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Draft B

Proposed Plan for Interim Remedial Measures at the 100-FR-1 Operable Unit



United States
Department of Energy
Richland, Washington



Approved for Public Release

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P.O. Box 550
Richland, Washington 99352

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PROPOSED PLAN FOR INTERIM REMEDIAL MEASURES AT THE 100-FR-1 OPERABLE UNIT

Hanford Site, Richland, Washington

EPA, DOE, AND ECOLOGY ANNOUNCE PROPOSED PLAN

This proposed plan identifies the preferred alternative for **interim remedial measures** for remedial action of radioactive liquid waste disposal sites (including contaminated soils and structures) at the 100-FR-1 **Operable Unit**, located at the Hanford Site (Figure 1). The plan also summarizes other remedial alternatives evaluated for interim remedial measures in this operable unit. The intent of interim remedial measures is to speed up remedial actions in contaminated areas that pose potential threats to human health and the environment.

This proposed plan is being issued by the U.S. Environmental Protection Agency (EPA), the lead regulatory agency; the Washington State Department of Ecology (Ecology), the support regulatory agency; and the U.S. Department of Energy (DOE), the responsible agency. EPA, Ecology, and the DOE are issuing this proposed plan as part of their public participation responsibilities under Section 117(a) of the **Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)**, commonly known as the "Superfund Program". *National Environmental Policy Act* values are addressed in the *100 Area Source Operable Unit Focused Feasibility Study Report (Appendix H)* (DOE/RL-94-61), which discusses the 100-FR-1 Operable Unit. This proposed plan is intended to be a fact sheet for public review that describes the remedial alternatives analyzed, identifies a preferred alternative, and summarizes the information relied upon to recommend the preferred alternative.

The preferred alternative presented in this proposed plan is to remove, treat (as appropriate or required), and dispose of the contaminated soil and associated structures from seven source areas within the 100-FR-1 Operable Unit. These are the 116-F-1 Lewis Canal, the 116-F-2 Basin Overflow Trench, the 116-F-3 Fuel Storage Basin Trench, the 116-F-6 Liquid Waste Disposal Trench, the 116-F-9 PNL Animal Waste Trench, the 116-F-14 Retention Basin, and the

108-F French Drain (Table 1). Treatment would be conducted as necessary or appropriate for cost effective operations (e.g., to meet land disposal restrictions, to reduce the size of the **Environmental Restoration Disposal Facility**, or to reduce overall costs). The preferred alternative will reduce potential threats to human health and the environment at the 100-FR-1 Operable Unit radioactive liquid waste disposal sites. The remedial actions described are intended to reduce potential human health and ecological risks, and ensure that contaminants present at these waste sites will not adversely impact the **groundwater** beneath the sites or the Columbia River. For the eighth source area, the 116-F-10 Dummy Decontamination French Drain, no interim action is the preferred alternative since site contaminants are below levels of concern.

Send written comments to:
U.S. Environmental Protection Agency
Attention: Kevin Oates
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Richland, WA 99352

The preferred alternative is the initial recommendation of the EPA, Ecology, and the DOE. The cleanup alternative will be selected only after the public has had the opportunity to comment on this recommendation and all comments have been reviewed and considered. The agencies are seeking comments on each alternative presented, not just the preferred alternative. Comments may be made in person at the public meeting or may be submitted in writing. Written comments must be submitted by {DATE}. Responses to comments will be presented in a responsiveness summary that will be part of the **record of decision (ROD)**, which is the legal decision document that selects the cleanup remedy.

The public is encouraged to review *Appendix H* of the *100 Area Source Operable Unit Focused*

Figure 1. 100-FR-1 Operable Unit.

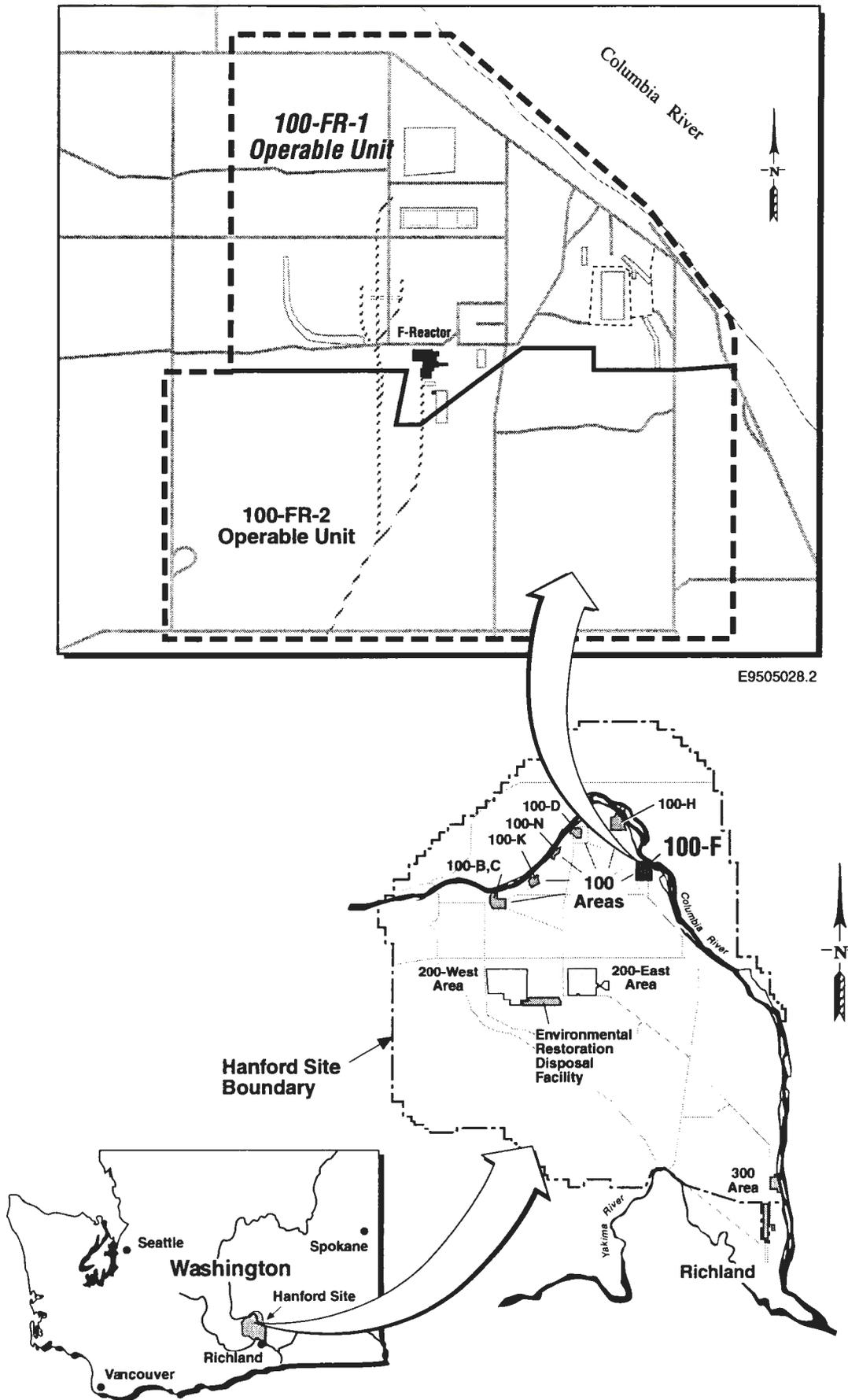


Table 1. High-Priority Radioactive Liquid Waste Disposal Sites Identified for Interim Remedial Measures in the 100-FR-1 Operable Unit

Waste Site Group	Waste Site Name	Physical Waste Site Description	Former Waste Site Use	Contaminants of Potential Concern ¹
Process Effluent Trench	116-F-1 Lewis Canal	Unlined Trench 914m x 12m x 3m deep	Received liquid waste from F Reactor and 190-F building and decontamination wastes from 189-F building	arsenic, cadmium, Co-60, Cs-137, Eu-152, Eu-154, K-40, lead, Ra-226, Th-228, U-238, zinc
Process Effluent Trench	116-F-2 Basin Overflow Trench (107-F)	Unlined Trench (three trenches connected together) - overflow trench 180m x 39m x 5m EM bypass ditch 116m x 12m x 5m diversion ditch 123m x 12m x 5m	Received overflow from 116-F-14 retention basin and F Reactor	cadmium, chromium, Co-60, Cs-137, Eu-152, Eu-154, Eu-155, Ir-192, K-40, Pu-239/240, Ra-226, Th-228, zinc
Fuel Storage Basin Trench	116-F-3 Fuel Storage Basin Trench (105-F)	Unlined Trench 30m x 6.1m x 2.4m deep	Received cooling water effluent and sludge from the F Reactor storage basin	chromium, Co-60, Cs-137, Eu-152, Eu-154, K-40, lead, mercury, PCB, Ra-226, Th-228, U-235, zinc, barium
Process Effluent Trench	116-F-6 Liquid Waste Disposal Trench (1608-F)	Unlined Trench 91m x 30.5m x 3.1m deep	Received diverted cooling water effluent during reactor maintenance outages	chromium, Co-60, Cs-137, Eu-152, Eu-154, K-40, Pu-239/240, Ra-226, Th-228, U-238, zinc
Process Effluent Trench	116-F-9 PNL Animal Waste Leach Trench	Unlined Trench (two trenches connected together) - long trench 122m x 5m x 3m deep short section - 30m x 5m x 3m deep	Contaminated wash/waste water from animal pens, containing strontium-90 and plutonium-239	chlordan, Co-60, Cs-137, Eu-152, K-40, Ra-226, silver, Sr-90, Th-228, zinc
French Drain	116-F-10 Dummy Decontamination French Drain (105-F)	1 m diameter x 2m deep	Received spent nitric acid and rinse water from the decontamination of fuel element spacers at F Reactor	Co-60, Cs-137, Eu-152, Eu-154, Eu-155
Retention Basin	116-F-14 Retention Basin (107-F)	Reinforced rectangular concrete retention basin 415m x 110.2m x 7.3m deep	Received cooling water effluent from F Reactor and reactor building drains	cadmium, chromium, Co-60, Cs-137, Cs-134, Eu-152, Eu-154, Eu-155, K-40, Ni-63, Pu-239/240, Ra-226, Sr-90, Th-228, U-238, zinc
French Drain	108-F French Drain	0.76m diameter x 1.8 m deep	Received condensate from hoods inside the 108-F biology laboratory	Am-241, chromium, copper, Cs-137, Eu-152, K-40, lead, PCB, Pu-238, Pu-239/240, Ra-226, selenium, Th-228, zinc

Am-241 = ²⁴¹Americium
 Cs-134 = ¹³⁴Cesium
 Eu-152 = ¹⁵²Europium
 Eu-155 = ¹⁵⁵Europium
 K-40 = ⁴⁰Potassium
 PCB = polychlorinated biphenyl
 Pu-239/240 = ^{239,240}Plutonium
 Sr-90 = ⁹⁰Strontium
 U-235 = ²³⁵Uranium

Co-60 = ⁶⁰Cobalt
 Cs-137 = ¹³⁷Cesium
 Eu-154 = ¹⁵⁴Europium
 Ir-192 = ¹⁹²Iridium
 Ni-63 = ⁶³Nickel
 Pu-238 = ²³⁸Plutonium
 Ra-226 = ²²⁶Radium
 Th-228 = ²²⁸Thorium
 U-238 = ²³⁸Uranium

¹The contaminants of potential concern were identified from the Qualitative Risk Assessment

Feasibility Study Report (DOE/RL-94-61), which discusses the 100-FR-1 Operable Unit. This report and other documents listed at the end of this proposed plan provide greater detail about this operable unit. These documents can be read at the information repositories listed at the end of this proposed plan.

MARK YOUR CALENDAR

A 45-day public comment period for the *100-FR-1 Proposed Plan* will be from ____ to ____

A public meeting on this proposed plan will be held as follows:

Date: ???

Time: ???

Place: ???

You will have an opportunity at the meeting to direct questions to the EPA, Ecology, and the DOE representatives and comment on the remedial alternatives.

SITE BACKGROUND

The Hanford Site is located in southeastern Washington (Figure 1). The 100 Area of the Hanford Site is located along the Columbia River, and includes nine DOE nuclear reactors previously used for plutonium production, one of which is the 100-F Reactor. In November 1989, the EPA placed the 100 Area on the **National Priority List** because of soil and groundwater contamination resulting from the past operation of nuclear facilities.

The 100-F Reactor operated between 1945 and 1965. Reactor operations and former waste handling practices have caused contamination around the 100-F Reactor, including support facilities, adjacent soil, and groundwater. To organize cleanup efforts under the Superfund Program, contaminated areas at the 100-F Reactor were subdivided into three geographic areas called "operable units." The three 100-F Operable Units are designated 100-FR-1, 100-FR-2 (Figure 1), and 100-FR-3.

The 100-FR-1 Operable Unit (Figure 2) encompasses an area of approximately 1.3 square kilometers (0.5 mi²). It includes former radioactive liquid waste disposal sites, wastes from the Experimental Animal Farm, and buried debris resulting from demolition of

some reactor support facilities. The sites fall into two general categories: shallow sites, where both soil exposure and groundwater impacts may be a concern; and deep sites, where groundwater impact is the primary concern. The 100-FR-2 Operable Unit comprises primarily solid waste burial grounds. Groundwater beneath the 100-FR-1 and 100-FR-2 Operable Units and vicinity is being addressed in the 100-FR-3 Operable Unit.

The 100-FR-1 Operable Unit includes 18 waste sites that have been designated by the EPA, Ecology, and the DOE as *high-priority* for interim remedial measures. *High-priority* waste sites are distinguished from *low-priority* waste sites based on the results of remedial investigation activities, an assessment of potential impacts to human health and the environment, and local community concerns. Fourteen of the eighteen sites discussed in the 100-FR-1 LFI were recommended to continue as IRM candidates. One of the fourteen (116-F-8 Outfall Structure) is to be addressed as part of the river pipelines ERA and will not be addressed as part of this proposed plan. For five of the fourteen sites (116-F-12, 116-F-13, UN-100-F-1, 132-F-6, and the PNL Outfall Structure) it was recommended in the LFI that additional data be collected before an IRM be performed. These will be addressed in a future proposed plan. This proposed plan presents interim cleanup actions for the remaining eight sites. The remaining 100-FR-1 Operable Unit waste sites, and the 100-FR-2 and 100-FR-3 Operable Units, will be addressed separately in future proposed plans. Table 1 summarizes information on the eight sites addressed in this proposed plan, based on former use, waste site dimensions, and **contaminants of potential concern**, and is based on historical process knowledge, previous investigations, and the limited field investigation undertaken by DOE. The waste site locations are shown in Figure 2.

SUMMARY OF SITE RISK

Potential risks to human health and ecological receptors were evaluated in the *Qualitative Risk Assessment Report*. The results of the **qualitative risk assessment** are summarized in Table 2 and described in the following sections of this proposed plan. These results indicate that interim remedial measures are warranted at the eight high priority sites.

In the Superfund process, potential risks to human health and the environment are evaluated to determine

Figure 2. Location of the 100-FR-1 Interim Remedial Measure Waste Sites.

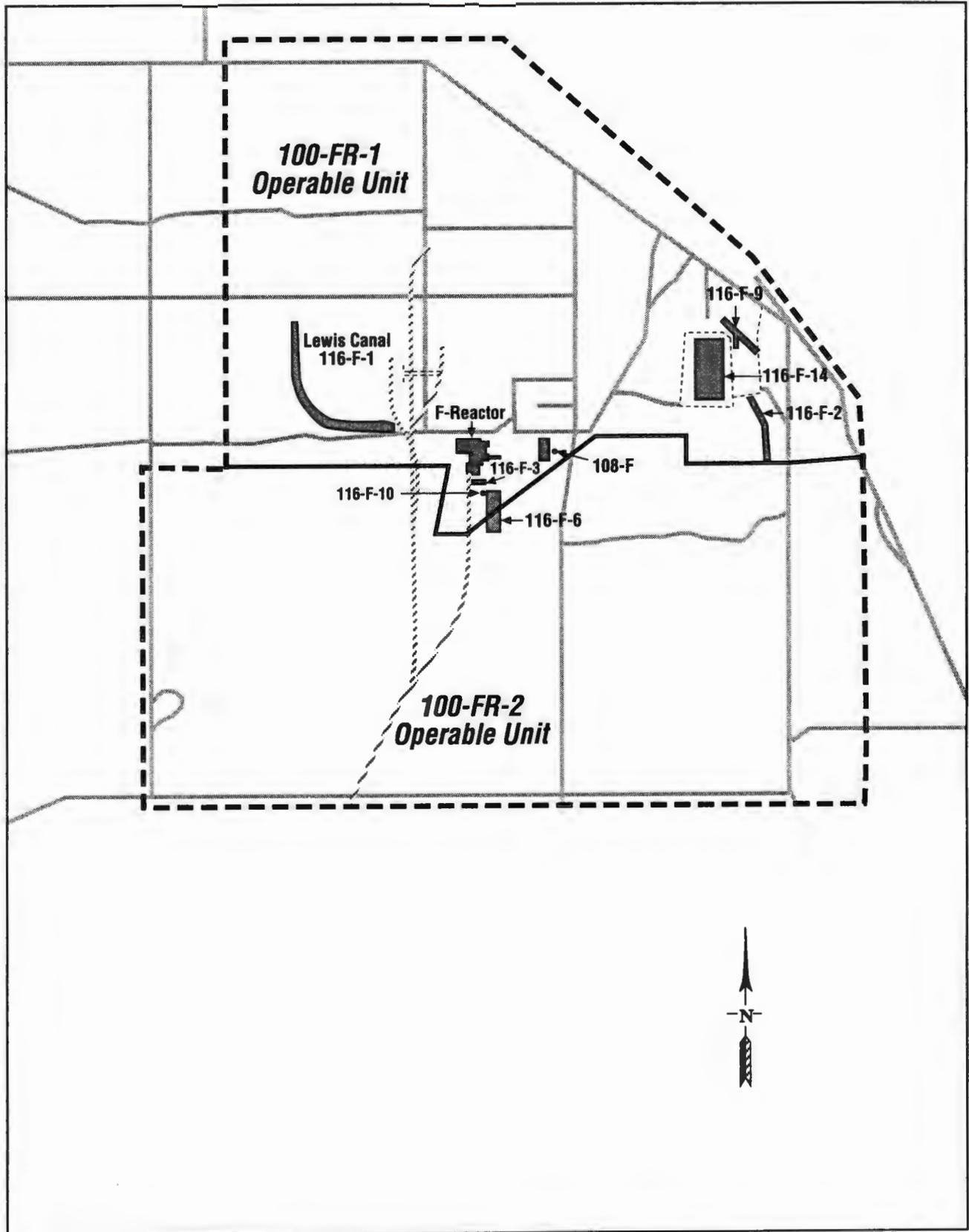


Table 2. Qualitative Risk Assessment¹ Summary for 100-FR-1 Interim Remedial Measure Sites

Waste Site	Human Health Risk Estimates ²				Ecological Risk Estimates ² (Environmental Hazard Quotient)
	Residential Land Use ³		Recreational Land Use ⁴		
	Increased Cancer Risk	Non-cancer Hazard Index	Increased Cancer Risk	Non-cancer Hazard Index	
116-F-1	$> 1 \times 10^{-2}$	1.8	1×10^{-4}	0.035	> 1.0
116-F-2	$> 1 \times 10^{-2}$	0.25	6×10^{-4}	0.047	> 1.0
116-F-3	$> 1 \times 10^{-2}$	0.19	1×10^{-4}	0.0036	> 1.0
116-F-6	$> 1 \times 10^{-2}$	0.076	2×10^{-4}	0.0015	> 1.0
116-F-9	6×10^{-4}	0.11	5×10^{-6}	0.0021	> 1.0
116-F-10	$> 1 \times 10^{-2}$	NC	1×10^{-4}	NC	NC
116-F-14	$> 1 \times 10^{-2}$	0.31	8×10^{-3}	0.006	> 1.0
108-F	6.5×10^{-4}	0.5	6.9×10^{-6}	0.01	> 1.0

¹Qualitative Risk Assessment provides an evaluation of the need for interim remedial measures at 100-FR-1 sites.

²Human health and ecological risks estimated in the Qualitative Risk Assessment are based on conservative assumption that may overstate the level of potential risks. Actual risks associated with the 100-FR-1 sites are likely to be lower than presented here.

³Corresponds to a frequent-use scenario.

⁴Corresponds to an occasional-use scenario.

NC - not calculated

whether significant risks exist due to site contaminants. Two types of potential human health effects due to contact with site contaminants are evaluated at Superfund sites. The first is the potential increase in cancer risks. This potential increase is expressed exponentially as 1×10^{-4} , 1×10^{-5} , and 1×10^{-6} (one in ten thousand, one in one hundred thousand, one in a million, respectively). This means that, for a 1×10^{-4} risk, if 10,000 people were exposed to a contaminant of concern for some period of time, one additional person could be expected to be diagnosed with cancer in his/her lifetime. Based on current national cancer rates, 2,500 people out of 10,000 are expected to be diagnosed with cancer. Under a 1×10^{-4} risk, 2,501 cancer diagnoses could be expected. Remedial actions generally are not required at risk levels below 1×10^{-4} unless there are other considerations such as adverse environmental impacts, potential for future migration, or uncertainty regarding future land use. For the second type of potential human health effect,

non-carcinogenic health impacts, a **Hazard Index (HI)** is calculated. An HI greater than or equal to 1.0 may pose a potential adverse human health risk.

Human Health Risk - Human health risks were evaluated for 100-FR-1 sites in order to select sites that should be addressed through interim remedial measures. Human health risks were evaluated using a qualitative risk assessment. The qualitative risk assessment used a limited set of exposure assumptions and pathways to estimate health risks. Contaminants detected in soils at the 100-FR-1 Operable Unit high priority radioactive liquid waste disposal sites pose a potential increased health risk to future users of the site. The level of potential health risk posed by these contaminants differs depending upon the future site use. Two scenarios were evaluated: an occasional use scenario, which corresponds to a recreational use, and a frequent use scenario, which corresponds to a residential use. In either case, future users could be exposed to contaminants in soil through ingestion of

soil, inhalation of wind-blown dust, or external exposure to radiation.

Based on the qualitative risk assessment, the contaminants in soil providing the highest contribution to potential increased cancer risks included the radionuclides cesium-137, cobalt-60, europium-152, europium-154, plutonium-238, and thorium-228. Noncancer hazard indices at 100-FR-1 Operable Unit sites were all less than 1.0, with the exception of 116-F-1, where a hazard index of 1.8 exists for arsenic. The risk estimates presented in Table 2 represent potential future risks if the area were to be used for recreational or residential purposes. These risks are outside of EPA's acceptable risk range, and they show that remedial actions should be taken at these sites. Past disposal of radioactive liquid wastes to the soils at the 100-FR-1 Operable Unit has resulted in impacts to the underlying groundwater. Should groundwater under the site be used, future users could be exposed to contaminants by drinking the groundwater. The existing groundwater contamination that resulted from these source operable units is part of the 100-FR-3 Operable Unit, and will be addressed in a future proposed plan for groundwater.

Ecological Risk - Ecological risks for the waste sites within the 100-FR-1 Operable Unit were estimated by evaluating potential impacts to the Great Basin pocket mouse. Risks to the mouse were estimated assuming the food pathway was the primary route of exposure to both radionuclides and inorganic/organic contaminants. An **Environmental Hazard Quotient (EHQ)** equal to or greater than 1.0 was considered to indicate that individual mice were at risk.

The inorganic contaminants that exceed an EHQ of 1.0 include barium, cadmium, copper, lead, mercury, selenium, silver, and zinc. Table 2 summarizes the risk estimates to the Great Basin pocket mouse due to exposure to contaminants at the 100-FR-1 Operable Unit waste sites.

SCOPE AND ROLE OF ACTION

This proposed plan presents interim remedial measures for eight high priority radioactive liquid waste disposal sites, and their associated contaminated soil and structures, at the 100-FR-1 Operable Unit. The objective of the proposed interim remedial measures is to reduce potential future threats to human health and the environment from these waste sites. It is expected that no additional remedial

measures will be required at these sites. A limited number of additional waste sites may be remediated during the interim remedial measures if they are adjacent to or within the excavation area for the eight high priority liquid waste disposal sites.

The public has provided input to the DOE on the future use of the 100 Area through various forums, including the **Hanford Future Site Uses Working Group**. However, the final land use for the 100 Area of the Hanford Site has not been established. Remedial action objectives and cleanup goals may be revisited if land use and groundwater use determinations are inconsistent with the goals presented in this plan. For the purposes of this proposed plan, the EPA, Ecology, and the DOE have agreed to cleanup goals that, to the extent practical, would support a goal not to limit future uses of the 100 Area land due to contaminants resulting from Hanford operations. This would be accomplished through remediation of the sites to address the potential direct effects of exposure, potential releases to air and groundwater, and would minimize ecological and cultural impacts. The development of mitigation plans to address site-specific ecological and cultural resources will occur during the remedial design phase that follows after the ROD is signed.

INTERIM REMEDIAL ACTION GOALS

Interim remedial action goals represent contaminant concentrations in soils that are considered to be protective of human health and the environment. Cleanup goals are based on the three laws and the draft regulation listed below.

- State of Washington *Model Toxics Control Act* for organic and inorganic chemical constituents in soil to support unrestricted (residential) use.
- Draft EPA and Nuclear Regulatory Commission proposed standard of 15 mrem/yr in soils above background for radionuclides for human health.
- Protection of groundwater such that contaminants remaining in the soil after remediation do not result in an impact to groundwater that could exceed **Maximum Contaminant Levels** under the *Safe Drinking Water Act*. This applies to waste sites where groundwater has not been impacted.
- Protection of the Columbia River such that contaminants remaining in the soil after

remediation do not result in an impact to groundwater and, therefore, the Columbia River that could exceed the Ambient Water Quality Criteria under the *Clean Water Act* for consumption of fish. This applies to sites where groundwater has already been impacted.

Other Sites in the 100-FR-1 Operable Unit
(not addressed in this proposed plan)

- 116-F-4 Pluto Crib*
- 116-F-5 Ball Washer Crib*
- 132-F-6 Lift Station Demolition Site*
- 116-F-7 French Drain
- 116-F-8 Outfall Structure*
- 116-F-11 Cushion Corridor French Drain*
- 116-F-12 French Drain*
- 116-F-13 Experimental Garden French Drain*
- 132-F-1 Chronic Feeding Barn
- 132-F-3 Gas Recirculation Facility Demolition Site
- 132-F-5 Filter Facility Demolition Site
- 1607-Septic Tanks and Drain Fields
- PNL Outfall Structure*
- Process/Discharge Pipelines*
- UN-100-F-1 Spill*

* High priority waste sites not addressed in this proposed plan.

For deep sites, the extent of remediation may be balanced against several factors, including reduction of risk by decay of radionuclides, protection of human health and the environment, costs, sizing of the Environmental Restoration Disposal Facility, worker safety, the presence of ecological and cultural resources, the use of institutional controls, and long term monitoring costs. In the event that contaminated soils above cleanup goals are left in place, additional public comment may be solicited.

SUMMARY OF ALTERNATIVES CONSIDERED

The *100 Area Source Operable Unit Focused Feasibility Study Report (DOE/RL-94-61)* identified six general response actions that could be applied to waste sites in the 100 Areas, including the 100-FR-1 Operable Unit. The alternatives evaluated for interim remediation are as follows:

- No Action
- Institutional Controls
- Containment
- Remove/Dispose
- In Situ Treatment
- Remove/Treat/Dispose.

NOTE: The No Action, Institutional Controls, Containment, and In Situ Treatment alternatives would limit the future uses of the 100 Area. A summary of alternatives considered is provided below.

No Action - The "no action" alternative was evaluated to provide a baseline for comparison to the other alternatives. It represents a hypothetical scenario where no additional restrictions, controls, or active remedial measures other than those currently existing are applied to a site.

Institutional Controls - This alternative involves the following:

- deed and/or access restrictions
- groundwater monitoring.

Deed restrictions would consist of limitations on certain types of land-uses (e.g., prohibiting drilling or excavation) at an individual waste site. Access restrictions would include fences or signs. Groundwater monitoring would include sampling for potential changes in groundwater contaminant concentrations underlying the waste sites. These institutional controls would limit exposure to humans and would monitor changes in groundwater quality until a final response action could be evaluated and implemented.

Containment - This alternative includes the following elements:

- institutional controls
- groundwater monitoring
- surface water controls
- installation of a barrier at the surface.

As described under the institutional control alternative, deed restrictions and/or access restrictions, combined with groundwater monitoring, would be implemented along with surface water controls during and after installation of a surface barrier, such as the Hanford Barrier.

Remove/Dispose - This alternative applies to contaminated soils and structures, and includes the following:

- remove contaminated media
- dispose media at an approved disposal facility
- backfill excavated areas and revegetation.

Under this alternative, contaminated media would be excavated, transported, and disposed at an appropriate facility (e.g., the Environmental Restoration Disposal Facility or 218-W-5 Burial Ground, Trench 31 [W025]), in accordance with waste acceptance criteria established for the disposal facility. Any material that exceeds the disposal facility acceptance criteria would be stored onsite consistent with requirements until the material is treated to meet acceptance criteria or a treatability variance is approved. As the contaminated material is excavated, it would be characterized and segregated prior to transportation. Excavation would continue until all contaminated material exceeding the cleanup goal is removed. The site would then be backfilled and the area revegetated. Site specific revegetation plans will be developed during remedial design with input from affected stakeholders, such as Natural Resource Trustees and Native American Tribes.

In Situ Treatment (for soil) - This alternative applies to contaminated soil and includes the following elements:

- institutional controls
- groundwater monitoring
- surface water controls
- **in situ vitrification.**

Institutional controls such as deed restrictions and/or access restrictions, groundwater monitoring, and surface water controls would be implemented as discussed under the institutional control and containment alternatives after completion of the in situ vitrification process. Under this alternative, the contaminated soil would be vitrified in place and covered with a minimum of one meter of soil. The disturbed area would then be revegetated.

Remove/Treat/Dispose - This alternative applies to sites with contaminated soil and structures, and includes the following elements:

- remove contaminated media
- **thermal desorption**, if required, for soil
- **soil washing**, as appropriate
- disposal at an approved facility
- backfill of excavated areas and revegetation.

Under this alternative, the contaminated soils would be excavated as described under the remove/dispose alternative. Soils contaminated with organic chemicals at levels exceeding waste disposal

acceptance criteria would be treated by thermal desorption, then recombined with the remaining contaminated soils prior to soil washing.

Soil washing could reduce the volume of contaminated soil for disposal. The application of soil washing to a waste site will depend on several factors, including soil conditions, contaminant specific cleanup goals, and the level of contaminants present. Soil washing is a desirable treatment only when significant volume reduction can be achieved. It would only be performed when such volume reduction could be achieved in a cost-effective manner. The greatest cost benefit would be achieved at large volume sites with low levels of contaminants. Treatability studies are currently in progress to evaluate the applicability of soil washing in the 100 Areas.

Following removal and treatment, contaminated soil and/or contaminated products resulting from treatment technologies would be disposed of in the same manner as the remove/dispose alternative. The excavation would be backfilled with washed soils and other soils, as needed, and revegetated.

PREFERRED INTERIM REMEDIAL MEASURES

The preferred alternative proposed for the 116-F-1 Lewis Canal, the 116-F-2 Basin Overflow Effluent Trench, the 116-F-3 Fuel Storage Basin, the 116-F-6 Liquid Waste Disposal Trench, the 116-F-9 PNL Animal Waste Trench, the 116-F-14 Retention Basin, and the 108-F French Drain is remove, treat (where appropriate or required), and dispose. The preferred alternatives meet the remedial action objectives under the future land use assumptions, provides long-term effectiveness and permanence, and overall protectiveness. It is implementable, utilizes proven technologies and equipment to complete the action, and is cost effective.

The preferred alternative for the 116-F-10 Dummy Decontamination French Drain is no interim action because no contaminants were identified at levels of concern for this waste site.

EVALUATION OF ALTERNATIVES

The preferred alternatives should provide the best balance of tradeoffs among the alternatives with respect to the nine evaluation criteria used to evaluate remedies. A description of those criteria is presented

EXPLANATION OF CERCLA EVALUATION CRITERIA

1. *Overall Protection of Human Health and the Environment* addresses whether or not a remedial action provides adequate protection and describes how potential risks posed through each exposure route are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. *Compliance with Applicable or Relevant and Appropriate Requirements* addresses whether or not a remedial action will meet all of the applicable or relevant and appropriate requirements and other federal and state environmental statutes or provide grounds for invoking a variance/waiver of the requirements.

3. *Long-Term Effectiveness and Permanence* refers to the magnitude of residual risk and the ability of a remedial action to maintain reliable protection of human health and the environment after remedial goals have been met.

4. *Reduction of Toxicity, Mobility, or Volume Through Treatment* evaluates the anticipated performance of the treatment technologies that may be employed in a remedy.

5. *Short-Term Effectiveness* refers to the speed with which the remedial action 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.

6. *Implementability* refers to the technical and administrative feasibility of a remedial action, including the availability of materials and services needed to implement the selected solution.

7. *Cost* evaluates capital, operation, and maintenance costs for each alternative by performing present worth cost analyses.

8. *State Acceptance*, based on review of the remedial investigation and focused feasibility study reports, and the proposed plan, indicates whether the state concurs with, opposes, or has no comment on the preferred interim alternative.

9. *Community Acceptance* is an assessment of the general public response to the proposed plan following a review of the public comments received on the remedial investigation, focused feasibility study, and proposed plan during the public comment period and open community meetings.

above. The criteria fall into three categories. The first two criteria, Overall Protection of Human Health and the Environment, and Compliance with **Applicable or Relevant and Appropriate Requirements (ARAR)**, are considered *threshold* criteria and, in general, must be met. ARAR may be waived in accordance with CERCLA Section 121. The next five criteria are considered *balancing* criteria, and are used to compare technical and cost aspects of the 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 will be evaluated after all public comments have been received. The following paragraphs discuss how the alternatives address the criteria for the 116-F-1 Lewis Canal, the 116-F-2

Basin Overflow Trench, the 116-F-3 Fuel Storage Basin, the 116-F-6 Liquid Waste Disposal Trench, the 116-F-9 PNL Animal Waste Trench, the 116-F-14 Retention Basin, and the 108-F French Drain.

OVERALL PROTECTION

The no action alternative does not meet this criteria. Institutional controls alone cannot be relied on to indefinitely provide protection, and therefore do not meet this criterion. The containment alternative would not provide adequate protection for the animal waste trench. The in situ alternative would provide good overall protection for the trenches and French drain. The remove/dispose and remove/treat/dispose alternatives would provide overall protection of human health and the environment.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The no action, institutional controls, containment, and in situ treatment alternatives would not meet all of the principal ARARs identified for all of the sites. The remove/dispose and the remove/treat/dispose alternatives would meet the ARAR, with the potential exception of Land Disposal Restrictions, under the *Resource Conservation and Recovery Act*. If Land Disposal Restrictions are encountered, contaminated soil would be treated or a treatability variance could be requested.

LONG TERM EFFECTIVENESS

The no action and institutional controls alternatives would not meet cleanup goals and, therefore, would not provide for long-term effectiveness. Containment and in situ treatment would provide a greater degree of long term effectiveness by stabilizing and isolating the wastes in place. The remove/dispose and remove/treat/dispose alternatives would provide the greatest long-term effectiveness and permanence.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

The no action and institutional controls alternatives do not reduce the mobility, toxicity, or volume of the contaminants. The containment and institutional controls alternatives do not include treatment. The containment, in situ treatment, and remove/dispose alternatives would reduce the mobility of contaminants but not the toxicity or volume. The remove/treat/dispose alternative provides the most significant level of treatment and would reduce volume and mobility.

SHORT-TERM EFFECTIVENESS

The no action and institutional controls alternatives require minimal effort to implement. The containment and in situ treatment options require technology that is readily available. The remove/dispose alternative would provide a greater degree of short-term protectiveness than the remove/treat/dispose alternative, because it requires less time to implement, utilizes standard technologies, and presents less short-term risk to workers and the environment.

IMPLEMENTABILITY

The institutional controls alternative would require administrative actions, such as deed restrictions. The containment and in situ treatment alternatives are implementable with existing technologies. The remove/dispose alternative is easier to implement than the remove/treat/dispose alternative.

COSTS

Table 3 provides a summary of costs for the alternatives for seven of the eight waste sites. Costs were not developed for the no interim action alternative at the 116-F-10 Dummy Decontamination French Drain.

EPA, Ecology, and the DOE believe the assumptions relied upon in developing the preliminary cost estimates for the cleanups has resulted in estimates that are too high. There is a high level of uncertainty in the cost estimates due to the lack of actual remediation experience at 100 Area waste sites. The Tri-Parties are working together to implement a demonstration project this summer in the 100-BC Area to address a number of concerns related to cleanup, including the verification of cost models. It is expected that contaminated materials from those actions will be disposed of at the 218-W-5 Burial Ground, Trench 31 (W025) in the 200 Area, or stored for future disposal at the Environmental Restoration Disposal Facility.

EVALUATION OF POTENTIAL ENVIRONMENTAL IMPACTS

In addition to evaluating whether the alternatives pose a risk to human and ecological receptors, the different remedial alternatives were compared relative to the potential impacts the action might have on cultural and natural resources, transportation, and regional socioeconomics. The evaluation of alternatives also considered avoidance and mitigation of the above impacts, what commitment of resources may be necessary, and how the actions at this operable unit relate to actions being planned or executed at other operable units (cumulative impacts).

The levels of impact from the alternatives will vary depending on requirements (such as equipment and

**Table 3. Summary of Estimated Costs for 100-FR-1 Operable Unit
Remedial Alternatives**

Waste Site	Containment			Remove/Dispose			In Situ Treatment			Remove/Treat/Dispose		
	CAP	O&M	PW	CAP	O&M	PW	CAP	O&M	PW	CAP	O&M	PW
116-F-1	NA	NA	NA	\$7.40	\$0	\$7.05	NA	NA	NA	\$7.84	\$0.773	\$8.21
116-F-2	NA	NA	NA	\$42.50	\$0	\$38.90	NA	NA	NA	\$41.20	\$9.24	\$45.50
116-F-3	NA	NA	NA	\$1.59	\$0	\$1.52	NA	NA	NA	\$1.95	\$0.55	\$2.18
116-F-6	NA	NA	NA	\$10.90	\$0	\$10.40	\$21.50	\$18.10	\$36.20	\$10.90	\$2.28	\$12.60
116-F-9	\$8.77	\$3.08	\$10.10	\$5.25	\$0	\$5.01	NA	NA	NA	\$5.49	\$1.17	\$6.34
116-F-10*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
116-F-14	NA	NA	NA	\$165.00	\$0	\$144.00	NA	NA	NA	\$167.00	\$26.70	\$147.10
108-F	NA	NA	NA	\$0.21	\$0	\$0.20	\$0.49	\$0.04	\$0.50	\$0.63	\$0.01	\$0.60

Notes:

Costs are in millions of dollars
 CAP - capital
 O&M - operation and maintenance
 PW - present worth
 NA - not applicable to the waste site (see FFS Report)

Costs presented are based on a different exposure scenario than the selected scenario, but the relative differences between alternatives is similar (see FFS Report for detailed cost analysis).

*No costs are associated with the no action alternative.

services), the need for borrow materials, and people that are needed to support each alternative.

Significant impacts are expected to be limited to potential exposure of remediation workers to hazardous or radioactive substances, short-term indirect impact to wildlife from construction noise, and the commitment of land area used for disposal. The extent of physical disturbance caused by the action was also evaluated because this has a direct relationship to the potential for impacting cultural and natural resources.

The development of avoidance and mitigation measures will be initiated as soon as the remedial alternative is selected. The waste sites to be remediated occur within areas previously disturbed by reactor operations and agricultural activities, so remediation and revegetation actions will likely result in improving rather than degrading ecological conditions in the area.

SUPPORTING DOCUMENTS	ADMINISTRATIVE RECORD
<p>The public is encouraged to review the following documents to gain a better understanding of the 100-FR-1 Operable Unit:</p> <ul style="list-style-type: none"> • <i>Remedial Investigation/Feasibility Study Work Plan for the 100-FR-1 Operable Unit</i> (DOE/RL-90-33) • <i>100-FR-1 Limited Field Investigation</i> (DOE/RL-93-82) • <i>Qualitative Risk Assessment for the 100-FR-1 Operable Unit Report</i> (BHI00053) • <i>100-Area Source Operable Unit Focused Feasibility Study Report</i> (DOE/RL-94-61), Appendix H • <i>100 Areas Feasibility Study, Phases 1 and 2</i> (DOE/RL-92-11) 	<p>The Administrative Record can be reviewed at the following locations:</p> <p>Washington State Department of Ecology Nuclear Waste Library 300 Desmond Drive S.E. Lacey, Washington 98503 360/407-7097 ATTN: Marilyn Smith</p> <p>EPA Region 10 Lobat-Anderson Inc. c/o U.S. Environmental Protection Agency 1200 Sixth Avenue Seattle, Washington 98101 206/553-4494 ATTN: Karen Prater</p> <p>U. S. Department of Energy - Richland Operations Administrative Record 2440 Stevens Center Place; Room 1101 Richland, Washington 99352 509/376-2530 ATTN: Debbie Isom</p>
POINTS OF CONTACT	INFORMATION REPOSITORIES
<p><u>Department of Energy Representative</u> Arlene Tortoso Unit Manager 509/373-9631</p> <p><u>U.S. Environmental Protection Agency Representative</u> EPA (Region 10) Kevin Oates Unit Manager 509/376-6623</p> <p><u>Washington State Department of Ecology Representative</u> Keith Holliday Unit Manager 509/736-3027</p>	<p>Supporting documents are available for review at the following repositories:</p> <p>University of Washington, Suzzallo Library Government Publications Room Seattle, Washington 98195 206/543-4664 ATTN: Eleanor Chase</p> <p>Gonzaga University, Foley Center E. 502 Boone Spokane, Washington 99258 509/328-4220 Ext. 3844 ATTN: Tim Fuhrman</p> <p>Portland State University, Branford Price Millar Library 934 S.W. Harrison Portland, Oregon 97207-1151 503/725-3690 ATTN: Michael Bowman/Susan Thomas</p> <p>U.S. Department of Energy Richland Public Reading Room Washington State University, Tri-Cities 100 Sprout Road, Room 130 West Richland, Washington 99352 509/376-8583 ATTN: Terri Traub</p>

GLOSSARY

Applicable or Relevant and Appropriate Requirements (ARARs) - These are federal and state requirements that apply to cleanup actions under CERCLA.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - This is a federal law that establishes a program that enables the Environmental Protection Agency to identify hazardous waste sites, ensure that they are cleaned up, and allow other government entities to evaluate damages to natural resources. CERCLA is also known as the "Superfund law." CERCLA applies to the 100-FR-1 Operable Unit.

Contaminants of Potential Concern - These are chemical and radioactive constituents that must be addressed by remedial action.

Environmental Hazard Quotient - The ratio of exposure toxicity for ecological receptors of contaminants. When the Environmental Hazard Quotient exceeds 1.0, a possible ecological risk is assumed to exist.

Environmental Restoration Disposal Facility - A disposal facility for contaminated soils and solid waste that will be available in October 1996 at the Hanford Site to support interim remedial measures.

Focused Feasibility Study (FFS) - An engineering study on a waste site that evaluates a limited number of remedial alternatives for cleaning up environmental contaminants.

Groundwater - Underground water that fills the spaces between particles of soil, sand, gravel, or fractures in rocks.

Hanford Future Site Uses Working Group - A working group made up of representatives of interested parties concerned with the cleanup and possible future uses of the Hanford Site. The group was active in 1992 and produced a report identifying possible future site uses and an examination of the cleanup necessary to make those uses possible.

Hazard Index - The ratio of exposure to toxicity for receptors of contaminants. When the Hazard Index exceeds 1.0, a possible human health risk is assumed to exist.

In Situ Vitrification - A treatment process that converts soil and other material into stable glass or glass-like crystalline substances and stabilizes the contaminants in place.

Interim Remedial Measure - A remedial action that is taken at a site to address one or more of the contamination problems, but not necessarily all of the contamination problems. The remedial action is based on a Limited Field Investigation/Focused Feasibility Study, and is selected in a record of decision.

Maximum Contaminant Level (MCL) - The maximum concentration of a particular contaminant allowable in drinking water under the *Safe Drinking Water Act* of 1974, as amended.

National Priority List - A list of top-priority hazardous waste sites in the United States that are eligible for investigation and cleanup under the Superfund law.

Operable Unit - This is a subset of a larger Superfund CERCLA site; it is typically the subject of Operable Unit-specific investigations and remedial actions.

Qualitative Risk Assessment - An evaluation of risk for a predefined set of human and environmental exposure scenarios that assists Tri-Party signatories in making defensible decisions on the necessity of interim remedial measures.

Record of Decision - The formal document in which the lead regulatory agency sets forth the selected remedial measure and the reasons for its selection.

Soil Washing - Soil washing is a means to reduce contaminated soil waste volume by concentrating contaminants in the fine (i.e., clay, silt, and sand) soil fractions. Only the contaminated fines, rather than the entire range of particle sizes, are disposed of at an approved waste disposal facility, thereby conserving space at the disposal facility. The uncontaminated gravel and cobble fractions can then be returned to the waste site excavation.

Thermal Desorption - A process that uses indirect low temperatures to thermally remove volatile and semi-volatile organic compounds from contaminated soil, sediment, or sludge.