addresses short-term risks to workers, the community, and the environment. Trucks used to haul offsite borrow are also used to construct the covers, which slightly increases short-term risks to the community.	❹ Construction resources and materials needed to construct covers for this alternative should be available. Institutional controls have been implemented in a similar manner on other contaminated residential sites in Oregon. 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.	$$$	$10,152,000

Exhibit 6. Summary of Comparative Analysis of Alternatives

Remedial Alternative	Description	Threshold Criteria		Balancing Criteria					
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost (Dollars)	
4	Capping of Contaminated Materials and Land Use Controls with Monitoring	❸ Contaminated materials still remain beneath covers across a large extent of the site and could pose risks if the covers are compromised.	❺ Addresses the location- and action-specific ARARs through adherence of the ARARs during implementation of the remedial action. Addresses chemical-specific ARARs by in-place capping of contamination.	❸ Contaminated materials still remain beneath covers across a large extent of the site and could pose risks if the covers 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.	❼ No treatment; therefore, does not reduce toxicity, mobility, or volume of contaminants through treatment.	❸ Similar to Alternative 3. However Alternative 4 involves significantly more surface disturbance of contaminated materials and larger number of haul trucks than Alternative 3.	❸ Similar to Alternative 3. However Alternative 4 requires covering a larger area of the site than Alternative 3 and requires a larger volume of borrow from offsite areas. Maintenance of the additional covered areas and monitoring, especially on privately owned parcels, could provide difficulties in the future.	$$$	$12,798,000
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	❷ Contaminated subsurface materials also remain across a large extent of the site beneath covers at disposal locations and backfill placed in excavations. These materials could pose risks if the covers or backfill are compromised. Upward migration of subsurface contaminated materials through backfill to the surface may occur over time and pose additional risks. Future excavations may only partially address these risks since they would only occur periodically.	❸ This alternative has a higher potential of future exposure at the surface to significant quantities of contaminated materials through frost heave processes than other alternatives. Thus compliance with the chemical-specific ARARs is questionable.	❷ Contaminated materials still remain under covers 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 covers at the onsite disposal locations are compromised or contaminated materials become exposed at the surface in backfilled excavations.	❼ No treatment; therefore, does not reduce toxicity, mobility, or volume of contaminants through treatment.	❷ Requires disturbance and consolidation of a large amount of contaminated materials across the site and large volumes of offsite borrow. These activities pose increased short-term risks to workers and the community than surface disturbance activities under Alternative 4. Alternative 5a involves initial excavation and future excavation of contaminated materials over a long period of time which increases the risks.	❸ 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 contaminated surface materials.	$$$	$10,467,000

Exhibit 6. Summary of Comparative Analysis of Alternatives

Remedial Alternative	Description	Threshold Criteria		Balancing Criteria					
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost (Dollars)	
5b	Excavation and Onsite Consolidation/Disposal of Contaminated Materials, and Land Use Controls with Monitoring	❸ 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.	❺ Addresses the location- and action-specific ARARs through adherence of the ARARs during implementation of the remedial action. Addresses chemical-specific ARARs by excavation of contaminated materials, onsite consolidation and disposal, and backfilling of excavations.	❹ 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.	❶ No treatment; therefore, does not reduce toxicity, mobility, or volume of contaminants through treatment.	❷ Similar to Alternative 5a. While Alternative 5b involves initial excavation and consolidation of a larger volume of contaminated materials than Alternative 5b, the increase in initial short-term risks during excavation is offset by not requiring future excavation of contaminated materials as under Alternative 5a.	❸ 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.	$$$	$14,028,000
6	Excavation and Offsite Disposal of Contaminated Materials at Permitted Facilities, and Land Use Controls with Monitoring	❹ Similar to Alternative 5b, except that contaminated materials are excavated and disposed of offsite rather than consolidated and disposed of onsite. Since the majority of the contaminated materials are excavated and disposed of offsite, long-term protection of human health and the environment is more certain than Alternative 5b.	❺ Addresses the location- and action-specific ARARs through adherence of the ARARs during implementation of the remedial action. Addresses chemical-specific ARARs by excavation of contaminated materials, offsite disposal, and backfilling of excavations.	❹ Similar to Alternative 5b, except offsite rather than onsite disposal of excavated contaminated materials is performed.	❶ No treatment; therefore, does not reduce toxicity, mobility, or volume of contaminants through treatment.	❷ Similar to Alternative 5b, offsite rather than onsite disposal of excavated contaminated materials is performed. Short-term impacts to workers and especially the community are greatly increased over alternatives that do not require offsite disposal due to truck traffic to the offsite disposal facilities.	❷ Similar to Alternative 5b except offsite rather than onsite disposal of excavated contaminated materials is performed. Offsite disposal of large volumes of removed materials requires additional coordination with the offsite disposal facilities. Additional difficulties exist in obtaining the necessary approvals and the logistics of transporting large volumes of contaminated materials for long distances to offsite disposal facilities.	$$$$$	$29,472,000

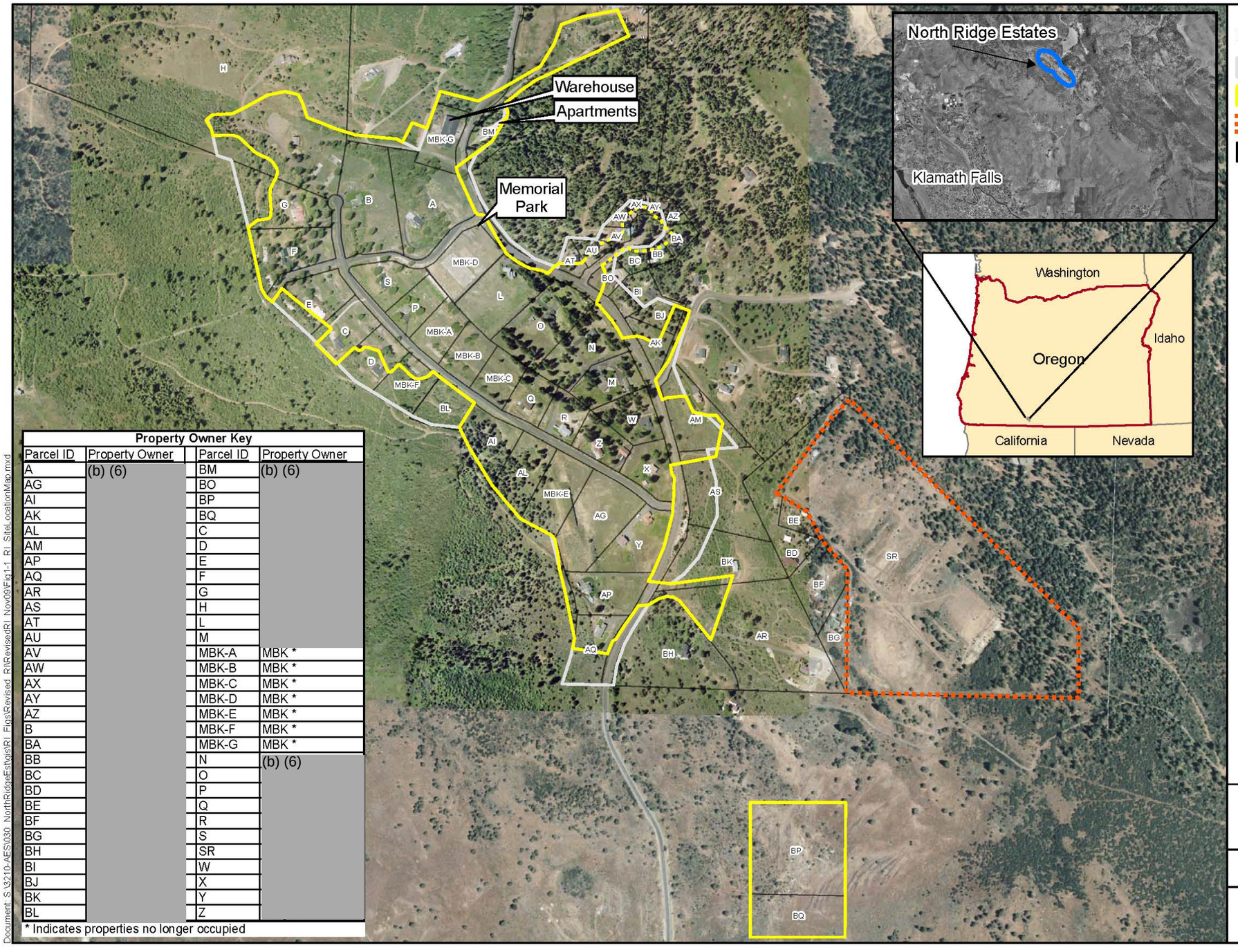
Exhibit 6. Summary of Comparative Analysis of Alternatives

Notes:

1. The detailed analysis of retained alternatives involves a qualitative assessment of the degree to which remedial alternatives address evaluation criteria. The numerical designations for the qualitative ratings system used in this table are not used to quantitatively assess remedial alternatives (for instance, individual rankings for an alternative are not additive).

Legend for Qualitative Ratings System:

Threshold and Balancing Criteria (Excluding Cost)		Balancing Criteria (Present Value Cost in Dollars)	
❶	**None**	❶	**None ($0)**
❷	**Low**	$	**Low ($0 through $5M)**
❸	**Low to moderate**	$$	**Low to moderate ($5M through $10M)**
❹	**Moderate**	$$$	**Moderate ($10M through $15M)**
❺	**Moderate to high**	$$$$	**Moderate to high ($15M through $20M)**
❻	**High**	$$$$$	**High (Greater than $20M)**



Property Owner Key

Parcel ID	Property Owner	Parcel ID	Property Owner
A	(b) (6)	BM	(b) (6)
AG		BO	
AI		BP	
AK		BQ	
AL		C	
AM		D	
AP		E	
AQ		F	
AR		G	
AS		H	
AT		L	
AU		M	
AV		MBK-A	MBK *
AW		MBK-B	MBK *
AX		MBK-C	MBK *
AY		MBK-D	MBK *
AZ		MBK-E	MBK *
B		MBK-F	MBK *
BA		MBK-G	MBK *
BB		N	(b) (6)
BC		O	
BD		P	
BE		Q	
BF		R	
BG		S	
BH		SR	
BI		W	
BJ		X	
BK		Y	
BL		Z	

* Indicates properties no longer occupied

Legend

- Original Site Boundary
- OU1 - North Ridge Estates
- OU2 - Firing Range
- Parcels

N

0 300 600 900 1,200

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

November 2009

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.

Site Location Map

Exhibit 1

CDM

Document: S:\3210-AES\030 NorthRidgeEstates\RI FigsRevised RIRevisedRI Nov09\Fig1-1 RI SiteLocationMap.mxd