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PROPOSED PLAN FOR THE 1100 AREA SUPERFUND SITE AT THE HANFORD RESERVATION, WASHINGTON

PUBLIC COMMENT PERIOD ON ALTERNATIVES APRIL 5, TO MAY 21, 1993

PUBLIC MEETING ON APRIL --, 1993. 7:00 PM

LOCATION

This Proposed Plan (Plan) describes alternatives that are being considered to cleanup contaminated areas of the 1100 Area Superfund Site at the Hanford Reservation in Benton County, Washington. This plan also identifies the preferred cleanup alternative for the various subunits within the overall 1100 Area. Detailed information can be found in the Final Remedial Investigation/Feasibility Study - Environmental Assessment Report (Final RI/FS-EA Report) currently available for public review and comment. The 1100 Area Superfund Site is one of four Superfund sites designated at the Hanford Reservation. The 1100 Area includes four "operable units" (OUs), designated as 1100-EM-1, 1100-EM-2, 1100-EM-3 and 1100-IU-1. The locations of the OUs is shown on Figure 1. The Environmental Protection Agency (EPA) the lead agency, in conjunction with the Washington Department of Ecology (Ecology) the support agency, and the U.S. Department of Energy (DOE) the responsible agency, assigned the 1100-EM-1 OU the highest priority amongst all Hanford Site OUs due to its proximity to the North Richland well field and concerns that groundwater contamination from the 1100-EM-1 OU might reach the well field. The investigations found that low levels of contaminants present in the groundwater are moving away from the well field. In the fall of 1992, a joint decision was made to accelerate the study and evaluation phase of the other three OUs, in order to develop a consolidated 1100 Area cleanup plan. The reader should consult the Final RI/FS-EA Report and the Administrative Record file to obtain complete information regarding the proposed remedial actions. The Administrative Record file contains information used in the evaluation of the site and cleanup alternatives. The Administrative Record file is available at the following locations:

U.S. Department of Energy
Richland Operations Office
Administrative Record Center
345 Hills Street
Richland, Washington 99352

EPA Region 10
Superfund Record Center
1200 Sixth Avenue
Park Place Bldg., 7th Floor
Mail Stop: HW-074
Seattle, Washington 98101

Written comments should be sent to:

[Identify POC]

EPA is issuing this proposed Plan as part of its public participation responsibilities under the Superfund Law, section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The preferred alternative presented in this Plan is EPA's initial recommendation. EPA will select the final cleanup activities only after the public comment period has ended and all of the comments have been reviewed and considered. EPA can extend the comment period an additional thirty days, if requested. Comments are encouraged from concerned citizens on all of the alternatives presented ,not just the preferred alternative. Comments may be made in person at the April --- public meeting, or may be submitted in writing.

All of the alternatives, including the proposed remedial actions associated with the preferred alternative, were evaluated to satisfy the requirements of the National Environmental Policy Act (NEPA). A summary of the NEPA values that were evaluated is presented in Table 1. In accordance with DOE policy under DOE Order 5400.4, NEPA values were integrated into the procedural and documentation requirements of CERCLA in order to analyze any potential environmental consequences of the proposed actions and the other alternatives. This was accomplished primarily by integrating the relevant aspects of the RI/FS required under CERCLA with the Environmental Assessment (EA) aspects required under NEPA into one document, the RI/FS-EA. However, nothing in this Proposed Plan, or other documents to be prepared, is intended to present a statement on the legal applicability of NEPA to remedial actions under CERCLA.

ACTIVITIES TO DATE

The 1100 Area was placed on the National Priority List in July 1989. Due to the presence of groundwater contamination and the close proximity of the North Richland Wellfield, the 1100-EM-1 OU was assigned the highest priority. The RI/FS-EA activities at the 1100-EM-1 OU were initiated in 1989, and the Phase I RI/FS was completed in August 1990. In the fall of 1992, a joint decision was made to accelerate the study and evaluation phase of the other three OUs, in order to develop a consolidated 1100 Area cleanup plan. In lieu of extensive field investigations, the 1100-EM-2, 1100-EM-3 and 1100-IU-1 OUs were evaluated by analysis of existing waste information, detailed visual inspections and through interviews with site personnel. A draft of the Final RI/FS-EA Report for the entire 1100 Area is currently available for public review.

The 1100-EM-1 evaluation was nearly completed at the time of the decision to accelerate the evaluation of the other three OUs. Because of this, the RI/FS-EA documents are organized in a manner that presents information on the 1100-EM-1 OU and an Addendum that presents information on the other three OUs. The information in this Plan is presented in a similar manner.

SITE BACKGROUND

The 1100 Area is the central warehousing, vehicle maintenance, and transportation distribution center for the entire Hanford Site. A wide range of materials and potential waste products were routinely used at and near the 1100 Area. The Final RI/FS-EA Report identified three subunits within the 1100-EM-1 OU that contained contaminants at levels that may pose potential long-term risks to human health. A description of each of these subunits and the contaminated media is provided below. The location of each of the subunits is shown on figure 2.

- Discolored Soil Site: The location of a spill onto the ground surface of bis(2-ethylhexyl)phthalate (BEHP) that resulted in the contamination of up to 340 cubic meters (440 cubic yards) of soil.

- Ephemeral Pool: An elongated manmade depression adjacent to a parking area where runoff water collects and evaporates. Up to 250 cubic meters (340 cubic yards) of soils are contaminated with polychlorinated biphenyls (PCBs) from an unknown release at this site.

- The Horn Rapids Landfill (HRL): A solid waste facility used primarily for the disposal of office and construction waste, asbestos, sewage sludge, fly ash, and reportedly numerous drums of organic liquids. The investigations did not confirm the presence of these drums. Contaminants of concern are the asbestos distributed throughout the landfill, and approximately 460 cubic meters (600 cubic yards) of PCB contaminated soils. Groundwater is contaminated with trichloroethene (TCE) and nitrates in the vicinity of the HRL. While the exact nature of the source and the release of the contamination has not been determined, it is believed to have originated offsite. The contamination consists of a TCE plume 1.6 kilometers (1 mile) long and 0.3 kilometers (0.2 miles) wide, and nitrate contamination throughout the area. The TCE plume currently extends below the HRL and downgradient to the northeast.

The 100-EM-2 and 1100-EM-3 OUs are adjacent to the 1100-EM-1 and have supported similar warehousing and vehicle maintenance activities. 18 waste management units (WMU's) within the two OUs were identified as candidates for remedial actions.

[(need to decide Y/N to show them all in a figure or list them out as in table 5.2 from the FFS (attached)].

The IU-1 OU consists of a former NIKE Missile Base and Control Center at the top of Rattlesnake Mountain. 32 WMU's were identified with that OU as candidates for remedial actions. In all three OUs, the WMU's primarily consist of tanks that were used for fuel and chemical solvent storage, transformers and pads, spills and disposal areas.

Only limited information for groundwater is currently available for 1100-EM-2 and 1100-EM-3. No information is available for 1100-IU-1. The current information indicates the presence of nitrates in groundwater beneath the 1100-EM-3 OU.

SCOPE AND ROLE OF ACTION

This Proposed Plan addresses contaminated soils found at the 1100-EM-1 subunits identified as: Discolored Soil Site; Ephemeral Pool; HRL; and the contaminated groundwater in the vicinity of the HRL. In addition, the plan presents a framework for surface and soil cleanups in the other 1100 OUs, as well as a framework for additional groundwater activities. The current and expected future use of the 1100-IU-1 is that it will remain part of the Arid Lands Ecology Reserve (ALE). The current and expected future use of the rest of the 1100 Area is industrial. For the 1100-EM-1 subunits, the potential threat to human health is associated with long-term worker exposure to contaminated media through direct contact, ingestion, or the inhalation of fugitive dust. The cleanup objectives are to prevent current

and future exposure to the contaminated media through treatment, containment, or the use of institutional controls and to prevent potential migration of soil contaminants to the groundwater. While the cleanup objectives for the other OUs is the same, a quantitative risk assessment was not performed for those OUs. Instead, a qualitative evaluation of overall potential risk was made based on existing state and Federal guidelines.

SUMMARY OF SITE RISKS

Potential adverse human health effects associated with exposure to site contaminants are expressed in two ways. The first is potential increased cancer risks associated with long-term exposure and are expressed exponentially as 1E-04, 1E-05, 1E-06 (one in ten thousand, one in one hundred thousand, one in a million). This means that for a 1E-04 risk, if 10,000 people were exposed to a contaminant of concern over a long period of time (typically 70 years), one additional person would be expected to be diagnosed with cancer. Based on current national cancer rates, 2,500 people out of a population of 10,000 are expected to be diagnosed with cancer. Under a 1E-04 risk, 2,501 cancer diagnoses would be expected. For non-carcinogenic health impacts, a Hazard Index (HI) is calculated. An HI greater than or equal to 1.0 is considered to pose a potential adverse human health risk.

Three separate risk assessments were conducted to estimate potential human health or environmental risks that could result if the soil and groundwater contamination at the 1100-EM-1 OU were not remediated. The Baseline Industrial Scenario Risk Assessment focused on industrial site workers and potential adverse health affects that could result from exposure to onsite contaminants in soil and groundwater. The Baseline Residential Scenario Risk Assessment was performed to establish a conservative baseline to evaluate potential risks associated with future land use, if the land use changed to residential. An Ecological Risk Assessment was also undertaken to evaluate potential adverse effects of onsite contaminants on the flora and fauna present in on-site ecosystems. That assessment indicated that there are no current adverse impacts to onsite ecosystems associated with 1100-EM-1 subunit contaminants.

Potential adverse health effects for onsite industrial workers were the primary consideration in evaluating site risks. The analysis focused on the contaminants of concern at each of the three subunits. The lifetime incremental cancer risks from contaminants at each area for an onsite industrial worker exposure are 2E-05 for the Discolored Soils area, 2E-05 for the Ephemeral Pool, and 5E-05 for the Horn Rapids Landfill. This risk is associated with long-term These risks are within the acceptable or target range (10E-04 to 10E-6) used by EPA. Remedial actions generally are not warranted at these risk levels unless there are other considerations such as adverse environmental impacts, potential for future migration, or uncertainty regarding future land use. Under a future residential scenario, if no cleanup actions were undertaken, the potential long-term risks for each subunit would be; 2E-03 for the Discolored Soils Site; 1E-03 for the Ephemeral Pool; and 3E-03 for the Horn Rapids Landfill.

The HI for all areas under the industrial scenarios is less than 1.0 For the future residential scenario, the HI for the Discolored Soils Site is 18; the HI for the Ephemeral Pool is 2.5; and the HI for the Horn Rapids Landfill is 1.2.

Though site risks are low, and DOE believes that the future land use is likely to remain industrial, EPA, Ecology, and DOE agreed to evaluate cleanup goals at the more stringent residential levels under the state of Washington Model Toxic Control Act (MTCA), where practicable. The Final RI/FS-EA report indicates that it is practicable to meet MTCA **residential** cleanup standards at the Discolored Soils Site and Ephemeral Pool subunits. The BEHP contaminated soil at the Discolored Soil Site subunit will be remediated to concentrations below 71 ppm, and the PCBs contaminated soil at the Ephemeral Pool subunit will be remediated to concentration levels at or below 1 ppm.

Because of the uncertainty and physical risks associated with excavating in old landfills, as well as the widespread, low levels of PCBs present in the landfill, meeting the more stringent MTCA requirements was not deemed practicable for the HRL subunit. However, approximately 10 cubic yards of soils with PCB's between 50 PPM and 100 PPM will be excavated to meet requirements of the Toxic Substances Control Act. The MTCA industrial criteria was used to evaluate a PCB contaminated soil cleanup level of 17 ppm. If that cleanup level were met, the incremental potential cancer risk for the HRL would be reduced from 5E-05 to 2E-05. For the other subunits, if the cleanup levels discussed above are met, the incremental cancer risks at each of the other subunits would be reduced to 9E-08 at the Discolored Soil Site and 1E-06 at the Ephemeral Pool.

The groundwater contaminants do not present any risks to human health under the current and expected future industrial land use scenario because: (1) current and future downgradient users are supplied by the city of Richland water distribution system; and (2) the remedial investigation

determined that the North Richland wellfield is not impacted by the contaminant plume. It should be emphasized that the wellfield is approximately two miles to the southeast from the HRL, while the contaminant plume is travelling to the northeast. However, DOE performed an uncertainty risk assessment for groundwater using the highly conservative assumption of a residential exposure scenario. This analysis determined that a lifetime incremental cancer risk associated with the current levels of TCE would be 3E-05 in the event that drinking water wells were installed in the contaminant plume. The Hazard Index would be 0.8. It should be emphasized that residential use of the land or groundwater is unlikely within the next 20 years.

As with soil contamination, the potential risks associated with the contaminated groundwater are within the acceptable risk range established by EPA for CERCLA sites. However, DOE has agreed to meet the MTCA groundwater criteria for industrial sites. Under that regulation, the groundwater must meet the Safe Drinking Water Act Maximum Concentration Levels (MCLs) of 5 parts per billion for TCE, and 10 parts per million for nitrate. Attainment of MCLs needs to be addressed due to the fact that groundwater as a drinking water source in the future cannot be ruled out entirely. Achieving MCLs in groundwater would reduce the lifetime incremental cancer risk for TCE to 1E-06 and the hazard index for nitrate to 0.17.

SUMMARY AND EVALUATION OF ALTERNATIVES

The remedial alternatives evaluated for the 1100-EM-1 OU are presented first. The remedial alternatives evaluated for the other three OUs follows. Due to the fact that soil and groundwater contamination are independent of each other at the 1100-EM-1 OU (soil contaminants of concern were not detected above screening levels in groundwater), the Final RI/FS-EA evaluated soil and groundwater alternatives separately. A complete discussion of technologies that were evaluated is presented in Chapter 8 of the RI/FS-EA Report. The presentation of alternatives in this Plan uses a shorthand notation followed by the corresponding alternatives presented in the RI/FS-EA report.

1100-EM-1 OPERABLE UNIT

Common Elements. All alternatives utilize institutional controls that consist of maintaining the current industrial land use, restricting access to those sites on which some contaminants would remain in place, continuing to supply downgradient consumers of water through the city of Richland distribution network and continuing groundwater monitoring.

The preferred alternative for the 1100-EM-1 subunits is:

Discolored Soils Site; Alternative S-3, Offsite incineration of BEHP contaminated soils.

Ephemeral Pool; Alternative S-1, Offsite disposal.

Horn Rapids Landfill; Alternative S-1 Asbestos Cap

Groundwater; Alternative GW-1, Natural attenuation and monitoring for compliance with MCLs.

The preferred alternative is believed to provide the best balance of trade-offs among the alternatives with respect to the nine evaluation criteria used to evaluate remedies. A description of those criteria is presented in the glossary on the last page. The criteria fall into three categories; the first two, protection of human health and the environment and attainment of ARARs, are considered threshold criteria and in general must be met or require waivers. The next five are considered balancing criteria and are used to compare technical and cost aspects of alternatives. The final two criteria, State and Community Acceptance are considered modifying criteria. Modifications to remedial actions may be made based upon state and local comments and concerns. These are evaluated after all public comment has been received.

1100-EM-1 SOILS

Discolored Soils Site Subunit

Alternative S-0: No Action. The CERCLA process requires that a "no action" alternative be evaluated to establish a baseline for comparison. Under this alternative, no active action would be taken to remediate the Discolored Soils Site.

Alternative S-1 (S-1B & S-1D): Onsite Bioremediation. The BEHP contaminated soils would be bioremediated. The treatment operations would comply with RCRA requirements. The treated soils would be placed back into the excavated area if treatment standards are achieved.

Alternative S-2 (S-2B & S-2D): Onsite Incineration. The BEHP contaminated soils would be incinerated on-site. The residuals from the incineration would be placed back in the excavated area and covered with six inches of soil.

Alternative S-3 (S-3B & S-3D): Offsite Incineration. Under this alternative, the BEHP contaminated soils would be excavated, transported by a licensed hazardous waste hauler, treated at a RCRA permitted incinerator and the ash disposed of in a RCRA permitted landfill. The excavated area would be backfilled with clean fill.

Evaluation of Alternatives for the Discolored Soils Site Subunit.

Overall Protection of Human Health and the Environment: Alternative S-0 does not address the BEHP soil contamination. Alternative S-1 would be expected to reduce the levels of BEHP contamination, although the degree to which this would be successful is unknown. Alternatives S-2 and S-3 would be expected to provide the greatest degree of effectiveness.

Compliance with ARARs: Alternative S-0 does not comply with ARARs. Alternative S-1 may not be efficient enough to meet MTCA cleanup levels. Alternatives S-2 and S-3 would be expected to meet cleanup levels. Both would be required to comply with appropriate transportation, storage and disposal (TSD) requirements.

Long-Term Effectiveness and Permanence: Alternative S-0 does not address these factors. Alternatives S-2 and S-3 would have the highest degree of long-term effectiveness and permanence. Alternative S-1 has the potential for a high degree of success.

Reduction in Toxicity, Mobility or Volume: Alternative S-0 does not address these factors. Alternatives S-2 and S-3 address these factors more completely through complete destruction than does S-1.

Short-Term Effectiveness: Alternative S-0 would pose no on-site remedial construction or implementation risks to workers since no action would be taken. The speed with which it addresses subunit risks is not relevant for S-0. Alternatives S-1, S-2 and S-3 are comparable from the standpoint of having minimal construction or implementation risks due to the low volume of soil to be remediated and that associated low level of activities. Alternatives S-2 and S-3 would be expected to completed more rapidly than S-1 due to the uncertainties associated with bioremediation.

Implementability: This criterion does not apply to S-0. Alternatives S-1 and S-2 would require some on-site training and monitoring for effectiveness. All components of S-3 are readily available.

Cost: The costs associated with the three alternatives are:

	S-0	S-1	S-2	S-3
Capital	0	997	1,491	2,131

(Costs in thousands of dollars)

Ephemeral Pool Soil Subunit

Alternative S-0: No Action. The CERCLA process requires that a "no action" alternative be evaluated to establish a baseline for comparison. Under this alternative, no active action would be taken to remediate the Ephemeral Pool Soil subunit.

Alternative S-1 (S-1B, S-1D, S-5B, S-5D): Offsite Disposal. The Ephemeral Pool soils contaminated with PCBs above 1 ppm would be excavated, transported by a licensed waste hauler, and disposed of in a TSCA permitted facility. The excavated area would be regraded and backfilled with clean soil.

Alternative S-2 (S-2B & S-2D): Onsite Incineration. The PCB contaminated soils would be incinerated on-site in a rotary kiln. The residuals from the incineration would be placed back in the excavated area and covered with six inches of soil.

Alternative S-3 (S-3B, S-3D): Offsite Incineration. The Ephemeral Pool soils contaminated with PCBs above 1 ppm would be excavated, transported by a licensed waste hauler, treated at a RCRA permitted offsite incinerator, and the ash disposed of in a RCRA permitted landfill. The excavated area would be backfilled with clean material and regraded.

Evaluation of Alternatives for the Ephemeral Pool Subunit: Overall Protection of Human Health & the Environment. Alternative S-0 does not address this criterion. Alternatives S-1, S-2 and S-3 are protective by eliminating potential onsite risks.

Compliance with ARARs: Alternative S-0 does not address ARARs. Alternatives S-1, S-2, and S-3 would be required to comply to meet ARARs for remediation, as well as for TSD facilities.

Long-Term Effectiveness and Permanence: Alternative S-0 does not address this criterion. Alternatives

S-2 and S-3 have a higher degree of permanence and effectiveness than S-1, due to the permanent destruction by incineration.

Reduction of Toxicity, Mobility or Volume: Alternative S-0 does not address this criterion. S-2 and S-3 have a greater degree of reduction than S-1 since contaminants are destroyed.

Short-Term Effectiveness: Alternative S-0 does not address short-term exposure risks. Construction and implementation hazards associated with S-1 and S-3 are equivalent and can be mitigated through proper construction management. S-2 would require a greater degree of control for on-site activities.

Implementability: Alternative S-0 is not relevant to this criterion. The technologies to implement S-1, S-2 and S-3 are readily available.

Cost: The costs associated with the alternatives are:

	S-0	S-1	S-2	S-3
Capital	0	356	1,391	1,214

(Costs in thousands of dollars)

Horn Rapids Landfill Subunit

Alternative S-0: No Action. The CERCLA process requires that a "no action" alternative be evaluated to establish a baseline for comparison. Under this alternative, no active action would be taken to remediate the Horn Rapids Landfill subunit.

Alternative S-1: Asbestos Cap The HRL would be capped with 60 centimeters (2 feet) of clean soil to meet federal requirements for capping inactive landfills containing asbestos. In addition, a six foot high, 1830 meter (6,000 foot) chainlink security fence posted with warning signs would be constructed to restrict access to the HRL.

Alternative S-2: Municipal Landfill Cap Under this alternative, the HRL would be capped in accordance with the State of Washington requirements for capping a municipal solid waste landfill in an arid region. This is an impermeable cap that consists of a minimum 15 centimeter (6 inch) topsoil cover, an underlying 50 milliliter thick synthetic liner and a subgrade of random fill in order to establish sufficient grades for surface water runoff.

Evaluation of Alternatives for the HRL Subunit.

Overall Protection of Human Health & the Environment. Alternative S-0 does not address this criterion. Alternative S-1 eliminates exposure pathways associated with windblown dust containing asbestos and potential contact with contaminated soils. S-2 also achieves this level of protection and provides an additional measure of protection to groundwater beneath the HRL by reducing infiltration of rainwater through the HRL.

Compliance with ARARs. Alternative S-0 does not address this criterion. S-1 and S-2 meet federal requirements for capping inactive asbestos and PCB landfills, while S-2 would meet these requirements as well as the state requirements for municipal solid waste landfills.

Long-Term Effectiveness and Permanence. Alternative S-0 does not address this criterion. S-1 will be effective in addressing asbestos and PCBs as long as the cap remains intact. S-2 will also be effective for these contaminants as long as the cap remains intact.

Reduction in Toxicity, Mobility or Volume. Alternative S-0 does not address this criterion. S-1 reduces the mobility of contaminants through the windblown dust pathway. S-2 would also reduce windblown dust and provide an additional measure of reduction of infiltration of rainwater into the HRL, which in turn would reduce the potential of contaminant leaching to groundwater from the HRL.

Short-Term Effectiveness. Alternative S-0 does not address potential risks at the HRL, and does not pose any short-term implementation hazards. S-1 and S-2 both pose implementation hazards associated with windblown dust. This can be mitigated with dust suppressants during construction. Both can be readily implemented, although S-1 can be implemented somewhat faster than S-2, which requires specialized equipment to install the PVC liner.

Implementability. Alternative S-0 does not address this criterion. S-1 and S-2 are readily implementable through existing technologies.

Cost: The costs associated with the three alternatives are:

	S-0	S-1	S-2
Capital	$0	$2,131	$5,445
O & M	$52	$41	$41
Present Worth	$802	$2,754	$6,608

(Costs in thousands of dollars)

1100-EM-1 GROUNDWATER

Alternative GW-0: No Action. The CERCLA process requires that a "no action" alternative be evaluated to establish a baseline for comparison. Under this alternative, the current groundwater monitoring wells would be sampled on an annual basis to identify any future releases.

Alternative GW-1: Monitor for Compliance. Under this alternative the groundwater contamination would be allowed to naturally attenuate. Groundwater monitoring and modelling has indicated that the TCE plume is expected to attenuate to levels below MCLs by the year 2017. Under this alternative, additional wells would be installed and monitored along George Washington Way as a point of compliance. In the event that TCE concentrations exceed MCLs there, active groundwater remediation would be evaluated.

Alternatives GW-2A; GW-2B; GW-3A; GW-3B: Groundwater Extraction and Treatment. Under these alternatives one or more groundwater extraction wells would be installed and the contaminated water would be treated through one of two treatment processes prior to reinjection.

GW-2A: TCE removal from contaminated groundwater would be accomplished through airstripping. Air emissions from this process would contain low levels of TCE that are not expected to require additional treatment. The treatment system would operate at 100 gallons per minute (GPM). TCE levels in groundwater would be expected to reach MCLs by the year 2012.

GW-3A: This is the same process as GW-2A. However, this system would utilize three extraction wells and operate at 300 GPM. TCE levels in groundwater would be expected to reach MCLs by the year 2008.

GW-2B: Extracted groundwater would be treated for TCE removal by a system consisting of a multimedia filter, and a UV radiation/chemical oxidation treatment unit using ozone and hydrogen peroxide to destroy TCE. In this process, TCE is chemically destroyed and converted to carbon dioxide and water. The process would operate at 100 GPM and TCE levels in groundwater would be expected to reach MCLs by the year 2012.

GW-3B: This is the same process as GW-2B. However, this system would utilize three extraction wells and operate at 300 GPM. TCE levels in groundwater would be expected to reach MCLs by the year 2008.

Evaluation of Groundwater Alternatives.

Overall Protection of Human health and the Environment. Alternative GW-0 does not address contamination present in groundwater. However, the groundwater is not currently or projected to be used for drinking water and the Richland wellfields are not affected by the contaminant plume. GW-1 provides for monitoring, the continuation of current institutional controls (restriction on potable well permits), and evaluation of active remediation in the event of changing water usage and/or unexpected contaminant migration. GW-2A, GW-2B, GW-3A and GW-3B would provide for active remediation.

Compliance with ARARs. All of the alternatives would be expected to achieve ARARs, although the timeframes vary from 16 years to 25 years.

Long-Term Effectiveness and Permanence. All of the alternatives would be expected to provide long-term effectiveness once cleanup goals are attained. As noted above, the timeframes to achieve cleanup goals vary.

Reduction in Toxicity, Mobility, or Volume. All alternatives reduce TCE toxicity, although at different timeframes. GW-0 and GW-1 do not reduce mobility and would result in a larger volume of lower level TCE contaminated groundwater. GW-2A, GW-2B, GW-3A and GW-3B all employ technologies that would reduce mobility and volume. GW-2B and GW-3B would provide the most immediate reduction in toxicity by destroying TCE in the treatment process.

Short-Term Effectiveness. Alternatives GW-3A and GW-3B would achieve cleanup goals in shortest time frame (approximately 16 years). Emissions from the air stripper used in GW-2A and GW-3A are relatively low and should not require additional treatment. Neither the active or passive alternatives pose any adverse risks for implementation.

Implementability. All alternatives are readily implementable. The treatment processes associated with extraction and treatment would require regulatory review for compliance with relevant environmental regulations.

Cost: The cost estimates for the alternatives are:

	GW0	GW1	GW2A	GW2B	GW3A	GW3B
Capital	$0	$685	$1,536	$2,072	$3,557	$4,228
O & M	$0	$0	$232	$238	$481	$514
P W	$0	$1,059	$5,111	$5,714	$8,989	$9,970

(Costs are in thousands of dollars)

SUMMARY OF PREFERRED ALTERNATIVE FOR 1100-EM-1 OU.

In summary, the preferred alternative would reduce the risks associated with the site by removing and treating or disposing of contaminated soils from the Discolored Soil and Ephemeral Pool subunits. Exposure to contaminants at the HRL would be reduced by imposing access restrictions and by providing an asbestos cap to prevent fugitive dust emissions. These soil remedial actions could be completed within a 6-month timeframe. Groundwater contamination would naturally attenuate to below MCLs under this alternative. The timeframe to achieve MCLs in groundwater using this alternative is approximately 22 years which is longer than the time frames for remediation under Plans 2A, 2B, 3A AND 3B. However, because this groundwater is not used as a drinking water source there are no current potential risks to human health. The additional cost ($4M to $8M) required to actively remediate the groundwater does not appear to be warranted. The preferred alternative meets the statutory preference of treating the contaminated soils for which treatment is practicable, containing soils where treatment is impracticable, and applying institutional controls to reduce the potential of exposure to contaminants, and monitoring to insure that no future releases occur.

<u>1100-EM-2, 1100-EM-3 AND 1100-IU-1 OPERABLE UNITS</u>

The preferred alternative for the 1100-EM-2, 1100-EM-3 and 1100-IU-1 Operable units is:

S-1: Offsite Disposal of contaminated soils and debris.

GW-1: Groundwater monitoring to determine the presence or absence of contaminants within the OU's and to identify appropriate remedial measures.

<u>1100-EM-2, 1100-EM-3 AND 1100-IU-1 SOILS</u>

Common Elements

The activities that would be undertaken to address the various waste management units in the three OUs includes the following;

o Field screening tests would be undertaken to determine the presence or absence of contaminants above cleanup goals.

o Soil gas surveys would be conducted as appropriate to determine the presence or absence of VOCs.

o Geophysical surveys, where needed, to identify the volume of abandoned USTS and to locate underground piping associated with the USTS.

o Trenching activities would be undertaken in conjunction with non-intrusive methodologies to further characterize below ground conditions.

o Excavation of UST, sump, cistern and piping, and sampling/excavation of visibly stained or contaminated soils adjacent to the UST, sump, cistern and piping.

o Excavation of visibly stained/contaminated soils.

o Confirmatory sampling of excavated areas to determine if cleanup goals have been met.

o Additional excavation and sampling in the event the original excavation does meet cleanup goals.

o Temporary onsite storage of materials during confirmational sampling activities. Any temporary storage facilities would be required to meet RCRA requirements for temporary storage facilities of hazardous wastes.

o Backfilling of excavated areas with clean fill and revegetation where appropriate.

o In the event unexploded ordinance is encountered, the U.S. Army Corps Huntsville, Alabama Explosive Ordinance Engineering Center would notified and assistance requested.

<u>Offsite Disposal</u>

Under this alternative, the activities listed as common elements would be implemented, then contaminated materials would be transportation and disposal of in accordance with applicable State and Federal requirements.

<u>Onsite Incineration</u>

This alternative was evaluated to determine if the costs of this alternative would be comparable to that of offsite disposal. Onsite incineration would be limited to

contaminated soils, sediments, and small debris. Larger items such as tanks, piping and demolition debris would be disposed of offsite. The activities for the various WMUs would be the same as those previously listed for the offsite disposal option. The difference would be that after the temporary onsite storage for soils, sediments, smaller debris step, those materials would be processed through an onsite incinerator. The residual materials would be placed back into the excavated areas and covered with clean fill. The operation of the incinerator would be required to comply with RCRA requirements for operation of incinerators, but would not be required to be a permitted operation since the activities would be conducted entirely onsite.

1100-EM-2, 1100-EM-3 AND IU-1 Costs.

There are several factors which may contribute to the uncertainty of the costs presented. In the case of soils, uncertainty in volume estimates due to limited sampling data could greatly influence costs. Quantity estimates in this report were based on conservative parameters.
[NOTE TO REVIEWERS...COSTS ESTIMATES PRESENTED HERE ARE STILL PRELIMINARY IN NATURE. THIS ESTIMATE WAS DEVELOPED EARLY IN THE LFI/FFS PROCESS AND DOES NOT INCLUDE ALL OF THE WMUS. A REVISED ESTIMATE IS BEING PREPARED TO REFLECT ADDITIONAL INFORMATION (AND ADDITIONAL WMUS) GATHERED SINCE THE ESTIMATE WAS FIRST MADE. FOR THE PURPOSES OF COMPARISON, THE COST ESTIMATES PRESENTED HERE WERE DEVELOPED BASED ON THE SAME ASSUMPTIONS AND THEREFORE ARE USEFUL FOR A COMPARATIVE ANALYSIS.]
In summary the estimated costs for the soil alternatives is as follows.

Offsite Disposal.

	1100-EM-2	1100-EM-3	IU-1
Contract	$ 82,000	$ 159,000	$ 357,000
S&A	$ 30,000	$ 48,000	$ 438,000
Contingency	$ 56,000	$ 65,000	$ 180,080
Total Cost	$ 168,000	$ 132,000	$ 975,000

The estimated total for all three operable units is $1,275,000. This does not include groundwater monitoring, which is presented in a following section.

Onsite Incineration

The costs provided here include the offsite disposal of debris that would not be processed by an incinerator unit (i.e. large construction debris, metallic items).

	1100-EM-2	1100-EM-3	IU-1
Contract	$ 371,000	$ 289,000	$ 353,000
S&A	$ 63,000	$ 58,000	$ 589,000
Contingency	$ 95,000	$ 83,000	$ 337,000
Total Cost	$ 529,000	$ 430,000	$ 1,279,000

The total cost of this alternative is estimated to be $2,238,000.

EVALUATION OF SOIL & DEBRIS ALTERNATIVES

Alternative S-0: (No Action). Under this alternative, no action would be taken to remediate the waste management units (WMUs) in the three operable units (OU's). Groundwater monitoring of existing wells would continue.

Overall Protection. In the absence of sufficient environmental data, it is uncertain whether remedial action objectives for the WMU's would be satisfied. The potential for exposure to contaminated soil by industrial onsite workers in the 1100-EM-2 and 1100-EM-3 OU's would be possible. The IU-1 OU is part of the ALE which has been closed to the public since 1940. Therefore, human contact with potential contaminants is unlikely. Any potential ecological impacts are unknown at this time.

Compliance with ARARs. In the event that contaminants are found at the WMUs that exceed state or federal criteria, those cleanup levels would not be achieved by this alternative.

Long-term Effectiveness. Potential residual risks would remain as stated above. Groundwater monitoring limited to existing wells would not be a reliable or adequate control to determine if contaminants are migrating from the WMUs. Continued industrial land use in the 1100-EM-2 and 1100-EM-3 OUs would ensure that potential exposure would be limited to onsite workers.

Reduction in Toxicity, Mobility, Volume. There would be no reduction in the toxicity, mobility, or volume of any identified contaminants under this alternative.

Short-term Effectiveness. Because no remedial actions are involved there would be no short-term risks to remedial workers or the public. There would be no impacts to the environment due to construction or operation.

Implementability This alternative would be easily implemented. Monitoring would be conducted using established procedures. No permits, special equipment, or

specialists would be required.

Cost The present worth cost of this alternative is $48,000.

Alternative S-1: Offsite Disposal Under this alternative soils and debris at the 1100-EM-2, 1100-EM-3 and 1100-IU-1 OUs that are found to exceed cleanup goals would be removed and disposed of offsite.

Overall Protection. In the event that contaminants are found at the WMUs that exceed state or federal criteria, it is expected that remedial action objectives would be satisfied by this alternative. Potential onsite receptor exposure to contaminated materials would be significantly reduced by reducing the toxicity of the contaminants through removal and offsite disposal of the contaminants, and, if needed, access restrictions.

Compliance with ARARs. All ARAR's will be met. The contaminated material will be hauled by a licensed DOT hazardous waste hauler. The receiving facility will have a permit to operate a RCRA facility, or if needed, a TSCA approved facility.

Long-term Effectiveness. Cleanup to State or Federal cleanup levels at the WMUs would reduce potential residual risks at those sites.

Reduction in Toxicity, Mobility, Volume. The offsite disposal of contaminated soil and debris would reduce the mobility of the contaminant onsite. Disposal in a controlled RCRA and/or TSCA facility would limit the mobility of the contaminant offsite. The volume and toxicity of any contaminated soil and debris would be unchanged. In the event residuals of the contaminant would still exist, mobility would remain essentially the same.

Short-term Effectiveness. There would not be any short-term risks to the community during the implementation phase of this alternative. Control measures would be taken to control any fugitive dust as part of any remedial action. Remedial workers will be required to wear protective coveralls to protect against dermal exposure. During remediation, there would be some disruption of the environment due to earthmoving activities. However, after the sites are remediated, the areas will be regraded to restore the land to near original conditions. In the event excavation at the IU-1 landfills is necessary, topsoil would be provided and the area seeded to dryland grass to provide habitat for birds and small mammals. The removal and offsite disposal actions can be completed within 6 months of beginning site work.

Implementability. Removal of soil and debris to an offsite facility is easily implemented. Excavation of material will be by using conventional earthmoving equipment. Confirmatory testing will be conducted to verify that cleanup goals have been achieved. An approved RCRA/TSCA facility with more than sufficient capacity is located at Arlington, Oregon, approximately 145 km (90 miles) away. A number of licensed DOT hazardous waste haulers are available who could transport this material. Earth materials for backfill are available within a 16.1-km (10-mile) radius of the site. No special permits are required.

Cost. The present worth estimated cost of this alternative is $1,275,000

Alternative S-2: Onsite Incineration

This alternative considers the use of onsite incineration for the destruction of organic contaminants at the WMUs. Annual downgradient groundwater monitoring is employed to evaluate remedial actions.

Overall Protection. Remedial action objectives would be met through this alternative. Potential human health threats would be reduced, if cleanup goals are achieved.

Compliance with ARARs. It is expected that state and federal cleanup levels would be met under this alternative. The onsite incineration facility would meet RCRA standards for incineration facilities and also meet regional air quality standards. Ash from the process would be expected to have little residual contaminant and should meet requirements to allow replacement at the excavated areas of the WMUs.

Long-term Effectiveness. There should be little or no residual risks associated with remediation of the WMUs. If contaminants above background remain, groundwater monitoring should provide reliable controls to establish if subsequent releases occur.

Reduction in Toxicity, Mobility, Volume. Toxicity of the

contaminants would be significantly reduced as these processes typically have 99.9999 percent destruction removal efficiencies. Incineration of soils will not reduce volume substantially. Mobility of remaining residuals, if any, would remain the same.

Short-Term Effectiveness. There should be no risk to the community during remediation under proper operating conditions. Air quality would be monitored and the operation would not proceed if emissions did not meet standards. Remedial workers would require protective clothing to prevent dermal contact. Impacts to the environment would consist of the excavation of contaminated materials and the construction of a pad to house incineration facilities. After remediation these areas would be regraded to return the site to near original conditions.

Implementability. Vendors are available to supply onsite incineration facilities that have proven effectiveness in remediating soils with similar contaminants. Operation of the incinerator is typically done by vendor supplied operators. Ashes would be tested to determine if cleanup goals are being met. The incinerator must meet the requirements of RCRA and be approved by state agencies in accordance with the TPA.

Cost. The present worth estimated cost of this alternative is $2,238,000.

EVALUAITION OF SOIL & DEBRIS ALTERNATIVES

n the following analysis, alternatives S-0, S-1 and S-2 are evaluated in relation to one another for each of the evaluation criteria. The purpose of this analysis is to identify the relative advantages and disadvantages of each alternative.

Overall Protectiveness. In the event that contaminants are found that exceed state or federal health based levels, Alternative S-0 would not be protective of human health. S-1 and S-2 would meet the remedial action objectives. For Alternative S-1, protection of human health would be provided by reducing the risks through removal and offsite disposal. Alternative S-2, would achieve protection through incineration.

Compliance with ARARs. In the event that contaminants are found that exceed State or Federal criteria, S-1 and S-2 have the potential of meeting ARAR's. For alternative S-0, MTCA cleanup levels would not be not attained. The efficiency of cleanup activities would need to be evaluated in order to evaluate if MTCA cleanup levels can be met. Confirmational sampling would be required to make such a determination.

Long-term Effectiveness. Alternative S-2 offers a greater degree of long-term permanence because that alternative uses a treatment method that permanently reduces toxicity through destruction. Alternative S-1 also has a high degree of long-term permanence because contaminants are removed offsite to a controlled facility. No long-term maintenance is currently expected for the WMUs. Alternative S-0 would not reduce any residual site risks.

Reduction in Toxicity, Mobility, Volume Alternative S-0 does not reduce toxicity, mobility or volume. Alternative S-1 would reduce onsite toxicity, mobility and volume through offsite disposal. Under Alternative S-2 toxicity, mobility and volume for contaminants present in the incinerated materials would be achieved. Overall soil volume is not reduced through incineration.

Short-Term Effectiveness. All alternatives present relatively low risks to the community during implementation. Some fugitive dust emissions from excavation activities are anticipated although precautions would be taken to reduce these to protect both remedial workers and the community. Risks to remedial workers for all other alternatives will be reduced by using protective clothing. The onsite incineration option of alternative S-2 is estimated to take less than 1 year to complete.

Implementability. All alternatives are technically easy to implement. Alternative S-2 requires mobilization, set up, and trial testing of the incinerator to ensure that applicable standards are met. Operating personnel would be supplied by the vendor. Offsite disposal facilities considered in alternative S-1 all have adequate capacity to receive potentially contaminated soils and debris. Also, there are numerous licensed haulers who are able to transport such materials.

Cost. The no action alternative has the least total present worth costs. The costs presented are associated with annual groundwater monitoring of existing wells in the three OUs for the next 30 years. Alternative S-2, onsite incineration is estimated to cost $963,000 (75%) more than Alternative S-1.

EVALUATION OF GROUNDWATER ALTERNATIVES FOR 1100-EM-2, 1100-EM-3,

1100-IU-1 .

In addition to the remediation activities for the WMUs described above, at least six additional groundwater monitoring locations would be established in the 1100-EM-3 and 1100- IU-1 areas. Five new locations would be established at the 1100-EM-3 OU between potential source areas and around the North Richland wellfield. One deep exploratory well would be established at the 1100-IU-1 in the vicinity of the NIKE Missile Base landfill. After the initial well provides basic groundwater information such as depth to the water table and occurrence of perched aquifers, additional monitoringh locations will be established as needed. Currently there is only limited information on groundwater conditions in the 1100-EM-2, 1100-EM-3 and IU-1 OUs. Due to this fact, the development of remedial alternatives beyond No Action or Groundwater Investigations at this time would be of limited value. Therefore, only those two options are briefly presented below.

The cost estimate presented below is for five seventy foot wells in the 1100-EM-3 area, and one 800 foot exploratory well in the 1100-IU-1 area, and sampling and analysis in all three OU's.

	1100-EM-2	1100-EM-3	IU-1
Contract	$0	$298,000	$ 680,000
S&A	$12,000	$ 60,000	$ 12,000
Contingency	$12,000	$ 45,000	$ 81,000
Total Cost	$24,000	$403,000	$ 773,000

The total estimated cost is $1,200,000

Alternative GW-0: No Action

No active groundwater investigations would be undertaken under this alternative. Existing administrative controls that specify land use and restrict well drilling for consumptive purposes would remain in place. It is expected that any new facilities in the 1100-EM-2 and 1100-EM-3 OUs would receive water supplied through the city of Richland's distribution network. It is not expected that any drinking water wells would be installed in the IU-1 OU due to the fact it is included in the Arid Lands Ecological reserve. Existing wells that are monitored in the 1100-EM-2 and 1100-EM-3 would continue to be monitored.

Overall Protection. In the event that contaminants are present that exceed state or federal health based levels, and, in the future, the groundwater is used for human consumption, this alternative would not be protective.

Compliance with ARARs. In the event that contaminants are present that exceed SDWA MCLs that ARAR's would not be met.

Long-Term Effectiveness. In the event that contaminants are present that exceed state or federal health based levels, any potential the long term incremental cancer risk would not be addressed.

Reduction in Toxicity, Mobility, Volume. In the event that contaminants are present that exceed state or federal health based levels, the toxicity, mobility and volume of those contaminants would not be addressed by the no action alternative.

Short-term Effectiveness. In absence of undertaking any groundwater investigations, this criteria does not apply to the alternative.

Implementability. In absence of undertaking any groundwater investigations, this criteria does not apply to the alternative.

Cost. The monitoring costs associated with this alternative are $48,000.

Alternative GW-1: Monitoring and Evaluation. Under this alternative additional monitoring wells would be installed in the 1100-EM-3, and in the IU-1 OUs. If contaminants above MCL's are detected at any of these wells, appropriate remedial measures would then be evaluated. In addition, the utility of additional monitoring locations would be established based on the results of RD/RA activities at the 1100-EM-2, 1100-EM-3 and 1100-IU-1 OUs.

Overall Protection. By undertaking groundwater investigations, the evaluation of potential risks to human health can be accomplished.

Compliance with ARARs. This alternative would be expected to provide sufficient information to determine if SDWA MCL's are being met in groundwater.

Long-Term Effectiveness. Groundwater monitoring is a reliable control to determine if further longer term actions are required.

Reduction in Toxicity, Mobility, Volume. In the event that contaminants are present in groundwater, this alternative would enable decision makers to evaluate appropriate remedial technologies and/or institutional controls for reduction of contaminant toxicity, volume or mobility.
As in the evaluation of remedial alternative for contaminants in groundwater in the 1100-EM-1 OU, contaminant toxicity and volume could be reduced through treatment, dispersion, diffusion, and dilution. In the event that similar contaminants are found in the 1100-EM-2, 1100-EM-3 or 1100-IU-1 OUs, the 1100-EM-1 remedial alternatives would directly apply.

Short-Term Effectiveness Risks associated with activities to establish groundwater monitoring locations are low.

Implementability. This alternative is technically easily implemented with the only new activity consisting of establishing groundwater monitoring locations. Groundwater monitoring is expected to reliably evaluate the presence or absence of contaminants above MCL's. Remedial action(s) could easily be initiated in a relatively short timeframe in the event contaminants are found at levels requiring remediation.

Cost. The estimated present worth costs of this alternative is $1,200,000. These costs include the capital costs of installation annual monitoring of new and existing monitoring locations over a 30-year period.

EVALUATION OF GROUNDWATER ALTERNATIVES FOR 1100-EM-2, 1100-EM-3 AND 1100-IU-1

The purpose of this analysis is to identify the relative advantages and disadvantages of each alternative. The alternatives are evaluated in relation to one another for each of the evaluation criteria in the paragraphs that follow.

Overall Protection. Groundwater monitoring is expected to reliably evaluate the presence or absence of contaminants to determine if site RAO's for groundwater are being achieved. While there are no current users of the groundwater and the continued use of institutional controls will ensure that consumptive use of the aquifer does not occur, the 1100-EM-3 OU is directly adjacent to the North Richland wellfield. Therefore it has the highest potential for adverse impacts to current domestic water supplies.

Compliance with ARARs. Groundwater monitoring is expected to reliably evaluate the presence or absence of contaminants above MCL's. In the event that contaminants are found at levels requiring remediation, remedial alternatives evaluated for the 1100-EM-1 OU could be implemented in order to achieve ARARs.

Long-Term Effectiveness. Neither alternative provides for long-term effectiveness or permanence in the event that contaminants are present in groundwater at levels that exceed MCL's. Alternative GW-1 would be expected to provide sufficient information to determine (1) what contaminants, if any, are present at levels requiring remediation and (2) appropriate remedial actions, if necessary.

Reduction in Toxicity, Mobility, Volume. Neither alternative GW-0 or GW-1 would directly reduce toxicity, mobility or volume of contaminants, if present. Alternative GW-1 would be expected to provide sufficient information to determine appropriate remedial actions, if necessary, to address contaminant toxicity, mobility and volume.

Short-Term Effectiveness. Both alternatives present low remedial risks to the community and to onsite remedial workers.

Implementability. Both alternatives are easy to implement technically.

Costs. The estimated costs for alternatives GW-0 and GW-1 are $48,000 and $1,200,000 respectively.

SUMMARY OF THE PREFERRED ALTERNATIVE FOR THE 1100-EM-2, 1100-EM-3 AND IU-1.

In summary the preferred alternative would reduce potential risks associated with the sites by removing and disposing of contaminated soils and debris. In addition, groundwater would be more fully characterized and appropriate remedial measures evaluated and implemented if needed. The preferred alternative meets the statutory preference of treating the contaminated soils for which treatment is practicable, containing soils where treatment is impracticable, and applying institutional controls to reduce the potential of exposure to contaminants.

GLOSSARY OF EVALUATION CRITERIA

- **Overall Protection of Human Health and Environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- **Compliance with ARARs** Compliance with applicable or relevant and appropriate requirements (ARAR's) addresses whether a remedy will meet all of the ARAR's of other Federal and State environmental laws and/or justifies a waiver.

- **Long-term effectiveness and permanence** refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

- **Reduction of toxicity, mobility, or volume through treatment** is the anticipated performance of the treatment technologies that may be employed in a remedy.

- **Short-term effectiveness** refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.

- **Implementability** is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the solution.

- **Cost** includes capital and operation and maintenance costs.

- **State Acceptance** indicates whether, based on its review of the final RI/FS and Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative.

- **Community Acceptance** will be assessed in the Record of Decision following a review of the public comments received on the final RI/FS report and the Proposed Plan.

[redacted]

1100-EM-1

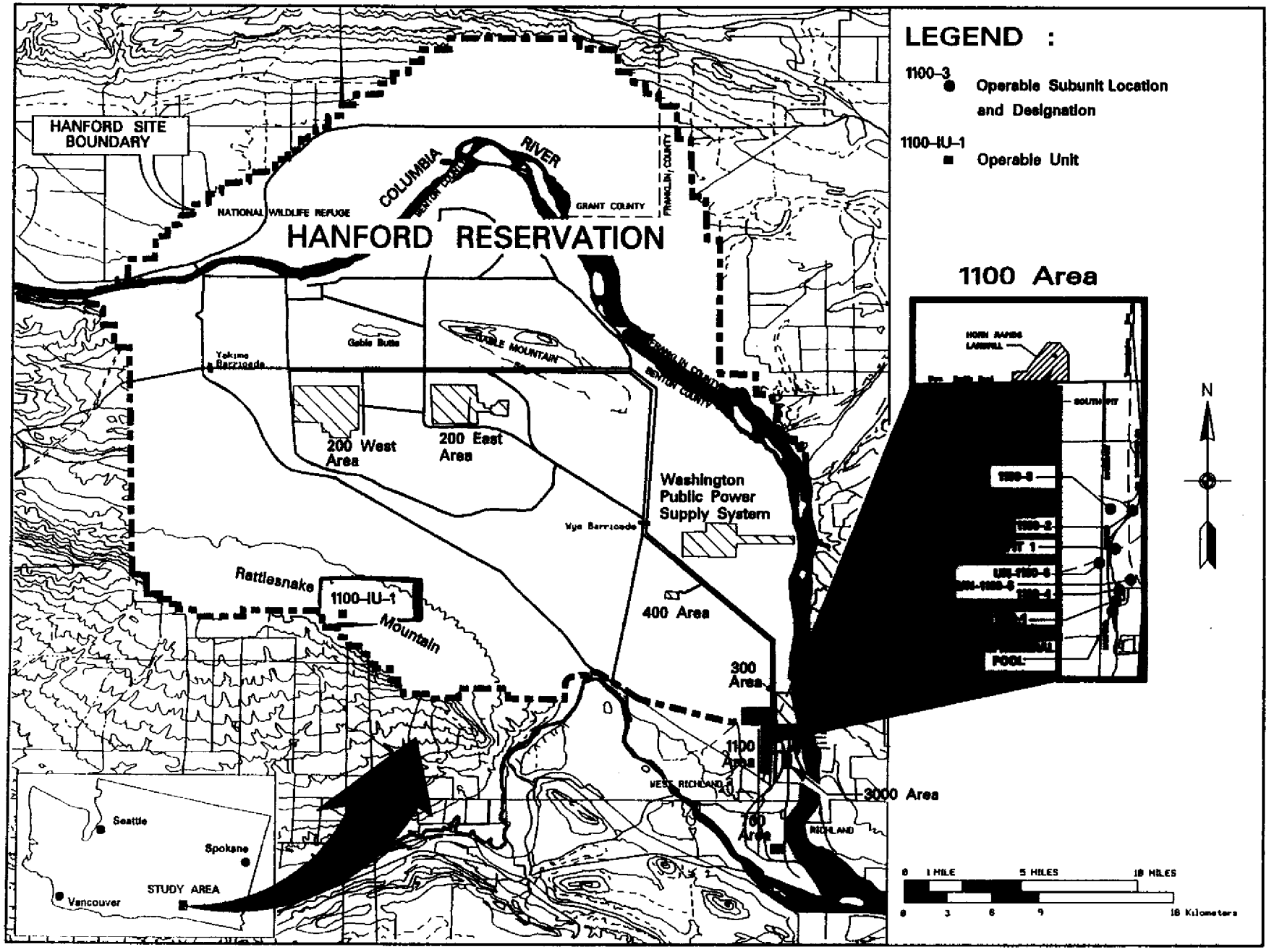
[redacted] NEPA VALUE LOCATION DIRECTORY

NEPA VALUE	1100-EM-1 DOCUMENT	1100-EM-1 DOCUMENT
	DOE/RL-90-18	DOE/RL-92-67
PHYSICAL CHARACTERISTICS		
Operable Unit Vicinity	Section 3.1	Section 1.4
Meteorology	Section 3.2	Section 2.1
Hydrology	Section 3.3	Section 2.3
Geology	Section 3.4	Section 2.2
ECOLOGICAL CHARACTERISTICS		
Human Ecology	Section 3.7.1	
Land Use	Section 3.7.1.1	
Water Use	Section 3.7.1.2	
Cultural Resources	Section 3.7.1.3	
Wildlife Ecology	Section 3.7.2	Appendix L
Terrestrial Ecology	Section 3.7.2.1	
Aquatic Ecology	Section 3.7.2.2	
Sensitive Environments	Section 3.7.2.3	
IMPACTS OF REMEDIAL ACTIONS		
Compliance with Statutory Law		Section 9.1.2, Appendix M
Short-Term Impacts		Section 9.1.5
Long-Term Impacts		Section 9.1.3
Impacts to Resources		Section 9.1.6, Appendixes G & N
Effects to Public Health		Sections 5.1, 5.2, 7.2, 9.2, Appendix K
AGENCIES/PERSONS CONTACTED		Section 1.2
LAND USE, POLICIES, CONTROLS		Section 7.2.4, Appendix J

[redacted]

TABLE [redacted] Directory of NEPA Values and Location in 1100 Documents For 1100-EM-2, 1100-EM-3 & 1100-IU-1

	DOE/RL-92-67 Addendum	DOE/RL-92-67
PHYSICAL CHARACTERISTICS		
Operable Unit Vicinity	Section 1.7	Section 1.4
Meteorology	Section 2.1.1	Section 2.1
Hydrology	Section 2.1.4	
Geology	Section 2.1.3	
ECOLOGICAL CHARACTERISTICS		
Human Ecology	Section 1.6.1	
Land Use	Section 4.2.3	
Water Use	Section 2.1.2, 2.2	
Cultural Resources	Section 1.5, 1.6	
Wildlife Ecology	Section 1.6.1	Appendix L
Terrestrial Ecology	Section 1.6.1	
Aquatic Ecology	Section 1.4.1	
Sensitive Environments	Section 1.6.1	
IMPACTS OF REMEDIAL ACTIONS		
Compliance with Statutory Law	Section 4.2, 4.4	
Short-Term Impacts	Section 4.4	
Long-Term Impacts	Section 4.4	
Impacts to Resources	Section 4.2, 4.4	
Effects to Public Health	Section 4.2	
AGENCIES/PERSONS CONTACTED	Section 1.3	
LAND USE, POLICIES, CONTROLS	Section 4.2.3	



Hanford Reservation Location Map

Fig. [illegible]