Proposed Plan for the Moses Lake Wellfield Contamination Superfund Site

Moses Lake, Washington
January 2008

INTRODUCTION

This Proposed Plan, issued by the U.S. Environmental Protection Agency (EPA), presents the preferred alternatives for cleanup of the Moses Lake Wellfield Contamination Superfund Site (Site). In addition, this plan also provides a summary of other cleanup alternatives evaluated in the feasibility study and describes EPA's rationale for selecting the preferred alternatives.

The Site encompasses potential source areas around the former Larson Air Force Base (see Figure 1), and is currently the home of the Grant County International Airport. Potential source areas are scattered throughout the area, and approximately 1000 acres of groundwater is contaminated. The contamination is the result of operations of the former Larson Air Force Base (Larson AFB) and industrial activities associated with the aircraft industry. There are 39 potentially contaminated soil waste sites and several groundwater plumes of trichloroethylene (TCE) that pose a threat to human health and the environment. TCE is a solvent used by industries to remove grease. EPA considers TCE highly likely to cause cancer in people.

This Proposed Plan serves as the public notice required under section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and 40 Code of Federal Regulations (CFR) 300.430(f)(3). EPA will select the final cleanup plan after public comment has ended and all comments received have been reviewed and considered. The public is encouraged to comment on all of the alternatives presented in this plan, not just the preferred alternative. To improve readability several alternatives for potential source areas were evaluated in the feasibility study but not carried forward in this Proposed Plan. You are also encouraged to review these alternatives.

HOW YOU CAN PARTICIPATE

The "Public Participation" section of this document provides dates for the public review period and other information regarding public involvement.

Written comments on the Proposed Plan will be accepted during the comment period from January 7, 2008 to March 7, 2008. Two public meetings will be held in January and February. More information regarding public participation can be found on page 25.

Comments can be sent to Dennis Faulk at the U.S. Environmental Protection Agency via:

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SITE BACKGROUND

The Larson AFB was established in 1942 to provide training for pilots and crews. Between 1945 and 1948, The Boeing Company (Boeing) used the former base to test aircraft. In 1948 the facility was reopened under the U.S. Air Force Defense Command.

The former base had many facilities including a hospital, barracks, fueling depot, hangars, schools, waste water treatment and disposal, and conventional weapons storage. In 1954 the Boeing Flight Center was established. Operations included contract work for the U.S. Air Force involving preparation of aircraft for delivery. In 1960 the Strategic Air Command and Titan Missile program began missile-launching activities at the site, and Boeing operations closed during this time. In 1965 the Air Force announced that the base would be closed.

In 1966 the Port of Moses Lake (Port) acquired much of the former base and has since operated the property as the Grant County Airport. In addition, the housing associated with the base was sold to the Grant County housing authority and is currently in use. Other facilities were transferred to Big Bend Community College. The five former base drinking water supply wells were transferred to the City of Moses Lake (City). In 1968, Boeing returned to the Airport by purchasing 130 acres, including the three-place hangar. Industrial activities are continuing around the Airport today. Most of the potential source areas either lie within the Airport boundary or are located adjacent to the Airport in the industrial designated area.

In 1988, TCE was detected in three of the City of Moses Lake's drinking water supply wells on the former base. Follow-up testing revealed TCE contamination in the drinking water, including impacts to the Skyline Water System. In 1992 EPA placed the Moses Lake Wellfield Contamination Superfund Site on the National Priority List (NPL). The NPL is EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term cleanup action under Superfund. Since 1992 the U.S. Army Corps of Engineers (USACE) has worked to characterize the Site under the Remedial Investigation/Feasibility Study (RI/FS) process. Since 1998 the USACE and EPA have worked together on the RI/FS process. The RI/FS was performed by the USACE on behalf of potentially responsible parties under EPA oversight. The USACE has the lead role for the Formerly Used Defense Sites (FUDS), including the former Larson AFB. The resulting RI/FS reports: one RI report, one FS for groundwater, and one FS for soil sites, form the basis for many of the conclusions described in this Proposed Plan.

Site Characteristics

Current Land Use

Current land use is variable and diverse within the area that was studied (Study Area) during the RI/FS. Land use in the southern portion and south of the Study Area consists of residential subdivisions, apartments, mobile home parks, commercial areas, and agricultural areas. The land in the northern portion of the Site is designated as commercial/industrial. In general, the areas north and east of the Site consist of unimproved open lands used for rural residences, agriculture, and rangeland; the western and southern edges of the Site are bounded by Moses Lake. The lake is used for recreation and the USACE has reported that it is also used for irrigation. The City limits begin approximately 1 mile south of the Airport; most of the property between the Airport

and the City limits is unincorporated Grant County (County). Two parcels of the former Larson AFB, the Larson Waste Water Treatment Plant and the former firing range, have been incorporated into the City.

City, County & Port

Three local governments – the City, the County and the Port – have jurisdictional authority over portions of the Study Area. Their respective jurisdictional boundaries have changed over time and may continue to change over the next 30 years. The City has designated Port property to be developed adjacent to the Airport as "Industrial Light" and "Industrial Heavy." Because of these multiple jurisdictions, implementing institutional controls (land use restrictions to prevent human exposure to contaminated areas) will require close coordination among the City, County, and Port.

Groundwater Use

Groundwater is defined as water located within the subsurface of the earth that supplies or is capable of supplying water to wells and springs. Groundwater in the Moses Lake area is either located in alluvial (river or glacial flood) sediments or in porous or weathered portions of fractured basalt (volcanic rock) bedrock. This underground layer of water-bearing porous rock, sand, gravel, or other material is called an aquifer. Groundwater is the major source of drinking water in Grant County. The groundwater consumed is either treated or untreated, depending on how the water is obtained**.** Groundwater is also used for irrigation, livestock watering, and manufacturing. Groundwater use in the area is adjudicated in State courts and is regulated by the Washington State Department of Ecology (Ecology). All domestic drinking water in the area is supplied via either City water systems, private community water systems, or via individual residential (less than five connection) drinking water wells.

Surface Water Use

The Site and surrounding areas are bounded in three directions by surface waters: Crab Creek to the east, Lewis Horn and Parker Horn to the south and southeast, and Moses Lake to the west and southwest. The lake is made up of three main arms, which are over 18 miles long and up to 1 mile wide. The lake is the largest natural body of fresh water in Grant County; it has over 120 miles of shoreline and covers 6,500 acres. Surface water use includes recreation and fishing.

Non-recreational surface water use is dictated by the Columbia Basin Irrigation Project, which diverts water from the Columbia River below the Ground Coulee Dam through a series of irrigation canals and siphons. This water is distributed over approximately 70,000 acres for irrigation purposes in an area designated by the Washington Department of Natural Resources as agricultural, including agricultural areas immediately to the east of the former Larson AFB. Some of the water flows into the lake and into Potholes Reservoir by way of Rocky Coulee Waterway and Crab Creek. Surface drainage is from north to south in the Site area. Other surface drainages in the area include a short intermittent stream west of the Airport and several channels associated with agriculture in the eastern portion of the Site.

Water quality in the lake is of concern to local residents as well as to downstream users of Potholes Reservoir. In the past, the lake has had indications that it receives excessive nutrient loading of nitrogen and phosphorus. The principal nutrient source is irrigation return water via Crab Creek. Groundwater seeps, septic tank leachate, and recycling from bottom sediments add nutrients which result in floating algal mats during the summer recreation season.

Local Water Systems
According to the 2000 City Water Service Plan, the City is the largest drinking water provider in the county. Other small providers of water, such as the Skyline Water System and the Cascade Valley Water District, serve small residential areas and mobile home parks. In addition to the large and small water providers, there are many private wells serving individual homes or small groups of homes. The City currently has 15 wells drawing from various basalt aquifers. It also has one well drawing mainly from the overlying unconsolidated alluvial aquifer. The City's pumping capacity is 24.8 million gallons per day with a peak demand estimated at 16.4 million gallons per day.

Physical Characteristics

Geologic Setting
The Study Area mostly occupies a nearly flat fluvial terrace bounded to the east by Crab Creek and to the south and west by Moses Lake. The geologic (earth, rock, sand, etc.) units affected by contamination include, with increasing depth and from youngest to oldest: sand and gravel deposited by huge glacial floods (Hanford formation), silt and sand deposited in lakes and rivers (Ringold Formation, locally eroded away to the north and east), and several extensive basalt (cooled lava) flows of the Wanapum Basalt Formation. The Wanapum Basalt at the Site is divided into three members, from geologically youngest to oldest: the Priest Rapids Member, the Roza Member, and the Frenchman Springs Member. At the Site, the Roza Member consists of three basalt flows, of which Roza 1 is the youngest and always the first encountered. The Priest Rapids Member overlies the Roza Member in the central portions of the Site, but is mostly highly weathered and has been eroded away entirely along the east and west margins.

Hydrostratigraphic Setting
The aquifers relevant to the Study Area are: 1) Hanford formation; 2) Priest Rapids and flow-top of Roza 1; 3) Roza 2 flow-top; and 4) Roza 3. The intervening water-confining units are: 1) Ringold Formation; 2) dense flow interior of Roza 1; and 3) dense flow interior of Roza 2. Based on feasibility study estimates, groundwater flows horizontally through the Hanford formation up to 100 times faster than in the basalt aquifers (the flow-top zones) and up to 1,000 times faster than in the Ringold Formation. Vertical groundwater flow is generally downward between all the units, and apparently some leakage of water (and contaminants where present) can occur naturally through the Ringold Formation and at least the first few dense basalt flow interiors.

Groundwater Occurrence and Flow Direction
Irrigation wells, small public water supply systems, and residential wells all withdraw groundwater from the upper aquifers (Hanford formation, Priest Rapids and Roza flow-tops). Larger public water supply systems, such as the City's, draw primarily from sources deeper than the Roza 2 aquifer. There are also some groundwater discharges from the Hanford formation and possibly the shallowest basalt aquifers to surface water bodies (Moses Lake, Lewis Horn, and Parker Horn). Generally speaking, groundwater flow is to the south and southwest, although Roza 2 groundwater appears to flow generally to the west. Water level differences between alluvial and basalt aquifers increase downgradient. Groundwater flow directions exhibit only minor seasonal variation in the alluvial and Priest Rapids-Roza 1 aquifers, although local variations in flow direction of up to 40 degrees have been observed in the central portion of the

Study Area. Winter and summer water level data are available and show significant seasonal effects in the Roza 2 aquifer. The summer variation in water table level is complex, probably due to groundwater withdrawals from wells and/or irrigation water recharge.

SCOPE AND ROLE OF REMEDIAL ACTION

The role of the proposed cleanup actions is to reduce potential threats to human health and the environment associated with hazardous substances in the soil and groundwater and to ultimately restore groundwater to its highest beneficial use. Cleanup levels identified in this Proposed Plan will be protective of groundwater, human health, and the environment.

Previous Actions

In 1988 the Washington State Department of Social and Health Services analyzed groundwater samples from eight wells serving the City municipal water supply system. Testing indicated that three of the wells contained concentrations of TCE above EPA's primary drinking water standard under the federal Safe Drinking Water Act, Maximum Contaminant Level (MCL, the maximum level of the contaminant allowed) of 5 ug/L (micrograms per liter, sometimes referenced as parts per billion).

Additionally, TCE was detected in two wells operated by the Skyline Water System, Inc., a private water provider located in unincorporated Grant County south of the former Larson AFB property. The USACE performed an early study of the extent of TCE contamination and likely sources, and investigated four potential source areas for TCE. Field investigations were conducted between August 1991 and January 1993, and monitoring well sampling continued until September 1994. Additional private wells and small water systems were sampled by the State and EPA.

Based on the TCE detections described above, between 1989 and 1993 the City used their own funds to fix three contaminated water-supply wells south of the Airport. The Port supplied bottled water to the Skyline community from 1997-1999, and in 2003, USACE completed construction of a replacement water-supply well for the Skyline Water System. The new Skyline water-supply well was constructed in approximately the same surface location, but the water was obtained from a deeper uncontaminated groundwater aquifer. To date this well continues to provide reliable, clean drinking water to the Skyline community.

SUMMARY OF SITE CONTAMINATION

Potential Source Areas (Soils)

There are 39 potential source areas that are covered under this plan. The following hazardous substances are suspected to be located or have been found at elevated concentrations in soil in one or more potential source areas. The specific risk criteria considered for each source area, including exposure pathways, are described later.

Metals	(Arsenic, Copper, Lead, Mercury, Nickel, Zinc)
PAHs	(Polycyclic Aromatic Hydrocarbons [Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,I)perylene, Indeno(1,2,3-cd)pyrene])
PCBs	(Polychlorinated Biphenyls [Aroclors 1254 and 1260])
VOCs	(Volatile organic compounds, TCE [Trichloroethene, Trichloroethylene])
TPH	(Total Petroleum Hydrocarbons)
Asbestos	
Perchlorate	
Discarded Military Munitions	

TCE Contamination in Groundwater

The following hazardous substances have been detected in groundwater at the Site: TCE (Trichloroethene, Trichloroethylene) and Acetone. However, only TCE has been elevated consistently over the past 10 years. The applicable cleanup standard for TCE in groundwater is 5 ug/L. Figure 1 shows the locations at the Site where EPA estimates that TCE is above 5 ug/L in the shallow basalt aquifer (Priest Rapids/Roza 1) and the deeper basalt aquifer (Roza 2).

TCE is the contaminant of greatest concern at this site, particularly in the groundwater, since contamination has resulted in three plumes of contaminated groundwater with TCE levels above the Drinking Water Standard.

A conceptual site model is a basic description of how contaminants entered the site, how they move through the site, and where organisms and humans may be exposed to the contaminants. It provides a framework for EPA to assess the health risks from contaminants and develop cleanup plans. The conceptual site model for TCE groundwater contamination at the Site is as follows. TCE was discharged from several locations associated with the military and the aircraft industry over many years to surface soils, moving vertically through the soil due to gravity and surface water infiltration. The TCE eventually reached the fractured basalt aquifers underlying the Site, and some of the TCE immediately contaminated groundwater and then moved off the former Larson AFB with large volumes of groundwater. In addition, a portion of the TCE was captured in basalt voids and fractures and has been released from these basalt voids and fractures into groundwater. It is possible TCE could be released into groundwater from these basalt voids and fractures for many years into the future, and new and existing groundwater wells could draw this contaminated groundwater into the drinking water systems for distribution to the public. An uncertainty remaining in the conceptual model is whether there is sufficient TCE remaining in landfill areas at the site to cause ongoing releases to groundwater from shallow soils. Also, TCE may continue to be released from the underlying basalts within the aquifer itself.

The conceptual site model for other Site contaminants is as follows. The remaining contaminants are less mobile than TCE and generally have remained where they were released in the soil. These hazardous substances present a direct exposure hazard to people who may inadvertently disturb contaminated soils in one or more source areas at the Site. In addition, TCE may have moved deeper into the vadose zone and has the potential to continue to contaminate the groundwater.

Areas Requiring No Further Action
During the remedial investigation EPA determined that 27 potential source areas do not warrant further investigation or action under CERCLA based on historical information (or in some cases limited investigation results that confirmed that the areas were not contaminated). Eleven of the "No Further Action" sites are located outside the Airport boundary, and 16 are located within the Airport boundary. The No-Action sites are:

Outside the Airport
Big Bend Community College Hangar (2) [Numbers refer to Figure 1]
Dumpster Wash Area (6b)
Rock Landfill (7)
Rock Drain Area (13)
Liquid Oxygen Plant Disposal Area (19b)
Municipal Wastewater Treatment Plant (21)
Conventional Ammo Storage (26)
Radioactive Waste Disposal Area (29)
South Burn Pit (32)
Patton Park Landfill (34)
Skyline Auto Wrecking Yard (36)

Inside the Airport
Tarmac Areas (4)
Japan Airline Hangar Area (5)
Stained Soil Area (35)
Gravel Pit (9)
Motor Pool Drain (12)
8-Place Hangar (14)
8-Place Hangar Ditch (15)
Engine Rebuild Facility (16)
Paint Hangar (18)
Engine Rebuild Facility (23)
Building 2802 (24)
Building 408 (25)
Tetraethyl Lead Disposal (27)
Tetraethyl Lead Disposal (28)
Bunker Disposal Area (30)
3-Place Hangar (17)

This Proposed Plan evaluates cleanup alternatives for the remaining 12 sites, 7 sites inside the Airport and 5 sites outside the Airport.

SUMMARY OF SITE RISKS

In the RI/FS, USACE examined and evaluated risks to both human receptors and ecological receptors. The ecological risks to plants and animals were determined to be very low. In addition, based on monitoring data, no significant amount of TCE appears to be entering Moses

Lake. As such, this Proposed Plan will focus on the human health risks at the Site and the necessary actions needed to address those risks.

While EPA must first determine which hazardous constituents are present and at what concentrations to begin the task of determining Site risks, EPA must also consider human exposure pathways based on reasonably anticipated present and potential future land uses (residential, commercial/industrial, recreational). Thus, we have separated the discussion about Site risks from specific areas into two categories: 1) sites located inside the Airport and 2) releases located outside the Airport. The current Airport boundary and lists of sites are shown on Figure 1.

The reason this distinction is important is because sites located inside the Airport are generally located on Port-owned land, and direct human exposures are therefore more easily controlled through security fencing required because public access to the Airport is already controlled by existing federal regulation.

Based on the available information, the following potential source areas pose actual or potential risks to human health or the environment:

Potential Source Areas Inside the Airport [Numbers refer to Figure 1]
Liquid Waste Disposal Area (1)
Aircraft Wash Rack (3)
Randolph Road Base Dump (8)
Fire Training Pit A (10)
Fire Training Pit B (11)
19th Avenue Base Dump (31)
Dump at End of Runway 32 (33)

Access is limited to sites inside the Airport boundary, and controls are in place to limit exposure. However, information on these sites is limited, and additional investigations should be performed as these sites have the highest probability of containing TCE or other contamination. If contaminants are found above health-based levels or at levels which may continue to contaminate groundwater, they will be removed.

Potential Source Areas Outside the Airport [Numbers refer to Figure 1]
Base Closure Landfill (6a)
Liquid Oxygen Plan (19)
South Base Dump (20)
Rocket Research
Paint Hangar Leach Pit (22)

The following paragraphs describe the contaminants found in each area outside the Airport and any actual or potential exposure pathways that were identified for each. In some areas, additional investigation is warranted to confirm our current understanding of the situation.

Rocket Research Area
The Rocket Research location, north of the Airport, is an area where perchlorate wastes were reportedly disposed at the Site.

Area 6a Base Closure Landfill
This area is privately owned and currently accessible to the general public. Solid waste disposed in the landfill included scrap metal, construction and demolition debris, lumber, concrete, plaster, glass bottles, plastic, and possible liquids (e.g., petroleum or common solvents). Hazardous substances reportedly disposed in the Base Closure Landfill included metals (arsenic, copper, lead, mercury, nickel) and possibly petroleum (including BTEX, PAH), TCE and other VOCs, semivolatile organic compounds (SVOCs), and PCBs. Lastly, discarded military munitions were reportedly disposed in various landfills at the Site, including the Base Closure Landfill.

Area 6a is located generally upgradient from a groundwater plume, and TCE was detected in soil gas (in the small spaces between particles of the soil); thus, the landfill may be a current and/or former source of TCE to groundwater. The Base Closure Landfill is in an area of the Site that EPA has designated to be within the 0.5 ug/L TCE-plume concentration line (see Figure 1). Additional investigation is required.

Area 19 Liquid Oxygen (LOX) Plant
The LOX Plant is no longer in use, but the buildings and other structures are accessible by the general public. Historically these buildings and structures were needed to support the handling of liquid oxygen used in the Titan I Missile Program at the Site. The handling of liquid oxygen is a dangerous and potentially explosive task, requiring clean surfaces free from oil and other surface contaminants. TCE was reportedly used in large quantities in this location as a solvent to ensure all metal surfaces coming in contact with liquid oxygen were clean. Hazardous substances reportedly discharged at the LOX Plant include TCE and other VOCs, SVOCs, and TPH. The USACE located and removed two sumps and associated piping that contained TCE-contaminated water and sludge and conducted several soil gas investigations. The high levels of soil gas found when the sumps were removed declined significantly over the following 3 years. One well located downgradient had no detections of TCE. However, significant uncertainty remains about deeper soil gas migration and whether a single well is sufficient to adequately characterize whether the LOX Plant continues to be a source of TCE contamination.

Area 20 South Base Dump
The South Base Dump area is privately owned and currently accessible to the general public. Solid waste disposed in the landfill included construction and demolition debris and other miscellaneous debris. Hazardous substances reportedly disposed at the South Base Dump include metals (arsenic, copper, lead, mercury, nickel) and possibly petroleum (including Benzene, Toluene, Ethylbenzene, and Xylenes [BTEX], PAH), VOCs, SVOCs, and PCBs.

Soil data did reveal elevated lead concentrations; discarded military munitions may also be present, and TCE appears to have been discharged into the environment from this location based on the TCE plume configurations observed (see Figure 1). There is a TCE groundwater plume that appears to begin at Area 20.

TCE detections in both soil gas and in shallow alluvial groundwater downgradient of this area suggest that it may be a source of continuing TCE releases to groundwater. While EPA believes

it is more likely that the current TCE plumes are being created by TCE slowly being released from basalt layers underlying the Site, it is possible that TCE continues to be released from the landfill area. Further investigation is required.

Area 22 Paint Hangar Leach Pit

The Paint Hangar Leach Pit is privately owned and currently accessible to the general public. The Leach Pit appears to have been designed to drain large quantities of wastewater and waste chemical solutions from the Paint Hangar clarifiers and runoff from the refueling area. Hazardous substances reportedly discharged into the Paint Hangar Leach Pit include metals (arsenic, copper, lead, mercury, and nickel), gasoline, diesel, oil, TPH, and PCBs.

Soil sampling revealed lead concentrations up to 1,200 mg/kg, exceeding the EPA screening level of 1,000 mg/kg for industrial land use. In addition, PCBs have been detected at concentrations as high as 8.1 mg/kg, exceeding the State Model Toxics Control Act (MTCA) soil cleanup limit of 1 mg/kg for industrial land use. The leach pit is also set up to continue receiving industrial wastewaters, and it is located on private property that EPA understands may be developed by the property owner. Removal of contaminants is warranted.

SUMMARY OF GROUNDWATER RISKS

The upper TCE groundwater plumes (see Figure 1) exist more than 100 feet below the ground surface in two fractured basalt flows that form one functional aquifer, Priest Rapids/Roza 1. The lower TCE groundwater plumes exist more than 200 feet below the ground surface and are located in the Roza 2 basalt flow aquifer. It is believed that the TCE passed through the coarse sand and a gravel aquifer above the basalt. Monitoring data indicates that this aquifer is relatively clean due to the high groundwater flow rates. There are a total of three upper TCE plumes: the Main Groundwater Plume, the Southerly Groundwater Plume, and the Northeast Groundwater Plume. The lower Roza 2 plumes are beneath the Main and Southerly upper plumes and are believed to have a similar size but lower concentrations. No wells have been drilled in Roza 2 below the Northeast Groundwater Plume, which has lower concentrations and is smaller than the other two upper plumes. The exposure pathways, risks, and conclusions for groundwater cleanup actions are described below for three areas with five distinct TCE plumes at the Site (three plumes in the upper aquifer and two plumes in the lower aquifer).

All five of the TCE groundwater plumes contain TCE concentrations exceeding 5 ug/L, which is the MCL for TCE. EPA considers TCE highly likely to cause cancer in humans. Any consumption of water from drinking water systems containing TCE above 5 ug/L is unacceptable per the federal Safe Drinking Water Act. Any groundwater that exceeds MCLs exceeds CERCLA's criteria for taking a cleanup action. Therefore, all five TCE groundwater plumes identified below require remedial action to protect human health and the environment.

South Groundwater Plume, Upper Basalt Aquifer, Priest Rapids/Roza 1

This TCE groundwater plume is the southerly plume (see Figure 1) in the Priest Rapid/Roza 1 and consists of groundwater in the upper aquifer. It extends from Site 20 (South Base Dump) approximately 7,000 feet south-southwest. The maximum TCE concentration most recently detected in this plume is 88 ug/L.

South Groundwater Plume, Lower Basalt Aquifer/Roza 2
This TCE groundwater plume is the southerly plume in the Roza 2 basalt aquifer and consists of groundwater in the next lower aquifer, believed to occur within the same areal extent as described above for the Priest Rapids/Roza 1. The maximum TCE concentration detected in this plume area is 30 ug/L.

Main North Groundwater Plume, Upper Basalt Aquifer, Priest Rapids/Roza 1
This TCE groundwater Main Plume is the larger and main portion of the northerly plume (see Figure 1), and consists of groundwater in the upper fractured basalt aquifer, extending from Site 33 (Dump at End of Runway 32) at least 6,000 feet south-southwest. The downgradient extent is poorly defined, and the plume may extend as much as another 4,000 feet further south-southwest. The maximum TCE concentration most recently detected in this plume is 41 ug/L.

Main North Groundwater Plume, Lower Basalt Aquifer, Roza 2
This TCE groundwater Main Plume in the Roza 2 basalt is the northerly plume (see Figure 1), and consists of groundwater in the next lower aquifer, assumed to occur within the same areal extent as described above. The only available TCE groundwater concentration sampling result for this plume is 22 ug/L.

Northeast Groundwater Plume, Upper Basalt Aquifer, Priest Rapids/Roza 1
This TCE groundwater Northeast Plume is the smaller portion of the northerly plume (see Figure 1), and consists of groundwater in the upper aquifer. It extends from approximately 500 feet southwest of Site 21 (currently the City of Moses Lake Wastewater Treatment Plant) to approximately 2,500 feet in a south-southwesterly direction. The maximum TCE concentration most recently detected in this plume is 14 ug/L.

Drinking Water Wells
Because there are TCE groundwater plumes at the Site that exceed the MCL of 5 ug/L, any drinking water wells installed in areas within the plumes have the potential of delivering TCE-contaminated water to people. The sampling of a representative set (up to 80) wells has been ongoing for several years. Based on this sampling, five wells/homes have had domestic whole-house filters installed to remove TCE contamination from the water prior to its domestic use.

Water supply systems with more than four connections are subject to the federal Safe Drinking Water Act and, if TCE is detected above standards in their water supplies, they are required to find new water sources or to treat the water before delivering groundwater to homes. However, water systems with fewer than five connections are not required to comply with the Safe Drinking Water Act. This could result in possible direct human consumption of TCE-contaminated groundwater without any regulatory authority, or perhaps the consumers themselves, being aware of the contamination.

SUMMARY OF OTHER RISKS

Discarded Military Munitions
During the remedial investigation, EPA requested USACE conduct trenching operations throughout the landfill areas for the purpose of finding sources that could still be releasing TCE to groundwater. The USACE agreed and requested that an unexploded ordnance team from the Department of Defense be on-Site to ensure the trenching operations were performed such that any remnant ordnance from the former Larson AFB would be detected, if present, and then handled properly. This effort proceeded safely, and about 50 percent of the burial trenches in the landfills were trenched looking for possible TCE sources. No TCE sources were found, but the following discarded military munitions were found: empty small-arms shells; scrap from a 5-inch rocket warhead for pyrotechnic flares; crushed 100-pound AN-M47 series fire bombs; fins, fuses; Navy Rocket 2.25; and 5-inch rocket motors.

Based on this field work, EPA believes the risk of finding unexploded or unreacted ordnance in the Site landfills is small.

Perchlorate
Perchlorate is a hazardous substance used in military munitions and in the commercial production of explosives and incendiaries. Based on information EPA received during the remedial investigation, perchlorate may have been disposed in an area in the northeast corner of the Site, which is outside the Airport. The USACE performed limited groundwater monitoring to investigate the release of perchlorate from this area. No perchlorate was detected during this effort. Additional monitoring will be performed to ensure that perchlorate has not impacted groundwater in the upper basalt aquifers.

Asbestos
Based on the history of the former Larson AFB and knowledge of similar private-sector and military sites, EPA estimates a high probability that asbestos has been disposed in one or more of the landfill areas and is likely present in buildings from the former Larson AFB era.

NEED FOR ACTION

The response actions described in this Proposed Plan are necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances to the environment. The releases that require action under CERCLA include contaminants in soils that present unacceptable risk and/or are sources of groundwater contamination and groundwater contamination that exceeds MCLs. Specifically, there are 12 potential source areas and 5 TCE groundwater plumes identified in the RI/FS and this Proposed Plan requiring cleanup action, additional investigation, and/or institutional controls in order to protect human health and the environment. The proposed actions for these areas and plumes, which are described later in this document, are intended to achieve the Remedial Action Objectives (RAOs) described below.

REMEDIAL ACTION OBJECTIVES

These are the objectives that any cleanup alternative selected by EPA must achieve to be protective of human health and the environment. Overall protectiveness is a threshold criterion

under the federal National Contingency Plan (NCP) for cleaning up oil spills and hazardous substance releases, so any cleanup alternative that does not achieve protectiveness may not be proposed by EPA as a selected alternative. The proposed alternatives in this Proposed Plan will achieve these RAOs.

- RAO 1 – Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with constituents at concentrations above the industrial use criteria, as defined in the Washington Administrative Code (WAC) 173-340-745(5), "Soil Cleanup Standards for Industrial Properties" for human health, or the screening criteria in WAC 173-340-7493, "Site specific terrestrial ecological evaluation procedures" for ecological receptors.

- RAO 2 – Prevent migration of hazardous chemical contaminants through the soil column to groundwater or reduce soil concentrations below WAC 173-340-747, "Deriving Soil Concentrations for Ground Water Protection," groundwater protection criteria, so that no further degradation of the groundwater results from contaminant leaching from the soil.

- RAO 3 – Restore groundwater to meet federal drinking water standards and State cleanup standards.

- RAO 4 – Until groundwater standards are met, prevent human exposure to groundwater contamination above MCLs.

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Applicable or relevant and appropriate requirements (ARARs) are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations placed into federal or state law that:

- Specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, (Applicable) or

- Address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site (Relevant and Appropriate).

The most significant ARARs for this site include:

- For groundwater: MCLs for TCE;

- For soils: WAC 173-340-745(5), "Soil Cleanup Standards for Industrial Properties" for human health, or the screening criteria in WAC 173-340-7493, "Site specific terrestrial ecological evaluation procedures" for ecological receptors.

- For soils: WAC 173-340-747, "Deriving Soil Concentrations for Ground Water Protection."

Additional standards that have not been promulgated into law or regulations can be used as "To-be-Considered" (TBC) criteria. These potential ARARs are incorporated into the remedial action objectives and preliminary remediation goals that are critical factors for the evaluation of alternatives and the selection of preferred remedies.

REMEDIAL ACTION ALTERNATIVES

There are 12 soil sites identified in this Proposed Plan requiring cleanup action, additional investigation, and/or institutional controls in order to protect human health and the environment, as well as 5 TCE groundwater plumes requiring a cleanup action. This section describes various individual remedial actions in a general sense that can be applied to multiple soil or groundwater sites. However, in the next section, EPA groups these individual remedial actions into unique remedial alternatives for each of the 12 sites and 5 plumes in order to show how human health and the environment are protected.

General Remedial Actions

No Action – This action consists of leaving a site and/or plume in its current condition with no further investigation or remedial action. EPA is required by the NCP to consider No Action to be used as a base situation to compare other remedial alternatives.

Institutional Controls – Institutional controls comprise non-engineering measures designed to prevent or limit exposure to hazardous substances left in place or to assure effectiveness of the selected remedy. Institutional controls can be in the form of governmental requirements (such as land use zoning), property restrictions, educational programs, and many other forms.

Excavation – This action consists of physically removing contaminated soil and debris from a waste site and disposal in an appropriate facility.

Alternate Water Supplies – Alternate drinking water may be made available for those systems and individuals with water exceeding 5 ug/L TCE.

Point-of-Use or Wellhead Water Treatment – Installation and maintenance of point-of-use filters or wellhead treatments are engineering controls.

Long-term Monitoring – Monitoring wells are a standard technique used to look for contaminants in groundwater (through collection and laboratory analysis of samples) and to monitor effectiveness and protectiveness of remedies. All remedial alternatives, except "No Action" will have some type of long-term monitoring associated with them, utilizing monitoring wells or a combination of monitoring wells and selected domestic wells. However, monitoring alone would not meet any of the RAOs.

Physical Controls – Locked wellhead caps can be used to protect wellheads of contaminated monitoring wells from being used as a drinking water source and to prevent vandalism. Fencing may be used to provide secure storage for investigation-derived wastes or to control access by the general public.

Groundwater Extraction of Plumes and/or Source Zones – Groundwater pumping, commonly referred to as pump and treat, can be used to stop the movement of the contaminant plume or source, and can speed up the rate at which contamination is removed from plumes. Typically, extraction wells can contain and restore the groundwater with the installation of multiple groundwater extraction wells, pumping the contaminated groundwater to the surface and into a holding tank, and where necessary, treating extracted water to remove TCE contamination exceeding the groundwater cleanup level before the pumped water is allowed to re-infiltrate or is re-injected. Sorbents (e.g. granular activated charcoal) and/or air stripping are frequently used to remove TCE from extracted groundwater.

In-Situ Chemical Treatment of Groundwater by Injection of Reagents – Reagents are injected into the affected aquifer at or near the source zone as a means of promoting an in-situ (in place) chemical oxidation or an in-situ reduction that results in breakdown of TCE. This action requires injection wells to deliver the reagents to the desired treatment zone and selection of a reagent suited for site conditions. Sub-options include: 1) sodium permanganate ($NaMnO_4$) oxidation of TCE; and 2) zero-valent iron (ZVI) dechlorination of TCE.

Natural Attenuation with Monitoring – Natural attenuation processes (dilution, dispersion, and/or mineralization) may slowly decrease TCE contamination in the shallow basalt aquifer. Natural attenuation processes could be assisted by hydraulically containing or treating source zones and portions of the plume with higher TCE concentration than those areas of the plumes extending horizontally and vertically downgradient. The areas near the plume margins may clean up more quickly through dilution by clean upgradient water.

Basic Action – This phrase applies only to the groundwater plume response actions, and it includes all of the generic response actions listed above that do not actually treat or clean up the TCE-groundwater plumes. The response actions above that are considered a Basic Action include: alternate water supplies, point-of-use or wellhead water treatment, testing of new groundwater sources of drinking water and existing untested drinking water wells (upon request), and long-term monitoring.

Remedial Alternatives

Each of the 12 sites and 5 plumes may require a unique combination of the general remedial actions described above in order to protect human health and the environment. EPA has looked at more than 36 remedial alternatives in order to propose an overall selected alternative for the Site.

In the following section, EPA evaluates competing alternatives for all of the sites and plumes needing some type of response action. For brevity, EPA's evaluations are summaries of a much larger body of information and data in the Administrative Record.

EVALUATION OF ALTERNATIVES

The nine remedy selection criteria against which all remedial alternatives for any site are evaluated are: 1) protection of human health and the environment; 2) compliance with applicable, relevant, and appropriate requirements (ARARs); 3) long-term effectiveness and

permanence; 4) reduction of toxicity, mobility, or volume through treatment; 5) short-term effectiveness; 6) implementability; and 7) cost. EPA considers the first two criteria to be "threshold criteria," which means an alternative must meet these two criteria or it cannot be considered. These are highlighted in each table. A "yes" or "no" evaluation for NCP criteria is provided for each contaminated area in the evaluation summaries below; the estimated cost for each alternative is also provided. After EPA receives comments on this Proposed Plan, two more criteria will be considered before EPA writes the Record of Decision on the chosen cleanup remedy: 8) state acceptance and 9) community acceptance.

Potential Source Areas (Soils)

There are 39 sites identified on Figure 1; 22 of these are located inside the Airport boundary and 17 are located outside the Airport. Additionally, during the remedial investigation EPA determined that 27 sites do not warrant further investigation, making these "No Further Action" sites (highlighted in green on Figure 1). This leaves 7 sites inside the Airport for which remedial alternatives are considered in this Proposed Plan and 5 sites outside the Airport.

Comparative Analysis of Alternatives for Sites:

Liquid Waste Disposal Area (1)
Aircraft Waste Rack (3)
Randolph Road Base Dump (8)
Fire Training Pit A (10)
Fire Training Pit B (11)
19th Avenue Base Dump (31)
Dump at End of Runway 32 (33)
Base Closure Landfill (6a)
Liquid Oxygen Plant (19)
South Base Dump (20)
Rocket Research
Paint Hangar Leach Pit (22)

These potential source areas are located both inside and outside the Airport boundary. However, the preferred cleanup alternative is the same, so they have been grouped together for convenience.

Three alternatives are evaluated for the source areas since they may contain TCE in quantities that may impact the groundwater or have metals present above a health-based limit.

- Alternative 1 – No Action
- Alternative 2 – Institutional Controls and Long-Term Monitoring
- Alternative 3 – Additional Investigation and Source Removal, Institutional Controls, and Long-Term Monitoring

The No-Action alternative is not protective of human health and the environment; therefore it is not evaluated further.

Comparison of Alternatives 2 and 3

- Overall Protectiveness. Alternative 2 may not be protective of the environment over the long term as there is a potential for residual source material TCE that could further impact groundwater. In addition, if these sites are redeveloped, there are areas with metal contamination above an industrial standard that people could come in contact with. Further characterization of the soil sites and removal of contaminants would be protective.

- Compliance with ARARs. Alternative 2 would not comply with ARARs if source material continues to migrate to groundwater or humans become exposed to metals during site disturbances. Characterization and removal of contamination would be compliant with ARARs.

- Short-term Effectiveness. Both alternatives are protective in the near term as there is no direct evidence of a continuing groundwater source of contamination. Currently no one has disturbed these sites.

- Long-term Effectiveness and Permanence. Alternative 2 does not remove any source of contamination, so over time exposure could occur. Alternative 3 would remove hazards and therefore is more protective.

- Reduction of Toxicity, Mobility, and Volume. Alternative 2 does not treat any waste. Alternative 3 would remove contaminants and treat them as required to meet disposal criteria.

- Implementability. Both alternatives are implementable.

- Cost. Alternative 2 would cost approximately $758,000. Alternative 3 would cost approximately $18,600,000. Costs for alternative 3 are based on the assumption that 10 percent of the landfill volume would need to be removed to meet cleanup standards.

Summary Table: Source Areas 1, 3, 8, 10, 11, 31, 33, 6a, 19, 20, 22 & Rocket Research

Remedial Alternatives	**Protect HH&E**	**Comply with ARARS**	**Long-Term Effective & Permanent**	**Reduction of Toxicity, Mobility, or Volume**	**Short-term Effective**	**Implementability**	**Cost**
1. No Action	No	No	No	No	No	Yes	$0
2. Institutional Controls & Long-term Monitoring	No	No	No	No	Yes	Yes	$758,000
3. Additional Characterization, Removal of COC Above Health-based Standards, Institutional Controls, Long-term Monitoring	Yes	Yes	Yes	Yes	Yes	Yes	$ 18,600,000

Based on EPA's evaluation of the Site record and NCP criteria, EPA recommends the following remedy alternative for 12 soil sites: Additional Characterization, Removal of Contaminants Above Health-based Standards, Institutional Controls, and Long-term Monitoring. The estimated present value cost to implement this alternative is $18,600,000. These sites have the highest potential to be a continuing source for TCE or contain other contaminants that pose a risk to human health or the environment. Further characterization will reduce the uncertainty. If contamination is found above RAOs, it will be removed. In addition, the paint hangar leach pit, a relatively small site, has lead and PCBs above the industrial cleanup levels, so it will be completely removed.

In general, the sites will be investigated using a combination of soil gas survey techniques coupled with extensive test pitting and soil sampling. Wastes above cleanup levels will be removed and sent offsite for disposal. Additional soil and groundwater investigations near the LOX Plant will also take place in order to determine if a subsurface source of TCE may be located and extracted. The benefits of finding and treating a subsurface TCE source could potentially be very large, perhaps significantly reducing both the long-term scope and cost of other selected groundwater response actions. In particular, the footprint of the northern Priest Rapids/Roza 1 TCE plume could be reduced, thus reducing the potential for downward migration of TCE to the Roza 2 aquifer.

Evaluation and Comparison of Alternatives for TCE Groundwater Plumes

Main Groundwater Plume, Upper Basalt Aquifer, Priest Rapids/Roza 1 and South Groundwater Plume, Upper Basalt Aquifer, Priest Rapids/Roza 1

Alternative 1 – No Action

The No-Action alternative is required by the NCP. This alternative provides a baseline for the comparison of active remedial alternatives developed. Under the No-Action alternative, institutional controls are not implemented, except for controls required to operate the airport in compliance with FAA regulations, and remediation and monitoring of groundwater contamination are not conducted. The No-Action alternative also does not address migration of contaminants from the vadose zone to groundwater. Because TCE is above the MCL, "No-Action" does not meet the threshold criterion of protection of health and the environment and is not evaluated further.

Alternative 2 – Basic Action Only

This alternative constitutes a variety of options so that the public is not exposed to levels of TCE above the MCL of 5 ug/L. The elements include institutional controls, alternate water supplies, such as new wells or point-of-use filters, and long-term monitoring. Alternative 2 is based on existing wells with additional wells in key aquifer locations.

Because Basic Action is also a part of Alternatives 3 and 4, the following evaluation is generally applicable to those other alternatives as well. Therefore the comparative analysis will focus on the differences between Alternatives 3 and 4.

- Overall protectiveness. Basic Action alone is protective of human health and the environment to prevent public exposure to TCE above the MCL to the extent that actions/controls can be applied in the areas of concern. If applied fully, there are no unacceptable short-term or cross-media impacts. The adequacy and reliability of the controls to prevent exposure to contamination will be periodically reviewed and changed if warranted. Because hazardous substances will remain on site, five-year reviews are required to assess effectiveness of institutional control measures, alternate water supply and individual well treatment systems, and long-term monitoring of groundwater.

- Compliance with ARARs. Basic Action alone does not meet ARARs throughout the Site. Alternative 2 assumes the aquifer contaminant concentration levels remain at current levels or are degrading at a slow pace such that current groundwater plumes will continue to exceed the MCL for an extended period of time. However, if combined with additional action in the upper aquifers, Basic Action does meet ARARs in certain plumes, as discussed below.

- Short-term Effectiveness. The alternative would prevent public exposure to groundwater with TCE over the MCL. These controls and measures would need to be continued long into the future in order to ensure that new exposures do not occur. Also, such controls require extensive coordination among federal, state, and local agencies, and regular planned monitoring to ensure success of institutional controls.

- Long-term Effectiveness and Permanence. The areas of the contaminated groundwater plumes comprise an area of about 1000 acres. This area would not be reduced under Alternative 2. It is not possible at this time to estimate how long it will take for groundwater contamination to be low enough to allow removing all controls.

- Reductions in Toxicity, Mobility, and Volume through Treatment. The actions taken under Alternative 2 do not address the treatment of the principal threat (the TCE contamination) in the groundwater.

- Implementability. All services and materials are readily available and obtainable for Basic Action. Implementation problems for this alternative are associated with the ability to consistently apply institutional controls, difficulties in connecting water users' existing (or future) water lines, operations and maintenance for individual well treatment, access to and sampling of long-term monitoring wells, and domestic well sampling. Key concerns about the controls in the short term and long term for this alternative involve the following:

    - The public must be made aware of the potential risks of withdrawing groundwater within an area of concern through an education/notification program. Delivery and availability of information to the public is critical in both short and long terms for this alternative.

    - Well testing must occur to determine specific risk for those living or working within the area of plume and aquifer of concern.

- Individual well treatment installation and operations and maintenance of point-of-use filters would be offered for residences known to be exposed to TCE-contaminated groundwater. For the public in affected residential areas, a clean long-term water supply is required.

For many of the elements within this alternative, implementation of measures may begin or be continued from existing programs almost immediately. Actions such as public notices to construct a well (required by Ecology for new wells drawing over 5,000 gallons per day) and new or continued well treatment installation and point-of-use filters would proceed as soon as practicable without awaiting a delay for remedial design. Some institutional controls also require agency coordination. Some of the constructed elements of this alternative, such as extending water lines or new well installation, have remedial design components that will occur subsequently.

- Cost. The estimated present value for Alternative 2 applied site-wide is $7.9 million.

Alternative 3 – Groundwater Extraction and Ex-Situ Treatment

Groundwater pumping (pump and treat) can be used to stop the movement of the contaminant plume or source. Typically, this approach involves the installation of multiple groundwater extraction wells, pumping the contaminated groundwater to the surface and into a holding tank, and where necessary, treating extracted water to remove TCE contamination exceeding the groundwater cleanup level before the pumped water is allowed to re-infiltrate or is re-injected. Sorbents (e.g. granular activated charcoal) and/or air stripping are frequently used to remove TCE from extracted groundwater. These pump and treat systems would be designed both to contain the groundwater source zones at the head of each plume and to pump the more contaminated areas of the plumes to speed up restoration. It is estimated that approximately six wells will be needed in each plume to provide adequate pumping capacity. The estimated water to be pumped from each plume is between 500 and 750 gallons per minute. A similar number of re-injection wells would be required to return treated water to the aquifer.

Alternative 4 – In-Situ Groundwater Treatment

In-Situ Chemical Treatment of Groundwater involves injection of a reagent into the affected aquifer at or near the source zone as a means of promoting an in-situ (in place) chemical oxidation or an in-situ reduction that results in breakdown of TCE. This action requires injection wells to deliver the reagents to the desired treatment zone and selection of a reagent suited for site conditions. Sub-options include: 1) sodium permanganate ($NaMnO_4$) oxidation of TCE; and 2) zero-valent iron (ZVI) dechlorination of TCE.

Comparative Analysis of Basic Action Combined with Groundwater Extraction and Ex-Situ Treatment and Basic Action Combined with In-Situ Treatment

- Overall Protectiveness. Both alternatives are considered protective. Reviews every five years would continue until such time as drinking water standards are met.

- Compliance with ARARs. Both alternatives would comply with applicable laws.

- Short-term Effectiveness. Since institutional controls are in place under the Basic Action, both alternatives are considered effective in the short term. Alternative 3, ex-situ treatment, has the potential to return the water to its highest beneficial use the soonest.

- Long-term Effectiveness and Permanence. Alternative 3, ex-situ treatment, would provide the highest likelihood of protecting the City's water supply and returning the aquifer to a drinking water source. In contrast, the long-term effectiveness of in-situ treatment is highly uncertain (as described below, see "Implementability").

- Reductions in Toxicity, Mobility, and Volume through Treatment. Both Alternative 3 and 4 employ treatment as a principal component. Ex-situ treatment rates slightly better because there is more uncertainty associated with in-situ treatment since it can be difficult to effectively deliver chemicals in all the source zones in a heterogeneous aquifer. An advantage of in-situ treatment is that little secondary waste is generated. However, if injections cease, contamination may rebound.

- Implementability. Pump and treat technology is common for groundwater contamination. This technology is well understood. The only difficulty is in determining how a fractured bedrock aquifer will respond to the treatment.

  Injection wells are not difficult technology per se, but the injection of the reactive slurry into the subsurface is more difficult in fractured bedrock than in gravelly or sandy aquifers. Technical difficulties of in-situ treatment may include injection of the treatment agent into the most concentrated areas of the treatment zone and optimizing applications of reagent to account for dissolved oxygen. It may also require an unknown number of repeated injections of the treatment chemicals, making costs more difficult to determine. Therefore the implementability of the in-situ treatment alternative is unknown.

- Cost. Cost for Alternative 3 combined with Basic Action is estimated at approximately $13 million, and the estimated cost for Alternative 4 combined with Basic Action is $14 million.

Summary Table: Main Groundwater Plume, Upper Basalt Aquifer, Priest Rapids/Roza 1 and South Groundwater Plume, Upper Basalt Aquifer, Priest Rapids/Roza 1 (Note the cost estimates include the cost of Basic Actions in other areas of the Site also.)

Remedial Alternatives	Protect HH&E	Comply with ARARS	Long-Term Effective & Permanent	Reduction of Toxicity, Mobility, or Volume	Short-term Effective	Implementability	Cost
1. No Action	No	No	No	No	No	Yes	$0
2. Basic Action	No	No	No	No	Possibly	Unknown	$7,900,000
3. Basic Action, Groundwater Extraction and Ex-Situ Treatment	Yes	Yes	Yes	Yes	Yes	Yes	$13,000,000 - 19,000,000 *
4. Basic Action, In-Situ Source Treatment	Yes	Yes	Yes	Yes	Yes	Unknown	$14,000,000

*Based on additional characterization groundwater extraction and treatment may be required for the Roza 2 and Northeast groundwater plumes.

Based on EPA's evaluation of the Site record and NCP criteria, EPA recommends the following remedy alternative: Basic Action, Groundwater Extraction and ex-situ treatment. The intent of these actions is to restore the groundwater to its highest beneficial use (drinking water) as soon as possible by pumping and treating groundwater areas contaminated with TCE that is significantly above the MCL of 5 ug/L in the Roza 1 aquifer and allowing natural attenuation (through dilution) to clean up the lower-concentration areas around the edges of the plumes. The estimated present value cost to implement this alternative is $13,000,000 for the south and main groundwater plumes.

Data is limited on the possibility of TCE contamination in the deeper part of the aquifer. Monitoring/extraction wells will be drilled to further define the extent of contamination in the Roza 1, Roza 2, and Roza 3 basalts. In addition, as wells are drilled, soil samples and soil gas samples will be taken to ascertain whether the vadose zone is a continuing source.

The No-Action alternative does not meet the threshold criteria. The southerly TCE plume in the upper basalt aquifer is the most problematic of the plumes in terms of negative impacts on the greatest number of privately-owned parcels of land. It is this plume that impacted the Skyline community wells and, based on a review of the groundwater data, it appears this plume derives from a TCE source in or near the South Base Dump.

The selected remedy assumes that containing the aquifer contamination sources and removing the more contaminated core zones of each plume through pumping will cause the areas near the plume margins to degrade more quickly through dilution than if the sources continued to feed the plumes. If attenuation of the outer portions of a plume is not occurring at an acceptable rate, additional wells may be added to treat more of the aquifer. Without an active remedy, the plumes are likely to persist for several decades or perhaps even longer.

A specific circumstance that could significantly impact implementation of the proposed remedy for the south groundwater plume is degradation of water quality (i.e., increasing TCE groundwater concentrations approaching the MCL) pumped from City of Moses Lake groundwater production wells. The proposed remedy is intended to facilitate continued delivery of clean drinking water supplies via City facilities, and any sampling data EPA obtains indicating this important objective is not being met by the proposed remedy will require EPA to reevaluate this remedy. If this specific circumstance does occur, EPA recommends a contingent remedy of wellhead treatment for impacted City production wells.

South Groundwater Plume, Lower Basalt Aquifer, Roza 2 Aquifer;
Main North Groundwater Plume, Lower Basalt Aquifer, Roza 2 Aquifer

Based on EPA's evaluation of the Site record and NCP criteria, EPA recommends the following remedy alternative: Basic Action. Basic Action consists of provision of alternate water supplies, point-of-use or wellhead water treatment, testing of new groundwater sources of drinking water, and long-term monitoring. This selection can only be understood in relationship to the recommended remedy for the upper basalt aquifer, already described above. The conceptual site model for the Site suggests that the TCE contamination migrates vertically from the upper aquifer down to the lower aquifer. Thus, as a technical strategy, it makes more sense to deal with the upper aquifer more aggressively. EPA has adopted this approach by selecting Basic

Action for the Roza 2 aquifer, while selecting the more aggressive treatment scenario for the upper Roza 1 aquifer to reduce the source of TCE to the Roza 2 aquifer below. Therefore, when evaluated in the context of additional actions being taken to address the upper aquifer, Basic Action in the Roza 2 aquifer satisfies the threshold criteria of protectiveness and compliance with ARARs. The cost is a component of the Sitewide estimate of $7.9 million for Basic action to address all 5 TCE plumes.

EPA also proposes to select a source treatment alternative as a contingent remedy here if, during drilling for long-term monitoring, EPA finds a high-concentration, large mass, localized TCE source in Roza 2 that needs to be treated. In other words, if the contamination mirrors what is seen in Roza 1, then additional pumping wells will be installed in the Roza 2 aquifer. Cost for this contingency is estimated in the FS at approximately $4,000,000.

The proposed remedy assumes that reducing the amount of contaminated groundwater migrating down to the Roza 2 aquifer will cause the existing plume to degrade or dilute more quickly than if the Roza 1 TCE source continued to feed the plume. Otherwise the plume would be likely to persist nearly as long as the Roza 1 plume.

Northeast Groundwater Plume, Upper Basalt Aquifer, Priest Rapids/Roza 1

Based on EPA's evaluation of the Site record and NCP criteria, EPA recommends the following remedy alternative: Basic Action. The costs for Basic Action are presented earlier. This plume is small and has relatively low TCE concentrations (see Figure 1). Therefore, when evaluated in the context of additional actions being taken to address the upper aquifer, Basic Action in the Northeast Plume satisfies the threshold criteria of protectiveness and compliance with ARARs.

It should be noted that given the proximity to the main groundwater plume there is a possibility that the capture zone for the main plume will also encompass the Northeast groundwater plume. If this plume is not captured by the main pump and treat system and additional monitoring indicates a need for action, additional pumping wells would be added. The cost for this contingency is estimated at approximately $2 million dollars.

Site-Wide Remedial Elements of All Alternatives

There are several response actions that are related to issues associated with the soil sites and groundwater plumes that EPA is proposing to select and implement for the overall Site:
1) institutional controls, 2) long-term monitoring, and 3) engineering controls.

Institutional Controls
For contaminated groundwater, EPA recommends the implementation of institutional controls designed to prevent human consumption of TCE-contaminated groundwater during the period before treatment remedies or natural attenuation have remediated the plumes. Such Site-wide institutional controls will likely be in the form of administrative (governmental) efforts that ensure new or expanded drinking water systems or private wells do not inadvertently deliver TCE-contaminated groundwater to people or do not increase the size and depth of the existing groundwater plumes. EPA proposes that the extent of such institutional controls be confined to the Institutional Control Boundary depicted in Figure 1. Within this area, which encompasses City, County, and Port jurisdictions, EPA anticipates being able to successfully implement

institutional controls in partnership with the City, County, and the Port. Land development, permitting, and enforcement are more properly a matter for local control, and EPA must by necessity rely on local governments to implement and enforce such controls. EPA envisions that Grant County would require testing for TCE in new wells drilled within the Institutional Control Boundary as part of the potable water suitability determination. If TCE is found above, at, or near the drinking water standard of 5 ug/L, then EPA would install a filter to allow for domestic use. If any of the soil sites are disturbed as development occurs, asbestos and military munitions could be uncovered. It is recommended that information be recorded in any deeds or covenants to require asbestos and munitions monitoring at these sites prior to any development or soil movement.

Long-term Groundwater Monitoring

EPA recommends the implementation of long-term groundwater monitoring designed to evaluate whether TCE plumes decrease in size and concentration over time. This monitoring will have the tertiary benefit of filling data gaps related to groundwater contamination. This monitoring will also evaluate whether the extent of TCE contamination is limited to the currently identified plume boundaries, and to determine whether the Roza 3 aquifer is contaminated. If the Roza 3 aquifer becomes contaminated in the future, additional cleanup actions in the Roza 2 or Roza 3 aquifer may be warranted. This groundwater monitoring is proposed for the area within the Institutional Control Boundary depicted on Figure 1. Long-term groundwater monitoring will likely include existing groundwater monitoring wells, some new monitoring wells, existing City and community system wells, and a representative subset of existing residential drinking water wells. If an unacceptable level of contamination is detected in individual wells, whole-house filters will be installed.

Engineering Controls

EPA recommends the implementation of engineering controls designed to remove TCE from groundwater with TCE concentrations exceeding 5 ug/L used by City, community, or residential (less than five connections) drinking water supply wells. There are currently five residential wells EPA is aware of that have elevated TCE concentrations; these wells currently have whole-house filters installed to remove TCE from household water. Until the groundwater is cleaned up, EPA anticipates that additional wells may need such wellhead treatment over time. As TCE concentrations in wells with whole-house filters drop consistently below 5 ug/L, the filters would be removed. These engineering controls are not considered a long-term remedy, but are instead intended to protect groundwater users while the entire Site-wide remedy is being implemented. In the area of the Northeast Plume, where there is no active remedy proposed and City water supply service is not expected to be extended in the foreseeable future, EPA proposes replacing any well with TCE concentrations exceeding 5 ug/L with a deeper, uncontaminated well.

Asbestos Monitoring and Abatement

EPA recommends that asbestos monitoring be performed if (or when) wastes in the landfill areas associated with the Site are disturbed in any manner. If asbestos is identified, EPA recommends that asbestos abatement be performed, if required, in accordance with applicable requirements. EPA is not aware of any specific data suggesting there is asbestos in these landfills and no asbestos samples were obtained during the remedial investigation. However, based on the history of the former Larson AFB and EPA's knowledge of similar private-sector and military sites, there is a high probability that asbestos has been disposed in one or more of these landfill areas.

SUMMARY OF ACTIONS PROPOSED

In summary, this Proposed Plan focuses on cleanup actions in potential source areas and groundwater to protect human health and the environment from Site contamination. Thirty-nine soil release sites were evaluated as part of the cleanup process, and it was determined that 27 sites posed little or no risk to human health or the environment. Twelve sites will require further characterization and removal of hazardous constituents if found, and one site, the paint hangar leach pit (22), will be completely removed. Groundwater pump-and-treat systems will be installed for two plumes of TCE to control the source zones and remove contaminants from the plumes until the drinking water standard of 5 ug/L could be met as quickly through natural attenuation.

There are contingencies to pump and treat other plumes based upon the groundwater monitoring that will be developed during the early phases of the cleanup. Additional monitoring wells and institutional controls will also be required on the groundwater plumes to ensure protection. The total estimated cost for all the soil and groundwater actions is approximately $31,600,000. Based on additional characterization, if treatment is needed in the lower basalt Roza 2 plumes and the Northeast upper basalt Roza 1 plume, the projected costs are $37,600,000.

COMMUNITY PARTICIPATION

Because this Proposed Plan presents a complex set of remedial action recommendations, EPA has determined that it is warranted in this case to extend our routine 30-day comment period to 60 days. Therefore, the comment period will begin on January 7, 2008 and will end on March 7, 2008.

Additionally, EPA will host two public meetings in the Moses Lake area, one late January and one in mid-February. The January meeting will be informal; you will be able to ask the EPA team any questions you might have, look at various maps, and see key documents EPA has used to develop this Proposed Plan.

The February meeting will be a formal public meeting; you will be able to submit your official comments to EPA regarding the Proposed Plan, either in writing or orally. (EPA will accept any written comments with a postmark date within the comment period.) A court reporter will be in attendance to record all oral comments made at the public meeting, so it is not required that your comments be in written form.

During the public comment period, please submit all written comments to:

Dennis Faulk
U.S. Environmental Protection Agency
309 Bradley Blvd., Suite 115
Richland, Washington 99352

If you have general project questions, please contact Dennis Faulk at 509-376-8631 or *faulk.dennis@epa.gov*.

If you have questions of a legal nature, please contact Ted Yackulic at 206-553-1218 or *yackulic.ted@epa.gov*.

Questions specifically related to hydrogeology or to EPA's interpretation of the groundwater data set reflected in Figure 1 should be directed to Marcia Knadle at 206-553-1641 or *knadle.marcia@epa.gov*.

Questions specifically related to the TCE MCL of 5 ug/L or to EPA screening levels for various contaminants should be directed to Julius Nwosu at 206-553-7121 or *nwosu.julius@epa.gov*.

Questions related to details about the public comment period or the two public meetings EPA is holding in the Moses Lake area should be directed to Suzanne Skadowski at 206-553-6689 or *skadowski.suzanne@epa.gov*.

This Proposed Plan and supporting documents are available for public review at the Moses Lake Superfund Site information repository:

Big Bend Community College Library
7611 Bolling Street, Building 1700
Moses Lake, WA 98837
509-762-6246