Review Draft

INACTIVE WASTE SITE STUDY REPORT

September 3, 1987

Submitted to:

Westinghouse Hanford Company
Richland, Washington 99352

Prepared by:

Science Applications International Corporation
Richland, Washington and
McLean, Virginia

SAIC PROJECT 1-246-02-539-10

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FOREWORD

This report is an account of work performed under Consultant Agreement MDD-SCA-432162 between June 19, 1987, and September 1, 1987. This work utilized information provided to SAIC by Westinghouse Hanford Company and Rockwell Hanford Operations. The documents used in this work are listed in Section 5 of this report.

It is the purpose of this report to provide an estimate of the cost of characterizing and remediating 81 potential CERCLA sites and more than 500 potential RCRA 3004(u) sites. The development of characterization plans and the selection of remedial actions to be implemented was outside the scope of this study and will require more detailed information on each site than is available in the documents reviewed for this study. This more detailed information will be obtained as a part of the Remedial Investigation/Feasibility studies performed for these sites.

not result in cost reductions, but they were made to facilitate a more efficient characterization and remediation schedule. Cost reductions of up to 80% have been identified by grouping of these sites. A more detailed discussion of the grouping of sites can be found in Section 4.0 of this report.

Although the remedial technology for each site cannot be determined at this time, some estimate can be made of the probable range of costs for each CERCLA site and each type of RCRA 3004(u) site. For the CERCLA sites evaluated in this study, the least cost alternative is nearly always the capping of the site with some type of subsurface barrier. The most expensive alternative is nearly always some type of removal action such as excavation and disposal. More detailed evaluation of each site as a part of Remedial Investigation/Feasibility Study will be required to select the remediation technologies to be used, to refine the cost estimates, and to provide the information required by EPA and State of Washington Regulations for use in the final selection of a remedial technology.

The schedule for the CERCLA sites indicates that it will take approximately ten years to complete site characterization based on a budget of $50 million per year. RCRA sites could take an additional 15 years. Remediation of the sites could take more than fifty years if all sites are remediated (assuming a budget limit of $100 million per year for remediation).

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1.0 INTRODUCTION

The purpose of this report is to develop a program plan for addressing the inactive waste sites at the Hanford Reservation. This study presents a plan for the characterization of the CERCLA sites and provides a preliminary engineering estimate of the remediation costs and schedule for these sites. This report also provides the strategy, assessment and recommendations for characterizing and planning the remediation of the RCRA 3004(u) sites.

It is not the intent of this report to provide a detailed characterization plan for addressing specific waste sites. Instead, this report provides sufficient information to provide projections of cost and time associated with addressing the inactive waste sites.

In the development of this information, it has been necessary to evaluate existing information against the data needs for characterizing inactive waste sites and selecting appropriate remedial actions. During this process, gaps in the necessary data have been identified, and the sampling needs for the collection of this information have been converted into a summary of activities for each of the identified sites. In addition, the available remedial action technologies were reviewed against the characteristics of each site to compile a preliminary listing of appropriate remedial actions. The information compiled was then used to develop estimates of the costs and schedules for addressing the inactive waste sites.

The remediation program for inactive waste disposal sites will follow the procedures for Remedial Investigations/Feasibility Studies (RI/FS) for CERCLA sites or the RCRA 3004(u) sites. As that process proceeds, the requirements for characterization will become better defined and the sampling program may change from that identified in this document. When further information becomes available from the characterization process, the remedial action appropriate to the site may also become better defined. Therefore, the RI/FS process will govern the actual activities to be undertaken at each site.

It can be seen, therefore, that the selected technologies for remediation of the sites discussed in this report may be different from the activities discussed here. This should not be surprising since the process is a dynamic one which leads to the final decision on what remedial action is best for a site. The costs and schedule presented in this report, however, represents the best estimate that can be made available using information provided for performing this work.

1.1 OVERVIEW

1.1.1 Overview of the Regulations, Procedures and Requirements.

The Superfund Amendments and Reauthorization Act (SARA) of 1986 adds Sections 120 and 121 to CERCLA, clarifying the applicability of CERCLA regulations by EPA and the states to cleanup at federal facilities. As a result of SARA, EPA is given final authority for approving remedial action at federal facilities. Section 120 of CERCLA however, does not apply to certain Department of Energy sites which had a response plan or remedial action under development on the date of enactment of SARA. SARA also sets out a schedule for EPA, and federal agencies with cleanup sites, to follow in considering those sites for the NPL and pursuing the required studies and cleanups.

The SARA requires that CERCLA actions, including cleanup at federal facilities on the NPL, must achieve "applicable or relevant and appropriate federal and state requirements" (ARAR's). Previously, as a matter of policy, EPA required CERCLA cleanups to meet ARAR's except under certain conditions. SARA formalizes that policy as a legislated requirement with specific conditions under which the requirement can be waived. This subjects hazardous waste cleanups at all federal facilities to the requirements of the Clean Air Act, the Clean Water Act, the Toxic Substances Control Act, and the Resource Conservation and Recovery Act, and to the requirements of the state in which the DOE facility is located.

The National Oil and Hazardous Substance Contingency Plan (NCP) (40 CFR Part 300) provides the regulatory framework for selecting and carrying out remedial responses under CERCLA. Selection of a response is based on factors such as health and environmental protection, technology, cost, institutional considerations, and site-specific factors. The NCP provides limited guidance regarding the standards to be applied to CERCLA cleanups, but directs that remedial actions must be protective of human health and the environment and attain legally applicable or relevant and appropriate Federal and State regulations (ARAR's).

The Superfund Amendments and Reauthorization Act of 1986 (SARA) incorporated several of these factors into the statute and added a new mandate with regard to standards for cleanup remedies. Remedial actions at CERCLA sites must be:

- Protective of human health and the environment (including meeting Federal and State ARARs);
- Cost effective in achieving goals; and
- Utilize permanent remedies and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The strong preference for "permanent" remedies is a significant new direction for the CERCLA program and will receive major emphasis at RCRA cleanups as well.

Application of RCRA requirements to CERCLA actions has recently been clarified by a working draft guidance that EPA has released for review and, as previously mentioned, by Section 121 of SARA which addresses ARAR's. The draft guidance is not to be cited or quoted, but it is very similar to the requirements in the SARA. SARA requirements indicate that all Superfund remedial actions are to attain ARAR's (except for permits for onsite actions), unless the Administrator waives the ARAR's. SARA lists six reasons for waiving applicable or relevant and appropriate requirements. These are:

- o The remedial action is an interim measure where the final remedy will attain the ARAR upon completion

- o Compliance will result in greater risk to human health and the environment than other options

- o Compliance is technically impracticable

- o An alternative remedial action will attain the equivalent of the ARAR

- o For state requirements,the state has not consistently applied the state requirement in similar circumstances

- o For Section 104 remedial actions, compliance with the ARAR will not provide a balance between protecting public health, welfare, and the environment at the facility with the availability of Fund money for response at other facilities (Fund-balancing).

The result of SARA Section 121 will be increased application of RCRA procedures and standards to CERCLA actions, especially for discreet disposal units that clearly meet the traditional sense of a solid waste management unit. Waivers will require additional efforts by the responsible parties to construct supporting arguments that the Administrator will need to incorporate with the consent decrees or records of decision.

Conflicts Identified for the CERCLA Sites. The DOE ORDER 5480.14, Comprehensive Environmental Response, Compensation and Liability Program, describes the decision process used by DOE in determining whether or not a site requires further action beyond phase 1. Sites posing no threat of release are eliminated from further consideration. Sites qualifying for the NPL are recommended for further action to quantify migration potential. Sites not qualifying for the NPL, but exceeding other applicable DOE remedial action criteria or guidance or posing potential regulatory concern under other environmental acts, are proposed for further action.

As a result of SARA, DOE facilities will be required to carry out the same activities as previously required of private facilities. The new law also requires that the Remedial Investigation/Feasibility Study (RI/FS) be a mandatory requirement for sites on the NPL. This will require the revision of DOE Order 5480.14 to require the initiation of the RI/FS process within 12 months of the site being listed on the NPL.

Certain guidelines are specified by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (40 CFR 300) for preliminary assessment of sites potentially containing hazardous substances that might adversely affect human health or welfare. The Superfund Amendments and Reauthorization Act of 1986 (SARA) modifies CERCLA but these changes will not apply to any response action or remedial action for which a plan is under development by the DOE at the Hanford Site. The Draft Phase I Installation Assessment of Inactive Waste-Disposal Sites at Hanford, June 1986, Volumes 1 and 2, meets the requirements of 40 CFR 300 for the preliminary assessment. The preliminary site investigation has compiled available literature, interviews of knowledegable sources, monitoring data, records and photographs of all sites currently in question into a comprehensive report. Volume 1 also describes the methods and data used as input to EPA's Hazard Ranking System (HRS) and the resulting scores. Some questions were raised as to the validity of some of the HRS scores. Particularly the handling of radioactive materials and the scores resulting from hazardous substances that may have been released in small quantities. An additional ranking was performed which was called mHRS. This reevaluation of sites resulted in the changing of some of the final HRS scores. The approach has been documented in Volume 1. With the notification of the Administrator of the EPA, the Hanford Site has fulfilled all requirements for the preliminary assessment as required by 40 CFR 300.

The RCRA corrective action authority is a redundant authority that EPA could use at DOE facilities. The RCRA authorities are broader than the CERCLA authorities because the standard that must be met in order to invoke the authority is as low as (for Section 3008(h)) the mere existence of a release,whether or not any person or any part of the environment is threatened by the release. EPA is not required by Sections 3004(u), 3004(v), or 3008(h) to show an "imminent and substantial endangerment", as required under CERCLA.

Sections 3004(u) and (v) and 3008(h) of RCRA were added by the Hazardous and Solid Waste Amendments of 1984 (HSWA). These "corrective action" provisions of RCRA authorize the EPA to require corrective action to be undertaken to address releases of hazardous constituents at sites located at either interim status facilities or facilities that will require a RCRA permit. Consequently, for any federal facility that will require a RCRA permit for one or more treatment, storage, or disposal units, releases from even pre-RCRA solid waste management units (SWMU's) at that facility can be addressed by EPA under RCRA authorities.

The corrective action programs already in place under CERCLA and RCRA Part 264 Subpart F are the foundation for the 3004 (u) program. Sections 104 and 106 of the Comprehensive Environmental Response Compensation and Liability Act authorize EPA to take response actions, including removal or remedial measures, when a release or threat of release of a hazardous substance is discovered which may effect health or welfare. Generally, these authorities are used in situations where contamination has occurred at abandoned sites. Where contamination is related to activities at hazardous waste management facilities that are operating or have operated at any time since November 1980, both RCRA and CERCLA potentially apply. EPA has chosen, as a matter of policy, to initiate action under RCRA rather than CERCLA at most facilities.

The RCRA program will utilize, where feasible, remedial approaches that provide for treatment of wastes and control of the source as opposed to limited solutions such as capping, where the contaminating material is allowed to remain in place.

The Hazardous Solid Waste Act (HSWA) corrective action regulations, when they become available, will represent the most important set of RCRA standards (ARARs) for CERCLA remedial actions. As such, a primary goal in development of the RCRA regulations will be to establish, to the maximum extent possible, a consistent approach between the RCRA and CERCLA programs to remediating environmental problems.

Existing RCRA regulations for ground water corrective action (40 CFR Part 264, Subpart F) prescribe a specific approach for detection, characterization, and cleanup of contaminated ground water from permitted land disposal units that received waste after July 26, 1982. Subpart F requires that ground water be removed or treated in-place within a reasonable period of time when a pre-determined performance standard has been exceeded at a point of compliance (unit boundary). The performance standard may be defined as background, a generic drinking water standard applicable to all facilities (maximum concentration limits or MCLs) or a health-based standard calculated on the basis of actual facility conditions (alternate concentration limits or ACLs).

RCRA standards for closure of operating hazardous waste management units are also related to establishing cleanup remedy standards for 3004(u) corrective action. Many corrective actions are likely to involve measures designed to control sources of contamination. RCRA closure regulations specify how wastes in units may be removed or decontaminated or otherwise subjected to post-closure care requirements. Although the concept of RCRA "closure" of operating units is in some ways different from cleanup of old, abandoned waste management units or contaminated areas, the approach to regulating corrective action should be consistent with the principles of RCRA closure.

Conflicts Identified for RCRA 3004(u) Sites. EPA has not resolved how it will apply the CERCLA and RCRA corrective action authorities. Many situations, at least over the short-term, can be addressed by orders under either authority, thus leaving EPA with a choice of tools. But, over the long-term, for active sites that will eventually require a permit, the Administrator of EPA is required by Section 3004(u) of RCRA to put conditions in the permit that require corrective actions to address releases from SWMU's. Thus, even if all SWMU's that score above 28.5 on the HRS (or the required score on the new replacement for the HRS which SARA requires) are addressed by DOE under CERCLA, DOE could later be required under RCRA to address releases from any sites that did not qualify for the NPL. Therefore, it is unclear for the present whether CERCLA or RCRA will apply at uncontrolled DOE waste sites.

Relationship Between DOE Orders, EPA and Washington Department of Ecology Regulations. The Operative CERCLA DOE Order is No. 5480.14. As noted in the previous section, the SARA requires that the Federal facilities respond to the same requirements as private facilities. Furthermore, the Environmental Protection Agency has just amended 40 CFR 300 to add several new Federal Facility Sites. In the explanation of the rule, EPA has indicated they may choose not to use CERCLA to respond to certain releases because other authorities can be used to achieve these cleanups (52 FR 27625, July 22, 1987). In most cases, Federal Facility cleanups can be conducted under the corrective action provisions of RCRA.

Therefore, Federal RCRA regulations may be used for CERCLA sites. EPA can delegate the authority for RCRA to the states; and in the case of Washington State, the State program has been accepted by EPA. In this situation, EPA retains oversight for the implementation of the regulations. Recent guidance from EPA indicates that the agency is moving in the direction of making corrective action guidance under CERCLA and the corrective action under RCRA equivalent.

The Washington State Regulations for Dangerous Waste (173-303 WAC) will apply to all dangerous waste interim status waste management units, dangerous waste permitted waste management units, and units seeking a closure/post-closure permit as a dangerous waste management unit. The corrective action provisions under this regulation include groundwater monitoring corrective action (interim and final status land disposal units) and closure requirements (clean up contamination to background or close as a "RCRA" landfill). These regulations are equivalent to 40 CFR 264.100, 264.112, 264.117, 265.93, 265.112, 265.117, and 265.118.

Corrective action of solid waste management units can be mandated by EPA under RCRA 3004(u). Any facility seeking a dangerous waste permit (final status or closure/post-closure) will be subject to the corrective action provisions of the 1984 RCRA amendments. EPA currently has sole authority for the 3004(u) corrective action program. No states have been delegated this authority. Under the EPA 3004(u) corrective action program, special conditions will be included in the permit specifying remediation or verification sampling to be performed and a schedule for meeting these requirements.

1.1.2 General Description of the Hanford Reservation and Inactive Waste Disposal Sites

The semiarid Hanford Site, operated by Westinghouse Hanford Company for the DOE, occupies about 1,476 square kilometers (570 sq mi) of the south-eastern part of Washington State north of where the Yakima River flows into the Columbia (see Figure 2.1). The Site lies about 320 kilometers (200 mi) east of Portland, Oregon, 270 kilometers (170 mi) southeast of Seattle, Washington, and 200 kilometers (125 mi) southwest of Spokane, Washington.

Established in 1943, the Hanford Site was originally designed, built, and operated to produce plutonium for nuclear weapons using production reactors and chemical reprocessing plants. Since then, waste management, energy research and development, isotope use, and other activities have been added to Hanford operations.

In 1943, after the Fermi experiment at the University of Chicago showed that nuclear fission could be controlled in a small reactor, the U.S. Army Corps of Engineers selected Hanford as one of the location to build larger versions of the Fermi reactor to produce plutonium for possible use in military weapons. Construction started in 1943 on three reactor facilities and three chemical processing facilities. The first of the reactors went into operation about 18 months after the start of construction, and the first plutonium was available some 4 months later.

After World War II, five reactors similar to those built during the war were constructed. A total of eight graphite-moderated reactors used the Columbia River for once-through cooling (i.e., water circulated through the reactors only once before being released back to the river).

Early in the 1950s construction began on the research and development facilities known as the Hanford Laboratories. This marked the first diversification of Hanford from a purely defense-materials production facility to one heavily involved in peacetime uses of the atom.

In 1963 the N Reactor was built. The N Reactor is different from the other eight reactors in that it generates steam as a by-product of the plutonium production and does not use river water as a once-through coolant. Since 1966 the Washington Public Power Supply System has used the steam to generate electricity.

A presidential decision was made in early 1964 to begin shutting down the older Hanford reactors. This decision resulted in the closing down of all eight of the older reactors by the end of 1971, leaving the N Reactor as the only operational production reactor.

Historical practices and operational changes of particular interest to this study are as follows:

- shutdown of the last of eight once-through cooled production reactors (adjacent to the Columbia River) in 1971

- substitution of a bismuth phosphate precipitation process with solvent extraction chemical reprocessing in 1956 (and associated replacement of bismuth phosphate first- and second-cycle wastes with solvent wastes)

- segregation of transuranic solid waste, stored for later shipment off site,beginning in 1970 by DOE Order

- termination of routine liquid discharges containing transuranics to the soil column in 1973

- consolidation of all radioactive solid-waste disposals in all Hanford areas to the 200 Areas and of all nonradioactive trash/chemicals to the Central Landfill (an area near the center of the site) in 1973.

As a result of these process changes and new DOE requirements, the sites of most interest to this study are those established early in the history of Hanford's waste-management operations. Current disposal practices at Hanford have not resulted in measurable public health impacts (Price et al. 1984, 1985; Price 1986; Cline et al. 1985).

General Description of Inactive Waste Disposal Sites

The operations at the Hanford Site have produced various low-level radioactive and chemical solid and liquid wastes. Most of the wastes have been stored on-site or disposed of on-site in the soil column. A total of 337 inactive waste disposal sites have been identified at the Hanford Site.

Twenty-one of the inactive sites (6%) were used to dispose of nonradioactive wastes only. Thirty-three more (10%) received predominantly water and radionuclides (100-Area reactor coolant and ruptured fuel effluents). The remainder of the Hanford waste-disposal sites (84%) contain a mixture of radionuclides and chemicals. Approximately three-quarters of Hanford's disposal sites were used to dispose of liquids.

The sites occupy surface areas ranging from 0.02 square meters (0.2 sq ft) to more than 15 hectares (37 acres) and were in service for periods ranging from a few days to 32 years. In total, the inactive waste-disposal sites occupy 1,416 hectares (3,500 acres), approximately 1% of Hanford's total area. The average depth to ground water from the surface of inactive waste-disposal sites varied from about 13 meters (43 ft) in the 300 Areas to 73 meters (240 ft) in the 200 Areas.

The Hanford Site is divided into 14 major operational areas. The nine 100 Operational Areas each contain one production reactor facility of which only one remains in operation. The nine 100 Operational Areas are all located along the Columbia River in the northern part of the Hanford Reservation. The two 200 Operational Areas contain reactor fuel processing, plutonium separation, and waste management facilities. Both 200 Operational Areas are located near the center of the Hanford Reservation on the Central Plateau approximately 7 miles from the Columbia River. The 300 Operational Area contains reactor fuel manufacturing facilities. It is located along the Columbia River approximately 1 mile north of the Richland city limits. The 400 Operational Area contains an experimental reactor and associated support facilities. It is located in the southeast section of the Hanford Reservation approximately 4.5 miles from the Columbia River. The 600 Operational Area consists of the rest of the Hanford Reservation that is not located in the other operational areas. Figures 1-1 through 1-10 shows the general locations of the operational areas within the Hanford Reservation.

Approximately 67% of the inactive waste disposal sites are located within or just outside of the 200 Operational Areas (East and West). Approximately 25% of the inactive sites are located within or just outside of the nine 100 Operational Areas (B, C, D, DR, KE, KW, F, H and N). The remaining 8% of the sites are located in the remaining operational areas (3090, 400 and 600).

Radioactive and nonradioactive wastes are stored or disposed of in a variety of disposal structures. The most prevalent systems, by area serviced, include burial grounds (100 and 600 Areas), cribs (200 Areas), and liquid-waste trenches (300 Area).

1.1.3 Overview of the Inactive Waste Sites Inventory

The inactive waste-disposal sites received an estimated 1.6 billion cubic meters (422 billion gallons) of aqueous wastes and 140,000 cubic meters (183,000 cubic yards) of solids, containing 75,000 metric tons of chemicals and 90,000 curies of radionuclides altogether. (The basis for these numbers is published literature and process estimates; the associated uncertainty of the estimates is unknown.)

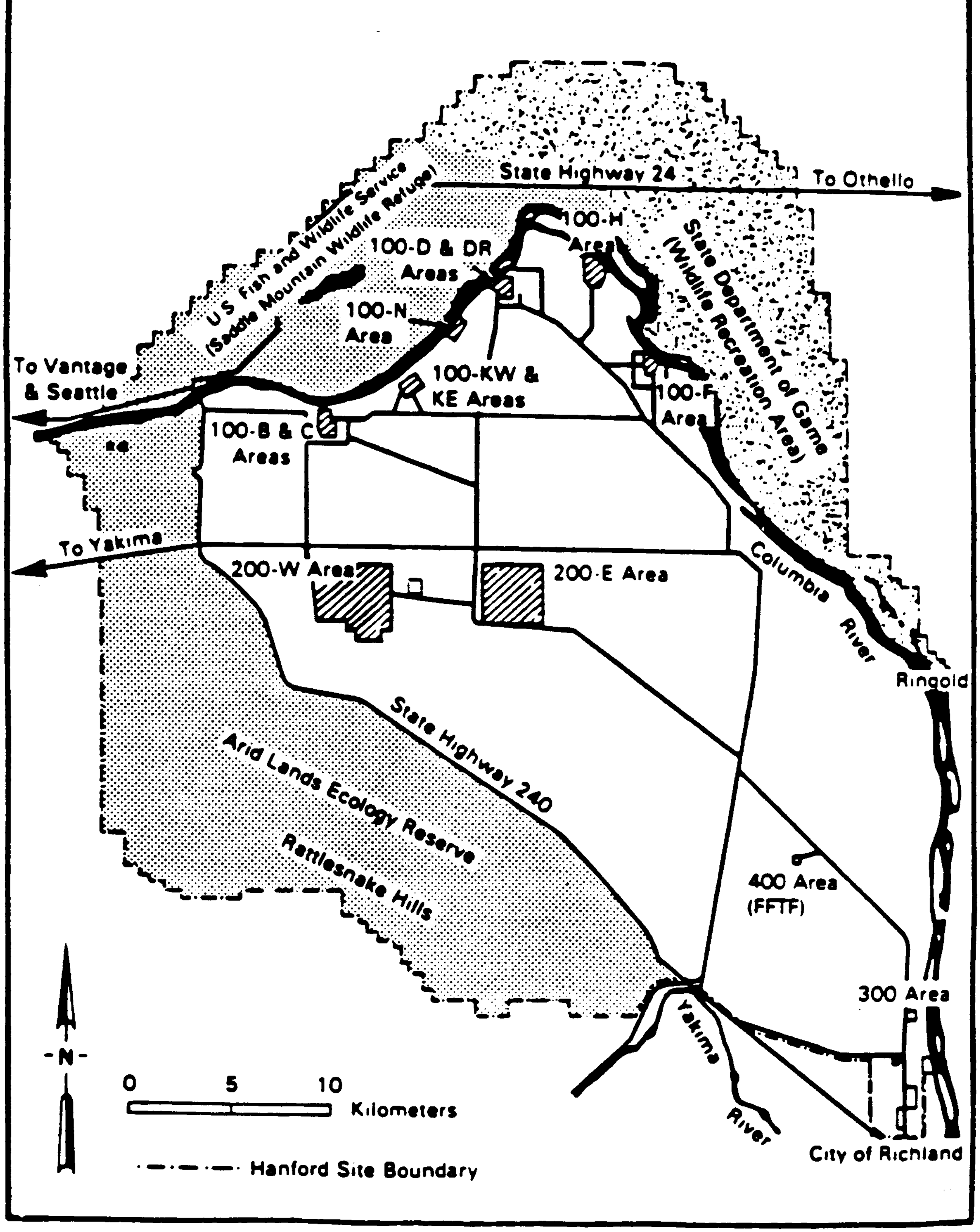
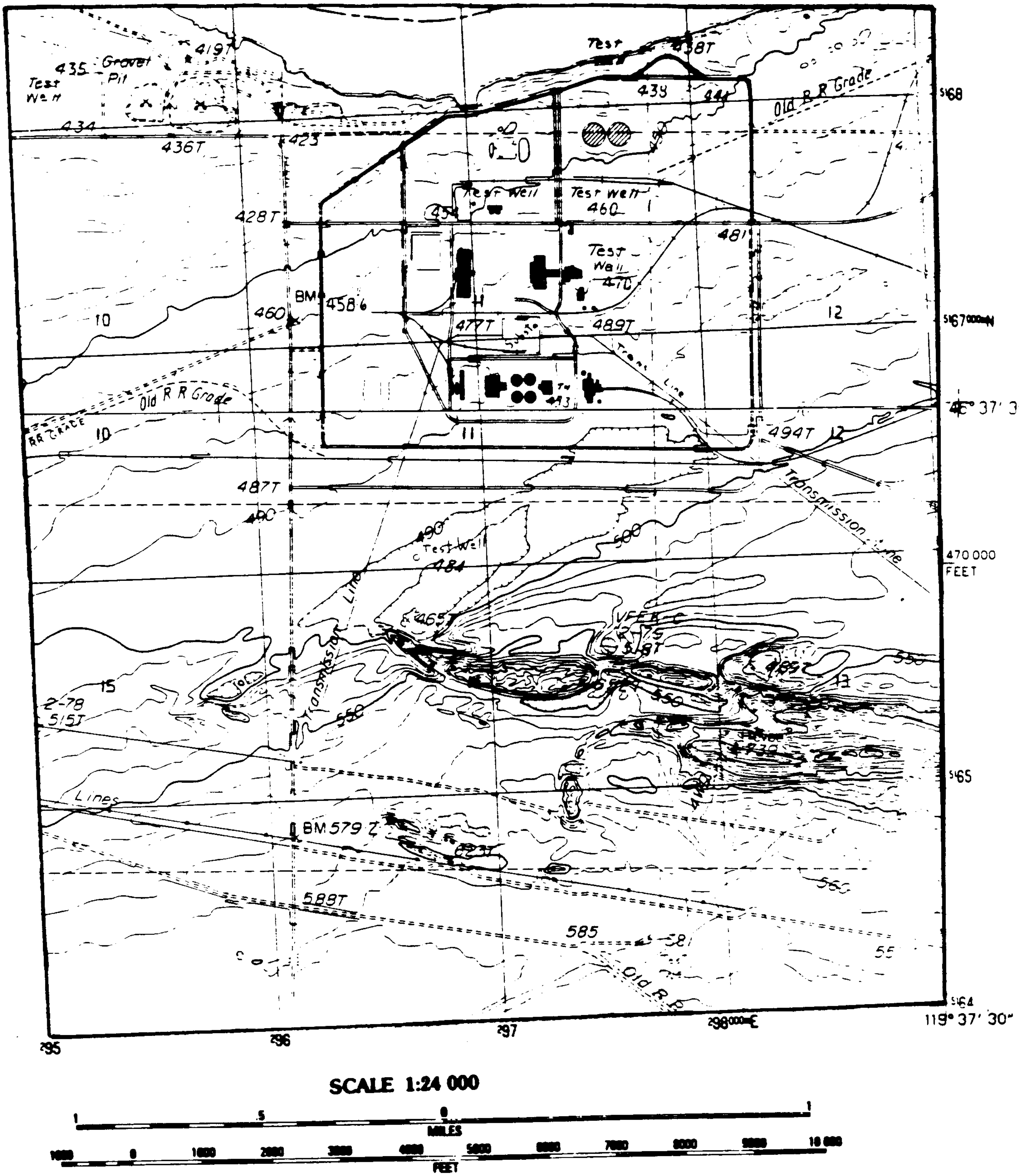


FIGURE 1-1. FEATURES OF THE HANFORD SITE.

SOURCE: U.S. DOE 1986a.



SCALE 1:24 000

MILES

FEET

ROAD LEGEND

Improved Road

Unimproved Road

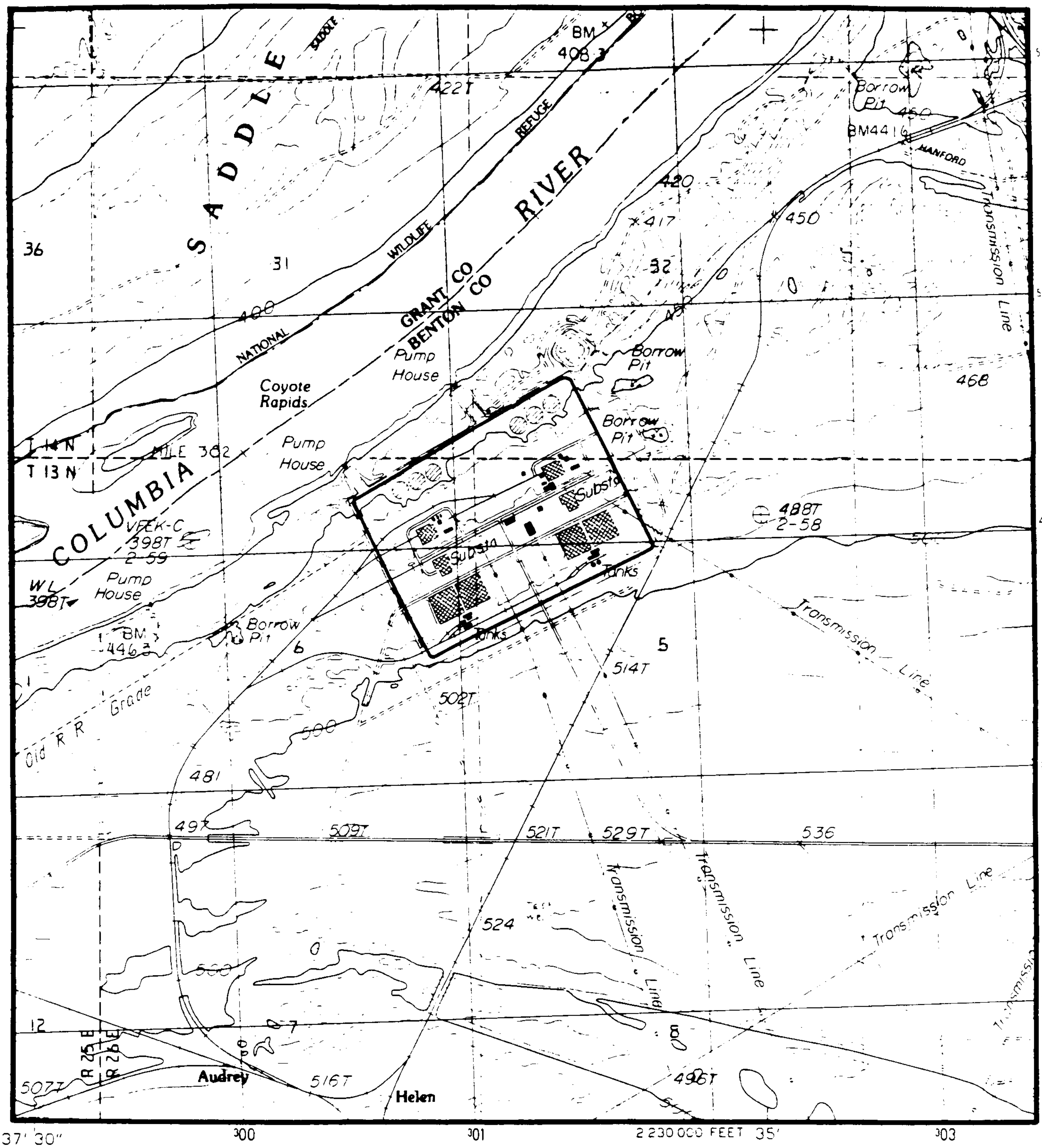
Trail

Interstate Route U.S. Route State Route

CONTOUR INTERVAL 10 FEET

SOURCE: USGS, 1986
Vernita Bridge, WA
46119-F6-TF-1024

FIGURE 1-2. 100 B/C AREA



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1 .5 0 1 MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000 FEET

ROAD LEGEND

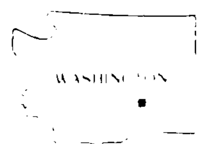
Improved Road ....

Unimproved Road ....

Trail ....

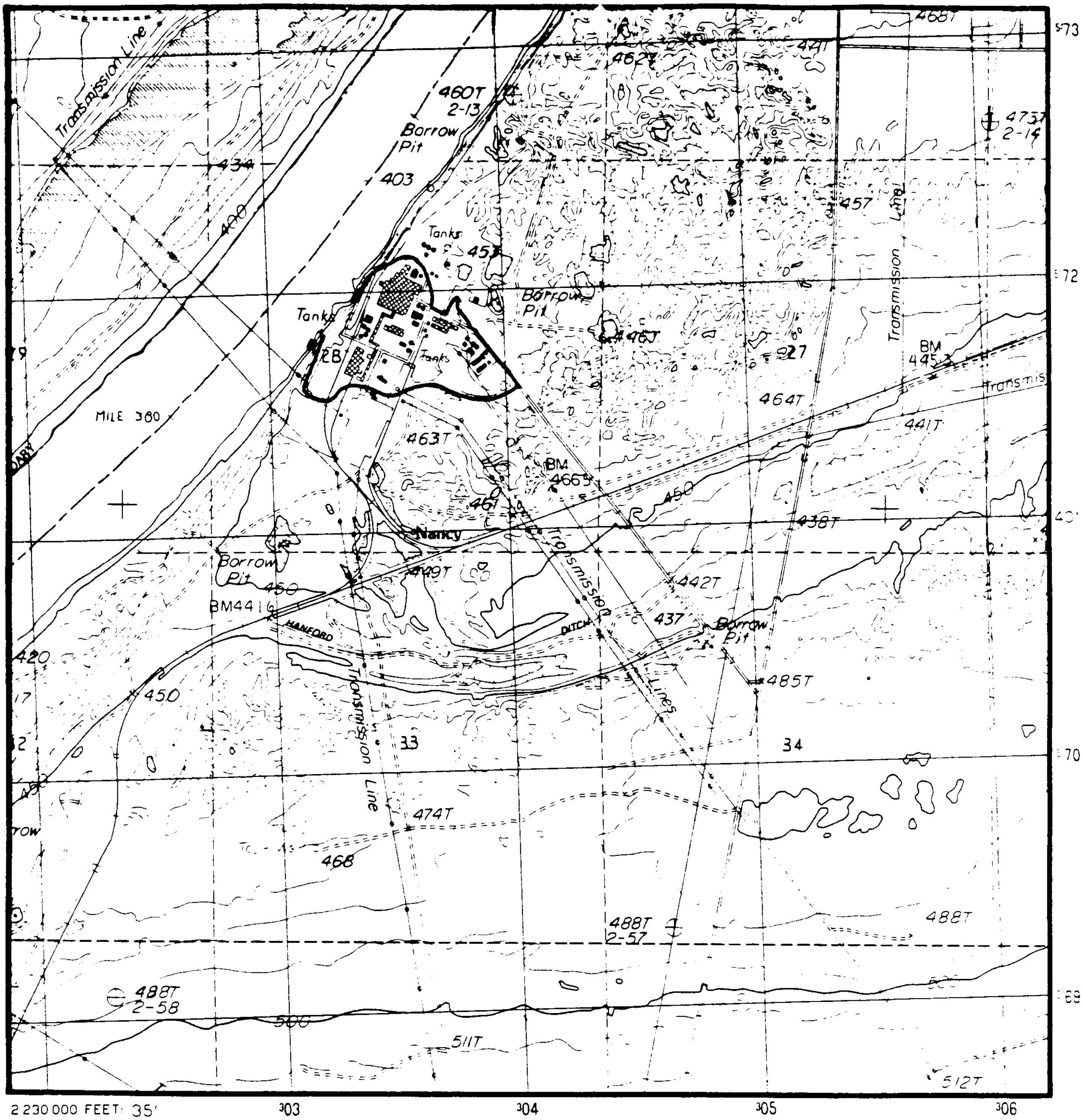
Interstate Route U.S. Route State Route

CONTOUR INTERVAL 10 FEET



SOURCE: USGS, 1986
Coyote Rapids, WA
46119-F5-TF-024
Provisional Edition
1986

FIGURE 1-3. 100 KE/KW AREA



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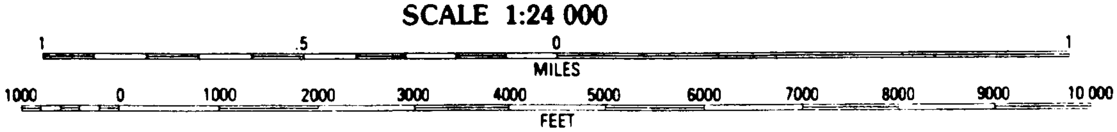


ROAD LEGEND

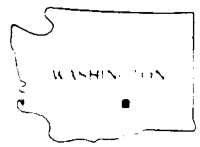
Improved Road ....

Unimproved Road ....

Trail ....

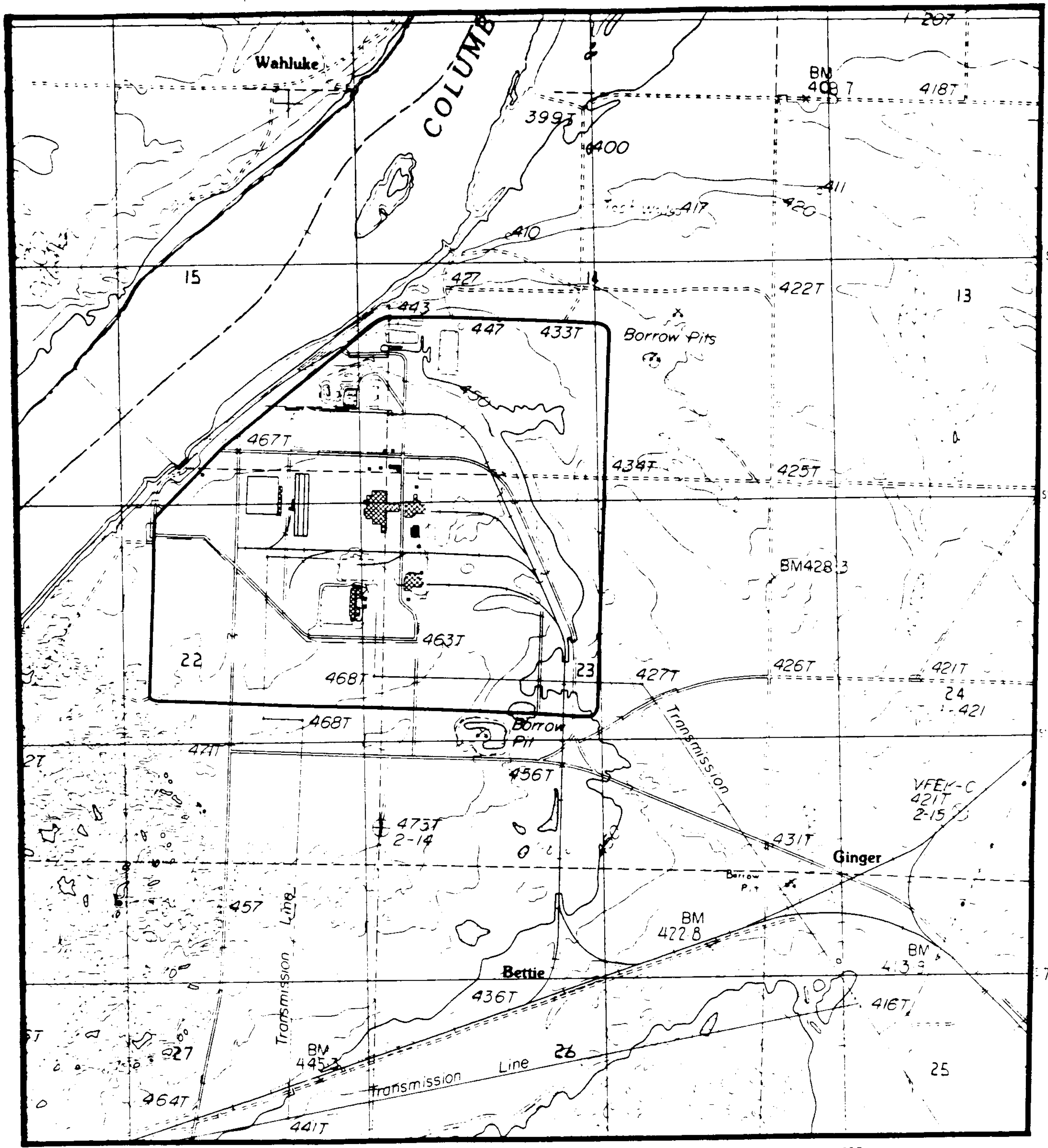
Interstate Route U.S. Route State Route

CONTOUR INTERVAL 10 FEET



SOURCE: USGS, 1986
Coyote Rapids, WA
46119-F5-TF-024

FIGURE 1-4. 100 N AREA



SCALE 1:24 000

1 .5 0 1 MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000 FEET

ROAD LEGEND

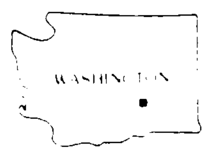
Improved Road ....

Unimproved Road ....

Trail ....

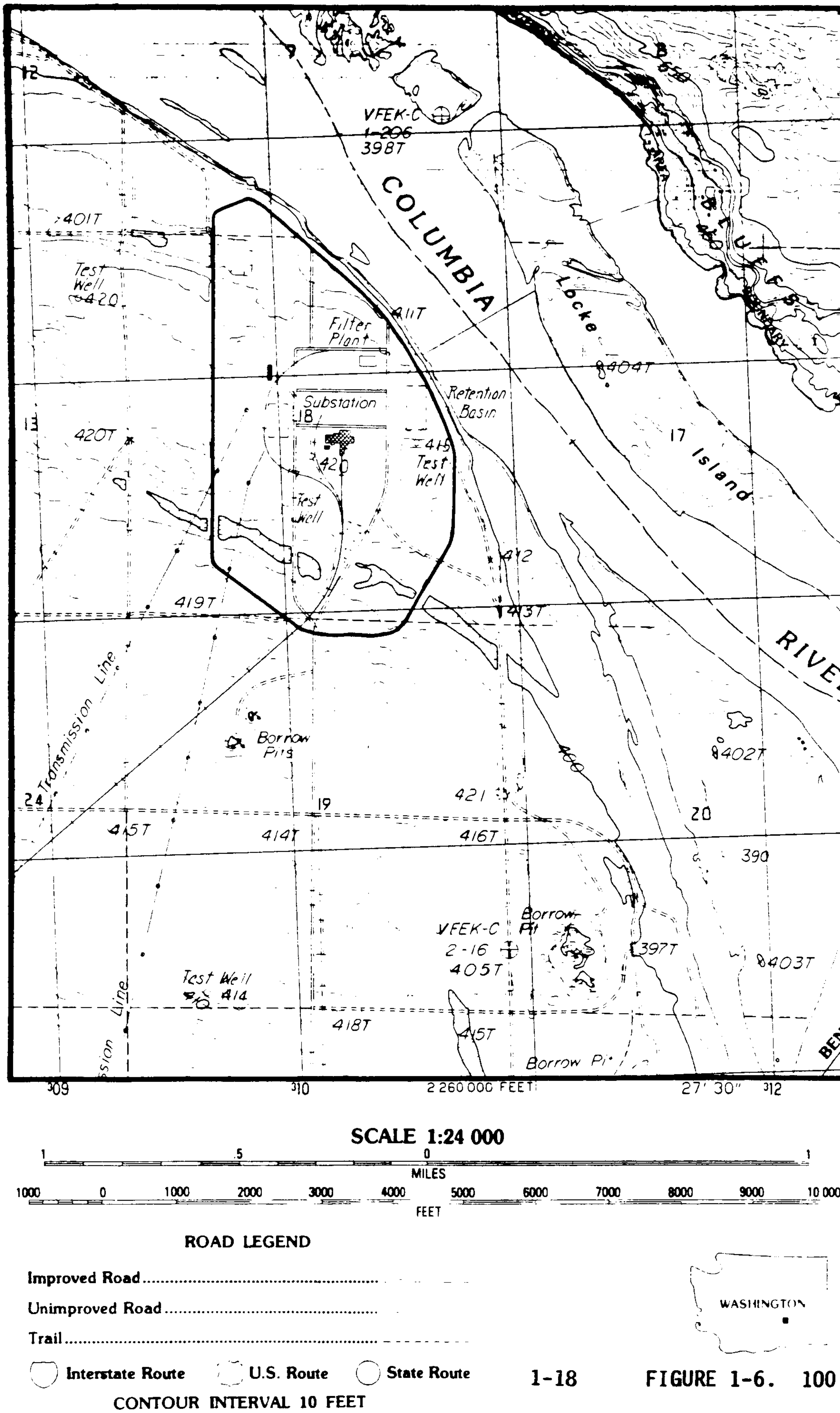
Interstate Route U.S. Route State Route

CONTOUR INTERVAL 10 FEET



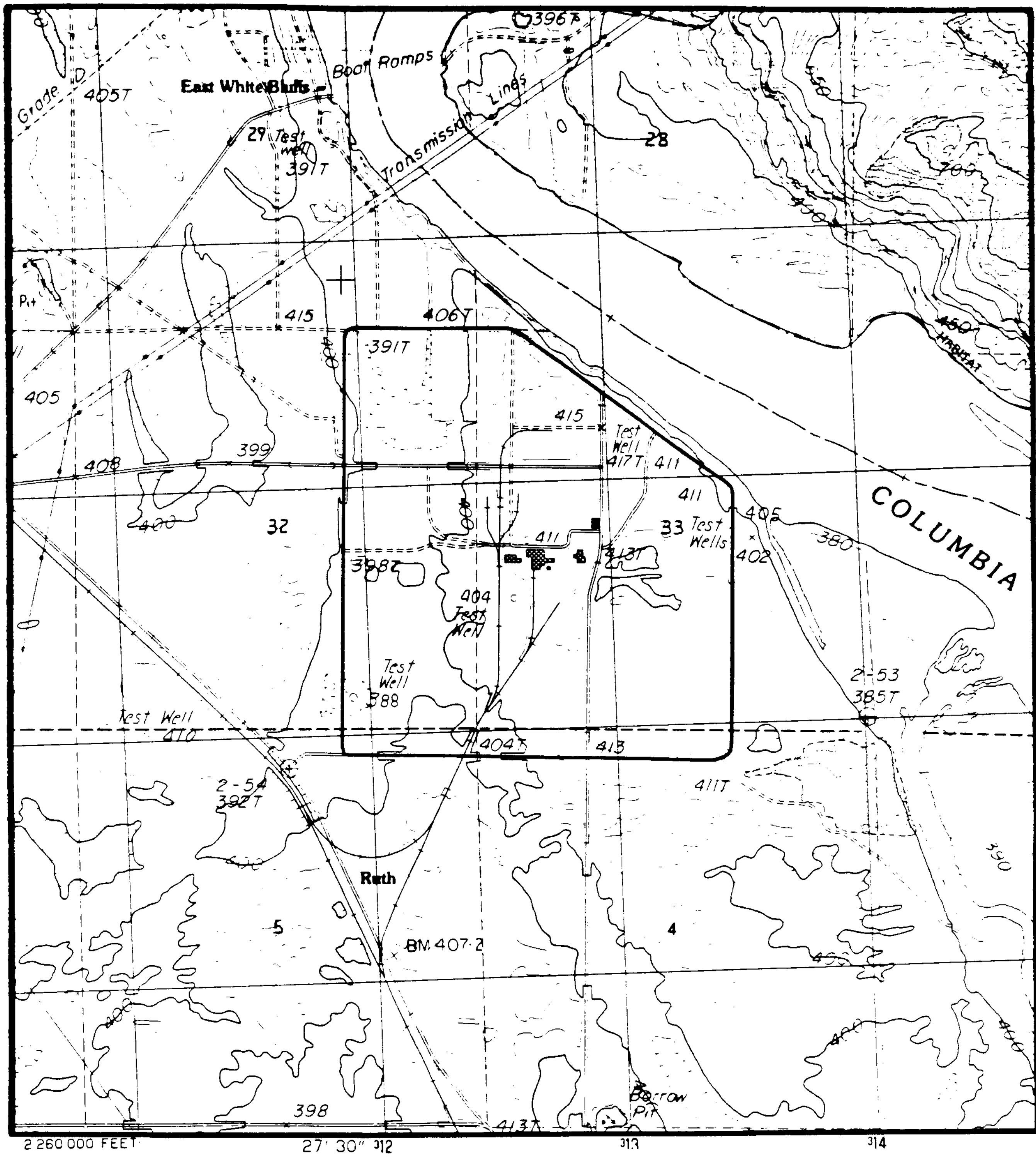
SOURCE: USGS, 1986
Coyote Rapids, WA
46119-F5-TF-024

FIGURE 1-5. 100 D/DR AREA



SOURCE: USGS, 1986
Locke Island, WA
46119-F4-TF-024

FIGURE 1-6. 100 H AREA



SCALE 1:24 000

1 .5 0 1 MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000 FEET

ROAD LEGEND

Improved Road ....

Unimproved Road ....

Trail ....

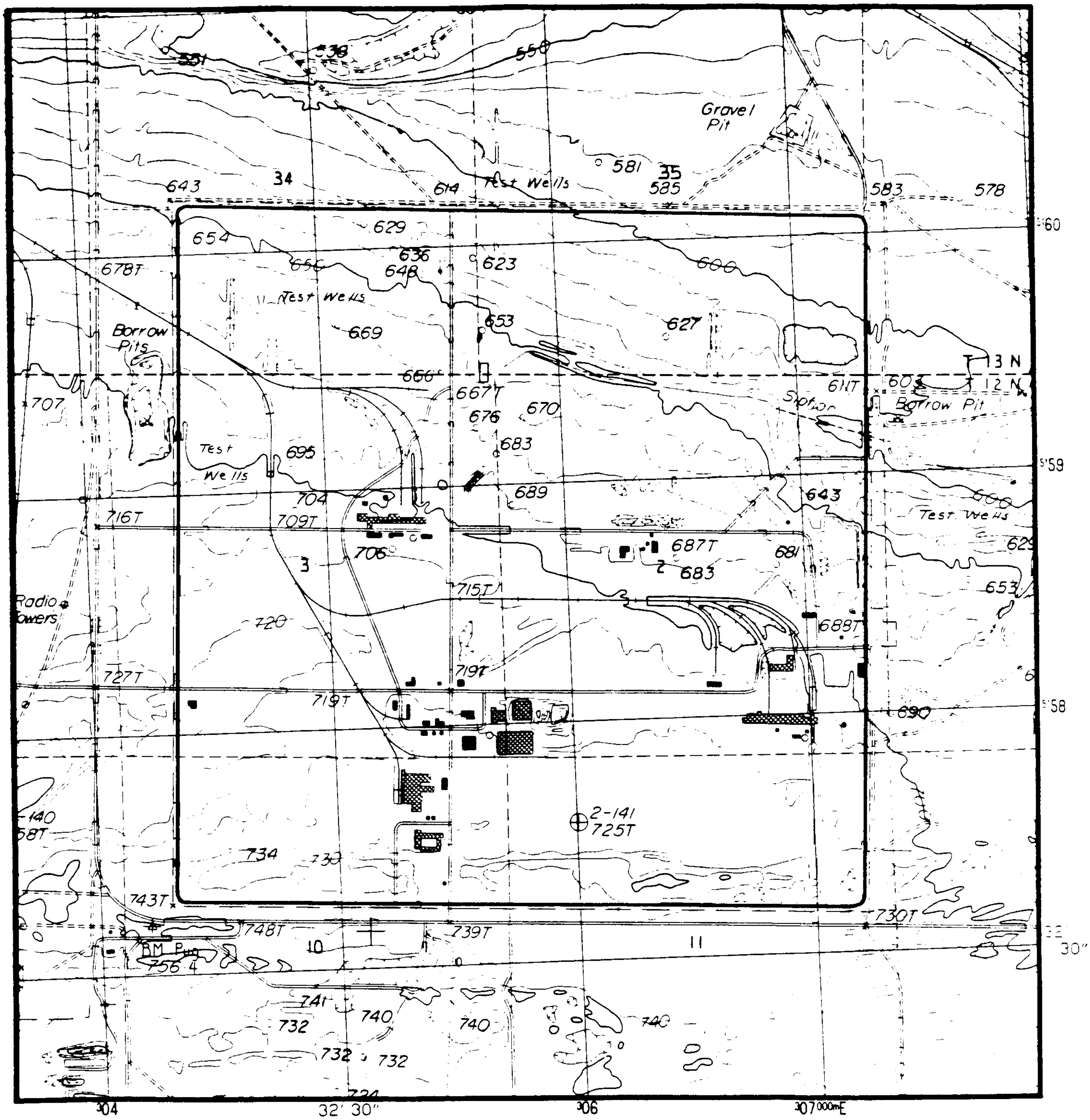
Interstate Route   U.S. Route   State Route

CONTOUR INTERVAL 10 FEET

WASHINGTON

SOURCE: USGS, 198
Locke Island, WA
46119-F4-TF-024

FIGURE 1-7. 100 F AREA



SCALE 1:24 000

1 .5 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000
FEET

ROAD LEGEND

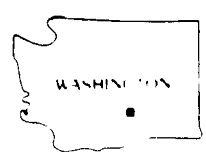
Improved Road ....

Unimproved Road ....

Trail ....

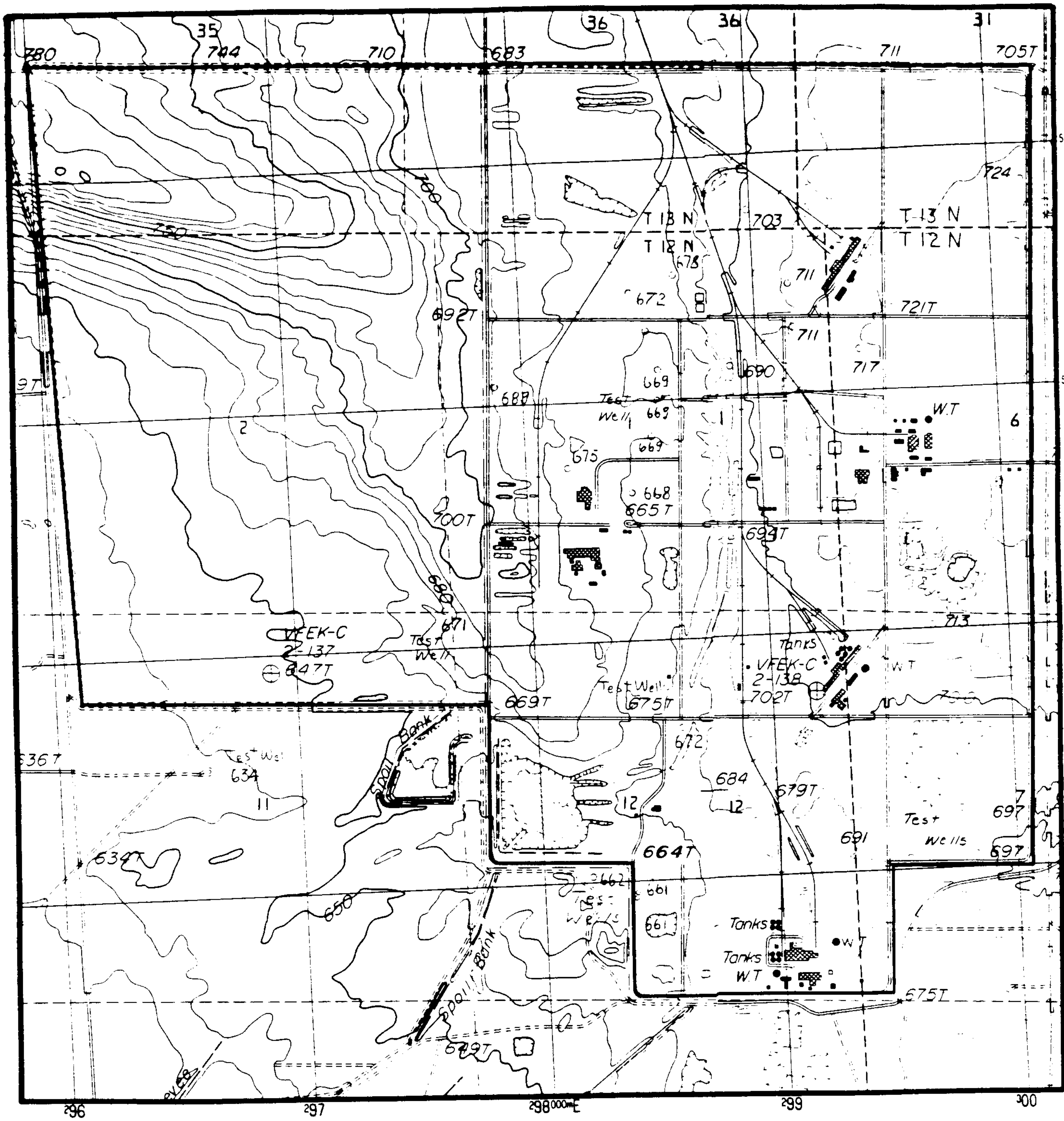
Interstate Route U.S. Route State Route

CONTOUR INTERVAL 10 FEET



SOURCE: USGS, 1986
Gable Butte, WA
46119-E5-TF-024

FIGURE 1-8. 200 EAST AREA



SCALE 1:24 000

1 .5 0 1 MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000 FEET

ROAD LEGEND

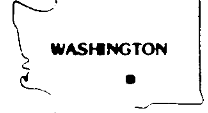
Improved Road

Unimproved Road

Trail

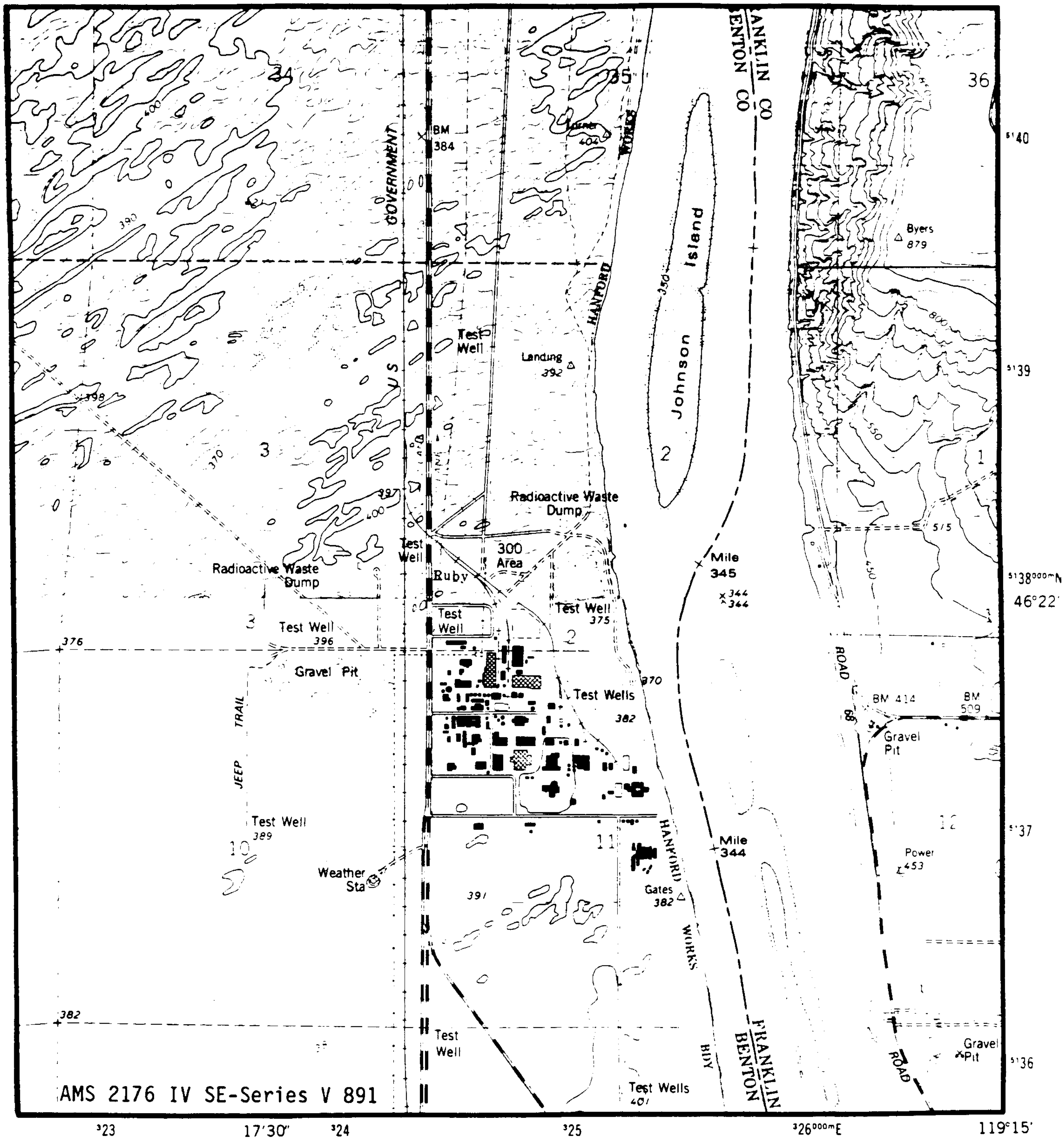
Interstate Route **U.S. Route** **State Route**

CONTOUR INTERVAL 10 FEET



SOURCE: USGS, 1986
Riverland, WA
46119-E6-TF-024 and
Gable Butte, WA
46119-E5-TF-024

FIGURE 1-9. 200 WEST AREA



SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

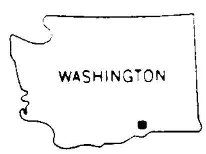
CONTOUR INTERVAL 10 FEET

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface

Secondary highway, hard surface — Unimproved road

Interstate Route U S Route State Route



SOURCE: USGS, 1978 Wooded Island, WA N4622.5-W11915/7.5 and Richland, WA N4615-W11915/7.5

FIGURE 1-10. 300 AREA

Although the quantity of chemicals disposed of in solid-waste disposal sites is unknown, it is estimated that the following contaminants and quantities were disposed of in liquid-waste disposal sites during routine plant operations:

Contaminant	Quantity (metric tons)	Quantity (tons)
Nitrate	63,000	69,445
Phosphate	4,400	4,850
Sulfate	3,000	3,307
Nitrite	2,200	2,425
Fluoride	970	1,069
Organic carbon	760	837
Chromium (VI)	260	287

A variety of radionuclides are also stored or disposed of in both solid- and liquid-waste disposal sites. The most significant quantities (decayed to current values) of radionuclides include:

Radionuclide	Quantity (curies)
^{239}Pu	29,900
^{137}Cs	28,000
^{90}Sr	23,700
^{240}Pu	8,000
^{238}U	200

These inventories were obtained through a combination of records search and estimates based on intimate knowledge of the processes used. The uncertainty associated with these estimates is unknown but may be significant.

Very little direct evidence exists to indicate if inactive waste sites have contaminated groundwater or surface waters. Application in Phase I of EPA's Hazard Ranking System (HRS) and the DOE's modified Hazard Ranking

System (mHRS) to Hanford's 337 inactive waste-disposal sites resulted in 81 sites receiving scores greater than 28.5 and 256 sites with scores less than 28.5. (The score of 28.5 out of a possible 100 is an arbitrary cutoff established by EPA as the point at which further action for potential CERCLA sites may be required.) The 81 Hanford inactive waste-disposal sites ranking greater than 28.5 will all be characterized. The sites had all received liquids containing radionuclides and/or chemicals. They were ranked high because they were suspected of having had releases to ground water and surface waters in the past. Most of these sites were designed and first operated in the 1940s and 1950s. Most of the sites received and transferred to the soil column large volumes of liquid waste.

The principal concern in the 100 area is the remobilization of cobalt-60 in the sediments of the Columbia River; and the movement of chromium, diodine-129, cobalt-60, and strontium-90 through the groundwater into the surface water of the Columbia River. In the 200 area, there are observed elevations of nitrates, tritium, iodine-129, carbon tetrachloride, cyanide, and uranium. In the 300 area, the observed releases of uranium, chromium, fluoride, TCE, and 1-2-DCE to groundwater, as well as release of copper to surface water, are of concern. Each of the areas within the Hanford Reservation is described below:

The nine 100 Areas (B, C, D, DR, KE, KW, F, H, N) border the Columbia River in the northern most part of the Hanford Site. Each of the nine areas has one production reactor. Eight of these reactors have been shut down; only the N Reactor, used for both plutonium and electricity production, is still operating. Because some of the areas are contiguous (B/C, D/DR, KE/KW), the Hanford Site map shows only six 100 Areas (Figure 1-11).

The 100 Areas are generally flat with no major surface features. The Hanford Formation lies near the surface of the 100 Areas, covered by a thin layer of wind-deposited silt and fine sand. The water table is found in these sediments at a depth of about 20 meters (66ft), except in the F and H Areas where the depth to the water table is about 35 meters (115 ft) and 40 meters (131 ft), respectively. The depth to the Ringold Formation is about

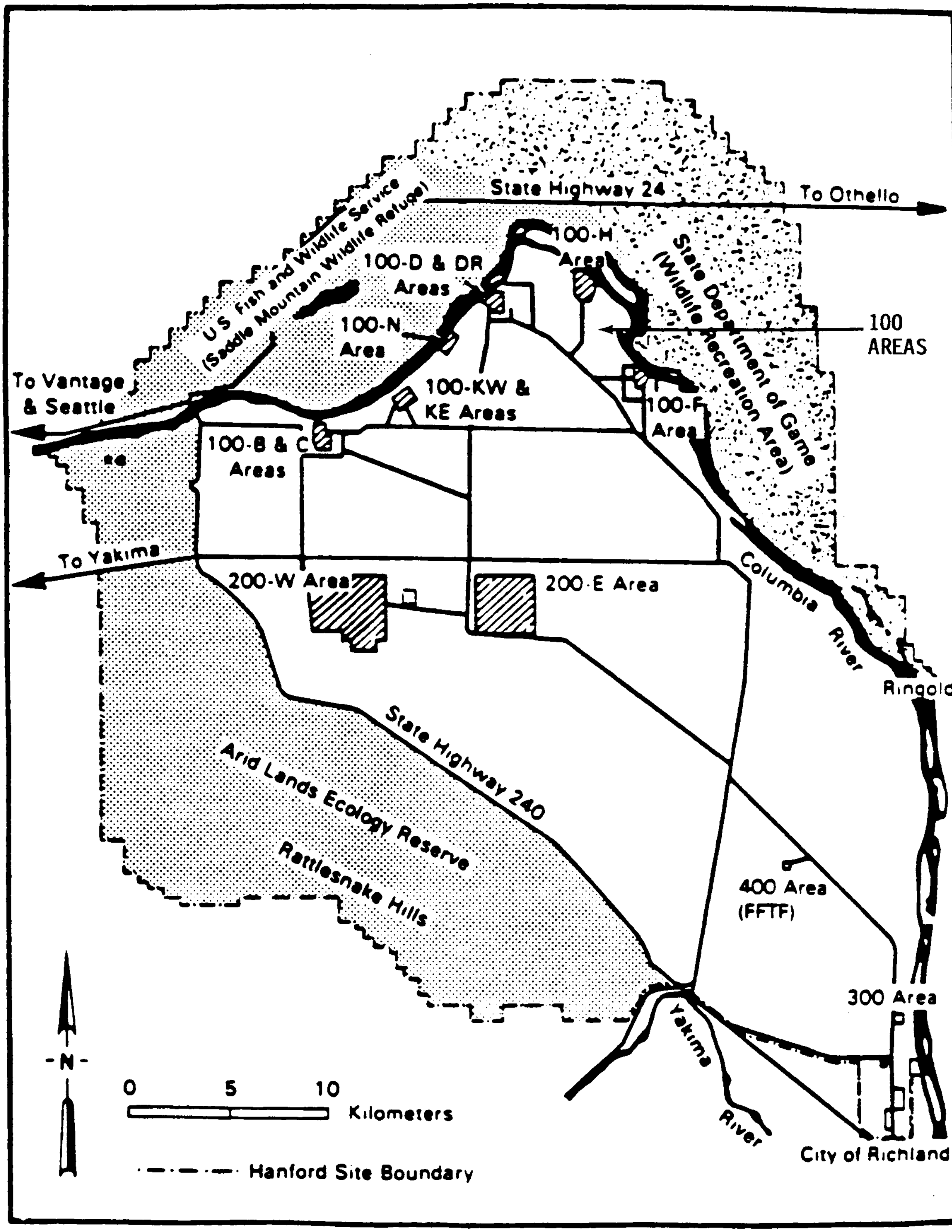


FIGURE 1-11. LOCATIONS OF THE 100 AREA SITES

SOURCE: U.S. DOE 1986a.

25 meters (82 ft); the top of the basalt bedrock is approximately 240 meters (790 ft) below the surface.

Because the water table occurs within the highly permeable sandy gravels of the Hanford Formation, it fluctuates as the river level rises and falls. The ground water generally flows from the 100 Areas and toward the river. When active, each of the 100 Areas included support facilities such as powerhouses. Except for 100-N, these powerhouses produced process steam from coal-fired boilers; 100-N has oil-fired boilers. Adjacent to each area's powerhouse were large storage areas that received railroad carloads of coal and disposal areas for flyash/clinker disposal. Most areas also included water-treatment plants, water-storage tanks, subsurface sewage-disposal systems, raw-water intake structures, and process sewers.

B and C Areas. The B and C reactors are located adjacent to each other on a 2.6-square-kilometer (650-acre) site (9the 100 B/C Area) and are the farthest upstream of the 100 Areas. The B Reactor was operated from 1944 to 1968, and the C Reactor was operated from 1952 to 1969. Virtually all the facilities in the area are inactive, with the exception of the B/C export water system, which continues to provide the raw water supply to the 200 Area and some 100 Areas. An electrical substation in the area taps power for the pumps providing the 200-Area water.

Four CERCLA sites are located on the 100 B/C Area. These sites are 116-B-1, 116-C-1, 116-B-4, and 116-C-2. 116-B-1 and 116-C-1 are trenches. 116-B-4 is a French Drain and 116-C-2 is a crib. All facilities are no longer in use and are considered inactive. See Figure 1-12 for location of the 100 B/C area building, facilities, railroads, etc.

The 650 acres of 100 B/C area are situated farthest upstream of the 100 facilities along the Columbia River.

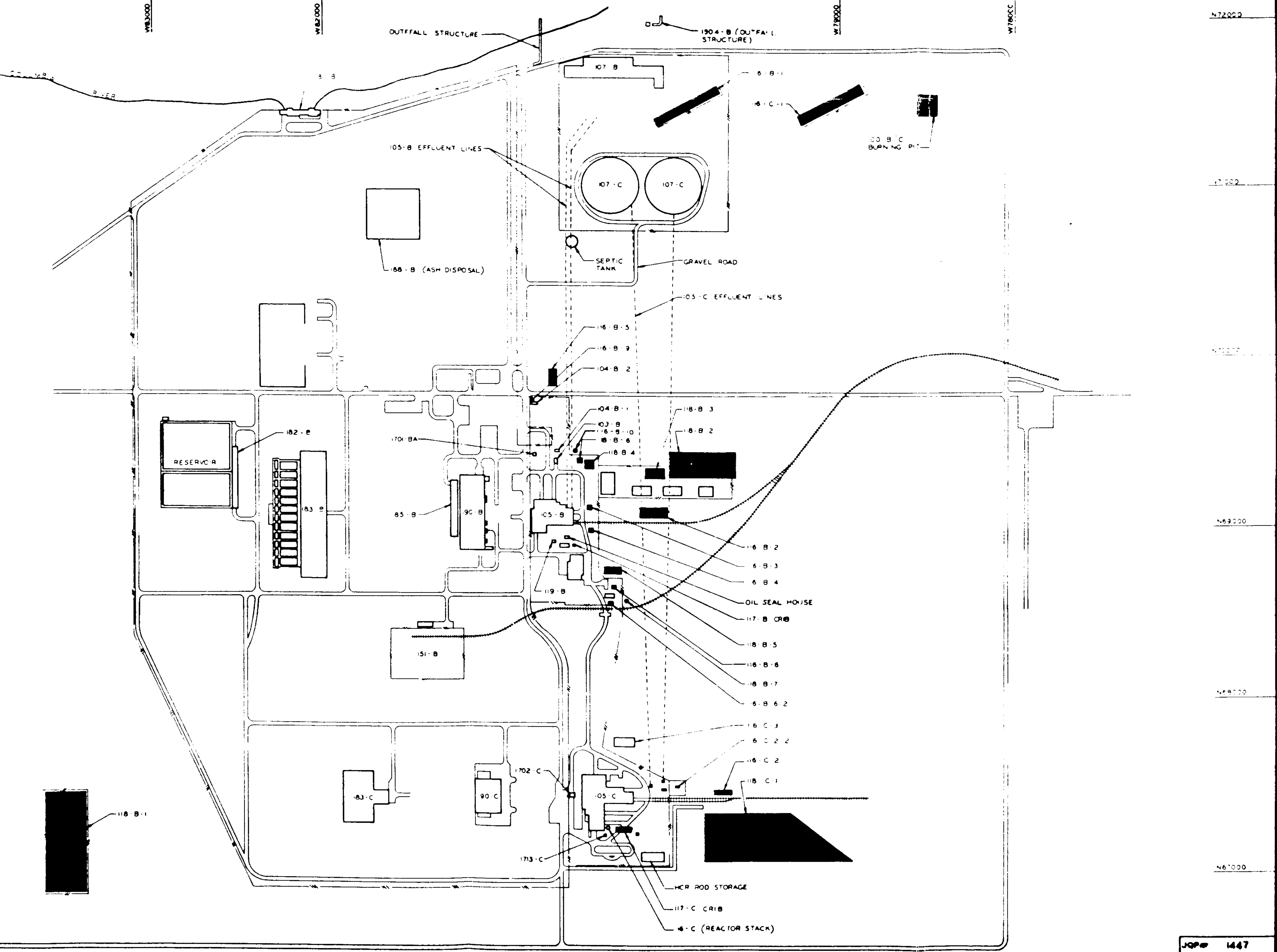
D and DR Areas. The 100-D/DR Areas, covering about 3.9 square kilometers (970 acres), are located 11 kilometers (7 mi) downriver of the 100-B/C Area. The D Reactor was operated from 1944 to 1967 and the DR Reactor from 1950 to 1965. These areas are extensively used, and their utilities and services

BUILDING LIST

BUILDING NUMBER	DESCRIPTION
103B	FUEL STORAGE BUILDING & RIGGER LOFT
104B-1	STORAGE BUILDING
104B-2	STORAGE BUILDING
105B	REACTOR BUILDING
110B	PRESSURE STORAGE-STRUCTURE
115B	GAS RECIRCULATION BUILDING
116B	REACTOR STACK STRUCTURE
117B	EXHAUST AIR FILTER BUILDING
119B	EXHAUST AIR SAMPLE BUILDING
185B	WATER LABORATORY-STRIPPED
1519	PRIMARY SUBSTATION-RHO
181B	RIVER PUMP HOUSE-RHO
182B	FILTER PLANT-STRIPPED
183B	FILTER PLANT-STRIPPED
190B	PUMP HOUSE-STRIPPED
1621B	EMERGENCY ALTERNATOR-STRIPPED
1701BA	LUNCH ROOM-1
105C	REACTOR BUILDING
117C	EXHAUST AIR FILTER BUILDING
183C	FILTER PLANT FACILITY
190C	MAIN PUMP HOUSE
1702C	BADGE HOUSE
1713C	SOLVENT STORAGE

RADIOLOGICAL UNDERGROUND SITES
(RETIRED)

118-B-1	B-BURIAL GROUND
118-C-1	C-BURIAL GROUND
118-B-2	CONSTRUCTION BURIAL GROUND
118-B-3	CONSTRUCTION BURIAL GROUND
107-C	C RETENTION BASIN
107-B	B RETENTION BASIN
118-B-4	DUMMY BURIAL
118-B-5	BALL X BURIAL GROUND
116-B-1	B-LIQUID TRENCH
116-C-1	C-LIQUID TRENCH
116-B-6	111 B PAD AND CRIB
116-C-1	LIQUID TRENCH
116-C-2	PLUTO CRIB
116-B-5	108 CRIB
118-B-6	108 BURIAL GROUND
116-B-2	B STORAGE BASIN CRIB
116-B-4	DUMMY DECONTAMINATION CRIB
116-C-3	CHEMICAL WASTE TANK



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OPERATED BY BATTELLE MEMORIAL INSTITUTE

JOP# 1447

100-B & 100-C AREA WASTE SITES

NOT REQD

NONE

100 AREA

0401

H-3-57210 | 2 | 10

are still in operation. The electrical substation serves as a backup supply for the 100-N Area. The water system is a backup system for the 100-B water system, which supplies water to the 200 Areas. The UNC Nuclear Industries engineering laboratory here is operated in support of the N Reactor.

CERCLA sites within the 100 D/DR area include: 116-DR-1 (trench), 116-DR-2 (trench), 116-D-1B (trench), 116-DR-6 (trench), and 116-DR-7 (crib) (see Figure 1-13 for site location).

F Area. The 100-F Area is located about 10.4 kilometers (6.4 mi) downriver of the 100-D/DR Reactors and is the 100 Area closest to Richland. This area covers about 2.2 square kilometers (540 acres). The F Reactor was operated from 1945 to 1965. At one time, the Pacific Northwest Laboratory (PNL) operated a biology laboratory in this area to study the effects of inhaled and ingested radioactive and toxic materials on animals. Except for the reactor and reactor support facilities, the site has been decommissioned.

The 100-F area has six CERCLA sites located on it. These six sites include 116-F-1, 116-F-2, 116-F-3, 116-F-6, 116-F-9, and 116-F-10 trenches. See Figure 1-14 for the location of 100-F area buildings, and facilities.

H Area. The 100-H Area is located about 5.2 kilometers (3.2 mi) downriver of the 100-D/DR Areas and covers about 1.3 square kilometers (320 acres). Very little activity continues in this area. Several major buildings, including the powerhouse, stacks, and some of the water treatment buildings have been removed. The H Reactor was operated between 1945 and 1965.

Located on the 100-H area are three CERCLA sites. These sites are 116-H-1, 116-H-2, and 116-H-3. 116-H-1 and 116-H-2 are trenches and 116-H-3 is a French Drain. See Figure 1-15 for location of 100-H area facilities.

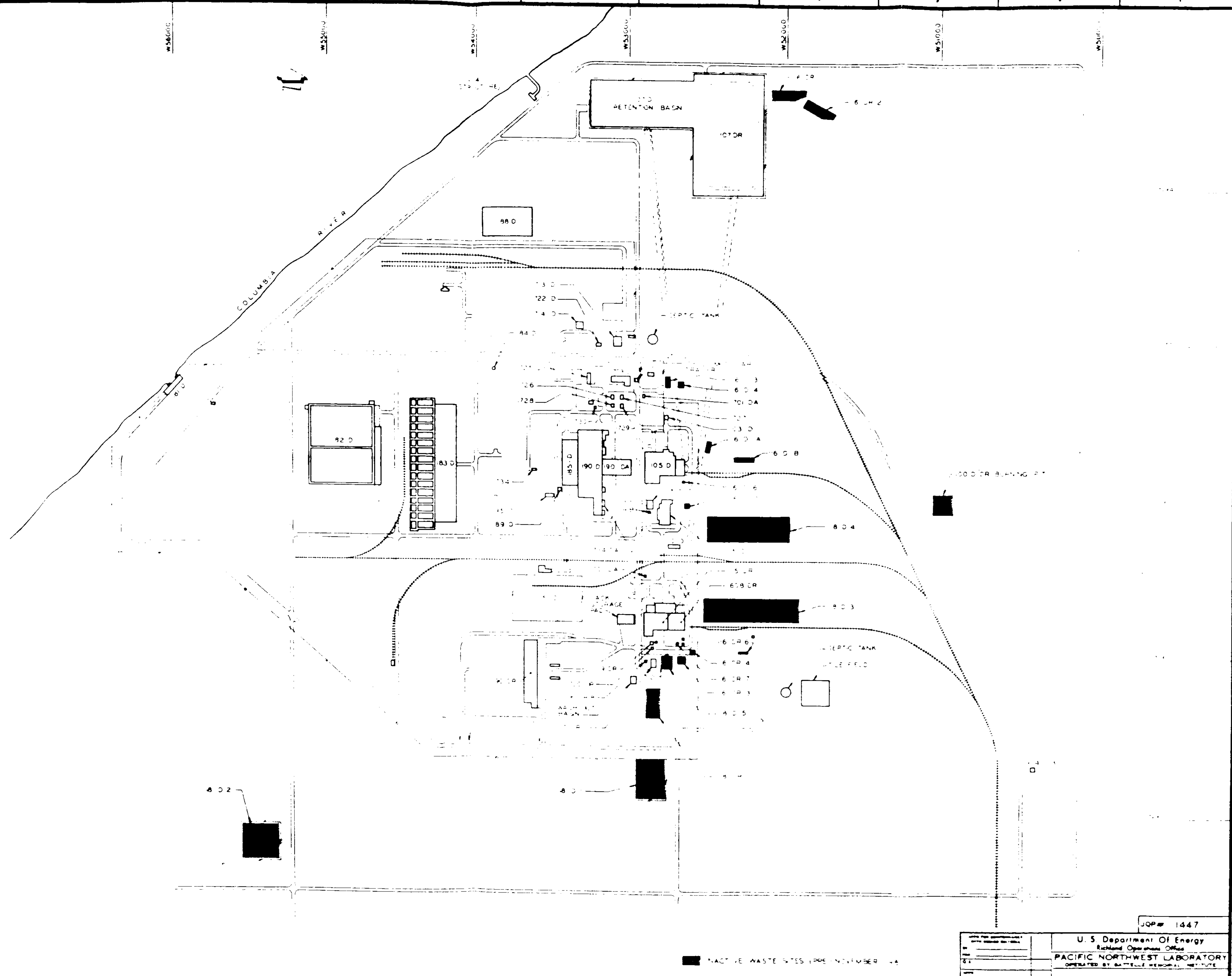
K Area. The 100-KE/KW Areas, covering about 0.6 square kilometers (150 acres), are almost 4 kilometers (2.5 mi) downriver of the 100-B/C complex and contain two shutdown reactors. These reactors were operated between 1955 and 1971.

BUILDING LIST

BUILDING NUMBER	DESCRIPTION
[illegible] D	FUEL ELEMENT STORAGE BUILDING
105 D	REACTOR BUILDING
110 D	HELIUM STORAGE
115 D	GAS RECIRCULATION BUILDING
117 D	REACTOR EXHAUST AIR FILTER BUILDING
151 D	PRIMARY SUBSTATION
181 D	RIVER PUMP HOUSE (STAVES D & DR) RHO
182 D	RESERVOIR & PUMP HOUSE RHO
183 D	FILTER PLANT OPERATIONS RHO
184 D	HIGH TANK RHO
185 D	THERMAL HYDRAULICS BUILDING
188 D	ASH DISPOSAL BASIN RHO
189 D	MECHANICAL DEVELOPMENT LAB
189 D	STORAGE
195 D	VERTICAL SAFETY ROD TEST TOWER
1608 D	WASTE WATER PUMP HOUSE
1701 DA	OFFICE BUILDING
1703 D	TECHNICAL OFFICE BUILDING
1713 D	INST & ELEC DEVELOPMENT LAB
1714 D	SOLVENT STORAGE
[illegible] D	EQUIPMENT DEVELOPMENT LAB
1725 D	TRAILER 1726-1727-1728-1729 & 1731 MODULAR
105 D	REACTOR BUILDING
116 DR	REACTOR STACK
[illegible] DR	REACTOR [illegible] AIR FILTER BUILDING
[illegible] DR	REACTOR EXHAUST INSTRUMENT BUILDING
[illegible] DR	[illegible]
[illegible]	VERTICAL SAFETY ROD TEST TOWER
[illegible] DR	WASTE WATER PUMP HOUSE
[illegible] DR	RADIO HOUSE
[illegible] DR	[illegible] TANK ENCLOSURE WHCO
	TANK STORAGE PAD
1724 D	UNDERWATER TEST FACILITY
1724-DA	UNDERWATER TEST FACILITY EXPANSION

RADIOLOGICAL UNDERGROUND SITES
(RETIRED)

118-D-1	ORIGINAL BURIAL GROUND NO. 1
[illegible]	[illegible] BURIAL GROUND NO. 2
[illegible]	[illegible] BURIAL GROUND NO. 3
[illegible] 4	[illegible]
[illegible] 5	[illegible] BURIAL GROUND
118-DR-1	105 DR GAS LOOP BURIAL GROUND
107-D	
107-DR	
116-DR-1 & 2	[illegible]
[illegible] A & B	[illegible]
116-D-3 & 4	[illegible]
116-D-2	105 D PLUTO CRIB
116-DR-3	105 DR STORAGE BASIN TRENCH
116-DR-4	105 DR PLUTO CRIB
116-D-5	1904-D OUTFALL
116-DR-5	1904-DR OUTFALL



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PACIFIC NORTHWEST LABORATORY
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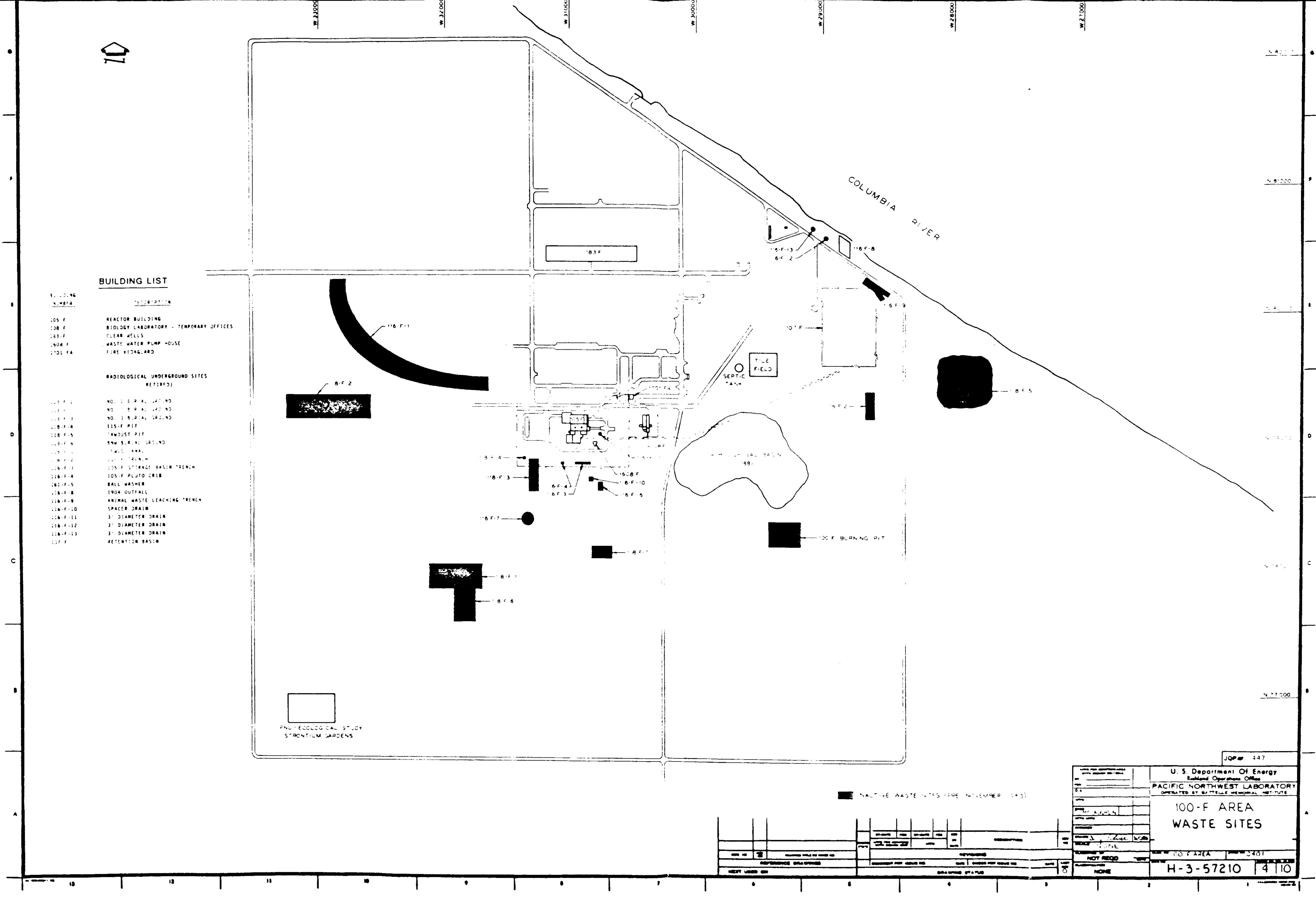
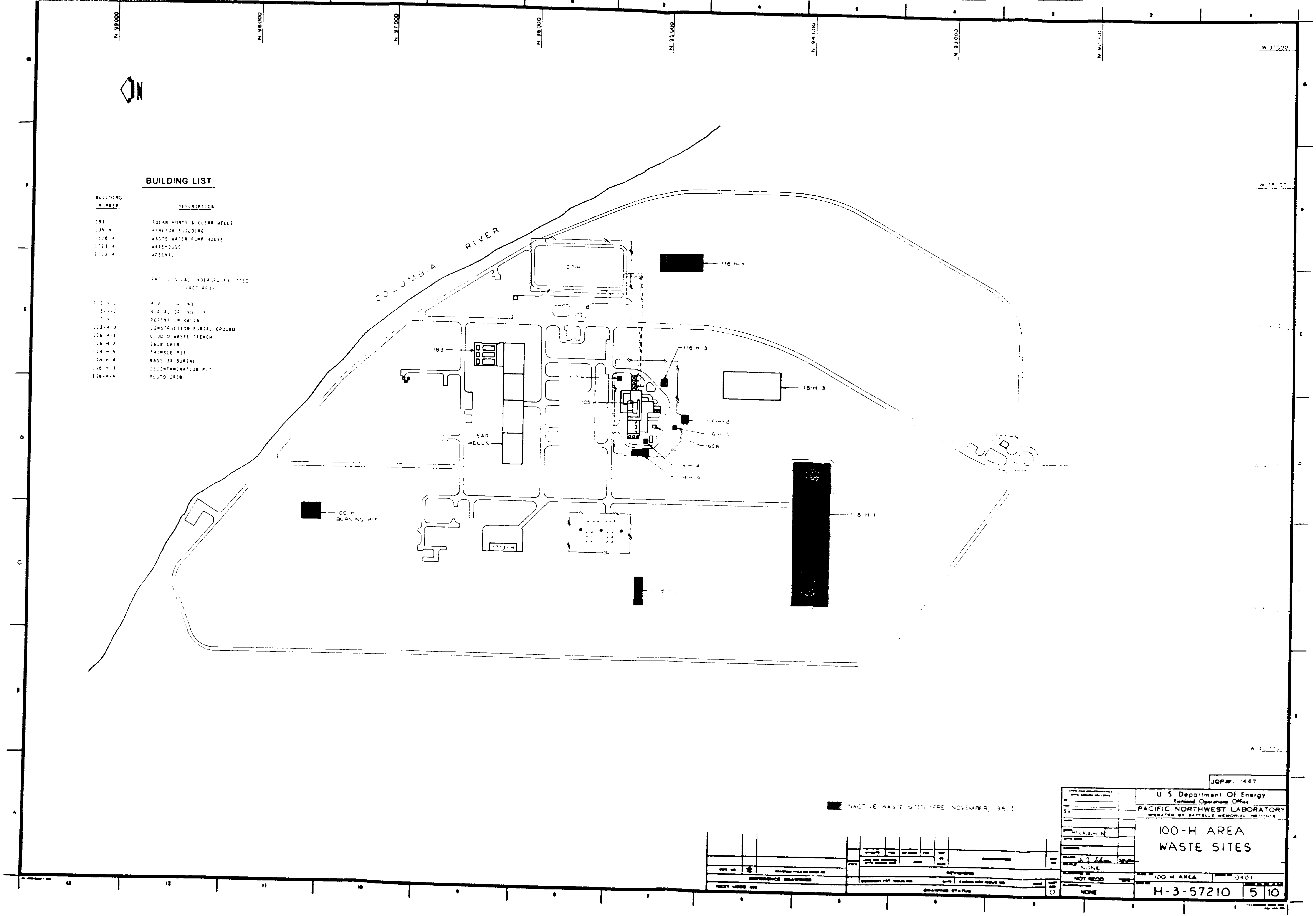
100-D & 100-DR AREA WASTE SITES

NONE
NOT REQD
100 AREA
0401
H-3-57210 | 3 | 10



BUILDING LIST
105 F REACTOR BUILDING
108 F BIOLOGY LABORATORY - TEMPORARY OFFICES
183-F CLEAR WELLS
1608 F WASTE WATER PUMP HOUSE
RADIOLOGICAL UNDERGROUND SITES
118-F-4 115-F PIT
105-F STORAGE BASIN TRENCH
116-F-4 105-F PLUTO CRIB
BALL WASHER
116-F-8 1904 OUTFALL
116-F-9 ANIMAL WASTE LEACHING TRENCH
116-F-10 SPACER DRAIN
116-F-11 3" DIAMETER DRAIN
116-F-12 3" DIAMETER DRAIN
116-F-13 3" DIAMETER DRAIN
RETENTION BASIN
COLUMBIA RIVER
116-F-1
183 F
SEPTIC TANK
TILE FIELD
100-F BURNING PIT
1608 F
STRONTIUM GARDENS
JQP# 447
U. S. Department Of Energy
PACIFIC NORTHWEST LABORATORY
100-F AREA
WASTE SITES
NOT REQD
NONE
H-3-57210
4
10


BUILDING LIST
DESCRIPTION
183 SOLAR PONDS & CLEAR WELLS
REACTOR BUILDING
WASTE WATER PUMP HOUSE
WAREHOUSE
ARSENAL
(RETIRED)
RETENTION BASIN
CONSTRUCTION BURIAL GROUND
LIQUID WASTE TRENCH
1608 CRIB
THIMBLE PIT
BASS OX BURIAL
DECONTAMINATION PIT
116-H-4 PLUTO CRIB
COLUMBIA RIVER
183
CLEAR WELLS
105-H
116-H-3
118-H-3
116-H-1
BURNING PIT
U. S. Department Of Energy
Richland Operations Office
PACIFIC NORTHWEST LABORATORY
100-H AREA
WASTE SITES
JQP#. 1447
NONE
NOT REQD
100-H AREA
0401
H-3-57210
5
10

Considerable use is made of the shutdown 100-KE/KW Areas. For example, spent fuel from the N Reactor is stored there. All services and utilities except the power house are in operation. The Decommissioning Services Section of UNC Nuclear Industries also operates from offices and laboratories in this area. UNC Nuclear Industries operates a research and development laboratory in this area; the Fuel Operations Section of UNC has personnel stationed at the K Area to operate the KE and KW fuel-storage basins. See Figure 1-16 for 100-KE/KW site locations.

In the approximate middle of the Hanford Site, on a plateau about 11 kilometers (7 mi) from the Columbia River, are the two 200 Areas (200-East and 200-West), dedicated to chemical separations and waste management. Irradiated fuel, waste-processing,and waste-storage activities are located in these two areas because they are the most isolated from the Site boundaries and are the farthest from both surface and ground water. The water table in this area is 46 to 911 meters (150 to 300 ft) below the surface.

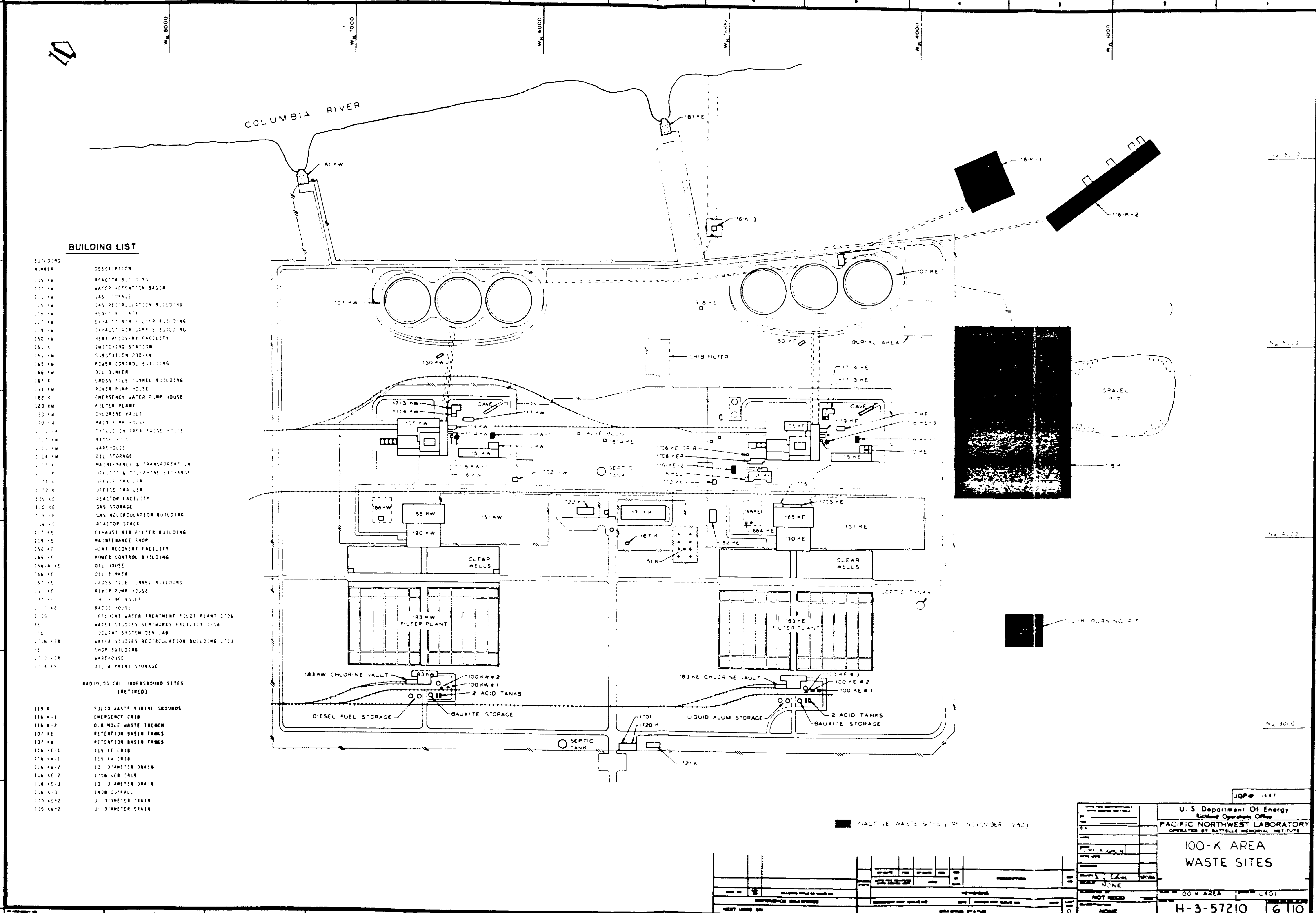
The 200-Area plateau is a glacial, fluvial gravel bar. A thin surface layer of wind-blown silts and sands covers the well-sorted, coarse sands that comprise the Hanford Formation sediments.

The 200 Areas contain nonradioactive support facilities,including transportation maintenance buildings, service stations,and coal-fired powerhouses (with baghouses for airstream cleanup) for process steam production, steam transmission lines, raw-water treatment plants, water-storage tanks, electrical maintenance facilities,and subsurface sewage disposal systems. In short, the 200 Areas are almost cities to themselves in that they have most of the utilities necessary to be self supporting.

Located on the 200 East Area are 26 inactive CERCLA sites, which can be grouped into fourteen units for characterization* (see Table 1-1). The units are groupings of sites that have the following:

---

*Further discussion of the characterization will be discussed in Section 2.4.


COLUMBIA RIVER
BUILDING LIST
BUILDING NUMBER
DESCRIPTION
REACTOR BUILDING
WATER RETENTION BASIN
GAS STORAGE
150 KW
HEAT RECOVERY FACILITY
151 K
SWITCHING STATION
SUBSTATION 230-KV
165 KW
POWER CONTROL BUILDING
166 KW
OIL BUNKER
167 K
CROSS TILE TUNNEL BUILDING
RIVER PUMP HOUSE
182 K
EMERGENCY WATER PUMP HOUSE
183 KW
FILTER PLANT
CHLORINE VAULT
MAIN PUMP HOUSE
BADGE HOUSE
WAREHOUSE
OIL STORAGE
MAINTENANCE & TRANSPORTATION
OFFICE TRAILER
REACTOR FACILITY
110 KE
GAS STORAGE
115 KE
GAS RECIRCULATION BUILDING
REACTOR STACK
EXHAUST AIR FILTER BUILDING
119 KE
MAINTENANCE SHOP
150 KE
HEAT RECOVERY FACILITY
165 KE
POWER CONTROL BUILDING
166-A KE
OIL HOUSE
OIL BUNKER
CROSS TILE TUNNEL BUILDING
RIVER PUMP HOUSE
CHLORINE VAULT
BADGE HOUSE
WATER STUDIES SEMIWORKS FACILITY 1706
COOLANT SYSTEM DEV LAB
WATER STUDIES RECIRCULATION BUILDING
SHOP BUILDING
WAREHOUSE
OIL & PAINT STORAGE
RADIOLOGICAL UNDERGROUND SITES
(RETIRED)
119 K
SOLID WASTE BURIAL GROUNDS
116 K-1
EMERGENCY CRIB
116 K-2
0.8 MILE WASTE TRENCH
107 KE
RETENTION BASIN TANKS
107 KW
RETENTION BASIN TANKS
116 KE-1
115 KE CRIB
116 KW-1
115 KW CRIB
116 KW-2
116 KE-2
1706 KER CRIB
116 KE-3
116 K-3
1938 OUTFALL
181 KW
181 KE
116-K-1
116-K-2
116-K-3
107 KW
107 KE
BURIAL AREA
CRIB FILTER
GRAVEL PIT
150 KW
150 KE
1713 KW
1714 KW
CAVE
1714 KE
1713 KE
105 KW
115 KW
115 KE
SEPTIC TANK
165 KW
190 KW
151 KW
1717 K
167 K
151 K
165 KE
190 KE
151 KE
CLEAR WELLS
183 KW FILTER PLANT
183 KE FILTER PLANT
100 K BURNING PIT
183 KW CHLORINE VAULT
183 KE CHLORINE VAULT
100 KW #2
100 KW #1
2 ACID TANKS
DIESEL FUEL STORAGE
BAUXITE STORAGE
LIQUID ALUM STORAGE
100 KE #3
100 KE #2
100 KE #1
1701
1720 K
SEPTIC TANK
1721 K
INACTIVE WASTE SITES (PRE NOVEMBER, 1980)
U. S. Department Of Energy
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PACIFIC NORTHWEST LABORATORY
OPERATED BY BATTELLE MEMORIAL INSTITUTE
100-K AREA
WASTE SITES
NONE
NOT REQD
H-3-57210
6
10

TABLE 1-1. LIST OF CERCLA SITES IN THE 200 EAST AREA

SUBAREA NO.	INACTIVE SITES	DISPOSAL METHOD	WASTE TYPE	USE DATES FROM	TO
I	216-B-43	Crib	T/SW	11/54	11/54
	216-B-44	Crib	T/SW	12/54	3/55
	216-B-45	Crib	T/SW	4/55	6/55
	216-B-46	Crib	T/SW	9/55	12/55
	216-B-48	Crib	T/SW	11/55	7/57
	216-B-49	Crib	T/SW	11/55	12/55
	216-B-50	Crib	T/SW	1/65	1/79
II	216-B-7A & B	Crib	T/SW	9/46	5/66
III	216-B-2-2	Ditch	SC & CW	11/63	5/70
IV	216-B-5	Reverse Well	T/SW	4/45	10/47
V	216-B-10-A	Crib	PW	12/49	1/52
	216-B-6	Reverse Well	PW	4/45	12/49
VI	216-C-1	Crib	PC	1/53	6/57
	216-C-10	Crib	PC	11/64	10/69
VII	216-B-16	Crib	T/SW	4/56	8/56
VIII	216-A-40	Trench	SC & CW	1/68	5/79
IX	216-A-24	Crib	T/SW	5/58	1/66
X	216-A-9	Crib	PW	3/56	8/69
XI	216-A-7	Crib	MLW	11/55	11/66
XII	216-A-28	French Drain	MLW	12/58	11/67
XIII	216-A-4	Crib	MLW	12/55	12/58
	216-A-5	Crib	PC	11/55	11/61
	216-A-21	Crib	PC	11/57	6/65
	216-A-27	Crib	MLW	6/65	7/70
	216-A-36A	Crib	MLW	9/65	3/66
XIV	216-A-6	Crib	MLW	11/55	1/70

Notes:

(From potentially least hazardous to potentially most hazardous)

SC & CW - Steam Condensate and Cooling Water
PC - Process Condensate
MLW - Miscellaneous Liquid Waste
PW - Process Waste
T/SW - Tank and Scavenged Waste

- o similar or identical waste types
- o close proximity to each other
- o similar sources of wastes.

The 200 East Area is located in a controlled area of approximately 8.4 sq. km (3.2 sq. mi.). It is about 6.2 miles from the Columbia River and 11 miles from the nearest Hanford Reservation boundary. It is located on a plateau approximately 1.8 miles southwest of Gable Mountains.

The historical operations in the 200 East Area included chemical separation and waste management. Irradiated fuel, waste processing, and waste storage activities are located in this area, due to its far distance from both surface and ground waters. The plants in the 200 East Area were first constructed in 1943 and are presently active. See Figure 1-17 for site locations in the 200 East area.

The 200 West Area has a total of 27 CERCLA sites divided into 15 units. The sites/units are listed in Table 1-2. These sites are no longer operating and are therefore considered "inactive."

The 200 West Area is located in the middle of the Hanford Site, on a plateau about 11 kilometers (7mi.) from the Columbia River.

The 200 West Area was dedicated to chemical separations and waste management. Irradiated fuel, waste-processing, and waste-storage activities are located in this area because of the isolation from the site boundaries and because it is the farthest from both surface and ground-water.

The 200 West Area is a controlled area of approximately 8.2 square kiometers (3.2 sq. mi.); it is about 8 kilometers (5 mi.) from the Columbia River and 11 kilometers (6.8 mi.) from the nearest site boundary. In the early 1980's, it was expanded to the west to add land for future burial grounds. There are no naturally occurring surface water bodies within the wpp West Area; however, process cooling water and aqueous waste are discharged to surface impoundments, creating several artificial ponds within

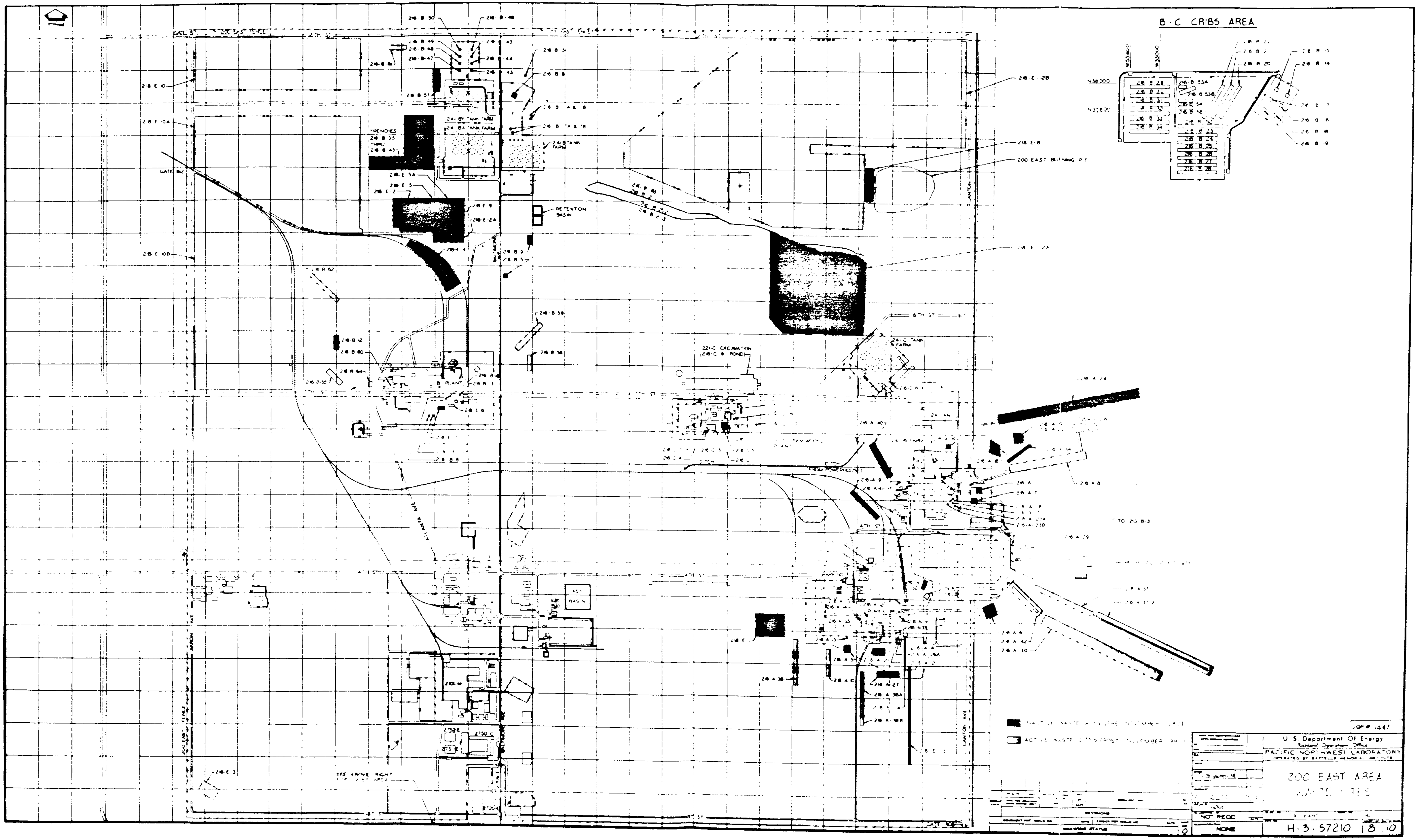
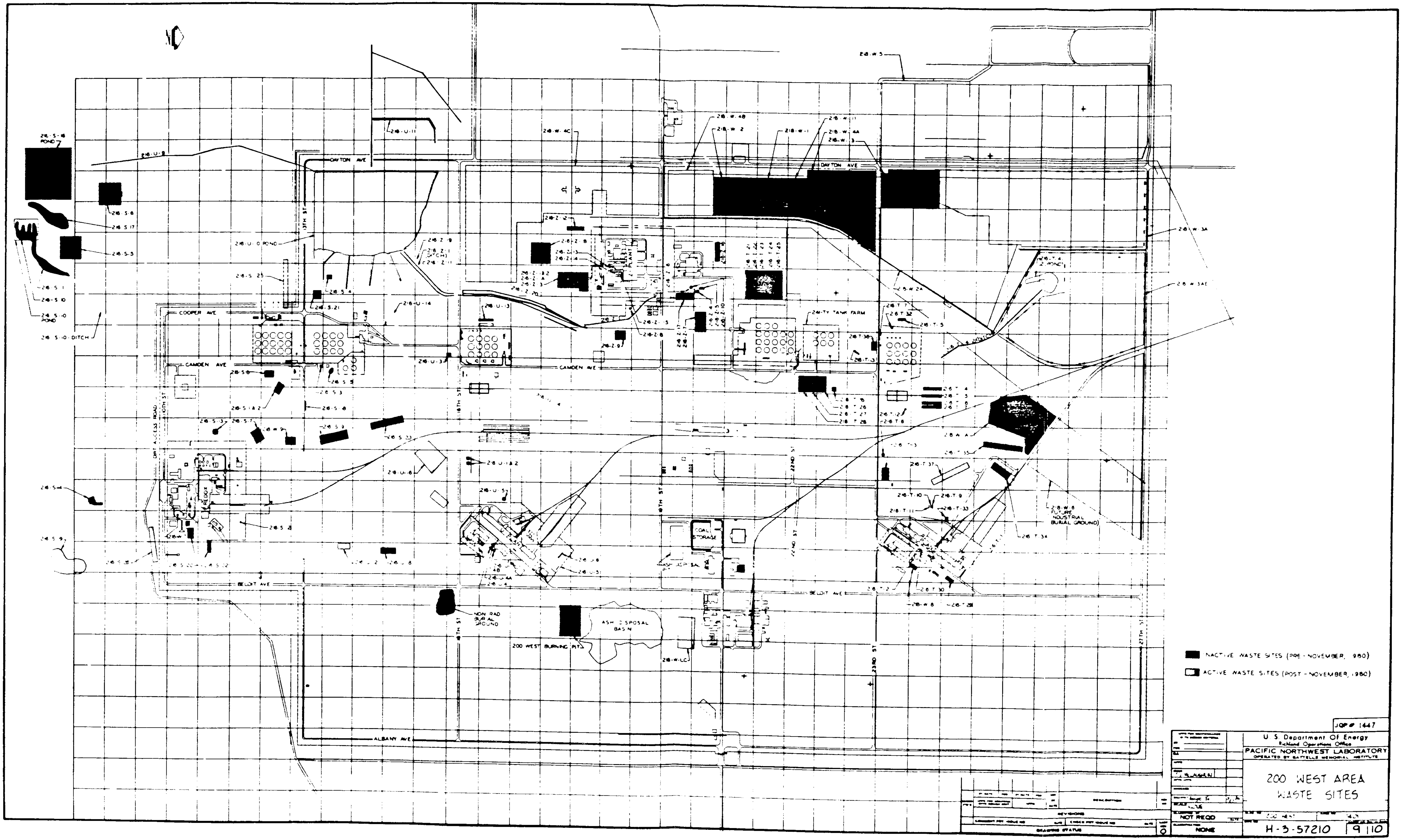

B-C CRIBS AREA
200 EAST BURNING PIT
RETENTION BASIN
B PLANT
221-C EXCAVATION
ATLANTA AVE
CANTON AVE
ASH BASIN
2101-M
SEE ABOVE RIGHT
U.S. Department Of Energy
Richland Operations Office
PACIFIC NORTHWEST LABORATORY
200 EAST AREA
NOT REQD
NONE
H-3-57210
JOP # 1447

TABLE 1-2. LIST OF CERCLA SITES IN THE 200 WEST AREA

Units No.	Inactive Sites	Disposal Method	Waste Type	Use Dates From	To
I	216-S-5	Crib	SC & CW	3/54	3/57
	216-S-6	Crib	SC & CW	11/54	7/72
	216-S-17	Pond	SC & CW	10/51	4/54
	216-S-16P	Pond	SC & CW	1/57	2/75
	216-S-16D	Ditch	SC & CW	1/57	2/75
II	216-S-1&2	Crib	PC	1/52	1/56
	216-S-7	Crib	PC	1/56	7/65
	216-S-3	French Drain	SC & CW	9/53	8/56
	216-S-9	Crib	PC	7/65	1/69
III	216-S-20	Crib	PW	1/52	5/73
IV	216-S-4	French Drain	SC & CW	8/53	8/56
	216-S-21	Crib	PC	4/54	2/69
V	216-U-11	Ditch	PW	4/44	1957
VI	216-U-3	French Drain	T/SW	5/54	8/55
VII	216-Z-1&2	Crib	PW	6/49	4/69
VIII	216-U-1&2	Crib	MLW	3/52	5/67
IX	216-U-4	Reverse Well	PW	3/47	7/55
	216-U-4A	French Drain	PW	7/55	7/70
	216-U-4B	French Drain	PW	1/60	7/70
X	216-Z-7	Crib	PW	2/47	2/67
	216-Z-10	Reverse Well	PW	2/45	6/45
XI	216-T-19	Crib and Tile Field	PC	9/51	7/80
XII	216-T-7	Crib and Tile Field	T/SW	7/78	11/55
XIII	216-T-28	Crib	PW	2/60	12/66
XIV	216-T-3	Reverse Well	MLW	6/45	8/46
XV	216-T-2	Reverse Well	PW	1/45	5/50
	216-T-8	Crib	PW	5/50	9/51

NOTES: (from potentially least hazardous to potentially most hazardous)

SC & CW = Steam Condensate and Cooling Water
PC = Process Condensate
MLW = Miscellaneous Liquid Waste
PW = Process Waste
T/SW = Tank and Scavenged Waste


INACTIVE WASTE SITES (PRE - NOVEMBER, 1980)
ACTIVE WASTE SITES (POST - NOVEMBER, 1980)
DAYTON AVE
CAMDEN AVE
COOPER AVE
BELOIT AVE
ALBANY AVE
13TH ST
18TH ST
19TH ST
22ND ST
23RD ST
27TH ST
10TH ST
ASH DISPOSAL BASIN
200 WEST BURNING PITS
NON RAD BURIAL GROUND
COAL STORAGE
241-TY TANK FARM
FUTURE INDUSTRIAL BURIAL GROUND
216-U-10 POND
216-S-16 POND
216-S-10 POND
216-S-10 DITCH
216-W-5
216-W-3A
216-W-3AE
216-U-8
216-U-11
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200 WEST AREA
WASTE SITES
H-3-57210
9 | 10
JOP # 1447
NOT REQD
NONE

or adjacent to the area. See Figure 1-18 for site locations in the 200 West area.

The 300 Area is located about 1.6 kilometers (1 mi) north of the Richland city limits, on the bank of the Columbia River. Roughly rectangular in shape, the area covers about 1.5 square kilometers (370 acres); waste-management facilities have been added just to the north of the 300 Area.

Occupying a relatively flat area on the west bank of the Columbia River, the area has an elevation that is about 15 meters (50 ft) above the average elevation of the adjacent river. The Hanford Site land surface surrounding the 300 Area is devoid of prominent surface features and slopes gently upward to the northwest.

The surface sediments in the 300 Area are largely wind-transported sands and silts. These sediments, which were deposited in dunes up to about 3 meters(9.8 ft) in depth, have been largely stabilized by vegetation. Below this layer lie 20 to 25 meters (66 to 82 ft) of coarse-grained glaciofluvial deposits known as the Pasco Gravels; the permeability of these deposits is very high.

The high porosity and permeability of the sands and gravels that underlie the the area allow any precipitation to infiltrate rapidly. Flooding of any portion of the 300 Area by rainwater is therefore highly improbable. There are no natural streams or watercourses other than the Columbia River within or adjacent to the 300 Area.

The residence nearest the 300 Area is approximately 1.5 kilometers (0.9 mi) east across the Columbia River. A number of irrigated farms are located just across the river from the 300 Area. The northern part of Richland, lying within about 4 kilometers (2.5 mi) of the 300 Area, is an industrial park. The nearest residences in Richland are about 4.6 kilometers (2.9 mi) from the 300-Area boundary. The nearest city water intake is the Richland pumping station, 6 kilometers (3.7 mi) downstream from the 300 Area.

The sites within the 300 area include: 316-1 (Pond), 316-2 (Pond), 316-3 (Trench), 316-4 (Crib). See Figure 1-19 for the location of site 316-1 in the 300 area. Because of the location of the sites, they could not be grouped for characterization or remediation.

The 400 Area is a controlled area of about 0.5 square kilometer (130 acres) located in the southeast part of the Hanford Site; it is approximately 7.2 kilometers (4.5 mi) from the Columbia River and 6.2 kilometers (3.9 mi) from the nearest Site boundary.

The area is located at an elevation of about 170 meters (558 ft) above MSL. The land around the site slopes gently away to the south and east toward the Columbia and Yakima rivers. The site is devoid of prominent topographic features.

The glaciofluvial deposits upon which the 400 Area is located extend from the surface to a depth of about 45 meters (148 ft). The surface sediments are coarse sands merging into the coarse Pasco gravels. The water table beneath the 400 Area is in the upper part of the Ringold Formation, at a depth of about 50 meters (164 ft).

The ground water moves from west to east toward the Columbia River. A small amount of ground water is withdrawn from the unconfined aquifer for sanitary use and air conditioning, but the effect on ground-water level is not significant.

The residence nearest to the 400 Area is approximately 8 kilometers (5 mi) to the southwest. The Richland city limits are about 11 kilometers (6.9 mi) to the southeast.

The 600 Area includes all of the Hanford Site not occupied by the 100, 200, 300, or 400 Areas. Land within the 600 Area is used for:

- o The Arid Lands Ecology (ALE) Reserve, a 310-square-kilometer (120-sq-mi) tract set aside for ecological studies

- A 4-square-kilometer (990-acre) tract leased to the State of Washington, part of which is used for low-level waste disposal

- A 4.4-square-kilometer (1,100-acre) tract for WNP nuclear power plants

- A 2.6-square-kilometer (640-acre) tract transferred to the State of Washington as a potential site for the disposal of nonradioactive hazardous wastes

- About 130 square kilometers (50 sq mi) under permit to U.S. Fish and Wildlife Service

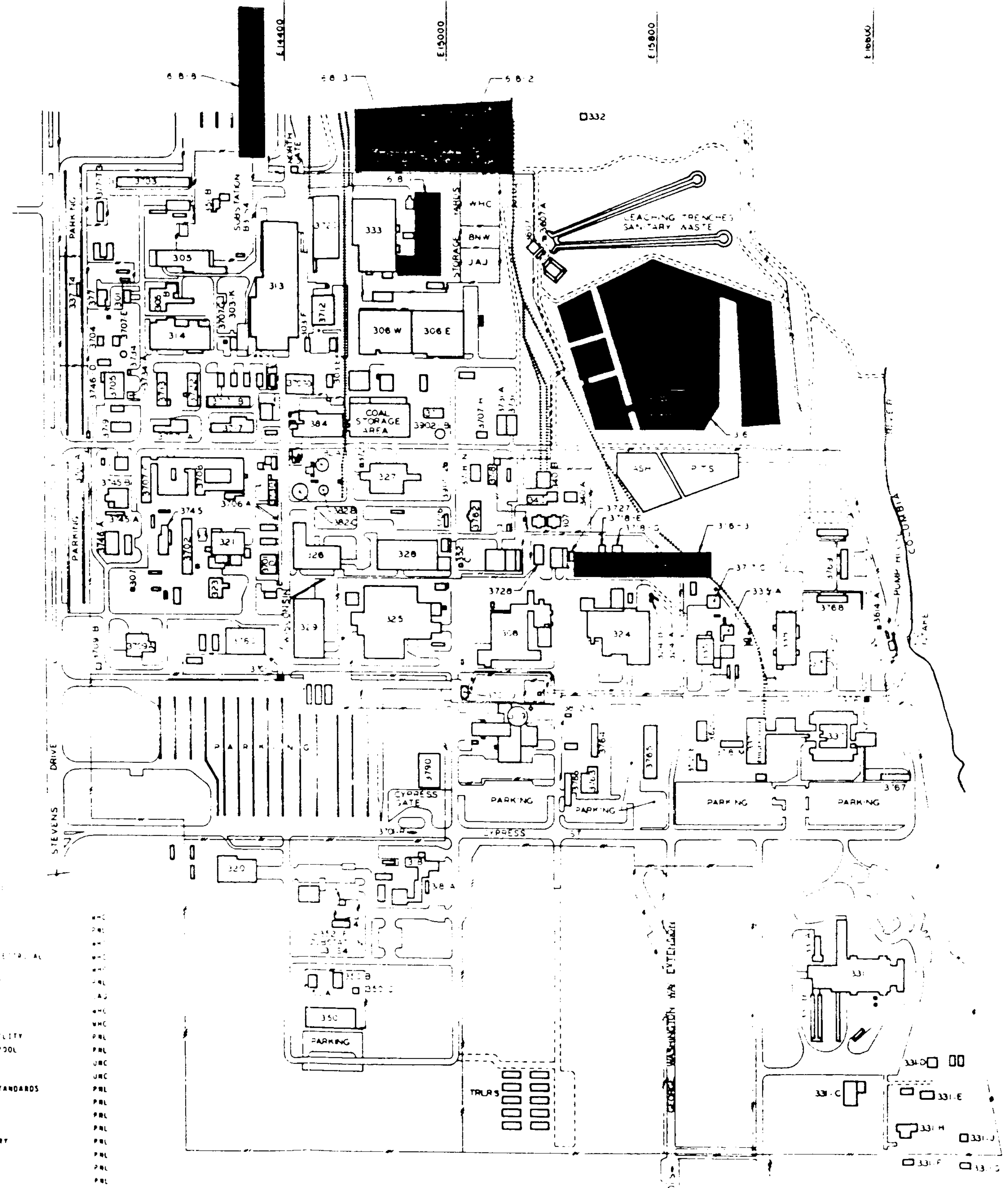
- A 225-square-kilometer (87-sq-mi) tract under permit to Washington State Department of Game for recreational game management

- Support facilities for the controlled-access areas

- The Near-Surface Test Facility in Gable Mountain, which is part of the Basalt Waste Isolation Project (BWIP) to assess the feasibility of storing high-level radioactive waste in basalt formations

- A 46.7-square-kilometer (18-sq-mi) tract for the reference repository location for the Basalt Waste Isolation Project (BWIP). This site includes all of the 200-West Area (U.S. DOE 1982, 1984). The site of the principal borehole and exploratory shaft for the BWIP covers about 1 square kilometer (250 acres) and is located just west of the 200-West Area within the reference repository location. See Figure 1-20 for the 600 area map.

Although they are not of significance for this study, other Hanford areas are in the downtown Richland area, where federal and contractor employees work in the Federal Building and several others (700 Area), the area south of the 300 Area primarily used for research and development (3000 Area), and the area between the 700 and 3000 Areas that is the main



BUILDING LIST

BUILDING NUMBER	BUILDING NAME	LANDLORD
101	STORAGE	WHC
303-A	URANIUM STORAGE	UNC
303-B	URANIUM STORAGE	UNC
303-C	URANIUM STORAGE	UNC
[illegible]	URANIUM STORAGE	UNC
[illegible]	CHEMICAL PUMP HOUSE	UNC
303-G	URANIUM STORAGE	UNC
303-J	STORAGE	PNL
303-K	STORAGE	UNC
303-M	URANIUM OXIDE FACILITY	UNC
304	CONSTRUCTION FACILITY	UNC
305	HOT CELL VERIFICATION FACILITY (HCVF)	WHC
305A	CONSTRUCTION OFFICE	JAJ
305B	ENGINEERING DEVELOPMENT LAB ANNEX	JAJ
306 EAST	FABRICATION AND TESTING LAB	WHC
306 WEST	METAL FABRICATION DEVELOPMENT BUILDING	PNL
308	FUELS DEVELOPMENT LABORATORY	WHC
309	CONTROL AND DATA SYSTEMS	WHC
311	STEEL HOUSE	UNC
313	FUELS MANUFACTURING LABORATORY	UNC
314	ENGINEERING DEPARTMENT	PNL
315	FILTERED WATER PLANT	WHC
318	HTLT REACTOR AND MONITORING SERVICES	PNL
320	LOW LEVEL RADIOCHEMISTRY BLDG	PNL
321	HYDROMECHANICAL FACILITY	WHC
323	METALS CREEP LABORATORY	WHC
324A & C	CHEMICAL ENGINEERING LABORATORY	WHC
325	RADIOCHEMISTRY LABORATORY	WHC
326	MATERIALS TECHNOLOGY LABORATORY	WHC
327	POST IRRADIATION TESTING LABORATORY	WHC
328	ENGINEERING SERVICES AND SAFETY	WHC
329	BIOPHYSICS LABORATORY	PNL
[illegible]	[illegible] LABORATORY	PNL
[illegible]	RADIOACTIVE WASTE [illegible] HANDLING FACILITY	PNL
[illegible]	[illegible] FUELS MANUFACTURING	
333-[illegible] TRL	OFFICES	
334	SAMPLING SHED	
334 A	SPENT ACID STORAGE	UNC
335	AEROSOL TEST FACILITY	PNL
335A	FAST REACTOR THERMAL ENGINEERING FACILITY	WHC
336	SODIUM TESTING FACILITY	WHC
337	HIGH TEMPERATURE SODIUM FACILITY AND OFFICES	WHC
339	SAFEGUARDS TEST FACILITY	WHC
340A	RETENTION AND NEUTRALIZATION FACILITY	WHC
340B & C	RR WASTE LOADOUT FACILITY	WHC
350	PLANT OPERATIONS AND MAINTENANCE FACILITY	PNL
[illegible] A	PAINT SHOP	PNL
[illegible] B	WAREHOUSE	PNL
[illegible]	STORAGE	PNL
[illegible] A	INFRA RED LAB	WHC
[illegible] E	GENERATOR STATION	WHC
[illegible]	[illegible] GENERATOR EXAMINATION FACILITY	WHC
[illegible]	[illegible]	WHC
[illegible] A	[illegible] WATER [illegible]	WHC
[illegible] B	[illegible] GROUND WATER TANK [illegible]	WHC
[illegible]	WEST GROUND WATER TANK [illegible]	WHC
384	POWER HOUSE	WHC
3506-A	MATERIALS PROPERTIES LAB	WHC
3506-B	SERVICE SHOP	WHC
3607	SEPTIC TANKS	WHC
3621B & C	EMERGENCY GENERATOR AND CONTROL	WHC
3621D	EMERGENCY GENERATOR STATION #3	WHC
3701A	APPLE STREET GUARD STATION	WHC
3701D	PATROL HEADQUARTERS	WHC
[illegible]	WASHINGTON STREET GUARD STATION	WHC
[illegible] N	NORTH GUARD STATION	WHC
[illegible] R	CYPRESS STREET GUARD STATION	WHC
[illegible]	[illegible] WASHINGTON WAY GUARD STATION	WHC
[illegible]	PROTECTED AREA GUARD STATION	WHC
[illegible]	OFFICES	WHC
[illegible]	OFFICES	WHC
[illegible] 4	STORAGE (JAJ)	JAJ
[illegible] 5	PNL PHOTOGRAPHY	PNL
[illegible] 6	INFORMATION SERVICES	WHC
[illegible] A	FUELS TRAINING	UNC
[illegible] B	[illegible]	WHC
3707C	AUTOMATED TECHNOLOGY	WHC
3707D	INFORMATION SERVICES	WHC
3707E	STORAGE (JAJ)	WHC
3707F	PERSONNEL SURVEY	WHC
3707	CHANGE ROOM	WHC
3708	RADIATION MEASUREMENTS	PNL
3709	HEDL PAINT SHOP	WHC
3709A	FIRE STATION	RHO
3710-A	OIL STORAGE	WHC
3711	MAINTENANCE STORAGE	WHC
3712	FUELS WAREHOUSE	UNC
3713	PAINT AND CARPENTER SHOP	UNC
[illegible] 5	STORAGE	WHC
[illegible] 6	STORAGE	UNC
[illegible]	SHEET METAL AND ENGINEERING OFFICES	UNC
[illegible] B	STANDARDS LABORATORY	WHC
[illegible]	[illegible] STORAGE	WHC
[illegible]	[illegible]	WHC
[illegible]	[illegible]	PNL
[illegible] B	LABORATORY EQUIPMENT CENTRAL POOL	PNL
[illegible] C	STORAGE [illegible]	WHC
[illegible] E	STORAGE (324)	WHC

(CONT'D AT ZONE 10-C)

(CONT'D FROM ZONE 12-A)

BUILDING NUMBER	BUILDING NAME	LANDLORD
[illegible] F	[illegible] STORAGE	WHC
[illegible] G	STORAGE BUILDING	PNL
[illegible] M	[illegible] STORAGE FACILITY	WHC
[illegible] N	[illegible] ELECTRICAL	WHC
[illegible] 9	[illegible] FACILITY	WHC
[illegible]	CENTRAL SERVICE AND LAB [illegible]	PNL
[illegible]	[illegible] SHOP	JAJ
[illegible]	[illegible] VAULT	WHC
3728	TEST ARTICLE STORAGE	WHC
3730	GAMMA NEUTRON IRRADIATION FACILITY	PNL
3731	LABORATORY EQUIPMENT CENTRAL POOL	PNL
3734	STORAGE	UNC
3734-A	PAINT STORAGE	UNC
3745	RADIOLOGICAL CALIBRATIONS & STANDARDS	PNL
3745A	ELECTRON ACCELERATOR	PNL
3745B	POSITIVE ION ACCELERATOR	PNL
3746	RADIOLOGICAL PHYSICS BLDG	PNL
3746A	RADIOLOGICAL PHYSICS LABORATORY	PNL
3746D	TECHNICAL SERVICE ANNEX	PNL
3760	TECHNICAL INFORMATION BLDG	PNL
3762	OFFICES	PNL
3763	OFFICES	WHC
3764	OFFICES	PNL
3765	OFFICES	WHC
3766	OFFICES	WHC
[illegible]	OFFICES	WHC
[illegible]	[illegible]	WHC
[illegible] 9	OFFICES	WHC
[illegible] 0	OFFICES	WHC
3790	SECURITY OPERATIONS	WHC

JOP# 1447

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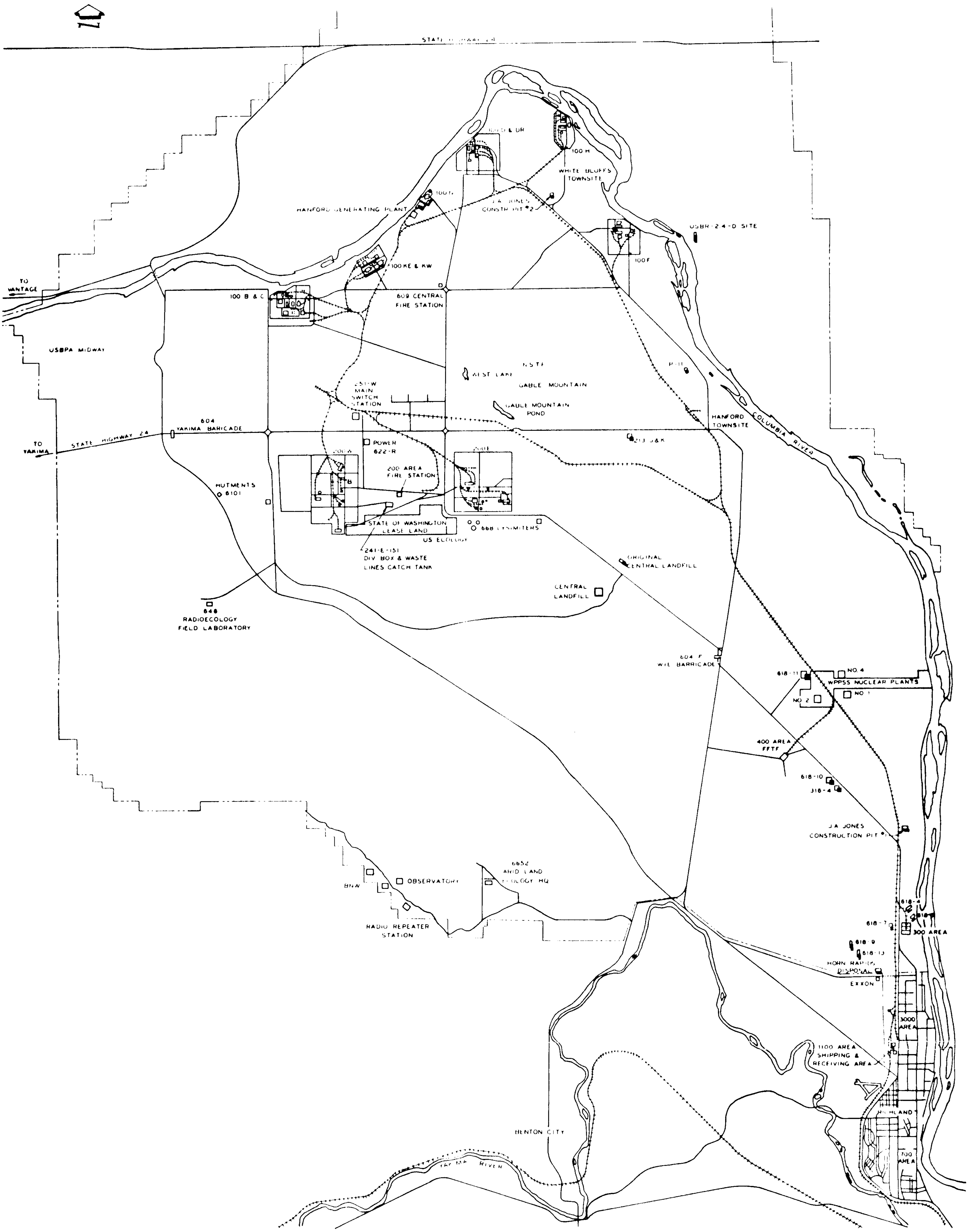
PACIFIC NORTHWEST LABORATORY
OPERATED BY BATTELLE MEMORIAL INSTITUTE

300 AREA
WASTE SITES

NOT REQD
NONE

H-3-57210 10|10



JQP#-1447

U. S. Department Of Energy
Richland Operations Office

PACIFIC NORTHWEST LABORATORY
OPERATED BY BATTELLE MEMORIAL INSTITUTE

600 AREA
WASTE SITES

McLAUGHLIN

SCALE NONE

NOT REQD

NONE

600 AREA

0401

H-3-57210 | 1 | 10

REFERENCE DRAWINGS

REVISIONS

DRAWING STATUS

NEXT USED ON

shipping, receiving, warehousing, transportation, maintenance, utilities, and service station area (1100 Area). These areas include small oil-fired boilers for space heating.

1.2 SUMMARY

Each of the individual CERCLA sites and each type of RCRA 3004(u) site was evaluated to identify the types of data that might be required for characterization (remedial investigation) or remediation. The data needs were identified for each site or type of site, and a plan for characterizing the site was prepared. This plan was then used to develop a summary of the potential cost and possible schedule for characterizing and remediating each site.

Table 1-2 presents a summary of the costs anticipated for characterizing each of the 81 CERCLA sites. On an individual site basis, the costs range from a low $3.2 million to a high of $7.7 million.* Similarly, the costs for the sampling and analysis required of RCRA 3004(u) sites ranges from a low of $23,000 for a generalized Hanford underground tank to a high of $8.6 million for a generalized Hanford ditch.** In many cases, the costs for characterizing adjacent sites can be materially reduced by treating these sites as a group rather than treating each site individually. Costs reductions of up to 85% have been identified by grouping of these sites. A more detailed discussion of the grouping of sites can be found in Section 4.0 of this report.

Although the remedial technology for each site can not be determined at this time, some estimate can be made of the probable range of costs for each CERCLA site and each type of RCRA 3004(u) site. Table 1-3 presents the range of costs for CERCLA sites evaluated in this study. As may be seen, the lest cost alternative is nearly always the capping of the site with some type of surface barrier. The most expensive alternative is nearly always some type

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* See Table 2-23

** See Tables 3-35 and 3-36

TABLE 1-2. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY AREA*

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater[1]	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
Area 100	$1,459,600	$55,813,550	$22,018,050	$1,372,800	$81,544,000
Area 200	E $ 866,800 W $2,372,900 $3,239,700	$41,622,400 $50,282,400 $91,904,800	$59,819,100 $61,855,000 $121,674,100	$810,400 $654,000 $1,464,400	$219,443,000
Area 300	$471,600	$3,174,800	$2,195,100	$187,200	$6,148,700
					$307,135,700

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square are specified in Table 2-14.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

[1]Assumes each site is evaluated separately. See Table 2-23 for detailed evaluation by site or group of sites.

TABLE 1-3. COST OF REMEDIAL TECHNOLOGIES IN MILLIONS OF DOLLARS FOR SEVERAL TYPES OF DISPOSAL UNITS

Type of Disposal Unit		REMEDIAL TECHNOLOGY								
		Cap/Cover	Grout-in-Place	In-situ Vitrification	Excavation with Disposal	Excavation with Incineration and Disposal	Soil Flushing	Soil Flushing after Excavation	Soil Flushing after Vitrification	No Action
Cribs	(min)	2.3	13	28	79	150	28	23	22	6.1
	(Aug)	2.4	47	63	120	210	58	44	36	6.1
	(max)	2.7	150	140	220	420	180	60	63	6.1
Ditch	(min)	6.7	230	---	1,200	---	280	220	---	6.1
	(Aug)	7.9	230	---	1,200	---	280	220	---	6.1
	(max)	9.2	230	---	1,200	---	280	220	---	6.1
Drywell	(min)	2.3	---	---	79	---	---	---	---	6.1
	(Aug)	2.3	---	---	79	---	---	---	---	6.1
	(max)	2.3	---	---	79	---	---	---	---	6.1
French	(min)	2.2	10	29	62	190	30	22	23	6.1
	(Aug)	2.2	20	45	69	190	30	22	23	6.1
	(max)	2.2	32	61	100	190	30	22	23	6.1
Pond	(min)	6.0	42	250	1,300	---	33	300	---	6.1
	(Aug)	7.6	200	300	1,400	---	270	330	---	6.1
	(max)	12.0	510	350	1,500	---	540	360	---	6.1
Reverse Well	(min)	2.2	19	---	---	---	22	---	---	6.1
	(Aug)	2.2	19	---	---	---	23	---	---	6.1
	(max)	2.2	19	---	---	---	24	---	---	6.1
Trench	(min)	2.3	15	68	92	---	8	---	---	6.1
	(Aug)	3.3	29	86	330	---	21	---	---	6.1
	(max)	7.4	93	130	1,200	---	74	---	---	6.1

of removal such as excavation and disposal. More detailed evaluation of each site as a part of the Remedial Investigation/Feasibility Study will be required to refine the cost estimates and provide the information required by EPA and State of Washington Regulations for use in selection of a remedial technology.

The schedule for the characterization of the sites indicates that the CERCLA sites will take approximately ten years to complete characterization. RCRA sites could take an additional 15 years. Remediation of the sites could take more than fifty years if all sites are remediated (assuming a budget cap of $100 million per year).

2.0 SUMMARY OF CERCLA SITES

The Draft Phase I Installation Assessment of Inactive Waste-Disposal Sites at Hanford, July 1986, Volumes 1 and 2, was the primary source of information used for the summary descriptions of the CERCLA sites. This information is presented in Tables 2-1 through 2-6. Table 2-3 combines sources of information from Volume 1 (as referenced on the table itself), that described the 81 CERCLA sites and indicates the subarea each site is located in, the method of disposal (unit type) and the waste disposed of at each site. From Table 2-3, Tables 2-1 and 2-2 were derived. Table 2-1 breaks the 81 sites into the number of sites located in each area and subarea. Table 2-2 gives the number of each unit type used in a subarea. Tables 2-4, 2-5 and 2-6 are sorts of Table 2-3. Table 2-3 has the sites listed with the site numbers in ascending order. Table 2-4 orders the sites by area. Tables 2-5 and 2-6 are ordered by unit type and waste disposed respectively.

Table 2-1 indicates that 65% of the CERCLA sites are located in the 200 area, 29% in the 100 area and 4% in the 300 area. Table 2-2 lists dry wells as a unit type while Volume 1 describes dry wells as monitoring measures of liquid releases in the vadose zone. Reverse wells are described in Volume 1 as being used at earlier sites but eventually discontinued when it was found that they released liquid wastes too close to the water table. It appears that reverse wells were used at sites that were in operation before the 1950's and that dry wells replaced reverse wells at later sites.

2.1 DETERMINING THE NEED FOR REMEDIATION

As will be noted in the sections which follow, the criteria presented are derived from a review of the federal and state regulations and DOE Orders which apply to the sites. These are known as the applicable relevant and appropriate regulations (ARARs).

TABLE 2-1. BREAKDOWN OF CERCLA SITES AT ROCKWELL HANFORD OPERATIONS BY AREA AND SUBAREA.

Area	Subarea	No. of CERCLA Sites
100	100-KE/KW	7
	100-B/C	4
	100-D/DR	5
	100-F	6
	100-H	3

	Total	25
200	200 East	26
	200 West	27

	Total	53
300	Total	3

TABLE 2-2. BREAKDOWN OF THE UNIT TYPE USED AT CERCLA SITES AT THE ROCKWELL HANFORD OPERATIONS BY AREA AND SUBAREA.

100-KE/KW Subarea
- 2 Dry Wells
- 2 Cribs
- 2 French Drains

100-B/C Subarea
- 1 French Drain
- 1 Crib
- 2 Trenches

100-D/DR Subarea
- 1 Crib
- 4 Trenches

100-F Subarea
- 5 Trenches
- 1 French Drain

100-H Subarea
- 1 French Drain
- 2 Trenches

200 East Subarea
- 1 French Drain
- 21 Cribs
- 2 Reverse Wells
- 1 Trench
- 1 Ditch

200 West Subarea
- 2 Ditches
- 5 French Drains
- 12 Cribs
- 4 Reverse Wells
- 2 Crib and Tile Fields
- 2 Ponds

300 Area
- 1 Trench
- 2 Ponds

TABLE 2-3. HANFORD INACTIVE WASTE SITES SORTED BY SITE ID.

81 Priority Sites Recommended for Characterization.

Site No. (1)	Area (12)	Unit Type (12)	Waste Disposed
100 KE*1	100-KE/KW	Dry Well (11&12)	Misc. (2)
100 KE*2	100-KE/KW	French Drain (12)	Misc. (2)
100 KW*1	100-KE/KW	Dry Well (11&12)	Misc. (2)
100 KW*2	100-KE/KW	French Drain (12)	Misc. (2)
116-B-1	100-B/C	Trench	Reactor coolant (a) (2)
116-B-4	100-B/C	French Drain	Decontamination Waste (2)
116-C-1	100-B/C	Trench	RC (a) (2)
116-C-2	100-B/C	Crib	Ruptured Fuel Effluent (2)
116-DR-1	100-D/DR	Trench	RC (2)
116-DR-2	100-D/DR	Trench	RC (2)
116-DR-6	100-D/DR	Trench	RC (2)
116-DR-7	100-D/DR	Crib	Misc. (2)
116-D-1B	100-D/DR	Trench	DW (2)
116-F-1	100-F	Trench	DW (2)
116-F-10	100-F	French Drain	RC (2)
116-F-2	100-F	Trench	RFE (2)
116-F-3	100-F	Trench	RFE (2)
116-F-6	100-F	Trench	RC (2)
116-F-9	100-F	Trench	Misc (2)
116-H-1	100-H	Trench	RFE (2)
116-H-2	100-H	Trench	RC (2)
116-H-3	100-H	French Drain	DW (2)
116-KE-2	100-KE/KW	Crib	Misc. (2)
116-K-1	100-KE/KW	Crib	RC (2)
116-K-2	100-KE/KW	Trench	Misc. Liquid Waste (3)
216-A-21	200 East	Crib (11&12)	PW (3)
216-A-24	200 East	Crib (12)	Tank/Scavenged Waste (3)
216-A-27	200 East	Crib (11&12)	MLW (3)
216-A-28	200 East	French Drain	MLW (3)
216-A-36A	200 East	Crib	MLW (3)
216-A-4	200 East	Crib (11&12)	MLW (3)
216-A-40	200 East	Trench	Steam Condensate, Cooling Water (3)
216-A-5	200 East	Crib (12)	Process Condensate (3)
216-A-6	200 East	Crib (12)	MLW (3)
216-A-7	200 East	Crib (12)	MLW (3)
216-A-9	200 East	Crib (12)	Process Waste (3)
216-B-10A	200 East	Crib	PW (4)
216-B-16	200 East	Crib (12)	T/SW (4)
216-B-2-2	200 East	Ditch	Steam Condensate, Cooling Water (4)
216-B-43	200 East	Crib	T/SW (4)
216-B-44	200 East	Crib (12)	T/SW (4)
216-B-45	200 East	Crib (12)	T/SW (4)
216-B-46	200 East	Crib (12)	T/SW (4)

TABLE 2-3. HANFORD INACTIVE WASTE SITES SORTED BY SITE ID. (Continued)

81 Priority Sites Recommended for Characterization.

Site No. (1)	Area (12)	Unit Type (12)	Waste Disposed
216-B-48	200 East	Crib (12)	T/SW (4)
216-B-49	200 East	Crib (12)	T/SW (4)
216-B-5	200 East	Reverse Well	T/SW (4)
216-B-50	200 East	Crib (12)	T/SW (4)
216-B-6	200 East	Reverse Well	PW (4)
216-B-7 A&B	200 East	Crib	T/SW (4)
216-C-1	200 East	Crib	PC (5)
216-C-10	200 East	Crib	PC (5)
216-S-16D	200 West	Ditch	Steam Condensate, Cooling Water (6)
216-S-16P	200 West	Pond	Steam Condensate, Cooling Water (6)
216-S-17	200 West	Pond	Steam Condensate, Cooling Water (6)
216-S-1&2	200 West	Crib	PC (6)
216-S-20	200 West	Crib	PW (6)
216-S-21	200 West	Crib	PC (6)
216-S-3	200 West	French Drain	Steam Condensate, Cooling Water (6)
216-S-4	200 West	French Drain	Steam Condensate, Cooling Water (6)
216-S-5	200 West	Crib	Steam Condensate, Cooling Water (6)
216-S-6	200 West	Crib	Steam Condensate, Cooling Water (6)
216-S-7	200 West	Crib	PC (6)
216-S-9	200 West	Crib	PC (6)
216-T-19	200 West	Crib & Tile Field	PC (7)
216-T-2	200 West	Reverse Well	PW (7)
216-T-28	200 West	Crib	PW (7)
216-T-3	200 West	Reverse Well	MLW (7)
216-T-7	200 West	Crib & Tile Field	T/SW (7)
216-T-8	200 West	Crib	PW (7)
216-U-11	200 West	Ditch	PW (8)
216-U-1&2	200 West	Crib	MLW (8)
216-U-3	200 West	French Drain	T/SW (8)
216-U-4	200 West	Reverse Well (11&12)	PW (8)
216-U-4A	200 West	French Drain (11&12)	PW (8)
216-U-4B	200 West	French Drain (11&12)	PW (8)
216-Z-10	200 West	Reverse Well	PW (9)
216-Z-1&2	200 West	Crib	PW (9)
216-Z-7	200 West	Crib	PW (9)
316-1	300 Area	Pond (11&12)	PW and Lab Wastes (10)
316-2	300 Area	Pond (11&12)	PW and Lab Wastes (10)
316-3	300 Area	Trench	PW and Lab Wastes (10)

References used in columns are given at the top of the column headings. The reference used in Unit Type is given at the column heading unless additional or different sources are listed in parenthesis for for a given site. References used for Waste Disposed are given in parenthesis for a site.

TABLE 2-4. HANFORD INACTIVE WASTE SITES SORTED BY AREA.

81 Priority Sites Recommended for Characterization.

Area (12)	Site No. (1)	Unit Type (12)	Waste Disposed
100-B/C	116-B-4	French Drain	Decontamination Waste (2)
100-B/C	116-B-1	Trench	Reactor coolant (a) (2)
100-B/C	116-C-2	Crib	Ruptured Fuel Effluent (2)
100-B/C	116-C-1	Trench	RC (a) (2)
100-D/DR	116-DR-2	Trench	RC (2)
100-D/DR	116-DR-7	Crib	Misc. (2)
100-D/DR	116-DR-6	Trench	RC (2)
100-D/DR	116-D-1B	Trench	DW (2)
100-D/DR	116-DR-1	Trench	RC (2)
100-F	116-F-1	Trench	DW (2)
100-F	116-F-9	Trench	Misc (2)
100-F	116-F-2	Trench	RFE (2)
100-F	116-F-3	Trench	RFE (2)
100-F	116-F-6	Trench	RC (2)
100-F	116-F-10	French Drain	RC (2)
100-H	116-H-1	Trench	RFE (2)
100-H	116-H-3	French Drain	DW (2)
100-H	116-H-2	Trench	RC (2)
100-KE/KW	100 KW*2	French Drain (12)	Misc. (2)
100-KE/KW	116-KE-2	Crib	Misc. (2)
100-KE/KW	116-K-1	Crib	RC (2)
100-KE/KW	100 KE*1	Dry Well (11&12)	Misc. (2)
100-KE/KW	100 KW*1	Dry Well (11&12)	Misc. (2)
100-KE/KW	100 KE*2	French Drain (12)	Misc. (2)
100-KE/KW	116-K-2	Trench	Misc. Liquid Waste (3)
200 East	216-B-44	Crib (12)	T/SW (4)
200 East	216-B-43	Crib	T/SW (4)
200 East	216-A-24	Crib (12)	Tank/Scavenged Waste (3)
200 East	216-A-21	Crib (11&12)	PW (3)
200 East	216-A-28	French Drain	MLW (3)
200 East	216-B-45	Crib (12)	T/SW (4)
200 East	216-A-4	Crib (11&12)	MLW (3)
200 East	216-B-46	Crib (12)	T/SW (4)
200 East	216-A-5	Crib (12)	Process Condensate (3)
200 East	216-B-48	Crib (12)	T/SW (4)
200 East	216-A-7	Crib (12)	MLW (3)
200 East	216-B-49	Crib (12)	T/SW (4)
200 East	216-B-10A	Crib	PW (4)
200 East	216-B-5	Reverse Well	T/SW (4)
200 East	216-B-2-2	Ditch	Steam Condensate, Cooling Water (4)
200 East	216-B-50	Crib (12)	T/SW (4)
200 East	216-A-36A	Crib	MLW (3)
200 East	216-B-6	Reverse Well	PW (4)
200 East	216-A-6	Crib (12)	MLW (3)
200 East	216-B-7 A&B	Crib	T/SW (4)
200 East	216-B-16	Crib (12)	T/SW (4)

TABLE 2-4. HANFORD INACTIVE WASTE SITES SORTED BY AREA. (Continued)

81 Priority Sites Recommended for Characterization.

Area (12)	Site No. (1)	Unit Type (12)	Waste Disposed
200 East	216-C-1	Crib	PC (5)
200 East	216-A-40	Trench	Steam Condensate, Cooling Water (3)
200 East	216-A-27	Crib (11&12)	MLW (3)
200 East	216-A-9	Crib (12)	Process Waste (3)
200 East	216-C-10	Crib	PC (5)
200 West	216-S-17	Pond	Steam Condensate, Cooling Water (6)
200 West	216-T-3	Reverse Well	MLW (7)
200 West	216-T-7	Crib & Tile Field	T/SW (7)
200 West	216-S-16D	Ditch	Steam Condensate, Cooling Water (6)
200 West	216-T-8	Crib	PW (7)
200 West	216-S-20	Crib	PW (6)
200 West	216-U-11	Ditch	PW (8)
200 West	216-S-3	French Drain	Steam Condensate, Cooling Water (6)
200 West	216-U-1&2	Crib	MLW (8)
200 West	216-S-5	Crib	Steam Condensate, Cooling Water (6)
200 West	216-U-3	French Drain	T/SW (8)
200 West	216-S-7	Crib	PC (6)
200 West	216-U-4	Reverse Well (11&12)	PW (8)
200 West	216-T-19	Crib & Tile Field	PC (7)
200 West	216-U-4A	French Drain (11&12)	PW (8)
200 West	216-T-28	Crib	PW (7)
200 West	216-U-4B	French Drain (11&12)	PW (8)
200 West	216-S-1&2	Crib	PC (6)
200 West	216-Z-10	Reverse Well	PW (9)
200 West	216-S-4	French Drain	Steam Condensate, Cooling Water (6)
200 West	216-Z-1&2	Crib	PW (9)
200 West	216-S-9	Crib	PC (6)
200 West	216-Z-7	Crib	PW (9)
200 West	216-S-16P	Pond	Steam Condensate, Cooling Water (6)
200 West	216-S-6	Crib	Steam Condensate, Cooling Water (6)
200 West	216-T-2	Reverse Well	PW (7)
200 West	216-S-21	Crib	PC (6)
300 Area	316-1	Pond (11&12)	PW and Lab Wastes (10)
300 Area	316-2	Pond (11&12)	PW and Lab Wastes (10)
300 Area	316-3	Trench	PW and Lab Wastes (10)

References used in columns are given at the top of the column headings. The reference used in Unit Type is given at the column heading unless additional or different sources are listed in parenthesis for for a given site. References used for Waste Disposed are given in parenthesis for a site.

TABLE 2-5. HANFORD INACTIVE WASTE SITES SORTED BY UNIT TYPE.

81 Priority Sites Recommended for Characterization.

Unit Type (12)	Site No. (1)	Area (12)	Waste Disposed
Crib	116-C-2	100-B/C	Ruptured Fuel Effluent (2)
Crib	116-DR-7	100-D/DR	Misc. (2)
Crib	116-KE-2	100-KE/KW	Misc. (2)
Crib	116-K-1	100-KE/KW	RC (2)
Crib	216-B-43	200 East	T/SW (4)
Crib	216-C-1	200 East	PC (5)
Crib	216-B-7 A&B	200 East	T/SW (4)
Crib	216-C-10	200 East	PC (5)
Crib	216-B-10A	200 East	PW (4)
Crib	216-A-36A	200 East	MLW (3)
Crib	216-Z-1&2	200 West	PW (9)
Crib	216-S-9	200 West	PC (6)
Crib	216-S-7	200 West	PC (6)
Crib	216-S-21	200 West	PC (6)
Crib	216-S-6	200 West	Steam Condensate, Cooling Water (6)
Crib	216-T-8	200 West	PW (7)
Crib	216-U-1&2	200 West	MLW (8)
Crib	216-S-1&2	200 West	PC (6)
Crib	216-S-5	200 West	Steam Condensate, Cooling Water (6)
Crib	216-Z-7	200 West	PW (9)
Crib	216-S-20	200 West	PW (6)
Crib	216-T-28	200 West	PW (7)
Crib & Tile Field	216-T-7	200 West	T/SW (7)
Crib & Tile Field	216-T-19	200 West	PC (7)
Crib (11&12)	216-A-27	200 East	MLW (3)
Crib (11&12)	216-A-4	200 East	MLW (3)
Crib (11&12)	216-A-21	200 East	PW (3)
Crib (12)	216-A-5	200 East	Process Condensate (3)
Crib (12)	216-B-45	200 East	T/SW (4)
Crib (12)	216-A-24	200 East	Tank/Scavenged Waste (3)
Crib (12)	216-B-46	200 East	T/SW (4)
Crib (12)	216-B-50	200 East	T/SW (4)
Crib (12)	216-B-48	200 East	T/SW (4)
Crib (12)	216-A-7	200 East	MLW (3)
Crib (12)	216-A-6	200 East	MLW (3)
Crib (12)	216-B-49	200 East	T/SW (4)
Crib (12)	216-A-9	200 East	Process Waste (3)
Crib (12)	216-B-44	200 East	T/SW (4)
Crib (12)	216-B-16	200 East	T/SW (4)
Ditch	216-B-2-2	200 East	Steam Condensate, Cooling Water (4)
Ditch	216-S-16D	200 West	Steam Condensate, Cooling Water (6)
Ditch	216-U-11	200 West	PW (8)
Dry Well (11&12)	100 KW*1	100-KE/KW	Misc. (2)
Dry Well (11&12)	100 KE*1	100-KE/KW	Misc. (2)
French Drain	116-B-4	100-B/C	Decontamination Waste (2)
French Drain	116-F-10	100-F	RC (2)

TABLE 2-5. HANFORD INACTIVE WASTE SITES SORTED BY UNIT TYPE.
(Continued)

81 Priority Sites Recommended for Characterization.

Unit Type (12)	Site No. (1)	Area (12)	Waste Disposed
French Drain	116-H-3	100-H	DW (2)
French Drain	216-A-28	200 East	MLW (3)
French Drain	216-S-4	200 West	Steam Condensate, Cooling Water (6)
French Drain	216-U-3	200 West	T/SW (8)
French Drain	216-S-3	200 West	Steam Condensate, Cooling Water (6)
French Drain (11&12)	216-U-4B	200 West	PW (8)
French Drain (11&12)	216-U-4A	200 West	PW (8)
French Drain (12)	100 KW*2	100-KE/KW	Misc. (2)
French Drain (12)	100 KE*2	100-KE/KW	Misc. (2)
Pond	216-S-17	200 West	Steam Condensate, Cooling Water (6)
Pond	216-S-16P	200 West	Steam Condensate, Cooling Water (6)
Pond (11&12)	316-2	300 Area	PW and Lab Wastes (10)
Pond (11&12)	316-1	300 Area	PW and Lab Wastes (10)
Reverse Well	216-B-6	200 East	PW (4)
Reverse Well	216-B-5	200 East	T/SW (4)
Reverse Well	216-T-2	200 West	PW (7)
Reverse Well	216-Z-10	200 West	PW (9)
Reverse Well	216-T-3	200 West	MLW (7)
Reverse Well (11&12)	216-U-4	200 West	PW (8)
Trench	116-B-1	100-B/C	Reactor coolant (a) (2)
Trench	116-C-1	100-B/C	RC (a) (2)
Trench	116-DR-6	100-D/DR	RC (2)
Trench	116-DR-2	100-D/DR	RC (2)
Trench	116-DR-1	100-D/DR	RC (2)
Trench	116-D-1B	100-D/DR	DW (2)
Trench	116-F-1	100-F	DW (2)
Trench	116-F-2	100-F	RFE (2)
Trench	116-F-3	100-F	RFE (2)
Trench	116-F-6	100-F	RC (2)
Trench	116-F-9	100-F	Misc (2)
Trench	116-H-1	100-H	RFE (2)
Trench	116-H-2	100-H	RC (2)
Trench	116-K-2	100-KE/KW	Misc. Liquid Waste (3)
Trench	216-A-40	200 East	Steam Condensate, Cooling Water (3)
Trench	316-3	300 Area	PW and Lab Wastes (10)

References used in columns are given at the top of the column headings. The reference used in Unit Type is given at the column heading unless additional or different sources are listed in parenthesis for for a given site. References used for Waste Disposed are given in parenthesis for a site.

TABLE 2-6. HANFORD INACTIVE WASTE SITES SORTED BY WASTE DISPOSED.

81 Priority Sites Recommended for Characterization.

Waste Disposed	Site No. (1)	Area (12)	Unit Type (12)
Decontamination Waste (2)	116-B-4	100-B/C	French Drain
DW (2)	116-H-3	100-H	French Drain
DW (2)	116-F-1	100-F	Trench
DW (2)	116-D-1B	100-D/DR	Trench
Misc (2)	116-F-9	100-F	Trench
Misc. Liquid Waste (3)	116-K-2	100-KE/KW	Trench
Misc. (2)	100 KE*1	100-KE/KW	Dry Well (11&12)
Misc. (2)	116-KE-2	100-KE/KW	Crib
Misc. (2)	100 KW*1	100-KE/KW	Dry Well (11&12)
Misc. (2)	100 KE*2	100-KE/KW	French Drain (12)
Misc. (2)	100 KW*2	100-KE/KW	French Drain (12)
Misc. (2)	116-DR-7	100-D/DR	Crib
MLW (3)	216-A-27	200 East	Crib (11&12)
MLW (3)	216-A-28	200 East	French Drain
MLW (3)	216-A-4	200 East	Crib (11&12)
MLW (3)	216-A-36A	200 East	Crib
MLW (3)	216-A-7	200 East	Crib (12)
MLW (3)	216-A-6	200 East	Crib (12)
MLW (7)	216-T-3	200 West	Reverse Well
MLW (8)	216-U-1&2	200 West	Crib
PC (5)	216-C-10	200 East	Crib
PC (5)	216-C-1	200 East	Crib
PC (6)	216-S-1&2	200 West	Crib
PC (6)	216-S-7	200 West	Crib
PC (6)	216-S-9	200 West	Crib
PC (6)	216-S-21	200 West	Crib
PC (7)	216-T-19	200 West	Crib & Tile Field
Process Condensate (3)	216-A-5	200 East	Crib (12)
Process Waste (3)	216-A-9	200 East	Crib (12)
PW and Lab Wastes (10)	316-1	300 Area	Pond (11&12)
PW and Lab Wastes (10)	316-3	300 Area	Trench
PW and Lab Wastes (10)	316-2	300 Area	Pond (11&12)
PW (3)	216-A-21	200 East	Crib (11&12)
PW (4)	216-B-10A	200 East	Crib
PW (4)	216-B-6	200 East	Reverse Well
PW (6)	216-S-20	200 West	Crib
PW (7)	216-T-8	200 West	Crib
PW (7)	216-T-2	200 West	Reverse Well
PW (7)	216-T-28	200 West	Crib
PW (8)	216-U-4A	200 West	French Drain (11&12)
PW (8)	216-U-4B	200 West	French Drain (11&12)
PW (8)	216-U-11	200 West	Ditch
PW (8)	216-U-4	200 West	Reverse Well (11&12)
PW (9)	216-Z-7	200 West	Crib
PW (9)	216-Z-10	200 West	Reverse Well
PW (9)	216-Z-1&2	200 West	Crib

TABLE 2-6. HANFORD INACTIVE WASTE SITES SORTED BY WASTE DISPOSED. (Continued)

81 Priority Sites Recommended for Characterization.

Waste Disposed	Site No. (1)	Area (12)	Unit Type (12)
RC (2)	116-K-1	100-KE/KW	Crib
RC (2)	116-H-2	100-H	Trench
RC (2)	116-DR-2	100-D/DR	Trench
RC (2)	116-DR-6	100-D/DR	Trench
RC (2)	116-F-6	100-F	Trench
RC (2)	116-F-10	100-F	French Drain
RC (2)	116-DR-1	100-D/DR	Trench
RC (a) (2)	116-C-1	100-B/C	Trench
Reactor coolant (a) (2)	116-B-1	100-B/C	Trench
RFE (2)	116-F-2	100-F	Trench
RFE (2)	116-H-1	100-H	Trench
RFE (2)	116-F-3	100-F	Trench
Ruptured Fuel Effluent (2)	116-C-2	100-B/C	Crib
Steam Condensate, Cooling Water (3)	216-A-40	200 East	Trench
Steam Condensate, Cooling Water (4)	216-B-2-2	200 East	Ditch
Steam Condensate, Cooling Water (6)	216-S-16D	200 West	Ditch
Steam Condensate, Cooling Water (6)	216-S-6	200 West	Crib
Steam Condensate, Cooling Water (6)	216-S-16P	200 West	Pond
Steam Condensate, Cooling Water (6)	216-S-5	200 West	Crib
Steam Condensate, Cooling Water (6)	216-S-3	200 West	French Drain
Steam Condensate, Cooling Water (6)	216-S-17	200 West	Pond
Steam Condensate, Cooling Water (6)	216-S-4	200 West	French Drain
Tank/Scavenged Waste (3)	216-A-24	200 East	Crib (12)
T/SW (4)	216-B-48	200 East	Crib (12)
T/SW (4)	216-B-45	200 East	Crib (12)
T/SW (4)	216-B-49	200 East	Crib (12)
T/SW (4)	216-B-5	200 East	Reverse Well
T/SW (4)	216-B-50	200 East	Crib (12)
T/SW (4)	216-B-16	200 East	Crib (12)
T/SW (4)	216-B-44	200 East	Crib (12)
T/SW (4)	216-B-46	200 East	Crib (12)
T/SW (4)	216-B-7 A&B	200 East	Crib
T/SW (4)	216-B-43	200 East	Crib
T/SW (7)	216-T-7	200 West	Crib & Tile Field
T/SW (8)	216-U-3	200 West	French Drain

References used in columns one and two are given at the column headings. The reference used in column three, Unit Type, is given at the column heading unless additional, or different, sources are listed in parenthesis for for a given site. References used for column four, Waste Disposed, are given in parenthesis for a site.

The criteria of importance in establishing whether a site is a potential CERCLA site or a RCRA 3004(u) site are presented in Table 2-7. In addition, the table provides a checklist for the information that is important to determining if there is a need for remediation. The matrix is divided into two sets of criteria, one set appropriate to CERCLA sites and one appropriate to RCRA 3004(u) sites. If a site meets all the criteria under the CERCLA listing, remedial action is required under 40 CFR 300. This remedial action may involve the collection of additional data to characterize the site, and/or the selection of a remedial alternative. Sites meeting only some of the criteria may be potential 3004(u) sites.

In the CERCLA process, sites are screened to determine if they have potential for being included on the National Priority List (NPL). This screening, using the Hazard Ranking System (HRS), or the Modified Hazard Ranking System (mHRS) in the case of sites with contamination from radionuclides, evaluates sites according to criteria contained in the National Oil and Hazardous Substances Contingency plan (NCP). In this way, sites are scored on their relative potential for releases that pose a hazard to health or the environment. Sites which score higher than 28.5 are candidates for the National Priority List (NPL).

The scoring is initially conducted during the Preliminary Assessment (PA) (DOE Phase I). Data collected in the PA are evaluated and the HRS (or mHRS) system is applied. The resulting score is a preliminary determination of the relative hazard/threat posed by the site. A score less than 28.5 is generally considered to pose no threat under the CERCLA program.

The HRS/mHRS considers a number of criteria in developing the relative score. These criteria include:

1. Principal injury, radiation, and exposure hazards

   - Injestion of contaminated groundwater or surface water
   - Direct contact with wastes
   - Fire and explosion

TABLE 2.7. CRITERIA APPLICABLE TO DETERMINING NEED FOR REMEDIATION - A FORM FOR SITE EVALUATION

Site	Release of Hazardous Material	Site not Used Since 11/19/80	HRS or mHRS score >28.5	Unit Used to Manage Solid Waste	Unit Contains Hazardous Constituents	Likely to have a Future Release	Likely to have had a Past Release

Note: a. A site requires Remedial Action under CERCLA if the site has an affirmative determination under 1, 2 and 3. If only affirmative under 1 and 2 it may still be a potential CERCLA site, but not one requiring remediation under 40 CFR 300.

b. A site which is not a CERCLA site with an affirmative determination for 4 and 5; and an affirmative finding for 1, 6, or 7 will require some type of remediation under corrective action regulation being currently developed by U.S. EPA.

- o Migration to contaminate drinking water or other human use resources, or to result in direct contact
- o Waste characteristics, toxicity, and persistence
- o Radioactive materials.

2. Physical security and safeguard requirements

- o Accessibility to hazardous substances
- o Containment of wastes and contamination
- o Proximity to populations and resources

3. Site location

- o Environmental setting (depth to aquifer of concern, unsaturated zone permeability, slope, surrounding terrain, distance to surface water)
- o Land use and resource use
- o Proximity to populations, sensitive environments, and resources

4. Risk and Natural forces

- o Migration along surface water, groundwater, and air routes to expose populations or impact natural resources
- o Chemical toxicity and radioactive materials.

The only criteria addressing artificial forces are containment and fire and explosion. The HRS/mHRS does not address regulations, codes, standards, and guides. However, these issues as well as many of the criteria addressed above are considered further under the selection of remediation. The CERCLA/SARA identify many of these criteria as the bases for assessment of remedial alternatives during the selection process.

The data used in the HRS process usually varies in quality from site to site and may require that some assumptions be made regarding site conditions, waste constituents, migration pathways, and potential receptors in order to develop a site score. When data quality is poor, the resulting score may be an artifact of the assumptions rather than a reasonable representation of the contamination situation. Under such circumstances, additional information (including limited sampling) may be conducted as part of the CERCLA site inspection (DOE Phase IIa) in order to confirm important assumptions. Site scores may then be reevaluated based on the new data. As a result, site scores may change and additional sites may be removed from consideration. Again, the need for remediation is determined by a site score greater than 28.5.

With the passage of the Superfund Amendments and Reauthorization Act of 1986 (SARA), all facilities, including federal facilities, are required to undertake a Remedial Investigation/Feasibility Study (RI/FS) for sites which qualify for the NPL (Scores greater than 28.5).

2.2 APPROACH TO DEVELOPING SITE CHARACTERIZATION METHODOLOGY

Requirements for characterizing the CERCLA sites derive from CERCLA and SARA regulations, particularly "applicable or relevant and appropriate regulations" (ARARs, see report) and the need for collecting site-specific information for ensuring that implemented remedial actions are capable of achieving and maintaining ARARs. Such information includes identification and quantification of contaminants (i.e., the source), identification and characterization of probable pathways of transport, and identification and characterization of probable receptors. This information is used to define the site and the problems caused by the site and to predict the effects of potential remedial action alternatives. Site-specific information is generally obtained through the use of multiple investigation techniques. The approach to developing the site characterization methodology integrates regulatory requirements, contaminant transport pathways of concern, and potentially applicable site characterization methods to establish a framework for planning the investigation of each of the CERCLA sites. The steps involved in developing the approach are summarized in the following subsections.

The methodology for characterizing the CERCLA sites is designed to provide necessary and sufficient data to allow definition of the sites and their problems; and to support the evaluation, selection, and implementation of appropriate remedial actions for meeting regulatory requirements and providing protection of public health and the environment. The methodology, which will guide and focus the development of site characterization plans consists of the following steps:

- Step 1 - Identify requirements for site characterization. "Requirements", as used herein, refers to the regulatory requirements of EPA and the State of Washington and directives issued by DOE. Regulations and directives have been evaluated in this Task for their applicability to the Hanford CERCLA sites; the specific requirements in each regulation will be identified in the preparation of site characterization plans.

- Step 2 - Identify pathways for each site. "Pathways" refers to the route(s) that contaminants could follow in transport from the source (the site) to receptors (human populations and/or plant and animal species). Pathways can consist of one or more environmental media. Potential pathways have been identified in this task for each site on using available information on the nature and environmental settings of the sites.

- Step 3 - Determine methods for characterizing sites. "Methods" refers to those activities that could be conducted to provide definition of the sites, the site problem, and the site setting. Site characterization methods are generally considered to consist of on-site investigation of the site using existing data and through the collection and evaluation of new data for sites for which relatively little data are available. Potentially applicable site investigation techniques have been identified in this task for the potential transport pathways.

During the site characterization activity information must be obtained on the following topics:

- Waste source -- physical and chemical aspects of the waste materials (solubility, persistence, quantity, toxicity) and the media in which they are contained.

- Geology -- structures influencing groundwater movement, geologic properties of aquifers and confining units (porosity, permeability, geochemistry).

- Groundwater -- direction and rate of flow, seasonal/temporal variations, aquifer properties, recharge/discharge areas.

- Surface Water -- drainage patterns, runoff, seasonal variations, sediment pathways.

- Pedology -- characteristics of surface soils and soils in the vadose zone, porosity, soil chemistry.

- Air -- climatic data, wind speed and direction.

- Public health -- demography, public use of groundwater surface water, and exposed animals/plants, contaminant toxicity.

- Plant and animal species -- bioaccumulation of contaminants, populations of plant/animal species.

2.2.1 Identification of Remedial Action Requirements

The site characterization process has three primary purposes. First, site characterization should define the nature and extent of contamination (waste type, concentration, and distribution). Second, it should allow data quality objectives (DQOs) to be refined. Finally, it should assess the need for treatability studies. This process is required for collection of data to determine the need for, and extent of, remedial action.

Since the information gathered in the remedial investigation is then used to proceed to the feasibility study, the process of selecting appropriate remedial action activities requires that the concentration and distribution of contaminants be determined. In order to accomplish this goal, it is necessary to identify the requirements as stated in Federal and State regulations and guidance. Table 2-8 identifies the specific regulations containing the requirements applicable to site characterization. In the matrix, the specific sections of each source which provides the requirement are noted. These sources contain very specific requirements which will be identified as part of the development of the site characterization plan.

2.2.2 Identification of Site-Specific Contaminant Transport Pathways of Concern

In order to identify appropriate investigation techniques for the CERCLA sites, the likely pathways of contaminant transport to be investigated must first be identified. Available information on waste disposal methods, the types of wastes disposed, and the environmental settings of the locations of the sites were evaluated and possible pathways of transport were identified for each site. The pathways, which include media that are both direct and intermediate pathways to receptors, that were considered include:

- Groundwater
- Surface soils
- Vadose zone
- Air
- Surface water
- Sediments
- Waste source
- Plant uptake
- Animal uptake

2.3 SITE CHARACTERIZATION METHODOLOGY

The primary purpose of site characterization is to define the sites, site problems, and settings to support the development, screening, evaluation and selection of remedial action alternatives in the feasibility

TABLE 2-8. THE REMEDIAL ACTION REQUIREMENTS TO SUPPORT THE SITE CHARACTERIZATION METHODOLOGY FOR CERCLA SITES

	Sources for Remedial Action Requirements				
	Federal			State	
Remedial Action Activities	Regulations	SARA (PL99-962)	Policy/Guidance/ Orders	Regulations	Policy/Guidance
Remedial Investigation	40 CFR 300.67	Title 1 Sec.120	DOE 5480.14 EPA Directive 9355.0-19		
Site Characterization			DOE 5480.14		--
Pathways Characterization				WAC 173-304-490	--
Receptors Characterization					
Problem Definition					
Feasibility Study	40 CFR 300.68		DOE 5480.14		
Cleanup Criteria	40 CFR 116.4 117.3 141.11 141.12 141.15 141.16 141.50 141.61 143.3	Title 1 Sec.120	EPA Directive 9355.0-19	WAC 173-201 173-303 173-304 -9901	--
Evaluation factors	10 CFR 61.41- 61.44	Title 1 Sec.121			--
Cost-effectiveness		Title 1 Sec.121			--
Selection/documentation	40 CFR 300.70 300.69				--
Implementation					
Permitting		Title 1 Sec.121		WAC 173-216 173-303	-- --
Compliance with other laws	10 CFR 61.41 61.43 61.44			173-304	--

study and the implementation of the selected remedial action. Site information should be sufficient to determine the necessity, extent, and feasibility of remedial actions, evaluate costs of potential remedial action alternatives, allow for the prioritization of sites based on threat to human health and the environment, and perform any required risk assessments.

The site characterization methodology consists of evaluation of existing data and collection and evaluation of additional data. Additional data may need to be collected and evaluated in more than one round in order to provide data on the sites and site problems sufficient to allow the evaluation, selection, and implementation of remedial actions.

2.3.1 Evaluation of Existing Data

The first step in site characterization is to locate, compile, and evaluate data available for each site. Investigators will, to the extent allowed by the available data, compile a site description, history, and chronology of significant events that will aid in planning subsequent detailed characterization efforts. Existing data will be evaluated to determine the following:

- Locations, quantities, concentrations, and characteristics of hazardous waste disposed at each site. The investigators will evaluate results of previous sampling, results of chemical and physical testing, and records of disposal practices and operating procedures to characterize the properties of the hazardous waste disposed at each site.

- Pathways and extent of contaminant migration. The investigators will evaluate existing monitoring data (water, soil, sediment, air, biota) and regional and site-specific information pertaining to site geology, pedology, hydrogeology, meteorology, and biology to identify the pathways and extent of contaminant migration at the site.

- Human and environmental receptors. The investigators will evaluate demographic and land use information, surface water/groundwater use adjacent and downstream/downgradient of the site, regional and site ecology, and the results of biological testing to identify the human populations and environmental species potentially impacted by the site.

- The impact of the site on human and environmental receptors. The investigators will evaluate the site with respect to waste characteristics and probable transport pathways to determine the site's impact on humans and the environment.

- Factors that must be considered in future field investigations (e.g., site-specific health and safety requirements, limitations in conducting field activities, extreme weather, or difficult terrain).

This information to characterize CERCLA sites can be grouped into four general categories:

1. Environmental Setting - These data characterize the regional aspects of the area that impact the movement of contaminants from the site and the potential of exposure to them. They include topography, regional hydrologic characteristics, meteorology, biota, soil type, among others. Secondary data sources contain sufficient information to define the environmental setting of the Hanford site.

2. Hazardous and Radioactive Substances - These data characterize the wastes disposed at the sites and include chemical constituents, concentrations, and the nature of the depositories. Secondary data sources provide some of this information at Hanford.

3. Environmental Concentrations - These data define the extent, direction, and rate of migration of contaminants in the ground, water, and air. Extensive sampling will be needed to develop a sufficient data base of environmental concentrations at the Hanford site.

4. Potential Impacts on Receptions - These data describe the human population likely to be exposed to contaminants and the pathways

through which the exposure is likely to occur. Available demographic information and the findings from the environmental sampling activities will provide the basis for making these assessments at Hanford.

The extent and completeness of the available data to characterize the site is discussed below:

2.3.1.1 Environmental Setting

The information needed to understand the environmental setting of the Hanford Reservation and the surrounding area is assessed in this subsection.

The information required for the environmental setting must be sufficient to allow an understanding of the factors impacting the source of contamination to the potential receptor; and the movement of the contaminant through the environment. The documents listed below and a few supplemental reports are sufficient to define the environmental setting. (It should be noted that information for the 200 Area is more extensive than for the other Hanford Reservation areas.)

Regional geology is essential to a discussion of the environmental setting. This includes information on the stratigraphy and structure of the area along with information regarding seismicity and tectonics. Also included should be information about geomorphology, geochemistry and soils.

Another important aspect of the regional setting is geohydrologic and hydrologic conditions. This discussion should address surface water conditions and characteristics, groundwater flow, pathways and bedrock structures and sources of drinking water including information dealing with confined and unconfined aquifers and vadose zone characteristics.

Information on meteorological and air quality conditions are also key elements of this section of the site characterization. Within this section wind direction and speed should be addressed along with the ranges of temperature and humidity, precipitation and dispersion conditions.

Terrestrial and aquatic ecosystems also have a role in the regional discussion. These include environmental quality, agricultural and other land use, vegetation and radiological conditions. Discussion should also include area mammals, birds, reptiles, insects, amphibians, and all threatened and endangered species.

Additionally, a discussion of natural resources such as archaeological, cultural and historical resources should be included. A discussion of population density and distribution and possible socioeconomic conditions may also be included.

For the Hanford Reservation and the surrounding area, information of the kind described above can be found in four documents.

- U.S. Department of Energy (U.S. DOE). Draft Phase I Installation Assessment of Inactive Waste-Disposal Sites at Hanford. Volume I. Methods and Analysis. Washington, D.C. July 1986.

- United States Energy Research and Development Administration. Final Environmental Statement - Waste Management Operations Hanford - Reservation, Richland, Washington. ERDA-1538 UC70. December 1975.

- U.S. Department of Energy. Environmental Assessment Reference Repository Location Hanford Site Washington. Volume I of 3. DOE/RW-0070. Washington, D.C. May 1986.

- U.S. Department of Energy. Environmental Assessment Reference Repository Location Hanford Site Washington. Volume II of 3. DOE/RW-0070. Washington, D.C. May 1986.

2.3.1.2 Hazardous and Radioactive Substances

Chemical and radioactive waste disposal inventories from documented sources are available for each source within the 100, 200 and 300 Areas.

There are indications, however, that undocumented release to the sites also took place. Key constituents and concentrations of the chemicals and radionuclides are given in these documented inventories. Volumes of liquid waste disposed of at the disposal sites are listed along with the nature of the disposal site. Radioactive materials releases and unplanned releases (i.e., spills, etc.) information is present in the documents that were reviewed under this task. In addition, well logs are needed for existing wells. The availability of this information could not be determined.

The following documents contain chemical and radionuclide inventories:

- U.S. Department of Energy (U.S. DOE). Draft Phase I Installation Assessment of Inactive Waste-Disposal Sites at Hanford. Volume I. Methods and Analysis. Washington, D.C. July 1986.

- U.S. Department of Energy (U.S. DOE). Draft Phase I Installation Assessment of Inactive Waste-Disposal Sites at Hanford. Volume II. HISS Data base. Washington, D.C. July 1986.

- United States Energy Research and Development Administration. Final Environmental Statement - Waste Management Operations Hanford - Reservation, Richland, Washington. ERDA-1538 UC70. December 1975.

The 200 Areas of the Hanford Reservation are better documented than either the 100 or the 300 Areas.

2.3.1.3 Environmental Concentrations

Table 2-9 lists the data needed to determine the type and extent of contamination at the Hanford site. The table also evaluates the utility of the environmental data available from past studies to make these determinations. The evaluations are based on a thorough examination of the environmental data reported in the various studies conducted to date. The evaluations assess whether:

TABLE 2-9. ADEQUACY OF PATHWAY CHARACTERISTICS DATA

GENERAL PATHWAY CHARACTERISTICS	DATA ADEQUACY 100 Area	200 Area	300 Area	PURPOSE OR RATIONALE
Groundwater				
Unconfined Aquifer	**Groundwater Unconfined Aquifer**			
Boundaries and Location	3	3	3	Determine quantity of subsurface water, extent of aquifer confinement
Aquifer Hydraulics	2	2	1	Identify flow rate and direction and contaminant pathway and rate
Hydrochemistry	1	2	2	
Contaminants	2	2	2	Determine contaminant plume to remediate
Stratigraphy	1	3	2	Determine the aquifers geometry, aquifer recharge and discharge; ground-water quality, movement, productivity and occurance
Structure	3	3	1	Determine barriers or controls on the natural flow
Recharge/Discharge	1	3	2	Determine gains and losses of water into the aquifer's total quantity of water
Well Data	2	2	2	Determine aquifer properties for the ease of movement, to store water and to access remediation and detect the spatial extent of contamination.
Confined Aquifer	**Groundwater Confined Aquifer**			
Boundary and Location	2	3	2	
Aquifer Hydraulics	1	1	2	
Hydrochemistry	1	1	3	
Contaminant	2	2	1	
Stratigraphy	2	2	2	
Structure	3	3	3	
Recharge/Discharge	1	1	1	
Well Data	2	2	1	
Surface Soils	**Surface Soils**			
Spatial Distribution	3	3		
Hydraulics	1	2	1	Determine spatial extent of contaminant resulting from infiltration of transported contaminant resulting from precipitation, spills, airborne particulates or overload flows
Chemistry	1	2	1	Surface soil is the first soil horizon to vadose zone (see vadose zone for similarities)
Podology	1	2	2	
Biology	1	1	1	
Contaminants in Surface Soil Environment	2	2	1	

TABLE 2-9. **ADEQUACY OF PATHWAY CHARACTERISTICS DATA (Continued)**

GENERAL PATHWAY CHARACTERISTICS	DATA ADEQUACY			PURPOSE OR RATIONALE
	100 Area	200 Area	300 Area	
Vadose Zone		**Vadose Zone**		
Unsaturated Hydraulics	1	1	1	Estimate the transport of contaminant through soil matrix
Unsaturated Zone Chemistry	1	1	1	Predict mobility of contaminant through the soil and determine environmental setting for chemical degradation for by-products
Podology	2	2	1	Determine the effects of physical properties on infiltration, retardation and attenuation of contaminant species
Biology	1	1	1	Understand the biological degradation by-products
Soil Gas	1	1	1	
Contaminants	2	2	1	Determine path of migration and contaminant type.
Air		**Air**		
Meterological Parameters	2	2	2	Determine contributions from other dispersion of contaminants from other sources, weather variation and outcome on remediation, defining recharge and evapotranspiration
Weather Extremes	2	2	2	
Surface Water		**Surface Water**		
River				Determine the degree of contaminant transport and quantity of contaminants
Hydraulics/Geometry	1	-	1	
Chemistry	1	-	1	
Ground Water - Surface Water Relationships				Evaluate for contaminant pathway cycling
Location/Quantities	1	1	1	
Chemistry	1	1	1	Determine water/sediment partitioning and capacity for water to assimilate contaminant
Drainage				
Location/Quantities	2	2	2	Determine if chemical flow or overload flow will remove contaminants offsite or on.
Sediments		**Sediments**		
Physical Characteristics	1	1	1	
Chemistry	1	1	1	Determine water/sediment partitioning of contaminants.
Mineralogy	1	1	1	
Contaminants	1	1	1	

Footnotes
(1) Complete sampling effort required resulting from an absence of information.
(2) Moderate sampling effort required to supplement the existing data.
(3) No further sampling effort required because sufficient data exists that is diagnostically useful.
(0) = 3

1) Little or no data is available and a complete sampling effort is needed

2) Sampling is needed to supplement the existing data base

3) Enough quality data is already available and no further sampling is needed.

This evaluation provides a basis for developing in the following section the sampling recommendations for generating the additional information to fully characterize the environmental condition of the sites.

2.3.1.4 Potential Impacts on Receptors

A quantitative risk assessment requires environmental, toxicological and exposure information. This information is used to assess the degree of degradation in environmental quality and to determine the potential risk to receptors in the environment.

Some information is available to help make these assessments. This information shows that potential receptors may eventually be impacted by contaminants from Hanford and a comprehensive risk assessment will probably be required.

The following documents contain the most extensive data:

- U.S. Department of Energy (U.S. DOE). Draft Phase I Installation Assessment of Inactive Waste-Disposal Sites at Hanford. Volume I. Methods and Analysis. Washington, D.C. July 1986.

- U.S. Department of Energy (U.S. DOE), Richland Operations Office. Hanford Environmental Management Program Plan. Richland, Washington. November 1986.

o United States Energy Research and Development Administration. Final Environmental Statement - Waste Management Operations Hanford - Reservation, Richland, Washington. ERDA-1538 UC70. December 1975.

o U.S. Department of Energy. Environmental Assessment Reference Repository Location Hanford Site Washington. Volume I of 3. DOE/RW-0070. Washington, D.C. May 1986.

o U.S. Department of Energy. Environmental Assessment Reference Repository Location Hanford Site Washington. Volume II of 3. DOE/RW-0070. Washington, D.C. May 1986.

This information, plus the results from the sampling activities should provide sufficient data to conduct a quantitative risk assessment of the 100, 200 and 300 Areas.

2.3.2 Collection and Evaluation of Additional Data

If existing information is not sufficient to meet the data needs of the feasibility study, additional information must be obtained. The collection and evaluation of additional data will serve two purposes. First, additional data will verify the information gathered from existing sources (e.g., pathways, receptors, contaminants of concern). Second, additional investigations will provide an opportunity to collect data that will support the development and screening of remedial action alternatives.

2.3.2.1 Identification of Potentially Applicable Site Characterization Methods.

Site investigation methods appropriate to the environmental setting of the CERCLA sites and the identified potential pathways of concern were identified for consideration in the development of site-specific characterization plans. The methods, each of which was determined to be potentially applicable to the sites, include:

- o Soil borings and sampling and analysis/testing of the soil column.

- o Test pit excavation, direct observation of subsurface conditions, and sampling and analysis/testing of excavated material.

- o Groundwater monitoring well installation,sampling and analysis of groundwater, monitoring groundwater levels.

- o Piezometer installation and monitoring groundwater levels.

- o Probe driving and sampling and analysis of soil gases in the vadose zone.

- o Sampling and analysis/testing of biota (terrestial and aquatic plants and animals).

- o Sampling and analysis of air for emission of gases and/or volatile compounds.

- o Grab sampling and analysis of wastes, surface soils, surface water, and/or sediments.

- o Remote sensing (i.e., geophysical surveys) of subsurface conditions, such as geologic anomalies and strata, contaminant distribution, and locations of underground structures:

  - ground-penetrating radar
  - electromagnetic induction
  - earth resistivity
  - borehole resistivity
  - borehole conductivity.

- o Aquifer tests for hydrogeologic properties such as transmissivity, storativity, and drawdown.

- o Modeling of groundwater flow to interpolate/extrapolate within/beyond areas of available data and to predict the effects of imposed subsurface conditions.

- o Aerial photography for identifying surface anomalies and historic surface changes (by comparison) and for supporting mapping of surface conditions.

- o Infrared imagery for identifying areas of vegetative stress and/or contamination.

These site characterization methods are the tools that are commonly used for defining the CERCLA sites and corresponding environmental problems. The applicability of these methods to characterizing and determining the presence and transport of contaminants in the each of the pathways of concern is shown in Table 2-10.

Each medium in the column heading of Table 2-10 is a potential migration pathway for both radioactive and hazardous chemical contaminants. The amount and nature of the contaminants present in these media need to be characterized in order to be able to assess the extent of existing contamination and the potential for future transport through that pathway. Chemical and radioactive analyses performed on samples obtained by the methods flagged by asterisks in the table, along with physical (i.e., hydrologic and structural) information obtained by using the other methods, provide the data necessary to perform this evaluation.

2.3.2.2 Compliance of Site Characterization Methods with Environmental Regulations

The sampling methods required for characterization are selected to satisfy the requirements of the regulations identified in Table 2-8. These regulations sometimes specify the methods to be employed, and otherwise allow the use of generally accepted and appropriate techniques. Table 2-11 presents a comparison of the identified site characterization methods with the applicable regulations.

TABLE 2-10. POTENTIALLY APPLICABLE SITE CHARACTERIZATION METHODS

Characterization Methods	Potential Environmental Pathways: Groundwater	Surface Soil	Vadose Zone	Air	Surface Water	Sediments	Waste Source	Plant Uptake	Animal Uptake
Borings*		X	X				X		
Test Pits*		X	X				X		
Well Installation/Sampling*	X	X	X				X		
Piezometer Installation*	X								
Hand Auger Samples*		X							
Soil Gas*	X	X	X						
Biological Samples*								X	X
Air Monitoring*				X					
Grab Sample Collection*		X			X	X	X		
Geophysical Surveys									
Ground Penetrating Radar	X		X				X		
Electromagnetic Induction	X		X				X		
Earth Resistivity	X		X				X		
Borehole Methods									
Resistivity	X		X				X		
Conductivity	X		X				X		
Aquifer Tests	X								
Models	X	X	X	X	X	X	X	X	X
Aerial Photography		X			X			X	X
Infrared Imagery					X			X	

* Samples obtained using these methods can be analyzed for a suite of organic chemical, inorganic chemical and radioactive contaminants.

TABLE 2-11. COMPLIANCE OF SITE CHARACTERIZATION METHODS WITH ENVIRONMENTAL REGULATIONS

Characterization Methods	Environmental Regulations: Federal Regulations	Federal Guidance	State Regulations	Local
Drilling/sampling/ analysis	40 CFR 264.90 40 CFR 147.2400	RCRA Groundwater Monitoring		---
Well installation/ sampling analysis	40 CFR 141.23 40 CFR 141.24 40 CFR 141.25	Technical Enforcement Guidance Document	WAC173-304-490 173-160	---
Hand auger sampling/ analysis				---
Soil gas sampling/ analysis				---
Geophysical surveys				---

2.4 PLAN FOR CONDUCTING THE SITE CHARACTERIZATION

The plan presented here is designed to identify contaminants and determine the migration rates through the eight pathways; groundwater, vadose zone, surface soils, air, surface water, sediments, direct contact plant uptake, and animal uptake for purposes of developing estimates of the cost and time required to conduct the Remedial Investigation required of the CERCLA RI/FS process. Of these, the vadose zone and the groundwater are generally the priority concerns for most of the CERCLA sites. In characterizing these pathways, the following nature of the contamination should be addressed:

- o Confirmation of releases of contaminants and evaluation of potential for future releases
- o Delineation of the horizontal and vertical extent of contaminant plumes and effects of the media characteristics on contaminant migration
- o Determination of existing surface and groundwater quality and characterization of chemical nature of contaminant plume
- o Determination of the direction and rate of contaminant movement.

A plan has been developed for each of the three areas (100, 200, and 300 Areas). Each plan specifies a sampling program for the CERCLA sources in the area (81 sources in total). A highly structured sampling program is being proposed to address each of the environmental pathways for each source. The characterization plans are designed to be implemented in a series of stages, with a maximum of five stages possible within an area. The main objective of this approach is to systematically build a data base for each site. These five stages are:

- Stage I: Review Existing Measurements Data
- Stage II: Conduct Proximity Contaminant Survey and Evaluation for the Unconfined Aquifer
- Stage III: Conduct Distal Contaminant Survey and Evaluation for the Unconfined Aquifer
- Stage IV: Conduct Confined Aquifer Survey and Evaluation
- Stage V: Conduct Sampling of Surface Water and Sediments and Final Data Evaluation

Stage I: Review Existing Data

The first stage reviews and evaluates existing environmental measurements data not available to SAIC at the time that this characterization plan was prepared.

Stages II and III: Proximity and Distal Surveys

The second and third stages provide the basis to verify and understand the types of chemicals and radionuclides resulting from the waste disposal at the sites impacting the uppermost aquifer. The second stage directs its efforts toward identifying contaminants residing in the immediate proximity of the source. The third stage addresses the lateral and horizontal extent of contamination and determines which contaminants have migrated. Stages II and III tasks are designed to investigate the geological and hydrogeological (including soil and vadose zone) conditions.

Geologic Investigations

The main purpose of the geologic investigation is to describe the geologic conditions that govern the movement of contaminants from the disposal sites. These goals will be met by reviewing and reevaluating available geologic data previously developed for the Hanford site complimented by detailed geological and geophysical logging of monitoring wells boreholes. A surface geophysical assessment around the site will also be made. This assessment will aid in the locating of new monitoring wells and in the definition of the contaminant plumes.

The review and reevaluation of previously developed geologic data will be included. These data, along with site construction records, will be used to confirm the accuracy of existing site geologic maps, construct appropriate cross-sections and fence diagrams, and to correlate data between separate site investigations. These efforts are expected to reveal the geologic conditions or other factors most likely to be responsible for current or future contaminant releases.

The review and reevaluation effort discussed above will help guide both the geophysical investigation and the final site selection for new borings for monitoring well installation. These investigative efforts are expected to identify the geologic factors governing the movement of contaminants from the sites into and through the groundwater and soil pathways.

Hydrogeologic and Chemical Investigations

In conjunction with the geologic investigations, hydrogeologic and hydrochemical investigations will be conducted. These investigations focus on groundwater movement and contaminant migration within the unconfined and confined aquifers. This process will begin with a thorough review of existing hydrogeologic and groundwater monitoring data. Validated monitoring data will be computerized and organized into data management basis. This will allow rapid evaluation of the data and development of a thorough evaluation of the pathway and evaluation of existing and historic potentiometric surface maps, and isocontours of geophysical and hydrochemical data. The results of this effort will be used to finalize the number and locations of new monitoring wells. Samples from all wells will undergo a complete chemical characterization.

Stage IV: Conduct Confined Aquifer Survey

Stage IV's objective is to assess the viability of vertical migration of contaminants into the confined aquifer and the interbeds. Although extensive examination of the Saddle Mountain basalts has been conducted by the Department of Energy and Rockwell, no information exists on contamination migration directly under the areas on which the sites source units exist. The tasks under this stage are similar to the media investigations discussed in Stages II and III.

Stage V: Surface Water and Sediment Sampling

Stage V evaluates the surface water, sediments, and animal contamination pathways. These are accomplished by collecting water and sediment samples from the Columbia River and conducting bioassays of resident species from the 100 Area to three miles below the 300 Area contaminant plume. A complete water quality sampling would follow the completion of the entire area's monitoring well installations.

Existing river monitoring stations and new river and river sediment sampling stations will be established and used to characterize the point of contaminant existence and contaminant migration down the river. Characterization of all potential contaminants in the surface water and bottom sediments will be conducted. Results of these analyses will show if the sites are contributing to surface water contamination and if contamination is found, will be compared to the results of groundwater analyses to give an indication of the likely route being followed by the contaminants.

The climate of this region of Washington State places some constraints on evaluating this potential contaminant pathway since stream flow in the vicinity of the Hanford site is ephemeral Nonetheless, nonflowing artificial and natural stream channels, gullies, and flowing seep will be located for sampling. An attempt will also be made to establish site-specific and local drainage patterns across the surface of the Hanford site.

As part of the technical approach in characterizing potential contaminants in the surface water and stream sediments, a revised water balance will be conducted for the site area to examine the interrelationships between groundwater and surface water. This water balance will allow for a determination of potential for the site affecting surface water quality.

Proposed Sampling Program

Tables 2-12 through 2-15 are matrices summarizing the sampling needs in the proposed characterization plans. Each matrix organization relates each area's sources to the pathways by means of a stage activated sampling regime. Tables 2-12, 2-13, and 2-14 discuss the unconfined aquifer's sampling efforts and Table 2-15 discusses the confined aquifer's sampling efforts.

These three tables demonstrate how the evaluation of staged sampling will provide the information to eliminate the deficiencies identified in Table 2-9. These matrices provide the groundwork to prepare the cost estimates and scheduling on a source(s) basis. With this in mind, Table 2-6 compiles the staged sampling needs for the 100, 200, and 300 Areas on an area basis.

Tables 2-12 through 2-14 are tables which identify by area the individual sampling needs. Their needs include the number of samples, soil borings, lysimeters, and monitoring wells along with the types of monitoring wells and samples to be taken for the 100, 200, and 300 Areas of the Hanford Reservation.

Table 2-16 is a summary table which identifies the number of monitoring wells samples, grab samples, lysimeter samples, soil boring samples, and random sediment and river sediment samples for each of the three CERCLA areas of the Hanford Reservation. This table is derived from Tables 2-12, 2-13, and 2-14.

TABLE 2-12 **Summary of Sampling Needs for the 100 Area Sources**

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	100 B/C Area: Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
116-B-1	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 10 borings sampled every 5 feet to water level. 188 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-B-4	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 150 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-C-1	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 150 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		

TABLE 2-12 **Summary of Sampling Needs for the 100 Area Sources**

Pathway / Source	100 B/C Area							
	Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
116-C-2	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 20 borings sampled every 5 feet to water level. 376 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples	-	

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

TABLE 2-12 **Summary of Sampling Needs for the 100 Area Sources**

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	100 H Area: Groundwater	Surface Soil	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
116-H-1	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 10 sampled every 5 feet to water level. 84 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-H-2	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 10 sampled every 5 feet to water level. 84 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-H-3	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 sampled every 5 feet to water level. 67 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		

TABLE 2-12 Summary of Sampling Needs for the 100 Area Sources

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	100 D/DR Area: Groundwater	Surface Soil	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
116-DR-1	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 10 borings sampled every 5 feet to water level. 166 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-DR-2	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 10 borings sampled every 5 feet to water level. 166 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-DR-1B	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 7 borings sampled every 5 feet to water level. 116 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		

Pathway / Source	Groundwater	Surface Soil	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
100 D/DR Area								
116-DR-6	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 133 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples	-	
116-DR-7	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 133 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Sources	100 F Area: Groundwater	Surface Soil	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
116-F-1	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 2 cluster (3 depths) lysimeters ... Soil Borings 40 borings sampled every 5 feet to water level. 400 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-F-2	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 13 borings sampled every 5 feet to water level. 130 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-F-3	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 10 borings sampled every 5 feet to water level. 100 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		

100 F Area								
Pathway / Sources	Groundwater	Surface Soil	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
I (2 sources) 116-F-6 116-F-10	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 2 cluster (3 depths) lysimeter ... Soil Borings 13 borings sampled every 5 feet to water level. 130 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-F-9	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 18 borings sampled every 5 feet to water level. 180 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

TABLE 2-12

Pathway / Source	100 KE/KW Area							
	Groundwater	Surface Soil	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
I (2 sources) 100-KW*1 100-KW*2	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 10 sampled every 5 feet to water level. 144 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
II (2 sources) 100-KE*1 100-KE*2	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 sampled every 5 feet to water level. 115 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-K-1	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 sampled every 5 feet to water level. 115 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

TABLE 2-12 Summary of Sampling Needs for the 100 Area Sources

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	100 KE/KW Area							
	Groundwater	Surface Soil	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
116-K-2	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 sampled every 5 feet to water level. 115 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
116-KE-2	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 10 sampled every 5 feet to water level. 144 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		

TABLE 2-13 **Summary of Sampling Needs for the 200 Area Sources**

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	Groundwater (200 E Area)	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
I (7 sources) 216-B-43 216-B-44 216-B-45 216-B-46 216-B-48 216-B-49 216-B-50	Stage II & III Installation of 13 monitoring wells Stage V Water Quality 20 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 10 borings sampled every 5 feet to water level. 676 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
II (1 source) 216-B-7A&B	Stage II & III Installation of 5 monitoring wells Stage V Water Quality 8 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 541 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
III (1 source) 216-B-2-2	Stage II & III Installation of 5 monitoring wells Stage V Water Quality 8 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 541 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		

TABLE 2-13 **Summary of Sampling Needs for the 200 Area Sources**

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	200 E Area: Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
IV (1 source) 216-B-5	Stage II & III Installation of 6 monitoring wells; Stage V Water Quality 9 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 6 borings sampled every 5 feet to water level. 406 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
V (2 sources) 216-B-10-A 216-B-6	Stage II & III Installation of 7 monitoring wells; Stage V Water Quality 11 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 10 borings sampled every 5 feet to water level. 676 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
VI (2 sources) 216-C-1 216-C-10	Stage II & III Installation of 5 monitoring wells; Stage V Water Quality 8 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 12 borings sampled every 5 feet to water level. 811 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		

200 E Area								
Pathway / Source	Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
VII (1 source) 216-B-16	Stage II & III Installation of 5 monitoring wells Stage V Water Quality 8 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 541 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples	-	
VIII (1 source) 216-A-40	Stage II & III Installation of 5 monitoring wells Stage V Water Quality 8 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 541 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
IX (1 source) 216-A-24	Stage II & III Installation of 5 monitoring wells Stage V Water Quality 8 Samples		Stage II & III Installation 2 cluster (3 depths) lysimeters ... Soil Borings 12 borings sampled every 5 feet to water level. 811 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

TABLE 2-13 **Summary of Sampling Needs for the 200 Area Sources**

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	200 E Area: Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
X (1 source) 216-A-9	Stage II & III Installation of 5 monitoring wells Stage V Water Quality 8 Samples		Stage II & III Installation 2 cluster (3 depths) lysimeters ... Soil Borings 12 borings sampled every 5 feet to water level. 811 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
XI (1 source) 216-A-7	Stage II & III Installation of 5 monitoring wells Stage V Water Quality 8 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 4 borings sampled every 5 feet to water level. 270 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
XII (1 source) 216-A-28	Stage II & III Installation of 5 monitoring wells Stage V Water Quality 8 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 4 borings sampled every 5 feet to water level. 270 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		

Pathway / Source	200 E Area							
	Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
XIII (5 sources) 216-A-4 216-A-21 216-A-27 216-A-5 216-A-36A	Stage II & III Installation of 10 monitoring wells Stage V Water Quality 15 Samples		Stage II & III Installation 2 cluster (3 depths) lysimeters ... Soil Borings 32 borings sampled every 5 feet to water level. 2163 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
XIV (1 source) 216-A-6	Stage II & III Installation of 5 monitoring wells Stage V Water Quality 8 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 541 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
XV (1 source) 216-A-28	Stage II & III Installation of 5 monitoring wells Stage V Water Quality 8 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 541 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

TABLE 2-13 **Summary of Sampling Needs for the 200 Area Sources**

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	200 W Area: Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
I (5 sources) 216-S-5 216-S-6 216-S-17 216-S-16P 216-S-16D	Stage II & III Installation of 6 cluster (3 depths) monitoring wells Stage V Water Quality 27 Samples		Stage II & III Installation 2 cluster (3 depths) lysimeters --- Soil Borings 40 borings sampled every 5 feet to water level. 2064 samples --- Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
II (4 sources) 216-S-1&2 216-S-7 216-S-3 216-S-9	Stage II & III Installation of 8 cluster (3 depths) monitoring wells Stage V Water Quality 36 Samples		Stage II & III Installation 2 cluster (3 depths) lysimeters --- Soil Borings 32 borings sampled every 5 feet to water level. 1651 samples --- Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
III (1 source) 216-S-20	Stage II & III Installation of 8 cluster (3 depths) monitoring wells Stage V Water Quality 36 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter --- Soil Borings 8 borings sampled every 5 feet to water level. 413 samples --- Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		

Pathway / Source	200 W Area							
	Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
IV (2 sources) 216-S-4 216-S-21	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 2 cluster (3 depths) lysimeters ... Soil Borings 16 borings sampled every 5 feet to water level. 826 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
V (1 source) 216-U-11	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 413 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
VI (1 source) 216-U-3	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 413 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

TABLE 2-13 **Summary of Sampling Needs for the 200 Area Sources**

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	200 W Area: Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
VII (1 source) 216-Z-1&2	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 413 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
VIII (1 source) 216-U-1&2	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 413 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
IX (3 sources) 216-U-4 216-U-4A 216-U-4B	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 12 borings sampled every 5 feet to water level. 619 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		

TABLE 2-13 Summary of Sampling Needs for the 200 Area Sources

Pathway / Source	200 W Area Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
X (2 sources) 216-Z-7 216-Z-10	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 413 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples	-	
XI (1 source) 216-T-19	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 413 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
XII (1 source) 216-T-7	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 413 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

TABLE 2-13 **Summary of Sampling Needs for the 200 Area Sources**

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	200 W Area: Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
XIII (1 source) 216-T-28	Stage II & III Installation of 5 cluster (3 depths) monitoring wells Stage V Water Quality 23 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 413 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
XIV (1 source) 216-T-3	Stage II & III Installation of 6 cluster (3 depths) monitoring wells Stage V Water Quality 27 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 8 borings sampled every 5 feet to water level. 413 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		
XV (2 sources) 216-T-2 216-T-8	Stage II & III Installation of 6 cluster (3 depths) monitoring wells Stage V Water Quality 27 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter ... Soil Borings 12 borings sampled every 5 feet to water level. 619 samples ... Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 6 random samples	Stage V Seepage 6 random samples		

TABLE 2-14 Summary of Sampling Needs for the 300 Area Sources

Notes A and B to this table define chronological stage implementation and source characterization activity rationale.

Pathway / Source	Groundwater	Surface Soils	Vadose Zone	Air	Sediments	Surface Water	Plant Uptake	Animal Uptake
	300 Area							
316-1	Stage II & III Installation of 8 cluster (2 depths) monitoring wells Stage V Water Quality 24 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter --- Soil Borings 12 borings sampled every 5 feet to water level. 103 samples --- Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
316-2	Stage II & III Installation of 8 cluster (2 depths) monitoring wells Stage V Water Quality 24 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter --- Soil Borings 14 borings sampled every 5 feet to water level. 120 samples --- Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		
316-3	Stage II & III Installation of 6 cluster (2 depths) monitoring wells Stage V Water Quality 18 Samples		Stage II & III Installation 1 cluster (3 depths) lysimeter --- Soil Borings 12 borings sampled every 5 feet to water level. 103 samples --- Soil Gas Survey for Volatile Organic Compounds 50 ft. grids		Stage V Ephemeral overflows 4 random samples	Stage V Seepage 4 random samples		

TABLE 2-15 Stage IV Confined Aquifer Drilling

AREA	Pathway Groundwater
100 B/C	Installation of one monitoring well to interbedded zone depth
100 KE/KW	Installation of one monitoring well to interbedded zone depth
100 D/DR	Installation of one monitoring well to interbedded zone depth
100 H	Installation of one monitoring well to interbedded zone depth
100 F	Installation of one monitoring well to interbedded zone depth
200 East	Installation of one monitoring well to interbedded zone depth
200 West	Installation of one monitoring well to interbedded zone depth
300	Installation of one monitoring well to interbedded zone depth

TABLE 2-16 Summary of the Complete Sampling Needs of the 100, 200 & 300 Areas

STAGE		100 Area	200 Area	300 Area
Stage I		No Sampling required at this stage	No Sampling required at this stage	No Sampling required at this stage
Stage II & Stage III	Groundwater	110 clusters	175 clusters	22 clusters
	Vadose Zone	24 clusters	36 clusters	3 clusters
	Soil Borings	255 soil borings	342 soil borings	38 soil borings
Stage IV	Groundwater	5 monitoring wells	2 monitoring wells	1 monitoring well
Stage V	Sediments	88 random samples	180 random samples	12 random samples
	Surface Water	88 samples	180 samples	12 random samples

Table 2-15 is a Stage IV summary table for well monitoring of the confined aquifer for the three CERCLA areas of the Hanford Reservation.

2.5 VERIFICATION OF COMPLIANCE OF CHARACTERIZATION METHODS WITH ENVIRONMENTAL REGULATIONS.

The characterization methods outlined in this document are based on Guidance on Remedial Investigations and Feasibility Studies Under CERCLA (EPA/540/G-85/002and 003). These methods must enable the determination of the nature and extent of the contamination, and provide information necessary to aid in the evaluation of a remedial alternative.

The levels of contamination which trigger the need for possible remediation are determined from the applicable or relevant and appropriate regulatory requirements (ARARS). These requirements are summarized in Tables 2-17 and 2-18. The type and frequency of sampling is given in 40 CFR 264.90 and 40 CFR 141. The regulatory limits are included in the Washington Annotated Code as Washington Department of Ecology Regulations.

The analysis of the samples collected as part of the characterization must be analyzed using acceptable techniquies and methods. Table 2-19 identifies accepted methods for analysis of the samples.

Since the characterization has been based on the EPA guidance for CERCLA sites, and is consistant with the applicable and appropriate relevant regulations, the characterization methods are in compliance with the regulatory requirements.

2.6 ENGINEERING ALTERNATIVES FOR REMEDIATING CERCLA SITES

The purpose of this section is to evaluate the available remedial action technologies that have been applied to the cleanup of radioactive and hazardous wastes and to select a number of technologies that are most applicable to the problems associated with the 81 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites at Hanford. This selection will enable a comparison of the technical feasibility and unit

TABLE 2-17. SELECTED APPLICABLE OR RELEVANT AND APPROPRIATE AMBIENT REQUIREMENTS

Chemical	Safe Drinking Water Act MCLs b/ (mg/l)	Safe Drinking Water Act MCLGs c/ (mg/l)	Clean Air Act NAAQS (ug/m3)
Arsenic	0.05		
Barium	1.0		
Benxene		0	
Cadmium	0.01		
Carbon monoxide			40,000 (1-hour) d/ 10,000 (8-hour) d/
Carbon tetrachloride		0	
Chlorophenoxys			
2,4-Dichlorophenoxyacetic acid (2,4-D)	0.1		
2,4,5-Trichlorophenoxy-propionic acid (2,4,5-TP)	0.01		
Chromium VI (hexavalent)	0.05		
p-Dichlorobenzene		0.75	
1,2-Dichloroethane		0	
1,1-Dichloroethylene		0.007	
Endrin	0.0002		
Fluoride	1.4-2.4		
Lindane (99% gamma-HCCH)	0.004		
Hydrocarbons (non-methane)			160 (3-hour) d/
Lead	0.05		1.5 (90-day) e/
Mercury	0.002		
Methoxychlor	0.1		
Nitrate (as N)	10.0		
Nitrogen dioxide			100 (1-year) f/
Ozone			235 (1-hour) d/
Particulate Matter			260 (24-hour) d/ 75 (1-year) g/
Radionuclides			
Radium-226 and 228	5 pCi/l		
Gross alpha activity	15 pCi/l		
Tritium	20,000 pCi/l		
Strontium-90	8 pCi/l		
Other man-made radionuclides	h/		
Selenium	0.01		
Silver	0.05		
Sulfur oxides			365 (24-hour) d/ 80 (1-year) f/
Toxaphene	0.005		
1,1,1-Trichloroethane		0.2	

TABLE 2-17. SELECTED APPLICABLE OR RELEVANT AND APPROPRIATE AMBIENT REQUIREMENTS (Continued)

Chemical	Safe Drinking Water Act MCLs b/ (mg/l)	Safe Drinking Water Act MCLGs c/ (mg/l)	Clean Air Act NAAQS (ug/m3)
Trichloroethylene		0	
Trihalomethanes (total) i/	0.1		
Vinyl chloride		0	

a/ Federal ambient water quality criteria (see Exhibit 4-6) and state environmental standards are also ARARS.

b/ EPA has also proposed MCLS for eight volatile organic chemicals: trichloroethylene, carbon tetrachloride, 1,1,1-trichloroethane, vinyl chloride, 1,2-dichloroethane, benzene, 1,1-dichlorethylene, and p-dichlorobenzene (50 Federal Register 46902-46933, November 13, 1985).

c/ EPA has also proposed MCLGs for 40 additional chemicals. Refer to Exhibit 4-7 for the proposed MCLG values.

d/ Maximum concentration not to be exceeded more than once per year.

e/ Three-month arithmetic mean concentration.

f/ Annual arithmetic mean concentration.

g/ Annual geometric mean concentration.

h/ Radionuclides in drinking water are limited to activity levels corresponding to a total body or any internal organ dose of 4 millirem/year, summed over all radionuclides present.

i/ Total trihalomethanes refers to the sum concentration of chloroform, bromodichlormethane, dibromochloromethane, and bromoform.

TABLE 2-18. EPA AMBIENT WATER QUALITY (WQC) FOR PROTECTION OF HUMAN HEALTH

Chemical	WQC (Concentrations in Parentheses Correspond to Midpoint of Risk Range for Potential Carcinogens Only) a/	
	Aquatic Organisms and Drinking Water	Adjusted for Drinking Water Only b/
Acenapthene	20 ug/l (Organoleptic) c/	20 ug/l (Organoleptic)
Acrolein	320 ug/l	540 ug/l
Acrylonitrile*	0 (58 ng/l)	0 (63 ng/l)
Aldrin*	0 (0.074 ng/l)	0 (1.2 ng/l)
Antimony*	146 ug/l	146 ug/l
Arsenic*	0 (2.2 ng/l)	(25 ng/l)
Asbestos	0 (30,000 fibers/l)	(30,000 fibers/l)
Benzene*	0 (0.66 ug/l)	0 (0.67 ug/l)
Benzidine*	0 (0.12 ng/l)	0 (0.15 ng/l)
Beryllium*	0 (3.7 ng/l)	0 (3.9 ng/l)
Cadmium*	10 ug/l	10 ug/l
Carbon tetrachloride*	0 (0.4 ug/l)	0 (0.42 ug/l)
Chlordane*	0 (0.46 ng/l)	0 (22 ng/l)
Chlorinated benzenes		
Hexachlorobenzene*	0 (0.72 ng/l)	0 (21 ng/l)
1,2,4,5-Tetrachlorobenzene*	38 ug/l	180 ug/l
Pentachlorobenzene*	74 ug/l	570 ug/l
Trichlorobenzene*	Insufficient data	Insufficient data
Monochlorobenzene*	488 ug/l	488 ug/l
Chlorinated ethanes		
1,2-Dichloroethane*	0 (0.94 ug/l)	0 (0.94 ug/l)
1,1,1-Trichloroethane*	18.4 mg/l	19 mg/l
1,1,2-Trichloroethane*	0 (0.6 ug/l)	0 (0.6 ug/l)
1,1,2,2-Tetrachloroethane*	0 (0.17 ug/l)	0 (0.17 ug/l)
Hexachloroethane*	0 (1.9 ug/l)	0 (2.4 ug/l)

TABLE 2-18. EPA AMBIENT WATER QUALITY (WQC) FOR PROTECTION OF HUMAN HEALTH (CONTINUED)

Chemical	WQC (Concentrations in Parentheses Correspond to Midpoint of Risk Range for Potential Carcinogens Only) a/	
	Aquatic Organisms and Drinking Water	Adjusted for Drinking Water Only b/
Monochloroethane*	Insufficient data	Insufficient data
1,1-Dichlorethane*	Insufficient data	Insufficient data
1,1,1,2-Tetrachlorethane	Insufficient data	Insufficient data
Pentachloroethane	Insufficient data	Insufficient data
Chlorinated naphthalenes	Insufficient data	Insufficient data
Chlorinated phenols		
3-Monochlorophenol	0.1 ug/l (Organoleptic)	0.1 ug/l (Organoleptic)
4-Monochlorophenol	0.1 ug/l (Organoleptic)	0.1 ug/l (Organoleptic)
2,3-Dichlorophenol	0.04 ug/l (Organoleptic)	0.04 ug/l (Organoleptic)
2,5-Dichlorophenol	0.5 ug/l (Organoleptic)	0.5 ug/l (Organoleptic)
2,6-Dichlorophenol	0.2 ug/l (Organoleptic)	0.2 ug/l (Organoleptic)
3,4-Dichlorophenol	0.3 ug/l (Organoleptic)	0.3 ug/l (Organoleptic)
2,3,4,6-Tetyrachlorophenol*	1.0 ug/l (Organoleptic)	1.0 ug/l (Organoleptic)
2,4,5-Trichlorophenol*	2600 ug/l	2600 ug/l
2,4,6-Trichlorophenol*	0 (1.2 ug/l)	0 (1.8 ug/l)
2-Methyl-4-chlorophenol	1800 ug/l (Organoleptic)	1800 ug/l (Organoleptic)
3-Methyl-4-chlorophenol	3000 ug/l (Organoleptic)	3000 ug/l (Organoleptic)
3-Methyl-6-chlorophenol	20 ug/l (Organoleptic)	20 ug/l (Organoleptic)
Chloroalkyl ethers		
bis-(Chloromethyl) ether*	0 (0.0038 ng/l)	0 (0.0039 ng/l)
bis-(2-Chloroethyl) ether*	0 (30 ng/l)	0 (30 ng/l)
bis-(2-Chloroisopropy) ether	34.7 ug/l	34.7 ug/l
Chloroform*	0 (0.19 ug/l)	0 (0.19 ug/l)
2-Chlorophenol	0.1 ug/l (Organoleptic)	0.1 ug/l (Organoleptic)

TABLE 2-18. EPA AMBIENT WATER QUALITY (WQC) FOR PROTECTION OF HUMAN HEALTH (CONTINUED)

Chemical	WQC (Concentrations in Parentheses Correspond to Midpoint of Risk Range for Potential Carcinogens Only) a/	
	Aquatic Organisms and Drinking Water	Adjusted for Drinking Water Only b/
Chromium Cr+6*	50 ug/1	50 ug/1
Cr+3*	170 mg/1	179 mg/1
Copper*	1 mg/1 (Organoleptic)	
Cyanide*	200 ug/1	200 ug/1
DDT*	0 (0.024 ng/1)	0 (> 1.2 ng/1)
Dichlorobenzenes* (all isomers)	400 ug/1	470 ug/1
Dichlorobenzidines	0 (10.3 ng/1)	0 (20.7 ng/1)
Dichloroethylenes		
1,1-Dichloroethylene*	0 (33 ng/1)	0 (33 ng/1)
1,2-Dichloroethylene	Insufficient data	Insufficient data
Dichloromethane*	See Halomethanes	See Halomethanes
2,4-Dichlorophenol*	3.09 mg/1	3.09 mg/1
Dichloropropanes/Dichloropropenes		
Dichloropropanes	Insufficient data	Insufficient data
Dichloropropenes	87 ug/1	87 ug/1
Dieldrin*	0 (0.071 ng/1)	0 (1.1 ng/1)
2,4-Dimenthylphenol	400 ug/1 (Organoleptic)	400 ug/1 (Organoleptic)
2,4-Dinitrotoluene*	0 (0.11 ug/1)	0 (0.11 ug/1)
1,2-Diphenylhydrazine*	0 (42 ng/1)	0 (46 ng/1)
Endosulfan*	74 ug/1	138 ug/1
Endrin	1 ug/1	1 ug/1
Ethylbenzene*	1.4 mg/1	2.4 mg/1
Fluoranthene	42 ug/1	188 ug/1
Haloethers	Insufficient data	Insufficient data
Halomethanes	0 (0.19 ug/1)	0 (0.19 ug/1)

TABLE 2-18 EPA AMBIENT WATER QUALITY (WQC) FOR PROTECTION OF HUMAN HEALTH (CONTINUED)

Chemical	WQC (Concentrations in Parentheses Correspond to Midpoint of Risk Range for Potential Carcinogens Only) a/	
	Aquatic Organisms and Drinking Water	Adjusted for Drinking Water Only b/
Heptachlor*	0 (0.28 ng/1)	0 (11 ng/1)
Hexachlorobutadiene*	0 (0.45 ug/1)	0 (0.45 ug/1)
Hexachlorocyclohexanes (HCCH)		
alpha-HCCH*	0 (9.2 ng/1)	0 (13 ng/1)
beta-HCCH*	0 (16.3 ng/1)	0 (23.2 ng/1)
gamma-HCCH*	0 12.3 ng/1)	0 (17.4 ng/1)
delta-HCCH	Insufficient data	Insufficient data
epsilon-HCCH	Insufficient data	Insufficient data
Technical-HCCH	0 (5.2 ng/1)	0 (7.4 ng/1)
Hexachlorocyclopentadiene*	206 ug/1	206 ud/1
Isophorone*	5.2 mg/1	5.2 mg/1
Lead*	50 ug/1	50 ug/1
Mercury*	144 ng/1	10 ug/1
Naphthalene	Insufficient data	Insufficient data
Nickel*	13.4 ug/1	15.4 ug/1
Nitrobenzene*	19.8 mg/1	19.8 mg/1
Nitrophenols		
2,4-Dinitro-o-cresol	13.4 ug/1	13.6 ug/1
Dinitrophenol*	70 ug/1	70 ug/1
Mononitrophenol	Insufficient Data	Insufficient Data
Trinitrophenol	Insufficient data	Insufficient data
Nitrosamines		
n-Nitrosodimethylamine*	0 (1.4 ng/1)	0 (1.4 ng/1)
n-Nitrosodiethylamine*	0 (0.8 ng/1)	0 (0.8 ng/1)
n-Nitrosodi-n-butylamine*	0 (6.4 ng/1)	0 (6.4 ng/1)

TABLE 2-18. EPA AMBIENT WATER QUALITY (WQC) FOR PROTECTION OF HUMAN HEALTH (CONTINUED)

	WQC (Concentrations in Parentheses Correspond to Midpoint of Risk Range for Potential Carcinogens Only) a/	
Chemical	Aquatic Organisms and Drinking Water	Adjusted for Drinking Water Only b/
n-Nitrosodiphenylamine	0 (4.9 ug/1)	0 (7.0 ug/1)
n-Nitrosopyrrolidine*	0 (16 ng/1)	0 (16 ng/1)
Pentachlorophenol*	1.01 mg/1	1.01 mg/1
Phenol*	3.5 mg/1	3.5 mg/1
Phthalate esters		
Dimethylphthalate	313 mg/1	350 mg/1
Diethylphthalate*	350 mg/1	434 mg/1
Dibutylphthalate*	34 mg/1	44 mg/1
Di-2-ethylhexylphthalate*	15 mg/1	21 mg/1
Polychlorinated biphenyls (PCBs)*	0 (0.079 ng/1)	0 (> 12.6 ng/1)
Polynyuclear aromatic hydrocarbons (PAHs)*	0 (2.8 ng/1)	0 (3.1 ng/1)
Selenium*	10 ug/1	10 ug/1
Silver*	50 ug/1	50 ug/1
2,3,7,8-TCDD*	0 (0.000013 ng/1)	0 (0.00018 ng/1)
Tetrachloroethylene*	0 (0.8 ug/1)	0 (0.88 ug/1)
Thallium*	13 ug/1	17.8 ug/1
Toluene*	14.3 mg/1	15 mg/1
Toxaphene*	0 (0.71 ng/1)	0 (26 ng/1)
Trichloroethylene*	0 (2.7 ug/1)	0 (2.8 ug/1)
Vinyl chloride*	0 (2.0 ug/1)	0 (2.0 ug/1)
Zinc*	5 mg/1 (Organoleptic)	5 mg/1 (Organoleptic)

* Toxicity values necessary for risk characterization are given in Appendix A.

a/ The criterion value, which is zero for all potential carcinogens, is listed for all chemicals in the table. The concentration value given in parentheses for potential carcinogens corresponds to a risk of 10^{-6}, which is the midpoint of the range of 10^{-5} to 10^{-7} given in water quality criteria documents. To obtain concentrations corresponding to risks of 10^{-5}, the 10^{-6} concentrations should be multiplied by 10. To obtain concentrations corresponding to risks of 10^{-7}, the 10^{-6} concentratons should be divided by 10.

b/ These adjusted criteria, for drinking water ingestion only, were derived from published EPA ambient water quality criteria (45 Federal Register 79318-79379, November 28, 1980) for combined fish and drinking water ingestion and for fish ingestion alone. The adjusted values are not official EPA ambient water quality criteria, but may be appropriate for Superfund sites with contaminated ground water. In the derivation of these values, intake was assumed to be 2 liters/day for drinking water and 6.5 grams/day for dish, and human body weight was assumed to be 70 kilograms. Values for bioconcentraton factor, carcinogenic potency, and acceptable daily intake were those used for water quality criteria development.

c/ Criteria designiated as organoleptic are based on taste and odor effects, not human health effects. Health-based water quality criteria are not available for these chemicals.

TABLE 2-19. ACCEPTED METHODS FOR ANALYSIS OF SAMPLES

Type of Sample	Method of Analysis
Groundwater	Method listed in Appendix IX to 40 CFR 264.98 and to 40 CFR 264.99 (52 FR 25946)
Surface Water	Methods listed in Appendix A to 40 CFR 136.3
Air	Methods listed in Appendix B to 40 CFR 61

costs of these technologies to evaluate their applicability to the sites at Hanford. The objective is to identify at least two remedial action alternatives (one a removal alternative, and one an in-place alternative) for each site that, based on the data available, have a high probability for application to the site problem.

2.6.1 Methodology of the Remedial Action Selection Process

The actual selection of a remedial action will be made as a part of The Remedial Investigation/Feasibility Study (RI/FS) performed for the site. In this effort, it is necessary to identify reasonable alternatives to allow the estimation of the cost and schedule for remediation of each site.

Selection of appropriate remedial actions for the 81 sites is dependent upon the following information:

- Physical site conditions
- Volume and types of wastes disposed
- Fate and transport mechanisms for the wastes
- Previous applications (and scale) of the remedial technology
- Technical feasibility of the technology for the waste type and site conditions in terms of effectiveness, reliability, and state of development
- Applicable environmental regulations
- Cost

The basic sequence for selecting the most applicable remedial technologies is illustrated in Figure 2-21. The first two tasks, done simultaneously, are the definition of the area, volume, form, and matrix of contaminated materials at each site and the identification of a list of potential remedial technologies.

2.6.1.1 Site Conditions and Waste Disposed

Definition of the problem at each site included summarizing the following information:

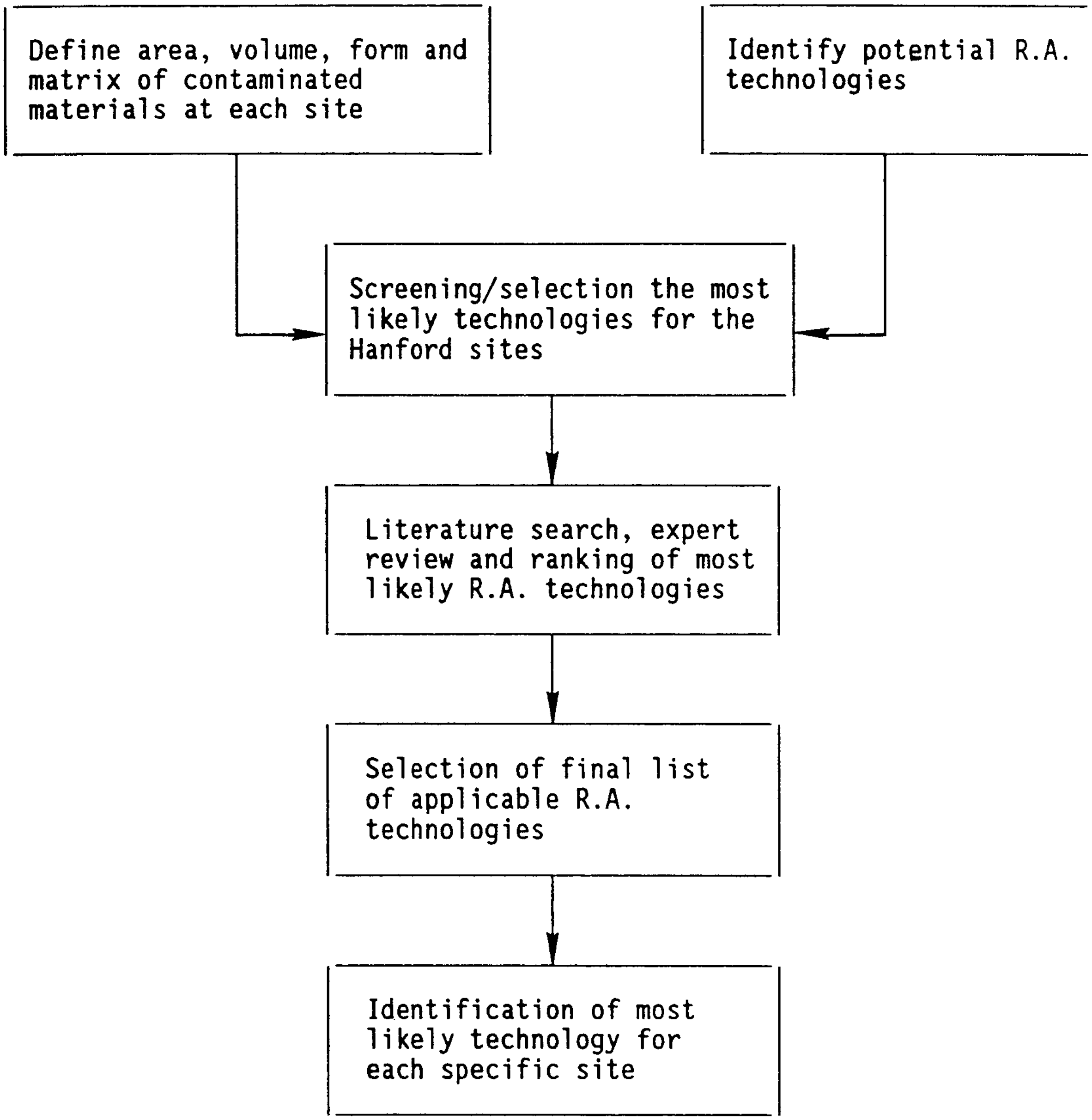

FIGURE 2-21

REMEDIATION TECHNOLOGY SELECTION SEQUENCE

- o Type of disposal unit
- o Proximal location
- o Radionuclides disposed and their solubility
- o Other wastes disposed, including salts
- o Depth of wastes
- o Depth to groundwater
- o Volume of liquid wastes disposed
- o Calculated field capacity for the soil column

This information is presented in Columns 1-15 of Table 2-20.

2.6.1.2 Pathways and Fate of Pollutants

Since selection of remedial technologies is primarily dependent on knowing how much contaminated material there is, and where it is, calculations or assumptions on the following pathways or fates were made for each site.

- o Soil attenuation - This is used to determine the probable fate of heavy metals and nonsoluble radionuclides. It is assumed that unless very high rates of water were applied to the site or acid solutions were disposed of at the site, most of these elements would adsorb to soil particles within a 20-foot depth below the point of application.

- o Downward migration - It has been assumed that the more soluble radionuclides such as tritium or cesium and salts such as nitrates or sulfates would have migrated through the soil column to groundwater in the time period since the sites were closed. It should be noted, however, that some active sites releasing these elements to the soil column may be near CERCLA sites.

- o Radionuclide uptake - An analysis was made of the potential for plant root uptake at each site. Maximum root penetration was assumed to be 40 feet.

KEY TO TABLE 2-20

POTENTIAL REMEDIAL ACTION ALTERNATIVES - CERCLA SITES

Column No.	Title	Explanation
1	Site number	Site ID number from Phase II report
2	Type	Type of disposal unit
3	Proximal location	0 - site is within 500' of another site 1 - continuous sites
4	HRS score	Not m HRS score
5	Total curies disposed	
6	Total of H, C, Ru, Eu	Total disposed curies of H-3, C-14, Ru-106, Eu-154, Eu-155
7	Total of Cs, Sr	Total disposed curies of cesium and strontium
8	Total of all else	Total disposed curies of all other radionuclides
9	Other waste disposed	See index at bottom of table
10	Depth to waste	Depth to point of application
11	Depth to groundwater	
12	Volume disposed	
13-15	Field capacity	These 3 columns are an estimate of the potential for the liquids disposed at each site to be either still in the soil column (0) or have probably entered the groundwater (X). Three different field capacities (FC = 0.05, 0.1 and 0.25) were used to cover the expected porosity ranges in the Hanford soils.

KEY TO TABLE 2-20 (Continued)

POTENTIAL REMEDIAL ACTION ALTERNATIVES - CERCLA SITES

Column No.	Title	Explanation
16	Soil attenuation	X - highly likely that significant amounts of radionuclides are adsorbed in soil column at less than 20′ depth O - highly likely that other metals (Hg, Cr, etc.) are stored in shallow depth of soil column
17	Downward migration	X - soluble radionuclides in excess of 1.0 curie applied to site O - less than 1.0 curie of soluble radionuclides applied to site
18	Radionuclide uptake	X - more than 1.0 curie of radionuclides stored in top 20′ of soil O - potentially either less than 1.0 curie in top 20′ of soil or more than 1.0 curie in the soil but at depths between 20′ and 40′ deep
19	Groundwater release	X - groundwater contamination highly likely because FC/WV is less than 1.0 O - potential groundwater contamination due to readily soluble contaminants, high volumes (more than 10 million liters) of disposed liquids or FC/WV less than 10
20	Surface erosion	O - waste is less than 10′ below the surface thus potentially subject to erosion
21-26	Potentially feasible remedial action	X - feasible for that site

TABLE 2-20. POTENTIAL REMEDIAL ACTION ALTERNATIVES (Continued)

Hanford Inactive Waste Site Study.

	Site No.	FATE OF CONTAMINANTS: Soil Attenuation	Downward Migration	Vegetation Uptake of Radionuclides	Ground-Water Release	Surface Errosion	Depth to Waste Feet	Depth to GW Feet	Volume Disposed (liters)	Field Capacity (FC=0.05)	Field Capacity (FC=0.1)	Field Capacity (FC=0.25)
1	116-B-1	o	x	o	x		20	41	6,000,000	x	x	x
2	116-B-4	x		o	o		20	71	300,000	o		
3	116-C-1	x	x	o	x		25	41	100,000,000	x	x	x
4	116-C-2	o	x		o		20	94	3,500,000	x	o	
5	116-D-1B	o	o	o	x		15	83	8,000,000	x	x	x
6	116-DR-1	x	x	o	x		20	56	40,000,000	x	x	x
7	116-DR-2	x	x	o	x		20	56	40,000,000	x	x	x
8	116-DR-6	o			x		10	83	7,000,000	x	x	x
9	116-DR-7	o					10	73	4,000			
10	116-F-1	o	x	x	x		10	13	1,000,000,000	x	x	x
11	116-F-2	o	x	x	x		15	35	60,000,000	x	x	x
12	116-F-3	o			x	o	8	37	4,000,000	x	x	x
13	116-F-6	o	x	x			10	36	100,000			
14	116-F-9	o	x	o	x		10	50	300,000,000	x	x	x
15	116-F-10	o	o	o	x		10	38	400,000	x	x	x
16	116-H-1	x	x	x	x		15	42	90,000,000	x	x	x
17	116-H-2	o	o	o	x	o	6	42	600,000,000	x	x	x
18	116-H-3	o	o	o	x		15	42	400,000	x	x	x
19	100 KE*1	x				o	4	68	0			
20	100 KE*2	x				o	3	68	0			
21	100 KW*1	x				o	4	72	0			
22	100 KW*2	x				o	3	72	0			
23	116-K-1	x	x	o	x		30	50	40,000,000	x	x	x
24	116-K-2	x	x	o	x		20	34	300,000,000,000	x	x	x
25	116-KE-2	x	x	o	x		32	68	3,000,000	x	x	x

TABLE 2-20. POTENTIAL REMEDIAL ACTION ALTERNATIVES (Continued)

Hanford Inactive Waste Site Study.

	Site No.	Type	Proximal Location (<500')	HRS Score	Total Curies Disposed (1)	Total of H,C,Ru,Eu	Total of Cs,Sr	Total of All Else	Other Wastes Disposed (2)	Cap/Cover w/ PC Monitoring	Grout-In-Place w/ PC Monitoring	In-Situ Vitrification	Solution Mining & GW Recovery/ Treatment	Excavation & Disposal	No Action
1	116-B-1	Trench	o	42.32	1.95	1.45	0.38	0.13	1	x			x		
2	116-B-4	Fr. Drain		44.55	4.33	0.00	0.00	4.33	1,2		x	x		x	
3	116-C-1	Trench	o	42.32	329.58	213.96	7.46	108.17	1		x	x	x	x	
4	116-C-2	Crib		42.32	1.33	0.33	0.98	0.01	1,2	x				x	x
5	116-D-1B	Trench		42.32	1.48	0.73	0.68	0.08	1,3	x				x	
6	116-DR-1	Trench	I	42.32	21.57	6.92	13.51	1.14	1		x		x		
7	116-DR-2	Trench		42.32	21.57	6.92	13.51	1.14	1		x		x		
8	116-DR-6	Trench	o	42.32	0.00	0.00	0.00	0.00	1	x				x	x
9	116-DR-7	Crib	o	28.96	0.00	0.00	0.00	0.00	4	x				x	x
10	116-F-1	Trench		44.55	2.17	0.96	0.96	0.25	1,2	x	x		x		
11	116-F-2	Trench		42.32	9.77	8.12	0.83	0.82	1			x	x		
12	116-F-3	Trench	o	42.32	0.00	0.00	0.00	0.00	1	x					x
13	116-F-6	Trench	o	28.96	3.94	2.87	0.72	0.35	3		x	x		x	
14	116-F-9	Trench		42.32	2.84	0.59	2.05	0.19	5		x		x		
15	116-F-10	Fr. Drain	o	42.32	0.07	0.05	0.01	0.01	1,2	x				x	x
16	116-H-1	Trench		42.32	20.12	14.42	4.56	1.14	1		x	x	x		
17	116-H-2	Trench	o	42.32	1.04	0.28	0.75	0.02	1	x			x		x
18	116-H-3	Fr. Drain	o	42.32	0.05	0.01	0.03	0.01	1,2	x				x	x
19	100 KE*1	Drywell	-	42.32	0.00	0.00	0.00	0.00	6	x				x	
20	100 KE*2	Fr. Drain	-	42.32	0.00	0.00	0.00	0.00	6	x				x	
21	100 KW*1	Drywell	-	40.09	0.00	0.00	0.00	0.00	6	x				x	
22	100 KW*2	Fr. Drain	-	40.09	0.00	0.00	0.00	0.00	6	x				x	
23	116-K-1	Crib	o	42.32	30.56	8.79	18.79	2.98	1			x	x		
24	116-K-2	Trench	o	51.23	1320.59	961.34	158.75	200.50	1,2,3,7		x		x	x	
25	116-KE-2	Crib		35.64	14.65	0.74	2.79	11.12	3	x	x	x		x	

TABLE 2-20. POTENTIAL REMEDIAL ACITON ALTERNATIVES (Continued)

Hanford Inactive Waste Site Study.

	Site No.	FATE OF CONTAMINANTS: Soil Attenuation	Downward Migration	Vegetation Uptake of Radionuclides	Ground-Water Release	Surface Errosion	Depth to Waste Feet	Depth to GW Feet	Volume Disposed (liters)	Field Capacity (FC=0.05)	Field Capacity (FC=0.1)	Field Capacity (FC=0.25)
73	216-T-2	o	o				75	256	6,000,000			
74	216-T-3	x	x		x		206	249	11,300,000	x	x	x
75	216-T-7	x	x	o	x		26	191	110,000,000	x	x	x
76	216-T-8	o	o				25	258	500,000			
77	216-T-19	x	x	o	x		23	189	455,000,000	x	x	x
78	216-T-28	x	x	x	x		15	195	42,300,000	x	x	x
79	316-1	x	x	x	x	o	9	34	10,000,000,000	x	x	x
80	316-2	x	x	x	x		10	34	10,000,000,000	x	x	x
81	316-3	x		o	x		20	43	1,000,000,000	x	x	x

TABLE 2-20. POTENTIAL REMEDIAL ACTION ALTERNATIVES (Continued)

Hanford Inactive Waste Site Study.

	Site No.	Type	Proximal Location (<500')	HRS Score	Total Curies Disposed (1)	Total of H,C,Ru,Eu	Total of Cs,Sr	Total of All Else	Other Wastes Disposed (2)	POTENTIALLY FEASIBLE REMEDIAL ACTIONS: Cap/Cover w/ PC Monitoring	Grout-in-Place w/ PC Monitoring	In-Situ Vitrification	Solution Mining & GW Recovery/ Treatment	Excavation & Disposal	No Action
73	216-T-2	Rec. Well		50.34	0.00	0.00	0.00	0.00	1,2,8	x					x
74	216-T-3	Rec. Well		60.40	286.20	0.00	43.60	242.60	2,3,8,9,11		x		x		
75	216-T-7	Crib		65.44	58.74	0.00	49.30	9.44	2,3,8,9,11		x	x	x		
76	216-T-8	Crib		47.82	1.21	0.00	0.85	0.36	1,2,8	x					x
77	216-T-19	Crib		45.19	0.00	0.00	326.00	5.53	3,8,9		x	x	x	x	
78	216-T-28	Crib		42.14	331.53	0.00	7.06	4.44	8		x	x		x	
79	316-1	Pond		79.28	0.00	0.00	0.00	0.00	8,12,13,14,15	x	x	x	x		
80	316-2	Pond		79.28	0.00	0.00	0.00	0.00	8,12,13,14,15	x	x	x	x		
81	316-3	Trench		79.28	0.00	0.00	0.00	0.00	12,15	x	x	x		x	

Sub set data file

Isotope (1)	Decay Mode	Other Wastes Disposed (2)	
H-3	Beta	1 Cr(2)O(7)	
C-14	Beta	2 NO(3)S	
Co-60	Gamma	3 SO(4)	
Ni-63	Beta	4 B(4)O(7)	
Sr-90	Beta	5 NH(3)	
Ru-106	Beta	6 Hg	
Cs-134	Beta,Gamma	7 Cu	
Cs-137	Gamma	8 NO(3)	
Eu-152	Beta	9 PO(4)	
Eu-154	Beta	10 CN	
Eu-155	Beta	11 F	
Pu-238	Alpha	12 Metals	(inc. Hg, Pb, Cr, Be, Ag, Ni, etc)
Pu-239	Alpha	13 TCE	Trichlorlethylene
Pu-240	Alpha	14 MIRK	Methyl Isobutyl Ketone
U-235	Alpha	15 U	Uranium
U-238	Alpha		

TABLE 2-20. POTENTIAL REMEDIAL ACTION ALTERNATIVES (Continued)

Hanford Inactive Waste Site Study.

	Site No.	Soil Attenuation	Downward Migration	Vegetation Uptake of Radionuclides	Ground-Water Release	Surface Errosion	Depth to Waste Feet	Depth to GW Feet	Volume Disposed (liters)	Field Capacity (FC=0.05)	Field Capacity (FC=0.1)	Field Capacity (FC=0.25)
		FATE OF CONTAMINANTS										
26	216-B-43	o	x	o			15	228	2,120,000			
27	216-B-44	x	x	x			15	222	5,600,000			
28	216-B-45	o	x	o			15	220	4,920,000			
29	216-B-46	x	x	x			15	219	6,700,000			
30	216-B-48	o	x	o			15	225	4,090,000			
31	216-B-49	x	x	x			15	223	6,700,000			
32	216-B-50	o	x	o	o		15	223	54,800,000	x	x	o
33	216-B-5	x	x		x		302	283	30,600,000	x	x	x
34	216-B-2-2	o	x	o	x	o	8	255	149,000,000,000	x	x	x
35	216-B-6	o	o		o		75	296	6,000,000			
36	216-B-7 A&B	x	x	x	o		14	241	43,600,000	x	x	o
37	216-B-10A	o	x				20	300	9,990,000			
38	216-B-16	o	x	o			12	338	5,600,000			
39	216-C-1	o	x	o	o		13	282	23,400,000	x	o	
40	216-C-10	o	x	o		o	7	286	897,000			
41	216-A-9	x	x	o	x		12	294	981,000,000	x	x	x
42	216-A-40		o				16	284	946,000			
43	216-A-4	x	x				25	305	6,210,000			
44	216-A-5	x	x	x	x		32	313	1,630,000,000	x	x	x
45	216-A-6	x	x	x	x		19	290	3,400,000,000	x	x	x
46	216-A-7	o	x				15	274	326,000			
47	216-A-21	x	x	o	o		19	310	77,800,000	x	x	o
48	216-A-24	o	x	x	x		15	242	820,000,000	x	x	x
49	216-A-27	x	x		o		14	308	23,100,000	o		
50	216-A-28	o					11	298	30,000			
51	216-A-36A	x	x				22	314	1,070,000			

TABLE 2-20. POTENTIAL REMEDIAL ACTION ALTERNATIVES (Continued)

Hanford Inactive Waste Site Study.

	Site No.	Type	Proximal Location (<500')	HRS Score	Total Curies Disposed (1)	Total of H,C,Ru,Eu	Total of Cs,Sr	Total of All Else	Other Wastes Disposed (2)	POTENTIALLY FEASIBLE REMEDIAL ACTIONS: Cap/Cover w/ PC Monitoring	Grout-In-Place w/ PC Monitoring	In-Situ Vitrification	Solution Mining & GW Recovery/ Treatment	Excavation & Disposal	No Action
26	216-B-43	Crib	I	48.67	942.06	170.00	772.00	0.06	2,3,9,10		x	x	x	x	
27	216-B-44	Crib	I	50.42	2097.17	450.00	1646.00	1.17	2,3,9,10		x	x	x	x	
28	216-B-45	Crib	I	52.20	2407.82	390.00	2017.00	0.82	2,3,9,10		x	x	x	x	
29	216-B-46	Crib	I	52.20	1326.50	536.00	788.90	1.60	2,3,9,10		x	x	x	x	
30	216-B-48	Crib	I	52.20	1145.38	327.00	818.00	0.38	2,3,9,10		x	x	x	x	
31	216-B-49	Crib	I	52.20	1975.28	536.00	1438.00	1.28	2,3,9,10		x	x	x	x	
32	216-B-50	Crib	I	43.70	149.57	90.00	59.52	0.05	3		x	x	x	x	
33	216-B-5	Rec. Well		61.54	369.40	0.00	59.70	309.70	3,8,9,11		x		x		
34	216-B-2-2	Ditch		30.67	235.49	0.00	235.49	0.00			x		x		
35	216-B-6	Rec. Well	o	50.34	0.00	0.00	0.00	0.00	1,3,8	x					x
36	216-B-7 A&B	Crib		65.44	2764.07	0.00	2451.80	312.27	3,8,9,11		x		x	x	
37	216-B-10A	Crib	o	47.82	3.22	0.00	2.51	0.72	1,3,8	x	x	x			
38	216-B-16	Crib		52.20	1104.94	450.00	654.00	0.94	3,8,9,10				x	x	
39	216-C-1	Crib	o	39.33	164.53	70.00	93.85	0.68	8		x	x	x		
40	216-C-10	Crib	o	33.29	37.92	0.00	37.89	0.02	8	x	x	x		x	
41	216-A-9	Crib	o	42.79	4017.21	4000.00	17.17	0.04	8		x		x		
42	216-A-40	Trench	o	32.72	0.00	0.00	0.00	0.00	8	x					x
43	216-A-4	Crib	o	47.82	22.68	0.00	12.37	10.31			x	x		x	
44	216-A-5	Crib	o	50.42	130066.92	130000.00	58.80	8.12		x	x		x		
45	216-A-6	Crib		42.14	166.21	0.00	163.40	2.81			x		x		
46	216-A-7	Crib		42.79	3.07	0.00	2.99	0.08		x				x	
47	216-A-21	Crib	o	57.89	105.25	0.00	93.84	11.41				x		x	
48	216-A-24	Crib		48.67	1712.51	1400.00	312.10	0.41			x		x		
49	216-A-27	Crib	o	59.63	69.52	0.00	62.20	7.32				x		x	
50	216-A-28	Fr. Drain		32.72	0.21	0.00	0.00	0.21		x				x	x
51	216-A-36A	Crib	o	32.62	2010.56	0.00	2004.00	6.56				x		x	

TABLE 2-20. POTENTIAL REMEDIAL ACTION ALTERNATIVES (Continued)

Hanford Inactive Waste Site Study.

	Site No.	Soil Attenuation	Downward Migration	Vegetation Uptake of Radionuclides	Ground-Water Release	Surface Errosion	Depth to Waste Feet	Depth to GW Feet	Volume Disposed (liters)	Field Capacity (FC=0.05)	Field Capacity (FC=0.1)	Field Capacity (FC=0.25)
		FATE OF CONTAMINANTS										
52	216-S-5	x	x	x	x		15	180	4,100,000,000	x	x	x
53	216-S-6	x	x	x	x		15	180	4,470,000,000	x	x	x
54	216-S-16D		o	o	o	o	3	180	400,000,000	x	x	o
55	216-S-16P	x	x	x	x	o	3	180	41,000,000,000	x	x	x
56	216-S-17	o	x	x	x		10	180	6,430,000,000	x	x	x
57	216-U-11	o	o	o		o	7	185	0			
58	216-S-1&2	x	x		x		35	197	160,000,000	x	x	x
59	216-S-3	o	x	o		o	6	190	4,200,000			
60	216-S-4		o				20	180	1,000,000			
61	216-S-7	x	x	o	x		22	202	390,000,000	x	x	x
62	216-S-9	x	x	o	o		30	205	50,300,000	x	x	o
63	216-S-20	x	x	o	x		30	208	135,000,000	x	x	x
64	216-S-21	o	x		x		21	180	87,100,000	x	x	x
65	216-U-1&2	o	o	o	o		24	209	15,900,000	x	o	
66	216-U-3		o	o			12	190	791,000			
67	216-U-4		o				75	227	300,000			
68	216-U-4A		o	o			10	227	545,000			
69	216-U-4B		o	o			10	230	33,000			
70	216-Z-1&2	x	o	o	x		21	191	38,900,000	x	x	x
71	216-Z-7	x	x	x	x	o	5	187	79,900,000	x	x	x
72	216-Z-10		o		o		150	193	1,000,000	x	x	o

TABLE 2-20. POTENTIAL REMEDIAL ACTION ALTERNATIVES (Continued)

Hanford Inactive Waste Site Study.

	Site No.	Type	Proximal Location (<500')	HRS Score	Total Curies Disposed (1)	Total of H,C,Ru,Eu	Total of Cs,Sr	Total of All Else	Other Wastes Disposed (2)	POTENTIALLY FEASIBLE REMEDIAL ACTIONS: Cap/Cover w/ PC Monitoring	Grout-in-Place w/ PC Monitoring	In-Situ Vitrification	Solution Mining & GW Recovery/ Treatment	Excavation & Disposal	No Action
52	216-S-5	Crib	o	30.75	130.48	0.16	88.20	42.12	8		x		x	x	
53	216-S-6	Crib	o	42.14	384.95	0.50	349.00	35.45	8		x		x	x	
54	216-S-16D	Ditch	o	42.14	0.00	0.00	0.00	0.00	8	x					x
55	216-S-16P	Pond	o	32.72	110.57	0.20	82.10	28.27	8	x			x	x	
56	216-S-17	Pond	o	38.07	31.62	0.06	31.30	0.26	8		x		x	x	
57	216-U-11	Ditch (2)		37.75	0.00	0.00	0.00	0.00	?	x				x	
58	216-S-1&2	Crib (2)		57.73	6657.93	4000.00	2570.00	87.93	8		x	x	x		
59	216-S-3	Fr Drain (2)		48.97	3024.41	3000.00	24.35	0.05	1,8		x	x	x	x	
60	216-S-4	Fr Drain	o	32.72	0.02	0.02	0.00	0.00	8	x					x
61	216-S-7	Crib (2)		59.63	2320.40	0.00	2287.00	33.39	8		x	x	x		
62	216-S-9	Crib		39.23	6428.89	6000.00	422.00	6.88	8		x	x	x		
63	216-S-20	Crib		43.70	98.76	0.00	86.30	12.46	8		x	x	x		
64	216-S-21	Crib	o	31.93	117.29	0.00	117.10	0.19	8		x	x	x		
65	216-U-1&2	Crib (2)		48.97	11.50	0.00	0.52	0.01	3,8,9	x					x
66	216-U-3	Fr Drain		33.89	0.53	0.00	0.00	0.00	8	x					x
67	216-U-4	Rev. Well		32.72	0.00	0.00	0.22	0.00	8		x				x
68	216-U-4A	Fr Drain		32.72	0.22	0.00	0.22	0.00	8,9	x	x				x
69	216-U-4B	Fr Drain		30.20	0.22	0.00	0.22	0.00	8	x	x				x
70	216-Z-1&2	Crib		37.75	4672.37	0.00	0.32	4672.04	8,11		x	x		x	
71	216-Z-7	Crib (2)		43.70	591.88	0.00	447.00	144.88	8		x	x		x	
72	216-Z-10	Rev. Well		32.72	3.62	0.00	0.00	3.62	8	x					x

- o Groundwater release - If the field capacity (FC) of the soil column is exceeded by the volume of waste disposed, groundwater contamination has been assumed. In addition, if the FC/volume ratio was less than ten, or more than ten million liters of water were applied, or the contaminate types were highly migratory, a high potential for discharge to groundwater was assumed. Note that no evaporation losses were considered.

- o Surface erosion - Those sites with contamination less than ten feet below the ground surface were identified as having a potential for waste dispersion by wind or water erosion.

The summary of the site data and pathways/fate of pollutants for each site is presented in Columns 16-20 of Table 2-20.

2.6.1.3 Selection of Technologies

As the first step, published Environmental Protection Agency (EPA) handbooks and conference proceedings that listed numerous potential remedial technologies for hazardous and radioactive wastes were reviewed (see Appendix B for a list of Potential Technologies). The remedial technologies were divided into three groups:

- o Waste isolation
- o Excavation/removal
- o In-situ treatment

Waste isolation addresses those technologies that contain all the contaminated material onsite and involve minimum movement of either wastes or contaminated soils. Excavation/removal addresses those technologies that generally involve removing the contaminated material and transferring it to another location for treatment and disposal. In-situ treatment involves technologies that effectively treat the contaminated material in place. Very little waste or soil is excavated or removed from the site by these technologies, which either extract the hazardous constituents for treatment/recovery or physically, chemically, or biologically detoxify the hazardous constituents.

These groups are listed in the general order of overall demonstrated effectiveness and environmental acceptability from the perspective of meeting applicable standards and providing a permanent solution.

2.6.1.4 Screening of Technologies

Specific remedial technologies were identified in each of the three groups discussed above. This technology list is presented in Table 2-21, which shows both primary technologies that are used to treat the contaminated materials and some of the major support technologies that are used to protect the environment during remedial action operations. The next step was to screen these technologies and determine those that would be most applicable to the 81 CERCLA sites at Hanford. This was done by reviewing the site conditions and pollutant pathways and fate and identifying those technologies that were most advantageous based on previous applications to comparable waste types or site conditions.

2.6.1.5 Selection of Final Remedial Technologies

Once the primary candidate technologies had been identified, a literature and case study review was conducted to determine the following:

- Operating range/conditions for each technology - effective depth, waste types, soil types, etc.
- State of development of technology - bench, pilot, full scale
- Similarity of wastes and site conditions to those expected at Hanford
- Acceptability - demonstrated ability to meet applicable regulations and standards

TABLE 2-21 GENERAL REMEDIATION TECHNOLOGY GROUPS

WASTE ISOLATION

Primary Technologies

- o cap/cover systems
- o slurry walls
- o grout-in-place
- o in-situ vitrification

Support Technologies

- o dust control
- o runoff diversion/collection/treatment
- o equipment decontamination

EXCAVATION/REMOVAL

Primary Technologies

- o excavation/disposal
- o groundwater pump/treat systems
- o solidification/fixation

Support Technologies

- o waste handling/transportation
- o dust control
- o runoff diversion/collection/treatment
- o equipment decontamination

IN SITU TREATMENT

Primary Technologies

- o solution mining
- o soil flushing
- o air/steam stripping
- o biodegradation systems
- o chemical fixation/complexation

Support Technologies

- o extraction/concentration facilities
- o equipment decontamination

- o Complexity - simpler is better

- o Throughput/capacity - length of time to treat expected waste volumes

- o O & M requirements (including decontamination needs)

This information was then reviewed by the task members, closely compared to the site conditions, and resulted in the selection of 6 technologies for potential application at Hanford:

- o Cap/cover
- o Grout-in-place
- o In-situ vitrification
- o Excavation and disposal
- o Soil flushing
- o Groundwater recovery and treatment

Table 2-22 provides a comparison of the technical feasibility, costs, applicable environmental regulations, and state of development for the technologies evaluated. The process, operations, costs, applications and limitations of the six selected technologies are described in more detail in Appendix C.

In addition, a no-action alternative has been included, since many of the sites received such apparently low volumes of wastes and had either no radionuclide or heavy metal waste or very low (less than two curies) amounts of radioactive materials.

2.6.1.6 Selection of the Remedial Technologies by Site

Once the final seven alternatives (six technologies plus no action) were selected, an evaluation was made for each site, and at least two technologies per site were identified as applicable. One further crucial assumption was made: to combine soil flushing and groundwater treatment as

TABLE 2-22

Summary Matrix of Applications of Remedial Action Technologies

	Technical Feasibility						Costs	
Remedial Action Technology	Total Radio-Nuclides	Soluble/ Non-Soluble Radionuclides	Heavy Metals	Organics	Effective Depth (Feet)	Other Limitations	Factor	Unit Cost
Cap/Cover	<10Ci	Non-Soluble	Yes	Yes	No Limit	Susceptible to Subsidence	100 Square Yards	$4,500
Grout-in-Place	No Limit	Non-Soluble	Yes	Yes	No Limit	Extensive Site Character Required Difficult to Verify Effectiveness	100 Cubic Yards	$6,000
Vitrification	No Limit	Non-Soluble Low Volatility	Yes	No	<50	Low Soil Moisture Required High Energy Demand	100 Cubic Yards	$38,900
Excavation/ Disposal	No Limit	Non-Soluble Low Volatility	Yes	Yes	<60	Worker H&S Concerns	100 Cubic Yards	$36,500 - $68,900
Groundwater Pump/ Treatment								
Soil Flushing	No Limit	Soluble	Yes	Poor	No Limit	Need Extensive Characteristics of Soil/Waste Matrix	100 Cubic Yards	$3,500
Water Treatment	No Limit	Soluble	Yes	Yes	No Limit	Required Extensive Aquifer Characterization	100 Cubic Yards	$1,200

TABLE 2-22

Summary Matrix of Applications of Remedial Action Technologies

Remedial Action Technology	Applicable Env. Requirements				Demonstrated Compliance with Environmental Regulations				State of Development		
	Air	Surface Water	Ground Water	RCRA	CERCLA Sites	RCRA Sites	LLRAD Sites	HLRAD Sites	Radionuclides	Heavy Metals	Organics
Source Controls CAP/Systems	Yes	Yes	No	No	Yes	Yes	Yes	Unknown	Full Scale	Full Scale	Full Scale
Grout-in-Place	No	Yes	Yes	No	No	Unknown	No	No	Pilot Scale	Pilot Scale	Unknown
Vitrification	Yes	Yes	No	Yes (Site Prep.)	Unknown	Yes	Yes	Unknown	Pilot Scale At Hanford	Pilot Scale	Unknown
Excavation/ Disposal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Full Scale	Full Scale	Full Scale
Groundwater Pump/ Treatment											
Soil Flushing	Yes	No	Yes	Yes (Recovered Solution)	Proposed	Yes	Yes	Proposed	Full Scale On Ore Bodies	Full Scale On Ore Bodies Pilot Scale On Wastes	Pilot Scale
Water Treatment	Yes	No	Yes	Yes (Recovered Solution)	Yes	Yes	Yes	Proposed	Full Scale	Full Scale	Full Scale (Stripping)

one technology since they both involved essentially the same equipment, configuration and operational concerns.

The alternatives were selected for each site based on the following definitions:

Cap/Cover: Potentially useful for sites where the total curie count is less than ten, with most wastes having low solubility. Depth of materials is not a relevant item in the decision process, but the volume of wastes applied to the site should be less than 10,000,000 liters so as to be reasonably assured of fairly shallow depths of contamination.

Grout-in-Place: In-situ grouting using bentonites and portland cement to both chemically stabilize the materials (mostly metals) and physically isolate the wastes from water migration. There are no limits on the depth of wastes.

In-Situ Vitrification: Physical isolation of the wastes, with a depth of effectiveness to approximately 50 feet (assumed for this analysis). The actual limitation is the volume rather than the depth.

Excavation and Disposal: Most useful with sites where wastes have low solubility, are near the surface, and have had a low volume of wastewater.

Soil Flushing/Groundwater Recovery and Treatment: Most useful with the soluble pollutants, but generally not effective on wastes where the nonsoluble fraction was greater than 25 percent.

The most likely application for each technology with respect to radionuclide contamination, depth of wastes, and volume of waste and chemical waste discharged is summarized as follows:

Technology	Limiting Site/Waste Conditions				
	Ci Total	Ci Nonsoluble	Chemical Wastes	Depth of Wastes	Volume of Wastes
Cap/Cover	≤10	≤ 1	N.S.	N.S.	< 10,000,000
Grout-in-Place	N.S.	N.S.	N.S.*	N.S.	<100,000,000
In-Situ Vitrification	N.S.	N.S.	N.S.	< 50'**	<100,000,000
Excavation and Disposal	N.S.	≥25% of Ci	N.S.	< 50'+	< 10,000,000
Soil Flushing/ Groundwater Recovery and Treatment	N.S.	≤25% of Ci	N.S.	N.S.	<100,000,000
No Action	< 2	< 1	N.S.	N.S.	N.S.

N.S. = Not significant in decision process (but considered).

* = Any application of grout-in-place must be custom tailored to the geohydrologic conditions and waste characteristics.

+ = Assumed for analysis purposes. Greater depth would require shoring of the work area.

** = This limit is only assumed for applicability of the technology to specific Hanford Sites. The limiting factor is actually the volume that can be vitrified.

Using these criteria, each technology was compared to each site and a decision made on the potential feasibility for application at that site. These decisions are summarized in Columns 21-25 of Table 2-20.

2.6.2 Summary of Selected Remedial Action by Site

An evaluation resulted in the selection of two or more remedial actions for each site. The selections were based on technical feasibility and the objective of establishing a reasonable cost range for each site. The remedial action alternatives presented for each site are presented in columns 21-26 of Table 2-20. In total, 19 sites were identified where the no-action alternative might be applicable, 36 sites for possible application of cap/cover, 49 sites for possible grout-in-place applications, 35 sites where in-situ vitrification may be appropriate, 42 sites for possible application of soil flushing and groundwater recovery and treatment, and 42 sites where excavation and disposal are feasible.

In terms of the number of possible remedial action alternatives per site, the 81 sites are distributed as follows:

No. of Possible Remedial Actions	No. of Sites
2	34
3	32
4	15

2.6.3 Remedial Action Unit Costs

As discussed in Appendix C, a unit cost has been developed for each proposed remedial action. The costs are in either $/100 cubic yard or $/square yard. The costs include equipment, materials, operation and maintenance (e.g., labor and power) and health and safety. Other costs, such as site preparation (e.g., demolition, road building, etc.), have not been included because they are highly variable for each site. Instead, it is proposed that a contingency factor or allowance for unforeseen costs be included in the site-specific remedial action cost estimate.

Unit costs for the remedial action alternatives are as follows:

- Cap/cover - $4,500/100 square yards (See Appendix C.1)
- Grout-in-place - $6,000/100 cubic yards (See Appendix C.2)
- In-situ vitrification - $38,900/100 cubic yards (See Appendix C.3)

- o Excavation and disposal with incineration - $68,900/100 cubic yards (See Appendix C.6)

  Excavation and disposal without incineration - $36,500/100 cubic yards (See Appendix C.6)

- o Soil flushing - $3,500/100 cubic yards (See Appendix C.4)

- o Groundwater recovery and treatment - $1,200/100 cubic yards (See Appendix C.5)

For excavation and disposal, the higher number includes waste treatment/preparation for disposal.

2.7 COST ESTIMATES FOR INACTIVE WASTE DISPOSAL CHARACTERIZATION AND REMEDIATION

This section provides an order of magnitude estimate of the costs associated with characterizing and implementing remedial actions at all of the identified inactive waste disposal sites on the Hanford Reservation. The objective is to provide specific cost estimates for the characterization and remediation of each of the CERCLA sites and for each type (crib, trench, pond, etc.) of RCRA site and to provide a summary cost estimate for each area of the Hanford Reservation.

2.7.1 Cost Elements

The potential CERCLA sites at Hanford are clustered in the 100, 200, and 300 areas. The costs for characterization and remediation of the CERCLA sites in each area are composed of four elements:

- o Characterization Costs
- o Feasibility Study, Engineering, and Construction Management Costs
- o Remedial Action (Cleanup) Costs
- o Post Remedial Action Costs, i.e., Monitoring Costs

For the characterization costs and remedial action costs, a range is presented. For characterization, the low range represents the cost of only having to do Stage II site characterization which would be applicable to those sites where the wastes are minimally dispersed in the vadose zone. The high range represents the potential need for full and widespread site characterization covering all pathways and receptors and assuming a wide dispersion of wastes in soils and groundwater.

The cost of the engineering and construction management is generally in the range of 10 to 20% of the actual construction cost for almost any type of engineering project. For instance, on the DOE CENTRA Project, which involves low-level radioactivity and heavy metals wastes, this element averages about 15% of the remedial return cost. Generally, the percentage is inversely proportional to the project size assuming the same degree of complexity. Thus, for the CERCLA site at Hanford we have assumed the following factor for this cost element based upon site size:

Size of Site	Costs Required for Engr/CM as a % of R.A.
Small (<1,000 sq ft)	20%
Medium (1,000-10,000 sq ft)	15%
Large (>10,000 sq ft)	10%

The Feasibility Study required by CERCLA is assumed to range from $100,000 for smaller, less complex sites to $2,000,000 for large, complex sites.

The third factor that impacts the site remediation cost is the range of cost of the remedial action itself.

The remedial action cost element range reflects the high and low cost estimates developed for the candidate alternatives for each site. At least two alternatives were considered for each site as documented in the previous section. The cost estimates for each of these or combinations of alternatives have been developed in this task. The cost estimates for each alternative generated for each site is presented in Section 2.7.2 while only the high and low cost alternatives for each site are presented in this summary matrix.

The last cost element, post remedial action monitoring, is oriented toward groundwater monitoring for each site covering both radionuclides, heavy metals, and other organic and inorganic pollutants of concern.

The cost associated with analyzing samples for the above contaminants is $4000 per sample. [Based on estimates provided by Susan Watt of Rocky Mountain Laboratory and Kelvin Wright of SAIC Rockville.] Assuming a 25% increase for blanks, duplicates, etc.; four wells per site and semi-annual sampling results in an annual site monitoring cost of $40,000 regardless of the site size or remedial action taken. Costs associated with soil and vegetation sampling were not included since this activity is currently contracted to Pacific Northwest Laboratory.

2.7.2 Site Characterization Costs

As mentioned early in this report, the degree and associated cost of site characterization depends upon the areal extent of the contamination and the pathways impacted. Each stage of the site characterization involves additional sampling and/or installation of monitoring devices. Since this is an order of magnitude estimate, it was decided to develop a unit cost for each activity of each stage and then summarize the costs by stage for each site. The unit cost for each activity is as follows:

Activity	Cost
1. Installation Sampling and Analysis of Clustered Monitoring Wells	$427,700 to $2,456,500 per cluster
2. Installation, and Analysis of Lysimeters	$9,900 to $25,400 (area range)
3. Soil Borings - Sampled Every 5 Feet (Inc. Analysis)	$51,000 to $418,200 (area average)
4. Soil gas Survey - 50′ Grid	$34.50 @ 50′ Centre
5. Areal Overflow Sediment Sampling and Analysis (Per Sample)	$650 per sample

The unit cost estimates are based on the following additional assumptions:

- o The majority of the labor force resides in the Hanford area
- o All work is done under Level C or D H&S conditions
- o The range of total footage per cluster = 142 ft to 977 ft
- o The range of depth of soil borings is 43 ft to 340 ft

Using these unit costs, working tables were developed that took the quantities and number of activities by stage by site identified and calculated the associated costs. Costs for each stage for each site were then summarized and are presented in Table 2-23.

2.7.3 Site Remedial Action Costs

The remedial action costs were developed using the unit costs developed in Task 5 for each alternative in conjunction with the surface and waste volume to be remediated at each site. For all the constructed sites (cribs, trenches, ditches, etc.) except the reverse wells, it was necessary to

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE - AREA 100 B/C*

Sources	PATHWAY				Source Total Cost**
	Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	
116-B-1	(1) $25,000 (2) $1,500	(3) $2,200,000 (4) $4,200 (5) $6,000 (8) $147,700	(6) $12,600 (7) $1,182,400	(9) $62,400	$3,681,800
116-B-4	(1) $13,600 (2) $800	(3) $2,200,000 (4) $4,200 (5) $6,000 (8) $147,700	(6) $12,600 (7) $945,900	(9) $62,400	$3,433,200
116-C-1	(1) $64,800 (2) $3,800	(3) $2,200,000 (4) $4,200 (5) $6,000 (8) $147,700	(6) $12,600 (7) $945,900	(9) $62,400	$3,487,400
116-C-2	(1) $38,700 (2) $2,200	(3) $2,200,000 (4) $4,200 (5) $6,000 (8) $147,700	(6) $25,200 (7) $2,364,700	(9) $62,400	$4,891,100

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-12.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 100 KE/KW* (Continued)

Sources	Pathway				
	Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
I 100-KW*1 100-KW*2	(1) $17,300 (2) $1,000	(3) $2,180,000 (4) $4,200 (5) $6,000 (8) $147,700	(6) $11,400 (7) $878,100	(9) $62,400	$3,348,100
II 100-KE*1 100-KE*2	(1) $17,300 (2) $1,000	(3) $2,180,000 (4) $4,200 (5) $6,000 (8) $147,700	(6) $11,400 (7) $702,500	(9) $62,400	$3,172,500

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-12.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 100 KE/KW* (Continued)

Sources	Pathway				
	Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
116-K-1	(1) $98,800 (2) $5,700	(3) $2,180,000 (4) $4,200 (5) $6,000 (8) $147,700	(6) $11,400 (7) $702,500	(9) $62,400	$3,258,700
116-K-2	(1) $375,200 (2) $21,800	(3) $2,180,000 (4) $4,200 (5) $6,000 (8) $147,700	(6) $11,400 (7) $702,500	(9) $62,400	$3,551,200
116-KE-2	(1) $17,300 (2) $1,100	(3) $2,180,000 (4) $4,200 (5) $6,000 (8) $147,700	(6) $11,400 (7) $878,100	(9) $62,400	$3,348,200

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-12.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 100 F* (Continued)

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
116-F-1	(1) $274,300 (2) $16,000	(3) $2,500,000 (4) $4,200 (5) $6,250 (8) $147,700	(6) $20,500 (7) $2,528,000	(9) $62,400	$5,599,350
116-F-2	(1) $47,000 (2) $2,700	(3) $2,500,000 (4) $4,200 (5) $6,250 (8) $147,700	(6) $10,250 (7) $821,600	(9) $62,400	$3,642,100
116-F-3	(1) $26,100 (2) $1,500	(3) $2,500,000 (4) $4,200 (5) $6,250 (8) $147,700	(6) $10,250 (7) $632,000	(9) $62,400	$3,430,400
I 116-F-6 116-F-10	(1) $68,900 (2) $4,000	(3) $2,500,000 (4) $4,200 (5) $6,250 (8) $147,700	(6) $20,500 (7) $1,327,200	(9) $62,400	$4,181,150

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-12.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 100 F* (Continued)

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
116-F-9	(1) $56,700 (2) $3,300	(3) $2,500,000 (4) $4,200 (5) $6,250 (8) $147,700	(6) $10,250 (7) $1,137,600	(9) $62,400	$3,968,400

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-12.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 100 H* (Continued)

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
116-H-1	(1) $34,700 (2) $2,000	(3) $2,495,500 (4) $4,200 (5) $6,250 (8) $147,700	(6) $9,850 (7) $510,700	(9) $62,400	$3,313,300
116-H-2	(1) $52,800 (2) $3,000	(3) $2,495,500 (4) $4,200 (5) $6,250 (8) $147,700	(6) $9,850 (7) $510,700	(9) $62,400	$3,332,400
116-H-3	(1) $13,500 (2) $800	(3) $2,495,500 (4) $4,200 (5) $6,250 (8) $147,700	(6) $9,850 (7) $408,600	(9) $62,400	$3,188,800

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-12.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 100 D/DR* (Continued)

Sources	Pathway: Surface Geophysics/ Soil Gas	Pathway: Groundwater	Pathway: Vadose Zone	Pathway: Surface Water/ Sediments	Source Total Cost
116-DR-1	(1) $41,000 (2) $2,400	(3) $2,530,000 (4) $4,200 (5) $6,250 (8) $147,700	(6) $12,000 (7) $1,059,950	(9) $62,400	$3,905,900
116-DR-2	(1) $28,900 (2) $1,700	(3) $2,530,000 (4) $4,200 (5) $6,250 (8) $147,700	(6) $12,000 (7) $1,059,950	(9) $62,400	$3,893,100
116-DR-1B	(1) $25,100 (2) $1,500	(3) $2,530,000 (4) $4,200 (5) $6,250 (8) $147,700	(6) $12,000 (7) $741,950	(9) $62,400	$3,571,100
116-DR-6	(1) $25,100 (2) $1,200	(3) $2,530,000 (4) $4,200 (5) $6,250 (8) $147,700	(6) $12,000 (7) $847,950	(9) $62,400	$3,676,800

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-12.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 100 D/DR* (Continued)

Sources	Pathway				Source Total Cost**
	Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	
116-DR-7	(1) $17,500 (2) $1,000	(3) $2,530,000 (4) $4,200 (5) $6,250 (8) $147,700	(6) $12,000 (7) $847,950	(9) $62,400	$3,669,000

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-12.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 200 EAST* (Continued)

Sources	Pathway				
	Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
I 216-B-43 216-B-44 216-B-45 216-B-46 216-B-48 216-B-49 216-B-50	(1) $63,800 (2) $3,700	(3) $6,136,000 (4) $4,200 (5) $16,300 (8) $138,100	(6) $25,400 (7) $4,182,200	(9) $93,600	$10,703,300
II 216-B-7A&B	(1) $18,900 (2) $1,100	(3) $2,360,000 (4) $1,400 (5) $6,300 (8) $52,400	(6) $25,400 (7) $3,345,800	(9) $93,600	$5,944,900
III 216-B-2-2	(1) $200,300 (2) $11,600	(3) $2,360,000 (4) $1,400 (5) $6,300 (8) $52,400	(6) $25,400 (7) $3,345,800	(9) $93,600	$6,136,800
IV 216-B-5	(1) $13,200 (2) $800	(3) $2,832,000 (4) $2,100 (5) $7,500 (8) $57,700	(6) $25,400 (7) $2,509,300	(9) $93,600	$5,581,600

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-13.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 200 EAST* (Continued)

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
V 216-B-10-A 216-B-6	(1) $32,100 (2) $1,900	(3) $3,304,000 (4) $2,100 (5) $8,800 (8) $71,700	(6) $25,400 (7) $4,182,200	(9) $43,600	$7,711,800
VI 216-C-1 216-C-10	(1) $39,200 (2) $2,200	(3) $2,360,000 (4) $1,400 (5) $6,300 (8) $52,400	(6) $25,400 (7) $5,018,600	(9) $43,600	$7,589,100
VII 216-B-16	(1) $30,400 (2) $1,800	(3) $2,360,000 (4) $1,400 (5) $6,300 (8) $52,400	(6) $25,400 (7) $3,345,800	(9) $43,600	$5,907,100
VIII 216-A-40	(1) $49,900 (2) $2,900	(3) $2,360,000 (4) $1,400 (5) $6,300 (8) $52,400	(6) $25,400 (7) $3,345,800	(9) $43,600	$5,927,700

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-13.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II, III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 200 EAST* (Continued)

Sources	Pathway				Source Total Cost**
	Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	
IX 216-A-24	(1) $129,100 (2) $7,500	(3) $2,360,000 (4) $1,400 (5) $6,300 (8) $52,400	(6) $50,800 (7) $5,018,600	(9) $43,600	$7,709,700
X 216-A-9	(1) $51,500 (2) $3,000	(3) $2,360,000 (4) $1,400 (5) $6,300 (8) $52,400	(6) $50,800 (7) $5,018,600	(9) $43,600	$7,627,600
XI 216-A-7	(1) $18,200 (2) $1,100	(3) $2,360,000 (4) $1,400 (5) $6,300 (8) $52,400	(6) $25,400 (7) $1,672,900	(9) $43,600	$4,221,300
XII 216-A-28	(1) $15,600 (2) $900	(3) $2,360,000 (4) $1,400 (5) $6,300 (8) $52,400	(6) $25,400 (7) $1,672,900	(9) $43,600	$4,218,500

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-13.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 200 EAST*

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
XIII 216-A-4 216-A-5 216-A-21 216-A-27 216-A-36A	(1) $122,500 (2) $7,100	(3) $4,720,000 (4) $3,500 (5) $12,500 (8) $104,900	(6) $50,800 (7) $13,383,000	(9) $43,600	$18,487,900
XIV 216-A-6	(1) $34,500 (2) $2,000	(3) $2,360,000 (4) $1,400 (5) $6,300 (8) $52,400	(6) $25,400 (7) $3,345,800	(9) $43,600	$5,911,400

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-13.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 200 W* (Continued)

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
I 216-S-5 216-S-6 216-S-17 216-S-16P 216-S-16D	(1) $1,354,100 (2) $78,600	(3) $3,396,000 (4) $6,300 (5) $7,700 (8) $173,000	(6) $42,300 (7) $12,807,200	(9) $43,600	$17,948,800
II 216-S-1&2 216-S-7 216-S-3 216-S-9	(1) $125,500 (2) $7,300	(3) $4,528,000 (4) $8,400 (5) $10,200 (8) $230,600	(6) $42,300 (7) $10,245,800	(9) $43,600	$15,281,700
III 216-S-20	(1) $27,400 (2) $1,600	(3) $4,528,000 (4) $8,400 (5) $10,200 (8) $230,600	(6) $21,150 (7) $2,561,400	(9) $43,600	$7,472,350
IV 216-S-4 216-S-21	(1) $38,300 (2) $2,200	(3) $2,830,000 (4) $4,200 (5) $6,400 (8) $157,300	(6) $42,300 (7) $5,122,900	(9) $43,600	$8,287,200

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-13.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 200 W* (Continued)

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
V 216-U-11	(1) $360,400 (2) $20,900	(3) $2,830,000 (4) $4,200 (5) $6,400 (8) $157,300	(6) $21,150 (7) $2,561,400	(9) $43,600	$6,045,350
VI 216-U-3	(1) $13,900 (2) $800	(3) $2,830,000 (4) $4,200 (5) $6,400 (8) $157,300	(6) $21,150 (7) $2,561,400	(9) $43,600	$5,678,750
VII 216-Z-1&2	(1) $21,400 (2) $1,200	(3) $2,830,000 (4) $4,200 (5) $6,400 (8) $157,300	(6) $21,150 (7) $2,561,400	(9) $43,600	$5,686,650
VIII 216-U-1&2	(1) $25,200 (2) $1,500	(3) $2,830,000 (4) $4,200 (5) $6,400 (8) $157,300	(6) $21,150 (7) $2,561,400	(9) $43,600	$5,690,750

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-13.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 200 W* (Continued)

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
IX 216-U-4 216-U-4A 216-U-4B	(1) $40,600 (2) $2,400	(3) $2,830,000 (4) $4,200 (5) $6,400 (8) $157,300	(6) $21,150 (7) $3,842,200	(9) $43,600	$6,987,850
X 216-Z-7 216-Z-10	(1) $51,400 (2) $3,000	(3) $2,830,000 (4) $4,200 (5) $6,400 (8) $157,300	(6) $21,150 (7) $2,561,400	(9) $43,600	$5,718,450
XI 216-T-19	(1) $61,900 (2) $3,600	(3) $2,830,000 (4) $4,200 (5) $6,400 (8) $157,300	(6) $21,150 (7) $2,561,400	(9) $43,600	$5,729,550
XII 216-T-7	(1) $53,700 (2) $3,100	(3) $2,830,000 (4) $4,200 (5) $6,400 (8) $157,300	(6) $21,150 (7) $2,561,400	(9) $43,600	$5,720,850

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-13.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 200 W* (Continued)

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
XIII 216-T-28	(1) $21,400 (2) $1,200	(3) $2,830,000 (4) $4,200 (5) $6,400 (8) $157,300	(6) $21,150 (7) $2,561,400	(9) $43,600	$5,686,650
XIV 216-T-3	(1) $13,200 (2) $800	(3) $3,396,000 (4) $6,300 (5) $7,700 (8) $173,000	(6) $21,150 (7) $2,561,400	(9) $43,600	$6,263,150
XV 216-T-2 216-T-8	(1) $34,300 (2) $2,000	(3) $3,396,000 (4) $6,300 (5) $7,700 (8) $173,000	(6) $21,150 (7) $3,842,200	(9) $43,600	$7,566,250

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-13.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

TABLE 2-23. SUMMARY OF STAGES II,III, AND V SITE CHARACTERIZATION COSTS BY SOURCE AREA - 300* (Continued)

Sources	Pathway: Surface Geophysics/ Soil Gas	Groundwater	Vadose Zone	Surface Water/ Sediments	Source Total Cost**
316-1	(1) $159,100 (2) $9,200	(3) $1,008,000 (4) $2,800 (5) $7,900 (8) $135,800	(6) $9,900 (7) $683,800	(9) $62,400	$2,118,900
316-2	(1) $223,500 (2) $13,000	(3) $1,008,000 (4) $2,800 (5) $7,900 (8) $135,800	(6) $9,900 (7) $797,800	(9) $62,400	$2,301,100
316-3	(1) $63,100 (2) $3,700	(3) $756,000 (4) 2,100 (5) 5,900 (8) $101,800	(6) $9,900 (7) $683,800	(9) $62,400	$1,728,700

Source Characterization Activity Cost Code:

(1). Soil Gas (see Note 1)
(2). Surface Geophysics (see Note 2)
(3). Cluster Wells (Installation/Development/Split Spoon Analysis (see Note 3)
(4). Aquifer (Slug) Tests (see Note 4)
(5). Borehole Geophysics (see Note 5)
(6). Lysimeters (Installation/Data Collection) (see Note 6)
(7). Soil Borings (see Note 7)
(8). Groundwater Sampling (Well Cluster Sample Collection/Analysis) (see Note 8)
(9). Ephemeral Overflow Sampling (Water and Sediment Sample Collection/Analysis) (see Note 9)

* Source Characterization cost elements presented in this table were derived as follows: source characterization activity unit costs were multiplied by the number of units (well clusters, survey acreages, soil borings, etc.) specified for each source. Unit costs derivations appear in Notes 1 through 9 to this table. Number of units for each square is specified in Table 2-14.

** Source Total Cost include Work Plan preparation ($8,000) and Remedial Investigation Report preparation ($32,000) for each source.

NOTE 1

ESTIMATED SOIL GAS SURVEY COSTS

- Assume 50 ft. centers; 17 samples per acre per day.
- Costs below are per acre, with on-site GC analysis.

Mobilization/Demobilization (pro-rated)	$ 100
Field Work 10 hours/day @ $250/hr	2,500
Direct Expenses 1 day @ $75/day vehicle, pipes, supplies	75
Per Diem 2 persons for 1 day @ $75/person/day	150
Report Preparation	N/C
1 Supervisor for 1 day o Labor o Expenses o Field Analysis	625
Total Soil Gas Surveys	$ 3,450 per Acre

NOTE 2

ESTIMATED SURFACE GEOPHYSICS SURVEY COSTS

o Assume 100 ft. centers; 35 acres per day at 10.0 hrs per day

Mobilization/Demobilization	Negligible
Electromagnetics (all inclusive)	$ 100/acre
Magnetometer (all inclusive)	$ 100/acre
Total Surface Geophysics Surveys	$ 200 per Acre

NOTE 3

ESTIMATED STAGE II AND III COSTS PER CLUSTER FOR SHALLOW MONITORING WELL DRILLING/INSTALLATION/SPLIT SPOON SAMPLING AND ANALYSIS

Area	Individual/ Total Well Footage	Drilling/ Install. w/Mat'ls @ $100/ft.	Drums @ $225/100 ft.	Drilling Subtotal/ Cluster	# Spoons Per Deep Well	Avg. S.S. Collection/ Analysis Costs*	Tot.Cost/ Cluster**
100 B/C	108/206/304 = 618'	$ 61,800	$ 1,391	$ 63,191	61	$ 6,015	$ 439,256 (439,000)
100 KE/KW	86/195/304 = 585'	58,500	1,320	59,820	61	6,015	435,885 (436,000)
100 D/DR	97/226/354 = 677'	67,700	1,525	69,225	71	6,015	505,440 (506,000)
100 H	56/205/354 = 615'	61,500	1,385	62,885	71	6,015	499,100 (499,000)
100 F	64/209/354 = 627'	62,700	1,411	64,111	71	6,015	500,326 (500,000)
200 E	354'	35,400	797	36,197	71	6,015	472,412 (472,000)
200 W	272/325/380 977'	97,700	2,250	99,950	76	6,015	566,240 (566,000)
300	57/85 142'	14,200	324	14,524	17	6,015	125,929 (126,000)

* Assumes collection cost of $150/spoon; 1/2 clusters installed/sampled in Stage II @ $6800/analysis (full suite) + 1/2 installed in Stage III @ $3400/analysis + 15% for Duplicates/Replicates.

** Includes drilling/installation costs, drilling "non-footage" costs, and total split spoon analytical cost. Non-footage costs are constant for any well, as follows:

o Development - 5 hrs x 2 men x $50/hr	
o Stick-ups, guard posts	$ 300
o Clean-up	200
o Geologist and H&S person - 2 men x 24 hrs/well x $50/hr	2,400
o Surveying - $150/well	150
Per any well	$ 3,050
Per cluster	$ 9,150

NOTE 4

ESTIMATED STAGE II AND III AQUIFER COST

- Assume costs to conduct and interpret data
- Assume only 1/3 or 1/2 of the clusters at a given site would be slug tested. Wells are sufficiently close that data from that proportion will be adequately representative for entire site.

4 hrs/test

Labor

2 staff @ 4 hrs/test = 8 hours x $50/hr =	$ 400 per well
Data Analysis 4 hrs/well x 50/hr =	200 per well
Miscellaneous expendables and all equipment inclusive	100 per well
	$ 700 per well or $2,100 per cluster

NOTE 5

ESTIMATED DOWNHOLE GEOPHYSICS COST FOR STAGE II AND III
GROUNDWATER MONITORING WELLS

Assumptions for equipment/operator time, labor, etc., as footnoted below; footage costs are area-specific. This is a per cluster cost, although downhole geophysics will only be run on deepest well of each cluster.

Area	Footage of Deepest Well	Total Cost x $1/ft + Fixed Cost of $900*
100 B/C	300	$ 1,200
100 KE/KW	300	$ 1,200
100 D/DR	350	$ 1,250
100 H	350	$ 1,250
100 F	350	$ 1,250
200 E	350	$ 1,250
200 W	380	$ 1,280
300	85	$ 985

* Downhole Geophysics; Shallow (Unconfined) Aquifer

Assume

o $1/foot for suite of tools applied against depth of deepest well in cluster in each area.

Equipment & Engineer - $450 per cluster	$ 450
H & S person 4 hrs - $50/hr - $200 per cluster	200
Misc. charges per cluster - $250 per cluster	250
	$ 900 fixed cost

Prorated Mobilization
Per diem
Computer Logs

NOTE 6

ESTIMATED LYSIMETER INSTALLATION COSTS *

Area	Footage to Groundwater	Boring $ @ $49/ft.	Drums $225/100 feet	Fixed** Costs	Lysimeter Cost	Borehole Geophys.***	Unit Cost of a Lysimeter Cost each Area
100 B/C	94	$ 4,606	$ 215	$5,000	$ 1,750	$ 994	$12,565 (12,600)
100 KE/KW	72	3,528	162	5,000	1,750	972	11,412 (11,400)
100 D/DR	83	4,067	187	5,000	1,750	983	11,987 (12,000)
100 H	42	2,058	95	5,000	1,750	942	9,845 (9,850)
100 F	50	2,450	113	5,000	1,750	950	10,263 (10,250)
200 E	340	16,660	765	5,000	1,750	1,240	25,415 (25,400)
200 W	258	12,642	581	5,000	1,750	1,158	21,131 (21,150)
300	43	2,107	97	5,000	1,750	943	9,897 (9,900)

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* Lysimeter installation costs were derived by modifying the Estimated Soil Boring Costs to reflect the additional labor of lysimeter installation in the open borehole and the lysimeter material costs.

** Fixed Costs - Additional Labor (over soil boring cost) for installation of lysimeters:

3 men x 10 hrs/day x 2 days x $50/hr = $3,000

*** $900 per hole fixed rate and $1/ft per Borehole Geophysics costing sheet

NOT

ESTIMATED STAGE II AND III SOIL BORING COSTS

Area	Footage to Groundwater	Boring $ @ $49/ft.	Drums $225/100 ft.	Fixed* Costs	Total Cost per Boring	No. Split Spoons	Avg. S.S. Analysis Cost	Tot.Cost/Boring w/S.S. Analysis
100 B/C	94	$ 4,606	$ 212	$2,000	$ 6,818 (6,800)	19	$ 5,865	$ 118,235
100 KE/KW	72	3,528	162	2,000	5,690 (5,700)	14	5,865	84,810
100 D/DR	83	4,067	187	2,000	6,254 (6,250)	17	5,865	105,955
100 H	42	2,058	95	2,000	4,153 (4,150)	8	5,865	51,070
100 F	50	2,450	113	2,000	4,563 (4,550)	10	5,865	63,200
200 E	340	16,660	765	2,000	19,425 (19,400)	68	5,865	418,220
200 W	258	12,642	581	2,000	15,223 (15,200)	52	5,865	320,180
300	43	2,107	97	2,000	4,204 (4,200)	9	5,865	56,985

* "Non-footage Costs" (Constant for any Boring - Assumed)

- o Driller labor for decon, clean-up, etc.
  3 hrs x $150/hr = $450/boring
- o Drilling expendables (grout, H&S equipment, etc.) = $200/boring
- o Surveying = $150/boring
- o Geologist and H&S Specialist
  2 men x 12 hrs/day x $50/hr = $1,200/boring

Total = $2,000/boring

NOTE 8. STAGE II & III
TOTAL COSTS FOR GROUNDWATER SAMPLING LABOR AND ANALYSIS

source	stage 2 cluster*	stage 2 gw sample*	per cluster labor cost**	stage 2 sampling labor***	stage 2 analysis cost (#samples X $7130) ****	stage 3 gw clusters*	stage 3 gw samples*	stage 3 sampling labor ***	stage 3 analysis cost (#samples X $3570) ****	total stage 2 + 3 costs
100 B/C	12	36	3750	$45,000	$256,680	20	60	$75,000	$214,200	$590,880
					$0					$0
116-B-1	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-B-4	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-C-1	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-C-2	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
					$0			$0	$0	$0
100 KE/KW	21	63	3750	$78,750	$449,190	35	105	$131,250	$374,850	$1,034,040
					$0					$0
100-KW*1	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
100-KW*2	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
100-KE*1	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
100-KE*2	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-K-1	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-K-2	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-KE-2	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
					$0					$0
100 D/DR	15	45	3750	$56,250	$320,850	25	75	$93,750	$267,750	$738,600
					$0					$0
116-DR-1	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-DR-2	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-DR-1B	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-DR-6	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-DR-7	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
					$0					$0
100 H	9	27	3750	$33,750	$192,510	15	45	$56,250	$160,650	$443,160
					$0					$0
116-H-1	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-H-2	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-H-3	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
					$0					$0
100 F	18	54	3750	$67,500	$385,020	30	90	$112,500	$321,300	$886,320
					$0					$0
116-F-1	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-F-2	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720

NOTE 8. STAGE II & III
TOTAL COSTS FOR GROUNDWATER SAMPLING LABOR AND ANALYSIS (Continued)

source	stage 2 cluster*	stage 2 gw sample*	per cluster labor cost**	stage 2 sampling labor***	stage 2 analysis cost (#samples X $7130) ****	stage 3 gw clusters*	stage 3 gw samples*	stage 3 sampling labor ***	stage 3 analysis cost (#samples X $3570) ****	total stage 2 + 3 costs
116-F-3	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-F-6	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-F-9	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
116-F-10	3	9	3750	$11,250	$64,170	5	15	$18,750	$53,550	$147,720
					$0					$0
200 EAST	51	51	1650	$84,150	$363,630	83	83	$136,950	$296,310	$881,040
					$0					$0
Source I	8	8	1650	$13,200	$57,040	13	13	$21,450	$46,410	$138,100
216-B-43				$0	$0			$0	$0	$0
216-B-44				$0	$0			$0	$0	$0
216-B-45				$0	$0			$0	$0	$0
216-B-46				$0	$0			$0	$0	$0
216-B-48				$0	$0			$0	$0	$0
216-B-49				$0	$0			$0	$0	$0
216-B-50				$0	$0			$0	$0	$0
Source II	3	3	1650	$4,950	$21,390	5	5	$8,250	$17,850	$52,440
216-B-7a&7b				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source III	3	3	1650	$4,950	$21,390	5	5	$8,250	$17,850	$52,440
216-B-2-2				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source IV	3	3	1650	$4,950	$21,390	6	6	$9,900	$21,420	$57,660
216-B-5				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source V	4	4	1650	$6,600	$28,520	7	7	$11,550	$24,990	$71,660
216-B-10-A				$0	$0			$0	$0	$0
216-B-6				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source VI	3	3	1650	$4,950	$21,390	5	5	$8,250	$17,850	$52,440
216-C-1				$0	$0			$0	$0	$0
216-C-10				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source VII	3	3	1650	$4,950	$21,390	5	5	$8,250	$17,850	$52,440
216-B-16				$0	$0			$0	$0	$0

NOTE 8. STAGE II & III
TOTAL COSTS FOR GROUNDWATER SAMPLING LABOR AND ANALYSIS (Continued)

source	stage 2 cluster*	stage 2 gw sample*	per cluster labor cost**	stage 2 sampling labor***	stage 2 analysis cost (#samples X $7130) ****	stage 3 gw clusters*	stage 3 gw samples*	stage 3 sampling labor ***	stage 3 analysis cost (#samples X $3570) ****	total stage 2 + 3 costs
Source VIII	3	3	1650	$4,950	$21,390	5	5	$8,250	$17,850	$52,440
216-A-40				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source IX	3	3	1650	$4,950	$21,390	5	5	$8,250	$17,850	$52,440
216-A-24				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source X	3	3	1650	$4,950	$21,390	5	5	$8,250	$17,850	$52,440
216-A-9				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source XI	3	3	1650	$4,950	$21,390	5	5	$8,250	$17,850	$52,440
216-A-7				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source XII	3	3	1650	$4,950	$21,390	5	5	$8,250	$17,850	$52,440
216-A-28				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source XIII	6	6	1650	$9,900	$42,780	10	10	$16,500	$35,700	$104,880
216-A-4				$0	$0			$0	$0	$0
216-A-5				$0	$0			$0	$0	$0
216-A-21				$0	$0			$0	$0	$0
216-A-27				$0	$0			$0	$0	$0
216-A-36A				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source XIV	3	3	1650	$4,950	$21,390	5	5	$8,250	$17,850	$52,440
216-A-6				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
200 WEST	48	141	4950	$237,600	$1,005,330	84	252	$415,800	$899,640	$2,558,370
				$0	$0			$0	$0	$0
Source I	3	9	4950	$14,850	$64,170	6	18	$29,700	$64,260	$172,980
216-S-5				$0	$0			$0	$0	$0
216-S-6				$0	$0			$0	$0	$0
216-S-17				$0	$0			$0	$0	$0
216-S-16P				$0	$0			$0	$0	$0
216-S-16D				$0	$0			$0	$0	$0

NOTE 8. STAGE II & III
TOTAL COSTS FOR GROUNDWATER SAMPLING LABOR AND ANALYSIS (Continued)

source	stage 2 cluster*	stage 2 gw sample*	per cluster labor cost**	stage 2 sampling labor***	stage 2 analysis cost (#samples X $7130) ****	stage 3 gw clusters*	stage 3 gw samples*	stage 3 sampling labor ***	stage 3 analysis cost (#samples X $3570) ****	total stage 2 + 3 costs
Source II	4	12	4950	$19,800	$85,560	8	24	$39,600	$85,680	$230,640
216-S-1&2				$0	$0			$0	$0	$0
216-S-7				$0	$0			$0	$0	$0
216-S-3				$0	$0			$0	$0	$0
216-S-9				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source III	4	12	4950	$19,800	$85,560	8	24	$39,600	$85,680	$230,640
216-S-20				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source IV	3	9	4950	$14,850	$64,170	5	15	$24,750	$53,550	$157,320
216-S-4				$0	$0			$0	$0	$0
216-S-21				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source V	3	9	4950	$14,850	$64,170	5	15	$24,750	$53,550	$157,320
216-U-11				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source VI	3	9	4950	$14,850	$64,170	5	15	$24,750	$53,550	$157,320
216-U-3				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source VII	3	9	4950	$14,850	$64,170	5	15	$24,750	$53,550	$157,320
216-Z-1&2				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source VIII	3	9	4950	$14,850	$64,170	5	15	$24,750	$53,550	$157,320
216-U-1&2				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source IX	3	9	4950	$14,850	$64,170	5	15	$24,750	$53,550	$157,320
216-U-4				$0	$0			$0	$0	$0
216-U-4A				$0	$0			$0	$0	$0
216-U-4B				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source X	3	9	4950	$14,850	$64,170	5	15	$24,750	$53,550	$157,320
216-Z-7				$0	$0			$0	$0	$0
216-Z-10				$0	$0			$0	$0	$0

NOTE 8. STAGE II & III

TOTAL COSTS FOR GROUNDWATER SAMPLING LABOR AND ANALYSIS (Continued)

source	stage 2 cluster*	stage 2 gw sample*	per cluster labor cost**	stage 2 sampling labor***	stage 2 analysis cost (#samples X $7130) ****	stage 3 gw clusters*	stage 3 gw samples*	stage 3 sampling labor ***	stage 3 analysis cost (#samples X $3570) ****	total stage 2 + 3 costs
Source XI	3	9	4950	$14,850	$64,170	5	15	$24,750	$53,550	$157,320
216-T-19				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source XII	3	9	4950	$14,850	$64,170	5	15	$24,750	$53,550	$157,320
216-T-7				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source XIII	3	9	4950	$14,850	$64,170	5	15	$24,750	$53,550	$157,320
216-T-28				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source XIV	3	9	4950	$14,850	$64,170	6	18	$29,700	$64,260	$172,980
216-T-3				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
Source XV	3	9	4950	$14,850	$64,170	6	18	$29,700	$64,260	$172,980
216-T-2				$0	$0			$0	$0	$0
216-T-8				$0	$0			$0	$0	$0
				$0	$0			$0	$0	$0
300 AREA	11	22		$0	$156,860	22	44	$0	$157,080	$313,940
				$0	$0			$0	$0	$0
316-1	4	8	1800	$7,200	$57,040	8	16	$14,400	$57,120	$135,760
				$0	$0			$0	$0	$0
316-2	4	8	1800	$7,200	$57,040	8	16	$14,400	$57,120	$135,760
				$0	$0			$0	$0	$0
316-3	3	6	1800	$5,400	$42,780	6	12	$10,800	$42,840	$101,820

* Numbers of clusters/groundwater samples per source per stage were derived from Table 3-2.

** See Note 8A.

*** Number of clusters sampled X per cluster sampling cost.

**** See Note 8C.

NOTE 8A

ESTIMATED COSTS FOR STAGE V
WELL CLUSTER SAMPLING

Area	Depth/Cost*	Depth/Cost*	Depth/Cost*	Per Cluster Total**
100 B/C	108/$900	206/$1200	304/$1650	$ 3,750
100 KE/KW	86/$900	195/$1200	304/$1650	3,750
100 D/DR	97/$900	226/$1200	354/$1650	3,750
100 H	56/$900	205/$1200	354/$1650	3,750
100 F	64/$900	209/$1200	354/$1650	3,750
200 E	354/$1650	---	---	1,650
200 W	272/$1650	325/$1650	380/$1650	4,950
300	57/$900	85/$900	---	1,800

* Per well labor/materials cost breakdown, as detailed in Note 8B.

** This represents the cost to sample any one cluster of wells in the area in question.

NOTE 8B

ESTIMATED COSTS FOR STAGE II & III WELL CLUSTER SAMPLING (Continued)

1. Average 80' Well

o Install pump/purge/withdraw pump 3 hrs x 3 men x $50/hr		$ 450
o Decon and Sample 1 hr x 3 men x $50/hr		150
o Dedicated bailer $200		200
o Equipment rental/expendables		100
	Total	$ 900

2. Average 150-175' Well

o 5 hrs x 3 men x $50/hr		$ 705
o 1 hr x 3 men x $50/hr		150
o $200		200
o Equipment rental/expendables		100
	Total	$1,200

3. Average 300-330' Well

o 7 hrs x 3 men x $50/hr		$ 1,050
o 2 hrs x 3 men x $50/hr		300
o $200		200
o Equipment rental/expendables		100
	Total	$ 1,650

NOTE 8C

ESTIMATED LABORATORY ANALYTICAL COSTS FOR SOILS AND WATER

Assume Laboratory Analysis Per Sample; Entire Appendix, 9 suite, Radionuclides, 4 pesticides*

Compound	Cost in Soil	Cost in Water
Organics		
VOX	580	500
Semi VOC	1,020	950
Chlorine Dioxius	1,000	850
Ferunds		
Inorganics	590	440
Pesticides		
Organo chlorine PCB Pesticide	360	300
Orthophosphate Pesticides	360	300
Radionuclides (complete suite on the Hanford Reservation)	2,855 $ (6,800)	2,855 $ 6,200
Subtotal	6,765	
Total Analytical Cost per Sample for Stage II Analysis**	$ 7,820	$ 7,130
Total Analytical Cost per Sample for Stage III Analysis***	$ 3,910	$ 3,570

* Note: Herbicides are not included in the Totals for soil and water: Soil cost 275 each species and water cost 200 each species.

** Assumes 15% increase for duplicates and replicates

**** It is assumed that by Stage III, the suite of analytes required can be reduced based upon evaluation of Stage II findings. A cost reduction of 50% is assumed.

NOTE 9

ESTIMATED "EPHEMERAL OVERFLOWS" SURFACE WATER/SEDIMENT SAMPLES COLLECTION COSTS

Per Sample Pt. (1 Surface Water + 1 Sediment), Excluding Analysis

o 2 Men x 6 hrs x $50/hr	$ 600
o Expendables	50
Sample Collection Cost Per Point	$ 650
o Analytical Cost (per estimated laboratory Analytical costs for Soils and Water Sheet)	$14,950
	$15,600

TABLE 2-23. SUMMARY OF UNCONFINED AQUIFER CHARACTERIZATION COSTS *

Area	Pathway
	Groundwater
100 B/C	$959,100
100K KE/KW	$959,100
100 D/DR	$959,100
100 H	$959,100
100 F	$959,100
200 E	$959,100
200 W	$959,100
300	$959,100
Total	$7,672,800

*Costs include estimated well installation, development, borehole geophysics, sampling and laboratory analysis. (see Notes A, B, C and D)

NOTE B

ESTIMATED BASALT GROUNDWATER MONITORING WELL
SAMPLING COSTS

Assume Average Well Depth = 700 feet

o Install pump/purge/withdraw pump 8 hours x 3 men x $50/hour		$1200
o Decon and sample 4 hours x 3 men x $50/hour		600
o Dedicated bailer		200
o Equipment rental/expendables		500
	Total	$2500/well

NOTE C

ESTIMATED DOWNHOLE GEOPHYSICS COSTS FOR STAGE IV GROUNDWATER MONITORING WELLS

o $1/foot - Average well depth = 700 ft. Assume 8 hours per hole drop $700 per suite per well	$ 700
o Engineers and Equipment	900
o H & S - 8 hr - $50/hr	400
o Miscellaneous	300
	$ 2,300 per well

ESTIMATED STAGE IV AQUIFER TEST COSTS

- o Assume costs to conduct and interpret data
- o 48 pump tests
- o Assume that no discharged well water will be contained

Labor

2 staff @ 55 hrs/test = 8 hrs X $50/hr	=	$ 5,500 per well
Data Analysis 4 hrs/well X $50/hr	=	200 per well
Miscellaneous expendables and all equipment inclusive	=	2,000 per well
		$ 5,700 per well

NOTE D

ESTIMATED BASALT GROUNDWATER AND CORE ANALYTICAL LABORATORY COSTS

Assume 4 water samples from the basalts	
o 4 water samples @ $7,130	$28,520
Assume a sample every 5 ft. from a 400 ft length of coring	
o 80 samples per well @ $7,820	$625,600

Total Cost per Well	$654,120

develop assumptions on the lateral and vertical migration of the wastes in order to determine which of the selected remedial alternatives, or combination of alternatives would be applied: The remedial alternatives and their associated unit costs are:

Alternative	Unit Cost
Cap/Cover Systems	$45/Sq Yd of Surface Area
Grouting In-Situ	$60/Cu Yd of Contaminated Soil
In-Situ Vitrification	$389/Cu Yd of Contaminated Soil
Soil Flushing	$35/Cu Yd of Contaminated Soil
Groundwater treatment	$47/Cu Yd of Soil Treated
Excavation	$365/Cu Yd excavated(1)

(1)$689/Cu Yd if thermal treatment is required prior to disposal.

The Waste Management Operations Report, Vol. 2, was reviewed and site 216-S-1&2 was selected to develop a representative scenario. Because a description of the extent of contaminant spread was not available for the other 80 sites, the information available for site 216-S-1&S was generalized in an attempt to describe the remaining sites. The application of the available site 216-S-1&2 information was applied to the remaining sites using the following assumptions:

- o Lateral migration appeared to be mainly caused by the occurrence of clay lenses or caliche at depths of 30 to 50 feet under many of the sites
- o The sites were not lined and the seepage of liquids from the site into and through the soil column was expected to be similar
- o Except for ponds and reverse wells, it was assumed that disposal conditions (hydraulic head, geologic substrat, rate of seepage ...) at each unit type were roughly the same

- o Because records did not indicate that a perched water table was created beneath a disposal pond or that sites near disposal ponds were inundated by subsurface lateral flow from ponds, it was assumed that the seepage from ponds was able to penetrate, dissolve and pass through discontinuities in the caliche or clay semi-permeable layers. Some lateral spread was expected, but, because additional information was unavailable, the same spread dimension described at site 216-S-1&2 was used. (Because the pond dimension are so large, the addition of this spread dimension is relatively insensitive for an order-of-magnitude analysis).

- o Reverse wells and dry wells are assumed to penetrate through the caliche layer but may lie within or above clay lenses that promote lateral spread. A clay lens is not expected to reduce vertical migration as much as a continuous caliche layer will. For this reason, and because of the large hydraulic pressures expected from these diagonal types, the lateral extent of contamination was again expected to be similar to site 216-S-1&2.

The lateral migration of radionuclides at site 216-S-1&2 is about 115 feet on each side (the concentration of radionuclides decreased to $\leq 10^{-4}$ uCi/gm outside that point) and it appears to be about average. Using the 115 feet as the average extent of lateral migration, we then calculated an approximate area for cap/cover or volume for excavation as follows:

$$A = (L + 230 + D)(W + 230 + D) \text{ and} \qquad (1)$$

V = A x D where
L = Length
W = Width
D = Depth of excavation

and site slopes are assumed to be 1:1. The maximum depth of excavation was limited to 60 feet to negate the need for shoring.

For the in-situ treatment processes (grout-in-place, in-situ vitrification and solution mining) the volume of soil treated is given by:

$$Vol = (L + 230)(W + 230)Z \quad (2)$$

Where Z = the thickness of the soil column to be treated

This volume was adjusted by the soil void fraction for the solution mining alternative, which was taken as 0.20. For solution mining it was further assumed that ten volume charges would be required to completely flush the soil.

Other assumptions used include:

Cap/Cover:	An additional 20 feet on each side beyond the contaminated zone.
Grout-in-Place:	The maximum depth was 160 feet or to the ground water elevation which ever was less. This limit of 160 feet is based on the available data from the S1&2 site which shows a maximum depth of concentrated contaminants of 150 feet. The recommended depth for grouting is 10 feet below this contaminated zone.
In-Situ Vitrification:	The vitrification zone extended from 10 feet above the waste, (i.e., bottom of crib, pond, etc.) to a maximum depth of 50 feet.
Excavation/ Disposal:	Available information regarding the chemicals disposed of in each site was reviewed and only those sites containing chemical wastes which can be thermally destroyed were assumed to be treated in such a manner, otherwise direct disposal following packaging was assumed.

Soil Flushing: Soil flushing was assumed to be used only to a depth of 250 feet or to the depth of the ground water, whichever was less.

Groundwater Recovery and Treatment: Costs associated with recovery and treatment of contaminated groundwater were estimated from the soil flushing scenario. Treatment costs were added.

The "No Action" cost is given whenever the original contaminants may have already been flushed through the soil. For these sites a cost associated with fencing the site was identified including a 200 foot buffer around the estimated laterally contaminated area, and monitoring the site. Monitoring costs are annual costs incurred during each of the assumed 100 years of institutional control.

For some of the sites where more than one technology was identified as being applicable, we have developed cost that reflect this combination of technologies. An example would be a site where excavation to 60 feet was identified along with solution mining to 250 feet. Since solution mining may not be highly efficient, especially for the non-soluble contaminants, and excavation would not reach the contaminants below 60 feet, we have calculated the combined cost of excavating to 60 feet followed by solution mining the from 60 feet to 250 feet below grade.

Using these assumptions a table was developed identifying all of the costs associated wtih each of the technologies previously identified as appropriate for each site. Table 2-24 shows these costs and identifies the range of costs.

Hanford Inactive Waste Site Study.

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

				Unit Type (feet)			CAPPING TECHNIQUE					
	Site No. (1)	Unit Type (12)	Depth	Length	Width	Diameter	Surface Area (sq yd)	FS ($)	ENG ($)	RA ($)	Mon ($)	Total Cost ($)
1	116-B-1	Trench	20	100	10		11,511	200,000	77,700	518,000	1,800,000	2,595,700
2	116-B-4	French Drain	20			4	0	0	0	0	0	0
3	116-C-1	Trench	25	500	50		0	0	0	0	0	0
4	116-C-2	Crib	20	140	100		16,856	300,000	75,850	758,500	1,800,000	2,934,350
5	116-D-1B	Trench	15	100	10		11,511	200,000	77,700	518,000	1,800,000	2,595,700
6	116-DR-1	Trench	20	300	15		0	0	0	0	0	0
7	116-DR-2	Trench	20	150	10		0	0	0	0	0	0
8	116-DR-6	Trench	10	50	10		9,956	100,000	89,600	448,000	1,800,000	2,437,600
9	116-DR-7	Crib	10	5	5		8,403	100,000	75,625	378,125	1,800,000	2,353,750
10	116-F-1	Trench	10	3000	40		112,633	300,000	506,850	5,068,500	1,800,000	7,675,350
11	116-F-2	Trench	15	300	50		0	0	0	0	0	0
12	116-F-3	Trench	8	100	20		11,922	200,000	80,475	536,500	1,800,000	2,616,975
13	116-F-6	Trench	10	300	100		0	0	0	0	0	0
14	116-F-9	Trench	10	500	15		0	0	0	0	0	0
15	116-F-10	French Drain	10			3	6,504	100,000	58,535	292,675	1,800,000	2,251,210
16	116-H-1	Trench	15	200	25		0	0	0	0	0	0
17	116-H-2	Trench	6	275	100		22,406	300,000	100,825	1,008,250	1,800,000	3,209,075
18	116-H-3	French Drain	15			3	6,504	100,000	58,535	292,675	1,800,000	2,251,210
19	100 KE*1	Dry Well (11&12)	4	4	4		8,342	100,000	75,076	375,380	1,800,000	2,350,456
20	100 KE*2	French Drain (12)	3	0	0	3	6,504	100,000	58,535	292,675	1,800,000	2,251,210
21	100 KW*1	Dry Well (11&12)	4	4	4		8,342	100,000	75,076	375,380	1,800,000	2,350,456
22	100 KW*2	French Drain (12)	3			3	6,504	100,000	58,535	292,675	1,800,000	2,251,210
23	116-K-1	Crib	30			400	0	0	0	0	0	0
24	116-K-2	Trench	20	4000	50		0	0	0	0	0	0
25	116-KE-2	Crib	32	16	16		9,088	100,000	81,796	408,980	1,800,000	2,390,776
26	216-B-43	Crib	15									
27	216-B-44	Crib (12)	15									
28	216-B-45	Crib (12)	15									
29	216-B-46	Crib (12)	15	150	300		0	0	0	0	0	0
30	216-B-48	Crib (12)	15									
31	216-B-49	Crib (12)	15									
32	216-B-50	Crib (12)	15									
33	216-B-2-2	Ditch	8	2350	15		0	0	0	0	0	0
34	216-B-5	Reverse Well	302			0.67	0	0	0	0	0	0
35	216-B-6	Reverse Well	75			0.5	6,385	100,000	57,468	287,339	1,800,000	2,244,807
36	216-B-7 A&B	Crib	14	14	14		0	0	0	0	0	0
37	216-B-10A	Crib	20	14	14		8,962	100,000	80,656	403,280	1,800,000	2,383,936

Hanford Inactive Waste Site Study.

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

GROUT-IN-PLACE TECHNIQUE

	Site No. (1)	Unit Type (12)	Unit Type (feet) Depth	Length	Width	Diameter	Surface Area (sq yd)	Grouting Depth (yd)	FS ($)	ENG ($)	RA ($)	Mon ($)	Total Cost ($)
1	116-B-1	Trench	20	100	10		8,800	0	0	0	0	0	0
2	116-B-4	French Drain	20			4	4,778	24	100,000	1,357,055	6,785,275	1,800,000	10,042,330
3	116-C-1	Trench	25	500	50		22,711	14	300,000	1,700,000	18,623,111	1,800,000	22,423,111
4	116-C-2	Crib	20	140	100		13,567	0	0	0	0	0	0
5	116-D-1B	Trench	15	100	10		8,800	0	0	0	0	0	0
6	116-DR-1	Trench	20	300	15		14,428	19	200,000	1,800,000	16,159,111	1,800,000	19,959,111
7	116-DR-2	Trench	20	150	10		10,133	19	200,000	1,702,400	11,349,333	1,800,000	15,051,733
8	116-DR-6	Trench	10	50	10		7,467	0	0	0	0	0	0
9	116-DR-7	Crib	10	5	5		6,136	0	0	0	0	0	0
10	116-F-1	Trench	10	3000	40		96,900	4	300,000	1,700,000	25,194,000	1,800,000	28,994,000
11	116-F-2	Trench	15	300	50		16,489	0	0	0	0	0	0
12	116-F-3	Trench	8	100	20		9,167	0	0	0	0	0	0
13	116-F-6	Trench	10	300	100		19,433	12	300,000	1,399,200	13,992,000	1,800,000	17,491,200
14	116-F-9	Trench	10	500	15		19,872	17	200,000	1,800,000	19,872,222	1,800,000	23,672,222
15	116-F-10	French Drain	10			3	4,738	0	0	0	0	0	0
16	116-H-1	Trench	15	200	25		12,183	14	200,000	1,535,100	10,234,000	1,800,000	13,769,100
17	116-H-2	Trench	6	275	100		18,517	0	0	0	0	0	0
18	116-H-3	French Drain	15			3	4,738	0	0	0	0	0	0
19	100 KE*1	Dry Well (11&12)	4	4	4		6,084	0	0	0	0	0	0
20	100 KE*2	French Drain (12)	3	0	0	3	4,738	0	0	0	0	0	0
21	100 KW*1	Dry Well (11&12)	4	4	4		6,084	0	0	0	0	0	0
22	100 KW*2	French Drain (12)	3			3	4,738	0	0	0	0	0	0
23	116-K-1	Crib	30			400	34,636	0	0	0	0	0	0
24	116-K-2	Trench	20	4000	50		131,600	11	300,000	1,700,000	89,488,000	1,800,000	93,288,000
25	116-KE-2	Crib	32	16	16		6,724	23	100,000	1,828,928	9,144,640	1,800,000	12,873,568
26	216-B-43	Crib	15										
27	216-B-44	Crib (12)	15										
28	216-B-45	Crib (12)	15										
29	216-B-46	Crib (12)	15	150	300		22,378	53	300,000	1,700,000	71,608,889	1,800,000	75,408,889
30	216-B-48	Crib (12)	15										
31	216-B-49	Crib (12)	15										
32	216-B-50	Crib (12)	15										
33	216-B-2-2	Ditch	8	2350	15		70,233	53	300,000	1,700,000	224,746,667	1,800,000	228,546,667
34	216-B-5	Reverse Well	302			0.67	4,643	53	100,000	1,900,000	14,858,658	1,800,000	18,658,658
35	216-B-6	Reverse Well	75			0.5	4,636	0	0	0	0	0	0
36	216-B-7 A&B	Crib	14	14	14		6,615	53	100,000	1,900,000	21,168,356	1,800,000	24,968,356
37	216-B-10A	Crib	20	14	14		6,615	53	100,000	1,900,000	21,168,356	1,800,000	24,968,356

Hanford Inactive Waste Site Study.

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

			Unit Type (feet)				VITRIFICATION TECHNIQUE					
	Site No. (1)	Unit Type (12)	Depth	Length	Width	Diameter	Vitrif. Depth (yd)	FS ($)	ENG ($)	RA ($)	Mon ($)	Total Cost ($)
1	116-B-1	Trench	20	100	10		0	0	0	0	0	0
2	116-B-4	French Drain	20			4	13	100,000	1,900,000	24,783,773	1,800,000	28,583,773
3	116-C-1	Trench	25	500	50		9	300,000	1,700,000	76,566,726	1,800,000	80,366,726
4	116-C-2	Crib	20	140	100		0	0	0	0	0	0
5	116-D-1B	Trench	15	100	10		0	0	0	0	0	0
6	116-DR-1	Trench	20	300	15		0	0	0	0	0	0
7	116-DR-2	Trench	20	150	10		0	0	0	0	0	0
8	116-DR-6	Trench	10	50	10		0	0	0	0	0	0
9	116-DR-7	Crib	10	5	5		0	0	0	0	0	0
10	116-F-1	Trench	10	3000	40		0	0	0	0	0	0
11	116-F-2	Trench	15	300	50		10	300,000	1,700,000	64,141,778	1,800,000	67,941,778
12	116-F-3	Trench	8	100	20		0	0	0	0	0	0
13	116-F-6	Trench	10	300	100		12	300,000	1,700,000	90,714,800	1,800,000	94,514,800
14	116-F-9	Trench	10	500	15		0	0	0	0	0	0
15	116-F-10	French Drain	10			3	0	0	0	0	0	0
16	116-H-1	Trench	15	200	25		12	200,000	1,800,000	58,451,572	1,800,000	62,251,572
17	116-H-2	Trench	6	275	100		0	0	0	0	0	0
18	116-H-3	French Drain	15			3	0	0	0	0	0	0
19	100 KE*1	Dry Well (11&12)	4	4	4		0	0	0	0	0	0
20	100 KE*2	French Drain (12)	3	0	0	3	0	0	0	0	0	0
21	100 KW*1	Dry Well (11&12)	4	4	4		0	0	0	0	0	0
22	100 KW*2	French Drain (12)	3			3	0	0	0	0	0	0
23	116-K-1	Crib	30			400	10	300,000	1,700,000	134,734,270	1,800,000	138,534,270
24	116-K-2	Trench	20	4000	50		0	0	0	0	0	0
25	116-KE-2	Crib	32	16	16		9	100,000	1,900,000	24,412,603	1,800,000	28,212,603
26	216-B-43	Crib	15									
27	216-B-44	Crib (12)	15									
28	216-B-45	Crib (12)	15									
29	216-B-46	Crib (12)	15	150	300		15	300,000	1,700,000	130,574,333	1,800,000	134,374,333
30	216-B-48	Crib (12)	15									
31	216-B-49	Crib (12)	15									
32	216-B-50	Crib (12)	15									
33	216-B-2-2	Ditch	8	2350	15		0	0	0	0	0	0
34	216-B-5	Reverse Well	302			0.67	0	0	0	0	0	0
35	216-B-6	Reverse Well	75			0.5	0	0	0	0	0	0
36	216-B-7 A&B	Crib	14	14	14		0	0	0	0	0	0
37	216-B-10A	Crib	20	14	14		13	100,000	1,900,000	34,310,376	1,800,000	38,110,376

Hanford Inact

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Table 2-24

EXCAVATION and DISPOSAL TECHNIQUES

	Site No. (1)	Excavation Volume (cu yd)	Excavation & Disposal FS ($)	Excavation & Disposal ENG ($)	Excavation & Disposal RA ($)	Total Cost (E/D only) ($)	Excavation & Incineration FS ($)	Excavation & Incineration ENG ($)	Excavation & Incineration RA ($)	Total Cost (E/D + INCIN) ($)	Mon ($)
1	116-B-1	0	0	0	0	0	0	0	0	0	0
2	116-B-4	161,296	100,000	1,900,000	58,873,167	62,573,167	0	0	0	0	1,800,000
3	116-C-1	392,554	300,000	1,700,000	143,282,115	146,782,115	0	0	0	0	1,800,000
4	116-C-2	243,572	300,000	1,700,000	88,903,739	92,403,739	300,000	1,700,000	167,821,031	171,621,031	1,800,000
5	116-D-1B	275,556	200,000	1,800,000	100,577,778	104,177,778	0	0	0	0	1,800,000
6	116-DR-1	0	0	0	0	0	0	0	0	0	0
7	116-DR-2	0	0	0	0	0	0	0	0	0	0
8	116-DR-6	241,111	100,000	1,900,000	88,005,556	91,705,556	0	0	0	0	1,800,000
9	116-DR-7	206,722	100,000	1,900,000	75,453,611	79,153,611	0	0	0	0	1,800,000
10	116-F-1	0	0	0	0	0	0	0	0	0	0
11	116-F-2	0	0	0	0	0	0	0	0	0	0
12	116-F-3	0	0	0	0	0	0	0	0	0	0
13	116-F-6	533,333	300,000	1,700,000	194,666,667	198,166,667	0	0	0	0	1,800,000
14	116-F-9	0	0	0	0	0	0	0	0	0	0
15	116-F-10	160,237	100,000	1,900,000	58,486,481	62,186,481	0	0	0	0	1,800,000
16	116-H-1	0	0	0	0	0	0	0	0	0	0
17	116-H-2	0	0	0	0	0	0	0	0	0	0
18	116-H-3	160,237	100,000	1,900,000	58,486,481	62,186,481	0	0	0	0	1,800,000
19	100 KE*1	205,369	100,000	1,900,000	74,959,644	78,659,644	0	0	0	0	1,800,000
20	100 KE*2	160,237	100,000	1,900,000	58,486,481	62,186,481	0	0	0	0	1,800,000
21	100 KW*1	205,369	100,000	1,900,000	74,959,644	78,659,644	0	0	0	0	1,800,000
22	100 KW*2	160,237	100,000	1,900,000	58,486,481	62,186,481	0	0	0	0	1,800,000
23	116-K-1	0	0	0	0	0	0	0	0	0	0
24	116-K-2	3,344,444	300,000	1,700,000	1,220,722,222	1,224,222,222	0	0	0	0	1,800,000
25	116-KE-2	221,902	100,000	1,900,000	80,994,311	84,694,311	0	0	0	0	1,800,000
26	216-B-43										
27	216-B-44										
28	216-B-45										
29	216-B-46	600,000	300,000	1,700,000	219,000,000	222,500,000	300,000	1,700,000	413,400,000	417,200,000	1,800,000
30	216-B-48										
31	216-B-49										
32	216-B-50										
33	216-B-2-2	0	0	0	0	0	0	0	0	0	0
34	216-B-5	0	0	0	0	0	0	0	0	0	0
35	216-B-6	0	0	0	0	0	0	0	0	0	0
36	216-B-7 A&B	219,102	100,000	1,900,000	79,972,311	83,672,311	100,000	1,900,000	150,961,431	154,761,431	1,800,000
37	216-B-10A	0	0	0	0	0	0	0	0	0	0

Hanford Inactive Waste Site Study.

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

			(of entire soil column)			Total Cost	Soil Flushing (with excavating)			Total Cost	
	Site No. (1)	Water Vol (cu yd)	FS ($)	ENG ($)	RA ($)	(SF only) ($)	FS ($)	ENG ($)	RA ($)	(SF + E/D) ($)	Mon ($)
1	116-B-1	120,267	200,000	847,880	5,652,533	8,500,413	0	0	0	0	1,800,000
2	116-B-4	0	0	0	0	0	0	0	0	0	0
3	116-C-1	310,385	300,000	1,458,810	14,588,104	18,146,914	0	0	0	0	1,800,000
4	116-C-2	0	0	0	0	0	0	0	0	0	0
5	116-D-1B	0	0	0	0	0	0	0	0	0	0
6	116-DR-1	269,319	200,000	1,800,000	12,657,970	16,457,970	0	0	0	0	1,800,000
7	116-DR-2	189,156	200,000	1,333,547	8,890,311	12,223,858	0	0	0	0	1,800,000
8	116-DR-6	0	0	0	0	0	0	0	0	0	0
9	116-DR-7	0	0	0	0	0	0	0	0	0	0
10	116-F-1	419,900	300,000	1,700,000	19,735,300	23,535,300	0	0	0	0	1,800,000
11	116-F-2	192,370	300,000	904,141	9,041,407	12,045,548	0	0	0	0	1,800,000
12	116-F-3	0	0	0	0	0	0	0	0	0	0
13	116-F-6	0	0	0	0	0	0	0	0	0	0
14	116-F-9	331,204	200,000	1,800,000	15,566,574	19,366,574	0	0	0	0	1,800,000
15	116-F-10	0	0	0	0	0	0	0	0	0	0
16	116-H-1	170,567	200,000	1,202,495	8,016,633	11,219,128	0	0	0	0	1,800,000
17	116-H-2	259,233	300,000	1,218,397	12,183,967	15,502,363	0	0	0	0	1,800,000
18	116-H-3	0	0	0	0	0	0	0	0	0	0
19	100 KE*1	0	0	0	0	0	0	0	0	0	0
20	100 KE*2	0	0	0	0	0	0	0	0	0	0
21	100 KW*1	0	0	0	0	0	0	0	0	0	0
22	100 KW*2	0	0	0	0	0	0	0	0	0	0
23	116-K-1	577,268	300,000	1,700,000	27,131,580	30,931,580	0	0	0	0	1,800,000
24	116-K-2	1,491,467	300,000	1,700,000	70,098,933	73,898,933	0	0	0	0	1,800,000
25	116-KE-2	0	0	0	0	0	0	0	0	0	0
26	216-B-43										
27	216-B-44										
28	216-B-45										
29	216-B-46	1,633,578	300,000	1,700,000	76,778,156	80,578,156	300,000	1,700,000	1,918,462,200	1,922,262,200	1,800,000
30	216-B-48										
31	216-B-49										
32	216-B-50										
33	216-B-2-2	5,969,833	300,000	1,700,000	280,582,167	284,382,167	0	0	0	0	1,800,000
34	216-B-5	484,454	100,000	1,900,000	22,769,345	26,569,345	0	0	0	0	1,800,000
35	216-B-6	0	0	0	0	0	0	0	0	0	0
36	216-B-7 A&B	531,414	100,000	1,900,000	24,976,455	28,776,455	100,000	1,900,000	657,434,183	661,234,183	1,800,000
37	216-B-10A	0	0	0	0	0	0	0	0	0	0

Hanford Inacti

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Table 2-24

							No Action				
		(with vitrification)			Total Cost						
	Site No. (1)	FS ($)	ENG ($)	RA ($)	(SF + VITRIF) ($)	Mon ($)	Perimeter (yd)	FS ($)	RA ($)	Mon ($)	Total Cost ($)
1	116-B-1	0	0	0	0	1,800,000	433	100,000	18,915	6,000,000	6,118,915
2	116-B-4	0	0	0	0	0	287	100,000	12,525	6,000,000	6,112,525
3	116-C-1	0	0	0	0	1,800,000	727	100,000	31,719	6,000,000	6,131,719
4	116-C-2	0	0	0	0	0	520	100,000	22,698	6,000,000	6,122,698
5	116-D-1B	0	0	0	0	0	433	100,000	18,915	6,000,000	6,118,915
6	116-DR-1	0	0	0	0	1,800,000	570	100,000	24,881	6,000,000	6,124,881
7	116-DR-2	0	0	0	0	1,800,000	467	100,000	20,370	6,000,000	6,120,370
8	116-DR-6	0	0	0	0	0	400	100,000	17,460	6,000,000	6,117,460
9	116-DR-7	0	0	0	0	0	367	100,000	16,005	6,000,000	6,116,005
10	116-F-1	0	0	0	0	1,800,000	2,387	100,000	104,178	6,000,000	6,204,178
11	116-F-2	0	0	0	0	1,800,000	593	100,000	25,899	6,000,000	6,125,899
12	116-F-3	0	0	0	0	0	440	100,000	19,206	6,000,000	6,119,206
13	116-F-6	0	0	0	0	0	627	100,000	27,354	6,000,000	6,127,354
14	116-F-9	0	0	0	0	1,800,000	703	100,000	30,701	6,000,000	6,130,701
15	116-F-10	0	0	0	0	0	286	100,000	12,479	6,000,000	6,112,479
16	116-H-1	0	0	0	0	1,800,000	510	100,000	22,262	6,000,000	6,122,262
17	116-H-2	0	0	0	0	1,800,000	610	100,000	26,627	6,000,000	6,126,627
18	116-H-3	0	0	0	0	0	286	100,000	12,479	6,000,000	6,112,479
19	100 KE*1	0	0	0	0	0	365	100,000	15,947	6,000,000	6,115,947
20	100 KE*2	0	0	0	0	0	286	100,000	12,479	6,000,000	6,112,479
21	100 KW*1	0	0	0	0	0	365	100,000	15,947	6,000,000	6,115,947
22	100 KW*2	0	0	0	0	0	286	100,000	12,479	6,000,000	6,112,479
23	116-K-1	0	0	0	0	1,800,000	702	100,000	30,626	6,000,000	6,130,626
24	116-K-2	0	0	0	0	1,800,000	3,060	100,000	133,569	6,000,000	6,233,569
25	116-KE-2	0	0	0	0	0	381	100,000	16,645	6,000,000	6,116,645
26	216-B-43										
27	216-B-44										
28	216-B-45										
29	216-B-46	300,000	1,700,000	1,730,294,533	1,733,794,533	1,800,000	660	100,000	28,809	6,000,000	6,128,809
30	216-B-48										
31	216-B-49										
32	216-B-50										
33	216-B-2-2	0	0	0	0	1,800,000	1,937	100,000	84,536	6,000,000	6,184,536
34	216-B-5	0	0	0	0	1,800,000	283	100,000	12,372	6,000,000	6,112,372
35	216-B-6	0	0	0	0	0	283	100,000	12,365	6,000,000	6,112,365
36	216-B-7 A&B	0	0	0	0	1,800,000	379	100,000	16,529	6,000,000	6,116,529
37	216-B-10A	0	0	0	0	0	379	100,000	16,529	6,000,000	6,116,529

Hanford Inactive Waste Site Study. (continued)

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

	Site No. (1)	Unit Type (12)	Unit Type (feet) Depth	Length	Width	Diameter	Vol. Disp.	CAPPING TECHNIQUE Surface Area (sq yd)	FS ($)	ENG ($)	RA ($)	Mon ($)	Total Cost ($)
38	216-B-16	Crib (12)	12	80	80		5,600,000	0	0	0	0	0	0
39	216-C-1	Crib	13	27	12		23,400,000	0	0	0	0	0	0
40	216-C-10	Crib	7	32	5		897,000	9,228	100,000	83,050	415,250	1,800,000	2,398,300
41	216-A-9	Crib (12)	12	420	20		981,000,000	0	0	0	0	0	0
42	216-A-40	Trench	16	400	20		946,000	21,589	200,000	145,725	971,500	1,800,000	3,117,225
43	216-A-4	Crib (11&12)	25	20	20		6,210,000	0	0	0	0	0	0
44	216-A-5	Crib (12)	32	35	35		1,630,000,000	10,336	200,000	69,769	465,125	1,800,000	2,534,894
45	216-A-6	Crib (12)	19	100	100		3,400,000,000	0	0	0	0	0	0
46	216-A-7	Crib (12)	15	10	10		326,000	8,711	100,000	78,400	392,000	1,800,000	2,370,400
47	216-A-21	Crib (11&12)	19	60	16		77,800,000	0	0	0	0	0	0
48	216-A-24	Crib (12)	15	1400	20		820,000,000	0	0	0	0	0	0
49	216-A-27	Crib (11&12)	14	200	10		23,100,000	0	0	0	0	0	0
50	216-A-28	French Drain	11			20	30,000	7,339	200,000	49,539	330,260	1,800,000	2,379,799
51	216-A-36A	Crib	22	100	11		1,070,000	0	0	0	0	0	0
52	216-S-5	Crib	15	210	210		4,100,000,000	0	0	0	0	0	0
53	216-S-6	Crib	15	210	210		4,470,000,000	0	0	0	0	0	0
54	216-S-16D	Ditch	3	3000	4		400,000,000	99,553	300,000	447,990	4,479,900	1,800,000	7,027,890
55	216-S-16P	Pond	3			1250	40,700,000,000	201,620	300,000	907,292	9,072,920	1,800,000	12,080,212
56	216-S-17	Pond	10	958	958		6,430,000,000	0	0	0	0	0	0
57	216-U-11	Ditch	7	4510	10			148,711	300,000	669,200	6,692,000	1,800,000	9,461,200
58	216-S-1&2	Crib	35	90	40		160,000,000	0	0	0	0	0	0
59	216-S-3	French Drain	6	100	10		4,200,000	0	0	0	0	0	0
60	216-S-4	French Drain	20			2.5	1,000,000	6,480	100,000	58,321	291,604	1,800,000	2,249,924
61	216-S-7	Crib	22	100	50		390,000,000	0	0	0	0	0	0
62	216-S-9	Crib	30	300	30		50,300,000	0	0	0	0	0	0
63	216-S-20	Crib	30	90	40		135,000,000	0	0	0	0	0	0
64	216-S-21	Crib	21	50	50		87,100,000	0	0	0	0	0	0
65	216-U-1&2	Crib	24	78	28		15,900,000	11,523	200,000	77,778	518,520	1,800,000	2,596,298
66	216-U-3	French Drain	12			6	791,000	6,648	100,000	59,828	299,142	1,800,000	2,258,971
67	216-U-4	Reverse Well (11&12)	75			0.5	300,000	0	0	0	0	0	0
68	216-U-4A	French Drain (11&12)	10			4.3	545,000	6,566	100,000	59,094	295,469	1,800,000	2,254,562
69	216-U-4B	French Drain (11&12)	10			4.3	33,000	6,566	100,000	59,094	295,469	1,800,000	2,254,562
70	216-Z-1&2	Crib	21	30	30		38,900,000	0	0	0	0	0	0
71	216-Z-7	Crib	5	210	44		79,900,000	0	0	0	0	0	0
72	216-Z-10	Reverse Well	150			0.5	1,000,000	6,385	100,000	57,468	287,339	1,800,000	2,244,807
73	216-T-2	Reverse Well	75			0.5	6,000,000	6,385	100,000	57,468	287,339	1,800,000	2,244,807

Hanford Inactive Waste Site Study. (continued)

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

GROUT-IN-PLACE TECHNIQUE

	Site No. (1)	Unit Type (12)	Unit Type (feet) Depth	Length	Width	Diameter	Surface Area (sq yd)	Grouting Depth (yd)	FS ($)	ENG ($)	RA ($)	Mon ($)	Total Cost ($)
38	216-B-16	Crib (12)	12	80	80		10,678	0	0	0	0	0	0
39	216-C-1	Crib	13	27	12		6,910	53	100,000	1,900,000	22,113,422	1,800,000	25,913,422
40	216-C-10	Crib	7	32	5		6,841	53	100,000	1,900,000	21,891,556	1,800,000	25,691,556
41	216-A-9	Crib (12)	12	420	20		18,056	53	200,000	1,800,000	57,777,778	1,800,000	61,577,778
42	216-A-40	Trench	16	400	20		17,500	0	0	0	0	0	0
43	216-A-4	Crib (11&12)	25	20	20		6,944	53	100,000	1,900,000	22,222,222	1,800,000	26,022,222
44	216-A-5	Crib (12)	32	35	35		7,803	53	200,000	1,800,000	24,968,889	1,800,000	28,768,889
45	216-A-6	Crib (12)	19	100	100		12,100	53	200,000	1,800,000	38,720,000	1,800,000	42,520,000
46	216-A-7	Crib (12)	15	10	10		6,400	0	0	0	0	0	0
47	216-A-21	Crib (11&12)	19	60	16		7,927	0	0	0	0	0	0
48	216-A-24	Crib (12)	15	1400	20		45,278	53	300,000	1,700,000	144,888,889	1,800,000	148,688,889
49	216-A-27	Crib (11&12)	14	200	10		11,467	0	0	0	0	0	0
50	216-A-28	French Drain	11			20	5,454	0	0	0	0	0	0
51	216-A-36A	Crib	22	100	11		8,837	0	0	0	0	0	0
52	216-S-5	Crib	15	210	210		21,511	53	300,000	1,700,000	68,835,556	1,800,000	72,635,556
53	216-S-6	Crib	15	210	210		21,511	53	300,000	1,700,000	68,835,556	1,800,000	72,635,556
54	216-S-16D	Ditch	3	3000	4		83,980	0	0	0	0	0	0
55	216-S-16P	Pond	3			1250	191,148	0	0	0	0	0	0
56	216-S-17	Pond	10	958	958		156,816	53	300,000	1,700,000	501,811,200	1,800,000	505,611,200
57	216-U-11	Ditch	7	4510	10		126,400	0	0	0	0	0	0
58	216-S-1&2	Crib	35	90	40		9,600	53	200,000	1,800,000	30,720,000	1,800,000	34,520,000
59	216-S-3	French Drain	6	100	10		8,800	53	200,000	1,800,000	28,160,000	1,800,000	31,960,000
60	216-S-4	French Drain	20			2.5	4,717	0	0	0	0	0	0
61	216-S-7	Crib	22	100	50		10,267	53	200,000	1,800,000	32,853,333	1,800,000	36,653,333
62	216-S-9	Crib	30	300	30		15,311	53	200,000	1,800,000	48,995,556	1,800,000	52,795,556
63	216-S-20	Crib	30	90	40		9,600	53	200,000	1,800,000	30,720,000	1,800,000	34,520,000
64	216-S-21	Crib	21	50	50		8,711	53	200,000	1,800,000	27,875,556	1,800,000	31,675,556
65	216-U-1&2	Crib	24	78	28		8,829	0	0	0	0	0	0
66	216-U-3	French Drain	12			6	4,860	0	0	0	0	0	0
67	216-U-4	Reverse Well (11&12)	75			0.5	4,636	53	100,000	1,900,000	14,836,765	1,800,000	18,636,765
68	216-U-4A	French Drain (11&12)	10			4.3	4,791	53	100,000	1,900,000	15,329,992	1,800,000	19,129,992
69	216-U-4B	French Drain (11&12)	10			4.3	4,791	53	100,000	1,900,000	15,329,992	1,800,000	19,129,992
70	216-Z-1&2	Crib	21	30	30		7,511	53	100,000	1,900,000	24,035,556	1,800,000	27,835,556
71	216-Z-7	Crib	5	210	44		13,396	53	200,000	1,800,000	42,865,778	1,800,000	46,665,778
72	216-Z-10	Reverse Well	150			0.5	4,636	0	0	0	0	0	0
73	216-T-2	Reverse Well	75			0.5	4,636	0	0	0	0	0	0

Hanford Inactive Waste Site Study. (continued)

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

			Unit Type (feet)				VITRIFICATION TECHNIQUE					
	Site No. (1)	Unit Type (12)	Depth	Length	Width	Diameter	Vitrif. Depth (yd)	FS ($)	ENG ($)	RA ($)	Mon ($)	Total Cost ($)
38	216-B-16	Crib (12)	12	80	80		0	0	0	0	0	0
39	216-C-1	Crib	13	27	12		16	100,000	1,900,000	42,114,552	1,800,000	45,914,552
40	216-C-10	Crib	7	32	5		17	100,000	1,900,000	44,353,204	1,800,000	48,153,204
41	216-A-9	Crib (12)	12	420	20		0	0	0	0	0	0
42	216-A-40	Trench	16	400	20		0	0	0	0	0	0
43	216-A-4	Crib (11&12)	25	20	20		11	100,000	1,900,000	30,615,741	1,800,000	34,415,741
44	216-A-5	Crib (12)	32	35	35		0	0	0	0	0	0
45	216-A-6	Crib (12)	19	100	100		0	0	0	0	0	0
46	216-A-7	Crib (12)	15	10	10		0	0	0	0	0	0
47	216-A-21	Crib (11&12)	19	60	16		14	100,000	1,900,000	42,140,802	1,800,000	45,940,802
48	216-A-24	Crib (12)	15	1400	20		0	0	0	0	0	0
49	216-A-27	Crib (11&12)	14	200	10		15	200,000	1,800,000	68,394,844	1,800,000	72,194,844
50	216-A-28	French Drain	11			20	0	0	0	0	0	0
51	216-A-36A	Crib	22	100	11		13	200,000	1,800,000	43,541,202	1,800,000	47,341,202
52	216-S-5	Crib	15	210	210		0	0	0	0	0	0
53	216-S-6	Crib	15	210	210		0	0	0	0	0	0
54	216-S-16D	Ditch	3	3000	4		0	0	0	0	0	0
55	216-S-16P	Pond	3			1250	0	0	0	0	0	0
56	216-S-17	Pond	10	958	958		0	0	0	0	0	0
57	216-U-11	Ditch	7	4510	10		0	0	0	0	0	0
58	216-S-1&2	Crib	35	90	40		8	200,000	1,800,000	31,120,000	1,800,000	34,920,000
59	216-S-3	French Drain	6	100	10		17	200,000	1,800,000	57,053,333	1,800,000	60,853,333
60	216-S-4	French Drain	20			2.5	0	0	0	0	0	0
61	216-S-7	Crib	22	100	50		13	200,000	1,800,000	50,587,289	1,800,000	54,387,289
62	216-S-9	Crib	30	300	30		13	200,000	1,800,000	77,428,289	1,800,000	81,228,289
63	216-S-20	Crib	30	90	40		10	200,000	1,800,000	37,344,000	1,800,000	41,144,000
64	216-S-21	Crib	21	50	50		13	200,000	1,800,000	44,052,089	1,800,000	47,852,089
65	216-U-1&2	Crib	24	78	28		0	0	0	0	0	0
66	216-U-3	French Drain	12			6	0	0	0	0	0	0
67	216-U-4	Reverse Well (11&12)	75			0.5	0	0	0	0	0	0
68	216-U-4A	French Drain (11&12)	10			4.3	0	0	0	0	0	0
69	216-U-4B	French Drain (11&12)	10			4.3	0	0	0	0	0	0
70	216-Z-1&2	Crib	21	30	30		13	100,000	1,900,000	37,983,689	1,800,000	41,783,689
71	216-Z-7	Crib	5	210	44		17	200,000	1,800,000	86,847,852	1,800,000	90,647,852
72	216-Z-10	Reverse Well	150			0.5	0	0	0	0	0	0
73	216-T-2	Reverse Well	75			0.5	0	0	0	0	0	0

Hanford Inactive Waste Site Study. (continued)

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

EXCAVATION and DISPOSAL TECHNIQUES

	Site No. (1)	Unit Type	Excavation Volume (cu yd)	Excavation & Disposal FS ($)	Excavation & Disposal ENG ($)	Excavation & Disposal RA ($)	Total Cost (E/D only) ($)	Excavation & Incineration FS ($)	Excavation & Incineration ENG ($)	Excavation & Incineration RA ($)	Total Cost (E/D + INCIN) ($)	Mon ($)
38	216-B-16	Crib (12)	320,889	200,000	1,800,000	117,124,444	120,924,444	200,000	1,800,000	221,092,444	224,892,444	1,800,000
39	216-C-1	Crib	0	0	0	0	0	0	0	0	0	0
40	216-C-10	Crib	225,022	100,000	1,900,000	82,133,111	85,933,111	100,000	1,900,000	155,040,311	158,840,311	1,800,000
41	216-A-9	Crib (12)	0	0	0	0	0	0	0	0	0	0
42	216-A-40	Trench	0	0	0	0	0	0	0	0	0	0
43	216-A-4	Crib (11&	227,556	100,000	1,900,000	83,057,778	86,857,778	0	0	0	0	1,800,000
44	216-A-5	Crib (12)	0	0	0	0	0	0	0	0	0	0
45	216-A-6	Crib (12)	0	0	0	0	0	0	0	0	0	0
46	216-A-7	Crib (12)	213,556	100,000	1,900,000	77,947,778	81,747,778	100,000	1,900,000	147,139,778	150,939,778	1,800,000
47	216-A-21	Crib (11&	252,800	100,000	1,900,000	92,272,000	96,072,000	100,000	1,900,000	174,179,200	177,979,200	1,800,000
48	216-A-24	Crib (12)	0	0	0	0	0	0	0	0	0	0
49	216-A-27	Crib (11&	344,444	200,000	1,800,000	125,722,222	129,522,222	200,000	1,800,000	237,322,222	241,122,222	1,800,000
50	216-A-28	French Dr	178,722	200,000	1,800,000	65,233,426	69,033,426	0	0	0	0	1,800,000
51	216-A-36A	Crib	276,444	200,000	1,800,000	100,902,222	104,702,222	0	0	0	0	1,800,000
52	216-S-5	Crib	578,000	300,000	1,700,000	210,970,000	214,770,000	0	0	0	0	1,800,000
53	216-S-6	Crib	578,000	300,000	1,700,000	210,970,000	214,770,000	0	0	0	0	1,800,000
54	216-S-16D	Ditch	0	0	0	0	0	0	0	0	0	0
55	216-S-16P	Pond	4,193,154	300,000	1,700,000	1,530,501,038	1,534,301,038	0	0	0	0	1,800,000
56	216-S-17	Pond	3,516,809	300,000	1,700,000	1,283,635,244	1,287,435,244	0	0	0	0	1,800,000
57	216-U-11	Ditch	3,313,556	300,000	1,700,000	1,209,447,778	1,213,247,778	0	0	0	0	1,800,000
58	216-S-1&2	Crib	0	0	0	0	0	0	0	0	0	0
59	216-S-3	French Dr	275,556	200,000	1,800,000	100,577,778	104,377,778	200,000	1,800,000	189,857,778	193,657,778	1,800,000
60	216-S-4	French Dr	0	0	0	0	0	0	0	0	0	0
61	216-S-7	Crib	0	0	0	0	0	0	0	0	0	0
62	216-S-9	Crib	0	0	0	0	0	0	0	0	0	0
63	216-S-20	Crib	0	0	0	0	0	0	0	0	0	0
64	216-S-21	Crib	0	0	0	0	0	0	0	0	0	0
65	216-U-1&2	Crib	0	0	0	0	0	0	0	0	0	0
66	216-U-3	French Dr	0	0	0	0	0	0	0	0	0	0
67	216-U-4	Reverse W	0	0	0	0	0	0	0	0	0	0
68	216-U-4A	French Dr	0	0	0	0	0	0	0	0	0	0
69	216-U-4B	French Dr	0	0	0	0	0	0	0	0	0	0
70	216-Z-1&2	Crib	242,000	100,000	1,900,000	88,330,000	92,130,000	0	0	0	0	1,800,000
71	216-Z-7	Crib	389,867	200,000	1,800,000	142,301,333	146,101,333	0	0	0	0	1,800,000
72	216-Z-10	Reverse W	0	0	0	0	0	0	0	0	0	0
73	216-T-2	Reverse W	0	0	0	0	0	0	0	0	0	0

Hanford Inactive Waste Site Study. (continued) Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

	Site No. (1)	Water Vol (cu yd)	FS ($)	ENG ($)	RA ($)	Total Cost (SF only) ($)	FS	ENG ($)	RA ($)	Total Cost (SF + E/D) ($)	Mon ($)
			(of entire soil column)				SOIL FLUSHING TECHNIQUES (with excavation)				
38	216-B-16	1,203,030	200,000	1,800,000	56,542,393	60,342,393	0	0	0	0	1,800,000
39	216-C-1	649,582	100,000	1,900,000	30,530,344	34,330,344	0	0	0	0	1,800,000
40	216-C-10	0	0	0	0	0	0	0	0	0	0
41	216-A-9	1,769,444	200,000	1,800,000	83,163,889	86,963,889	0	0	0	0	1,800,000
42	216-A-40	0	0	0	0	0	0	0	0	0	0
43	216-A-4	0	0	0	0	0	0	0	0	0	0
44	216-A-5	814,090	200,000	1,800,000	38,262,221	42,062,221	0	0	0	0	1,800,000
45	216-A-6	1,169,667	200,000	1,800,000	54,974,333	58,774,333	0	0	0	0	1,800,000
46	216-A-7	0	0	0	0	0	0	0	0	0	0
47	216-A-21	0	0	0	0	0	0	0	0	0	0
48	216-A-24	3,652,407	300,000	1,700,000	171,663,148	175,463,148	0	0	0	0	1,800,000
49	216-A-27	0	0	0	0	0	0	0	0	0	0
50	216-A-28	0	0	0	0	0	0	0	0	0	0
51	216-A-36A	0	0	0	0	0	0	0	0	0	0
52	216-S-5	1,290,667	300,000	1,700,000	60,661,333	64,461,333	300,000	1,700,000	1,302,874,000	1,306,674,000	1,800,000
53	216-S-6	1,290,667	300,000	1,700,000	60,661,333	64,461,333	300,000	1,700,000	1,302,874,000	1,306,674,000	1,800,000
54	216-S-16D	0	0	0	0	0	0	0	0	0	0
55	216-S-16P	11,468,908	300,000	1,700,000	539,038,656	542,838,656	300,000	1,700,000	1,828,857,038	1,832,657,038	1,800,000
56	216-S-17	9,408,960	300,000	1,700,000	442,221,120	446,021,120	300,000	1,700,000	9,243,615,404	9,247,415,404	1,800,000
57	216-U-11	0	0	0	0	0	0	0	0	0	0
58	216-S-1&2	630,400	200,000	1,800,000	29,628,800	33,428,800	0	0	0	0	1,800,000
59	216-S-3	557,333	200,000	1,800,000	26,194,667	29,994,667	200,000	1,800,000	673,769,778	677,569,778	1,800,000
60	216-S-4	0	0	0	0	0	0	0	0	0	0
61	216-S-7	691,289	200,000	1,800,000	32,490,578	36,290,578	0	0	0	0	1,800,000
62	216-S-9	1,046,259	200,000	1,800,000	49,174,185	52,974,185	0	0	0	0	1,800,000
63	216-S-20	665,600	200,000	1,800,000	31,283,200	35,083,200	0	0	0	0	1,800,000
64	216-S-21	522,667	200,000	1,800,000	24,565,333	28,365,333	0	0	0	0	1,800,000
65	216-U-1&2	0	0	0	0	0	0	0	0	0	0
66	216-U-3	0	0	0	0	0	0	0	0	0	0
67	216-U-4	0	0	0	0	0	0	0	0	0	0
68	216-U-4A	0	0	0	0	0	0	0	0	0	0
69	216-U-4B	0	0	0	0	0	0	0	0	0	0
70	216-Z-1&2	0	0	0	0	0	0	0	0	0	0
71	216-Z-7	0	0	0	0	0	0	0	0	0	0
72	216-Z-10	0	0	0	0	0	0	0	0	0	0
73	216-T-2	0	0	0	0	0	0	0	0	0	0

Hanford Inactive Waste Site Study. (continued)

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

		SOIL FLUSHING TECHNIQUES (after vitrification)			Total Cost		No Action				
	Site No. (1)	FS ($)	ENG ($)	RA ($)	(SF + VITRIF) ($)	Mon ($)	Perimeter (yd)	FS ($)	RA ($)	Mon ($)	Total Cost ($)
38	216-B-16	0	0	0	0	1,800,000	467	100,000	20,370	6,000,000	6,120,370
39	216-C-1	100,000	1,900,000	720,277,928	724,077,928	1,800,000	386	100,000	16,849	6,000,000	6,116,849
40	216-C-10	0	0	0	0	0	385	100,000	16,791	6,000,000	6,116,791
41	216-A-9	0	0	0	0	1,800,000	653	100,000	28,518	6,000,000	6,128,518
42	216-A-40	0	0	0	0	0	640	100,000	27,936	6,000,000	6,127,936
43	216-A-4	0	0	0	0	0	387	100,000	16,878	6,000,000	6,116,878
44	216-A-5	0	0	0	0	1,800,000	407	100,000	17,751	6,000,000	6,117,751
45	216-A-6	0	0	0	0	1,800,000	493	100,000	21,534	6,000,000	6,121,534
46	216-A-7	0	0	0	0	0	373	100,000	16,296	6,000,000	6,116,296
47	216-A-21	0	0	0	0	0	411	100,000	17,926	6,000,000	6,117,926
48	216-A-24	0	0	0	0	1,800,000	1,307	100,000	57,036	6,000,000	6,157,036
49	216-A-27	0	0	0	0	0	500	100,000	21,825	6,000,000	6,121,825
50	216-A-28	0	0	0	0	0	304	100,000	13,256	6,000,000	6,113,256
51	216-A-36A	0	0	0	0	0	434	100,000	18,944	6,000,000	6,118,944
52	216-S-5	0	0	0	0	1,800,000	640	100,000	27,936	6,000,000	6,127,936
53	216-S-6	0	0	0	0	1,800,000	640	100,000	27,936	6,000,000	6,127,936
54	216-S-16D	0	0	0	0	0	2,363	100,000	103,130	6,000,000	6,203,130
55	216-S-16P	0	0	0	0	1,800,000	1,592	100,000	69,479	6,000,000	6,169,479
56	216-S-17	0	0	0	0	1,800,000	1,637	100,000	71,470	6,000,000	6,171,470
57	216-U-11	0	0	0	0	0	3,373	100,000	147,246	6,000,000	6,247,246
58	216-S-1&2	200,000	1,800,000	628,057,600	631,857,600	1,800,000	447	100,000	19,497	6,000,000	6,119,497
59	216-S-3	200,000	1,800,000	578,189,333	581,989,333	1,800,000	433	100,000	18,915	6,000,000	6,118,915
60	216-S-4	0	0	0	0	0	285	100,000	12,456	6,000,000	6,112,456
61	216-S-7	200,000	1,800,000	710,692,889	714,492,889	1,800,000	460	100,000	20,079	6,000,000	6,120,079
62	216-S-9	200,000	1,800,000	1,081,301,289	1,085,101,289	1,800,000	580	100,000	25,317	6,000,000	6,125,317
63	216-S-20	200,000	1,800,000	678,950,400	682,750,400	1,800,000	447	100,000	19,497	6,000,000	6,119,497
64	216-S-21	200,000	1,800,000	523,076,089	526,876,089	1,800,000	427	100,000	18,624	6,000,000	6,118,624
65	216-U-1&2	0	0	0	0	0	431	100,000	18,799	6,000,000	6,118,799
66	216-U-3	0	0	0	0	0	289	100,000	12,616	6,000,000	6,112,616
67	216-U-4	0	0	0	0	0	283	100,000	12,365	6,000,000	6,112,365
68	216-U-4A	0	0	0	0	0	287	100,000	12,538	6,000,000	6,112,538
69	216-U-4B	0	0	0	0	0	287	100,000	12,538	6,000,000	6,112,538
70	216-Z-1&2	0	0	0	0	0	400	100,000	17,460	6,000,000	6,117,460
71	216-Z-7	0	0	0	0	0	529	100,000	23,105	6,000,000	6,123,105
72	216-Z-10	0	0	0	0	0	283	100,000	12,365	6,000,000	6,112,365
73	216-T-2	0	0	0	0	0	283	100,000	12,365	6,000,000	6,112,365

Table 2-24

Hanford Inactive Waste Site Study. (continued)

81 Priority Sites Recommended for Phase II Characterization.

			Unit Type (feet)					CAPPING TECHNIQUE					
	Site No. (1)	Unit Type (12)	Depth	Length	Width	Diameter	Vol. Disp.	Surface Area (sq yd)	FS ($)	ENG ($)	RA ($)	Mon ($)	Total Cost ($)
74	216-T-3	Reverse Well	206			0.75	11300000	6	100,000	54	270	0	100,324
75	216-T-7	Crib & Tile Field	26	310	84		110,000,000	0	0	0	0	0	0
76	216-T-8	Crib	25	28	28		500,000	9,867	100,000	88,804	444,020	1,800,000	2,432,824
77	216-T-19	Crib & Tile Field	23	390	85		455,000,000	0	0	0	0	0	0
78	216-T-28	Crib	15	30	30		42,300,000	0	0	0	0	0	0
79	316-1	Pond (11&12)	9	600	375		10,000,000,000	62,350	300,000	280,575	2,805,750	1,800,000	5,186,325
80	316-2	Pond (11&12)	10	620	600		10,000,000,000	86,033	300,000	387,150	3,871,500	1,800,000	6,358,650
81	316-3	Trench	20	600	10		1,000,000,000	27,067	200,000	182,700	1,218,000	1,800,000	3,400,700

Hanford Inactive Waste Site Study. (continued)

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

GROUT-IN-PLACE TECHNIQUE

			Unit Type (feet)										
	Site No. (1)	Unit Type (12)	Depth	Length	Width	Diameter	Surface Area (sq yd)	Grouting Depth (yd)	FS ($)	ENG ($)	RA ($)	Mon ($)	Total Cost ($)
74	216-T-3	Reverse Well	206			0.75	4,647	0	0	0	0	0	0
75	216-T-7	Crib & Tile Field	26	310	84		18,840	53	300,000	1,700,000	60,288,000	1,800,000	64,088,000
76	216-T-8	Crib	25	28	28		7,396	0	0	0	0	0	0
77	216-T-19	Crib & Tile Field	23	390	85		21,700	53	300,000	1,700,000	69,440,000	1,800,000	73,240,000
78	216-T-28	Crib	15	30	30		7,511	53	100,000	1,900,000	24,035,556	1,800,000	27,835,556
79	316-1	Pond (11&12)	9	600	375		55,794	11	300,000	1,700,000	37,940,222	1,800,000	41,740,222
80	316-2	Pond (11&12)	10	620	600		78,389	11	300,000	1,700,000	53,304,444	1,800,000	57,104,444
81	316-3	Trench	20	600	10		22,133	14	200,000	1,800,000	19,034,667	1,800,000	22,834,667

Hanford Inactive Waste Site Study. (continued)

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

			Unit Type (feet)				VITRIFICATION TECHNIQUE					
	Site No. (1)	Unit Type (12)	Depth	Length	Width	Diameter	Vitrif. Depth (yd)	FS ($)	ENG ($)	RA ($)	Mon ($)	Total Cost ($)
74	216-T-3	Reverse Well	206			0.75	0	0	0	0	0	0
75	216-T-7	Crib & Tile Field	26	310	84		11	300,000	1,700,000	83,059,280	1,800,000	86,859,280
76	216-T-8	Crib	25	28	28		0	0	0	0	0	0
77	216-T-19	Crib & Tile Field	23	390	85		12	300,000	1,700,000	104,109,367	1,800,000	107,909,367
78	216-T-28	Crib	15	30	30		15	100,000	1,900,000	43,827,333	1,800,000	47,627,333
79	316-1	Pond (11&12)	9	600	375		11	300,000	1,700,000	245,979,107	1,800,000	249,779,107
80	316-2	Pond (11&12)	10	620	600		11	300,000	1,700,000	345,590,481	1,800,000	349,390,481
81	316-3	Trench	20	600	10		14	200,000	1,800,000	123,408,089	1,800,000	127,208,089

Hanford Inactive Waste Site Study. (continued)

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

EXCAVATION and DISPOSAL TECHNIQUES

			Excavation & Disposal			Total Cost	Excavation & Incineration			Total Cost	
	Site No. (1)	Excavation Volume (cu yd)	FS ($)	ENG ($)	RA ($)	(E/D only) ($)	FS ($)	ENG ($)	RA ($)	(E/D + INCIN) ($)	Mon ($)
74	216-T-3	0	0	0	0	0	0	0	0	0	0
75	216-T-7	0	0	0	0	0	0	0	0	0	0
76	216-T-8	0	0	0	0	0	0	0	0	0	0
77	216-T-19	590,333	300,000	1,700,000	215,471,667	219,271,667	0	0	0	0	1,800,000
78	216-T-28	242,000	100,000	1,900,000	88,330,000	92,130,000	0	0	0	0	1,800,000
79	316-1	0	0	0	0	0	0	0	0	0	0
80	316-2	0	0	0	0	0	0	0	0	0	0
81	316-3	620,000	200,000	1,800,000	226,300,000	230,100,000	0	0	0	0	1,800,000

Hanford Inactive Waste Site Study. (continued) Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

			(of entire soil column)				SOIL FLUSHING TECHNIQUES (with excavation)				
	Site No.	Water Vol (cu yd)	FS ($)	ENG ($)	RA ($)	Total Cost (SF only) ($)	FS	ENG ($)	RA ($)	Total Cost (SF + E/D) ($)	Mon ($)
74	216-T-3	385,664	100,000	1,900,000	18,126,199	21,926,199	0	0	0	0	1,800,000
75	216-T-7	1,199,480	300,000	1,700,000	56,375,560	60,175,560	300,000	1,700,000	1,043,980,920	1,047,780,920	1,800,000
76	216-T-8	0	0	0	0	0	0	0	0	0	0
77	216-T-19	1,367,100	300,000	1,700,000	64,253,700	68,053,700	300,000	1,700,000	1,399,575,567	1,403,375,567	1,800,000
78	216-T-28	0	0	0	0	0	0	0	0	0	0
79	316-1	632,337	300,000	1,700,000	29,719,841	33,519,841	0	0	0	0	1,800,000
80	316-2	888,407	300,000	1,700,000	41,755,148	45,555,148	0	0	0	0	1,800,000
81	316-3	0	0	0	0	0	0	0	0	0	0

Hanford Inactive Waste Site Study. (continued)

Table 2-24

81 Priority Sites Recommended for Phase II Characterization.

		(with vitrification)			Total Cost		No Action				
	Site No. (1)	FS ($)	ENG ($)	RA ($)	(SF + VITRIF) ($)	Mon ($)	Perimeter (yd)	FS ($)	RA ($)	Mon ($)	Total Cost ($)
74	216-T-3	0	0	0	0	1,800,000	284	100,000	12,376	6,000,000	6,112,376
75	216-T-7	0	0	0	0	1,800,000	623	300,000	27,179	6,000,000	6,327,179
76	216-T-8	0	0	0	0	0	397	100,000	17,344	6,000,000	6,117,344
77	216-T-19	300,000	1,700,000	1,380,004,267	1,383,804,267	1,800,000	677	300,000	29,537	6,000,000	6,329,537
78	216-T-28	0	0	0	0	0	400	100,000	17,460	6,000,000	6,117,460
79	316-1	0	0	0	0	1,800,000	1,010	300,000	44,087	6,000,000	6,344,087
80	316-2	0	0	0	0	1,800,000	1,173	300,000	51,216	6,000,000	6,351,216
81	316-3	0	0	0	0	0	767	200,000	33,465	6,000,000	6,233,465

KEY and SUMMARY to CERCLA TABLES

Key to abbreviations

BLS	Below land surface
ENG	Engineering and design
FS	Feasibility Study
MON	Post Remedial Action monitoring
RA	Remedial Action

Summary of methods and assumptions

* The area or volume of measure used to calculate the costs of a technique is generally included along with the associated costs.

* Feasibility Study costs range from $100,000 to $300,000 depending on the size of the site. (See section 3.3).

* Engineering and design costs are a percentage of the Remedial Action costs, but, the sum of the engineering and design costs (ENG) and the Feasibility Study (FS) costs must be less than or equal to $1,200,000. (See section 3.3).

* Remedial Action costs are a function of the technology costs and the unit of measure for a given site, i.e., square yards or cubic yards.

* Some sites have a combination of technologies identified, such as soil flushing following excavation and disposal. The combination of Feasibility Study and engineering and design costs retain the $2,000,000 maximum limit, however, the Remedial Action costs are combined. The Remedial Action labeled Soil Flushing Techniques (with excavation) has a RA cost of the RA the flushing costs for the site after excavation plus the excavation and disposal cost.

* Total costs are a sum of the Feasibility Study, engineering and design, Remedial Action, and post Remedial Action costs.

* Post Remedial Action monitoring is carried out semi-annually for 30 years for all remediated sites. Sites that received No Action are monitored for 100 years on a semi-annual basis.

Reference List:

(1)	Table 5.1, page 5.2
(2)	Table 3.4, page 3.13
(3)	Table 3.7, page 3.16
(4)	Table 3.9, page 3.19
(5)	Page 3.22
(6)	Table 3.12, page 3.24
(7)	Table 3.14, page 3.27
(8)	Table 3.16, page 3.30
(9)	Page 3.31
(10)	Page 3.35
(11)	Page 4.7
(12)	Table C.1, page C.14
(13)	Table 4.2, page 4.10
(14)	Table 3.2, page 3.3

From: DOE 1986a

2.8 ESTIMATED SCHEDULES AND MANPOWER

This section provides a description of the schedules and manpower needed to complete site characterization and remedial action for the CERCLA sites. This effort was necessary to ultimately produce a master schedule for addressing both RCRA and CERCLA sites as described in Section 4. The methods used to develop estimates of manpower and scheduling recommended for characterization and remediation are also provided in this section.

Characterization of the CERCLA sources assumes an 18 month period to complete any one source. Each source will involve two drilling rigs: one for soil boring and the other for well installation. Staff for each drilling rig will involve a supervisory geologist, driller, and a health and safety or sampling specialist per drilling location. Additional characterization activities such as lysimeter installation, soil gas sampling, and water quality sampling will each involve additional staff ranging from 1 to 3 persons. In addition, one field manager coordinating the overall operation will be necessary.

The remediation of the CERCLA sites will involve the preparation of a Feasibility Study report, engineering analysis and design of the selected remediation approach, conduct of the remedial action, and post-remedial action monitoring. For the purposes of this study, a period of nine months was scheduled for completion of the feasibility study. Six additional months were added for the review of the feasibility study by EPA and the State of Washington. Thus, a total of 15 months was scheduled to complete this task. This is consistent with the requirements promulgated under SARA. The total number of manweeks required to complete the feasibility study can be determined based on the costs considered for the feasibility study as outlined earlier in Section 2.7. An average labor rate of $60/hr was used based on the level of scientific and engineering expertise needed to perform the study. The feasibility study costs vary by the type of site being remediated, but the total manweeks for each site may be estimated by dividing the feasibility study costs for each site by the average labor rate.

After the feasibility study has been completed, reviewed, and approved by EPA and the State, engineering analysis of the recommended remedial alternatives can be started. It is assumed that a period of one year (52 weeks) is required to conduct the engineering analysis which includes initial engineering design and review, cost estimates, and construction management. Based on the costs required to perform this activity (as identified in Section 2.7), the total manpower requirement can be calculated as for the feasibility study using the $60/hr labor cost. The total manpower requirement will vary significantly on a site-by-site basis and with each different remediation technology considered in this analysis.

The scheduling and manpower requirements for remediating each site are based on the estimated volume of waste, soil, or water identified as requiring remediation or treatment at each unit. These requirements are presented in Appendix A for each of the remediation technologies.

After a unit has been remediated, it will be necessary to perform post-remedial action groundwater monitoring. A 30-year groundwater monitoring program is recommended so that the site cleanup program will be consistent with the RCRA post-closure monitoring program. Under the RCRA program, land disposal facilities that have undergone closure are required to perform groundwater sampling at the facility on a semi-annual basis for a period of 30 years. The objective of this program is to verify that the remediation or closure action has resulted in either the elimination of hazardous constituents from the environment or the reduction of constituent concentrations to levels below the applicable regulatory standards. Under this program, semi-annual groundwater sampling for hazardous constituents will be performed at one upgradient and three downgradient wells at each remediated site. Each of the wells will be purged and sampled, the samples analyzed, and a report prepared. This will require a total of 8 weeks to complete on a twice-yearly basis. Clerical support, well maintenance support, and monthly well inspection will also be required. The total manpower required on a yearly basis would be 216 hours or 162 manweeks over a period of 30 years.

Based on the above analyses, the unit master schedule for a CERCLA site would be as follows:

Characterization	Feas. Study	Eng.	Remedial Action	Post-RA Mon.
18 mo.	15 mo.	12 mo.	variable	30 yrs

3.0 ASSESSMENT DOCUMENT FOR RCRA 3004(u) SITES

This assessment document presents an evaluation of the possible characterization and remediation needs of RCRA 3004(u) sites at Hanford. The purpose of this effort is to develop an estimate of the costs and time required for addressing these sites.

Sections 3004(u) and (v) and 3008(h) of RCRA were added by the Hazardous and Solid Waste Amendments of 1984 (HSWA). These "corrective action" provisions of RCRA authorize the EPA to require corrective action to be undertaken to address releases of hazardous constituents at sites located at either interim status facilities or facilities that will require a RCRA permit. Consequently, for any federal facility that will require a RCRA permit for one or more treatment, storage, or disposal units, releases from solid waste management units (SWMUs) at that facility can be addressed by the EPA under RCRA authorities. SWMUs include both past and presently operating facilities whether or not their operations were before 1980.

The RCRA corrective action authority is a redundant authority that EPA could use at DOE facilities. The RCRA authorities are broader than the CERCLA authorities because the standard that must be met in order to invoke the authority is as low as [under Section 3004(u)] the mere existence of a release, whether or not any person or any part of the environment is threatened by the release. EPA is not required by Sections 3004(u), 3004(v), or 3008(h) to show an "imminent and substantial endangerment," as required under CERCLA.

The corrective action programs already in place under CERCLA and RCRA 40 CFR Part 264 Subpart F are the foundation for the 3004(u) program. Sections 104 and 106 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authorize EPA to take response actions, including removal or remedial measures, when a release or threat of release of a hazardous substance is discovered which may effect health or welfare. Generally, these authorities are used in situations where contamination has occurred at abandoned sites. Where contamination is related to activities at hazardous waste management facilities that are currently operating or related to former waste management units at currently operating facilities, both RCRA and CERCLA potentially apply. EPA has usually chosen, as a matter of policy, to initiate action under RCRA rather than CERCLA at many facilities.

The Hazardous Solid Waste Act (HSWA) corrective action regulations, when they become available, will represent the most important set of RCRA standards (ARARs) for CERCLA remedial actions. As such, a primary goal in development of the RCRA regulations will be to establish, to the maximum extent possible, a consistent approach between the RCRA and CERCLA programs in remediating environmental problems.

Existing RCRA regulations for groundwater corrective action (40 CFR Part 264 Subpart F) prescribe a specific approach for detection, characterization, and cleanup of contaminated groundwater from permitted land disposal units that received waste after July 26, 1982 (40 CFR Part 265 Subpart F, for interim status facilities). Subpart F requires that groundwater be removed or treated in-place within a reasonable period of time when a pre-determined performance standard has been exceeded at a point of compliance (waste unit boundary). The performance standard may be defined as background concentrations, a generic drinking water standard applicable to all facilities (maximum concentration limits or MCLs), or a health-based standard calculated on the basis of actual facility conditions (alternate concentration limits or ACLs).

RCRA standards for closure of operating hazardous waste management units are also related to establishing cleanup remedy standards for 3004(u) corrective action. Many corrective actions are likely to involve measures designed to control sources of contamination. RCRA closure regulations specify how wastes in waste management units may be removed or decontaminated or otherwise subjected to post-closure care requirements. Although the concept of RCRA "closure" of operating waste management units is in some ways different from cleanup of old, abandoned waste management units or contaminated areas, the approach to regulating corrective action is taken to be consistent with the principles of RCRA closure.

EPA has not resolved how it will apply the CERCLA and RCRA corrective action authorities. Many situations, at least over the short-term, can be addressed by orders under either authority, thus leaving EPA with a choice of tools. But, over the long-term, for active sites that will eventually require a permit, the Administrator of EPA is required by Section 3004(u) of RCRA to put conditions in the permit that require corrective actions to address releases from SWMUs. Thus, even if all SWMUs that score above 28.5 on the HRS (or the required score on the new HRS replacement that SARA requires) are addressed by DOE under CERCLA, DOE could later be required under RCRA to address releases from any sites that did not qualify for the NPL. Therefore, it is unclear for the present whether CERCLA or RCRA will apply at uncontrolled DOE waste sites. This decision is one that EPA Region X will most likely retain responsibility for making rather than DOE.

The Washington State Regulations for Dangerous Waste (173-303 WAC) will apply to all dangerous waste interim management units, dangerous waste permitted waste management units, and units seeking a closure/post-closure permit as a dangerous waste management unit. The corrective action provisions under this regulation include groundwater monitoring corrective action (interim and final status land disposal units) and closure requirements (clean up contamination to background or close as a "RCRA" landfill). These regulations are equivalent to 40 CFR 264.100, 264.112, 264.117, 265.93, 265.112, 265.117, and 265.118.

Corrective action of solid waste management units can only be mandated by EPA under RCRA 3004(u). Any facility seeking a dangerous waste permit (final status or closure/post-closure) will be subject to the corrective action provisions of the 1984 RCRA amendments. EPA currently has sole authority for the 3004(u) corrective action program. No states have been delegated this authority. Under the EPA 3004(u) corrective action program, special conditions will be included in the permit specifying remediation or verification sampling to be performed and a schedule for the meeting these requirements.

In order to plan for addressing potential RCRA 3004(u) sites in addition to CERCLA sites, a preliminary assessment was performed. The statement of work for this assessment required the development of both a characterization strategy for potential 3004(u) sites and a remediation strategy. To develop the characterization strategy, a feasibility and scoping effort was performed to identify the types of potential RCRA 3004(u) sites from the inactive waste site or past spill information provided by Westinghouse. As outlined in the statement of work, these sites were evaluated to determine generalized facility types to serve as the analysis base.

The characterization strategy involved evaluations of wastes managed at specific sites and waste characteristics. This information served as the basis of an assessment of the potential for past, present, or future release of hazardous constitutents to the environment and an assessment as to whether remediation may be required or whether verification of the absence of releases or hazardous constituents through site characterization was a potential action. The activities that might be performed with characterization and the costs associated with these activities were estimated.

The remediation strategy under the statement of work required two alternatives be considered: (1) exhumation in all cases, and (2) one in-place remediation technique for each type of site. In-place remediation techniques were evaluated and one technique selected for each type of waste site. The activities and costs associated with exhumation and the in-place remediation techniques were described and estimated. Finally, implementation schedules were developed for 3004(u) site characterization and remediation.

The preliminary assessment presented in this section represents a site-by-site analysis of characterization and remediation. Grouping sites together on a more regional scale will realize significant cost savings and will be more practical for characterization and remediation given the complex waste management unit interactions at Hanford. These issues are addressed in Section 4.

This section presents the preliminary assessment of the RCRA 3004(u) sites for budgetary costing and scheduling purposes. Section 3.1 describes the feasibility and scoping effort. Section 3.2 presents the characterization strategy. Section 3.3 presents the remediation strategy. Section 3.4 presents the estimated manpower and scheduling requirements. Section 3.5 describes support activities for characterization and remediation. Section 3.6 describes data limitations associated with this analysis.

3.1 FEASIBILITY AND SCOPING

Figure 3-1 presents an overview of the evaluation process used to determine whether a waste management unit is potentially subject to RCRA 3004(u) and to determine the need for characterization or remediation action. This section addresses the scoping process for determining which inactive Hanford sites are potentially subject to RCRA 3004(u) corrective action prior to the application of a characterization strategy and a remediation strategy. The need for action evaluation is presented in Section 3.2.

The scoping process consists of identifying sites that are subject to RCRA 3004(u) corrective action. SAIC has reviewed the information provided on inactive waste sites at the Hanford Reservation to determine the potential applicability of RCRA 3004(u) corrective action requirements to those sites. The information provided included inactive sites with CERCLA HRS/mHRS scores less than 28.5, reactor buildings, other radioactively contaminated structures, inactive waste management sites, past waste spills, and areas denoted as having radioactive contamination.

In order to make each decision required in the process outlined in Figure 3-1, certain criteria are used to examine available data. Criteria-based evaluations are conducted at the following points:

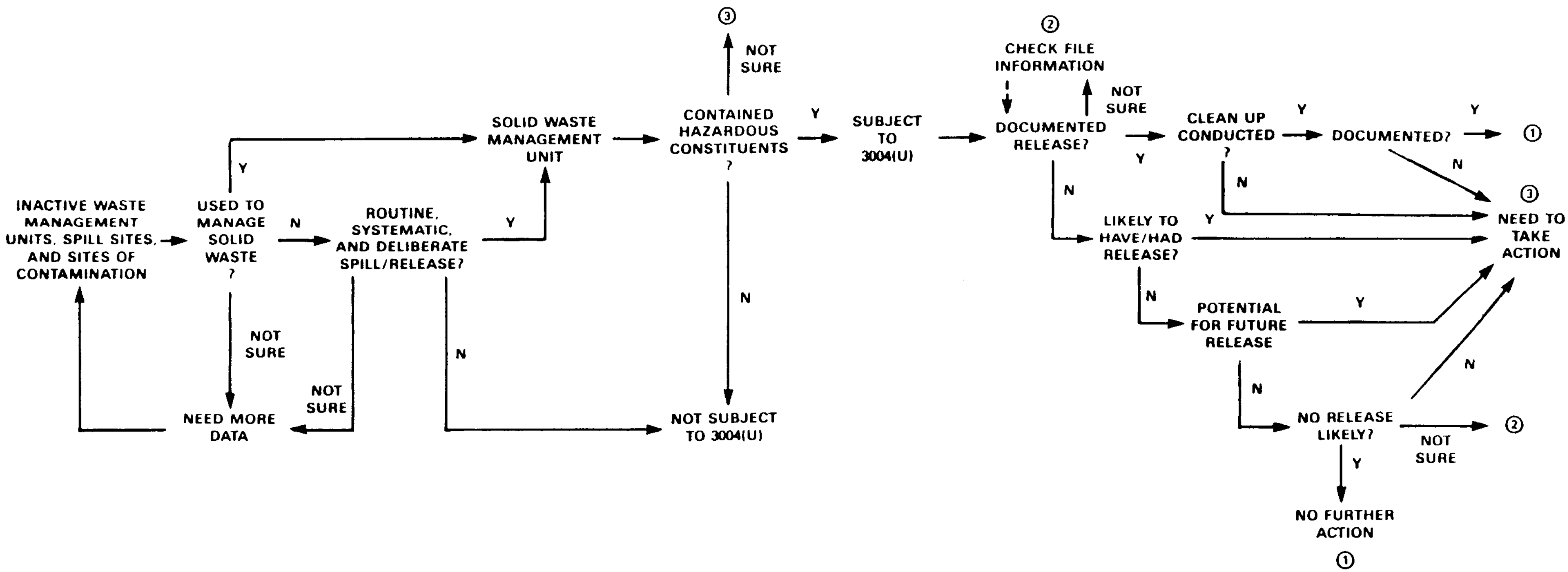


FIGURE 3-1. RCRA 3004(u) Need for Action

o <u>Unit Used to Manage Solid Waste</u>

Inactive waste management units, process units, material storage areas, spill sites, and sites of contamination are evaluated to determine whether the unit or site was used (or is now used) to manage solid waste. This evaluation relies on the definition of solid waste as presented in 40 CFR 261.2. Solid waste includes any discarded material that is abandoned, recycled, or inherently waste-like. Figure 3-2 presents a summary decision chart outlining the process for determining whether a material is a solid waste. The regulatory definition of solid waste <u>excludes</u> materials such as domestic sewage; untreated sanitary wastes mixed with other wastes for discharge to a POTW for treatment; point source discharges regulated under the CWA; irrigation return flows; source, special nuclear, or byproduct material subject to the AEA of 1954; materials subjected to in-situ mining techniques; pulping liquors that are reclaimed; and spent sulfuric acid used to produce virgin sulfuric acid. These exclusions are presented in 40 CFR 261.4. **It should be noted, however, that units or sites containing mixtures of low level byproduct materials and hazardous waste are considered to be units used to manage solid wastes.**

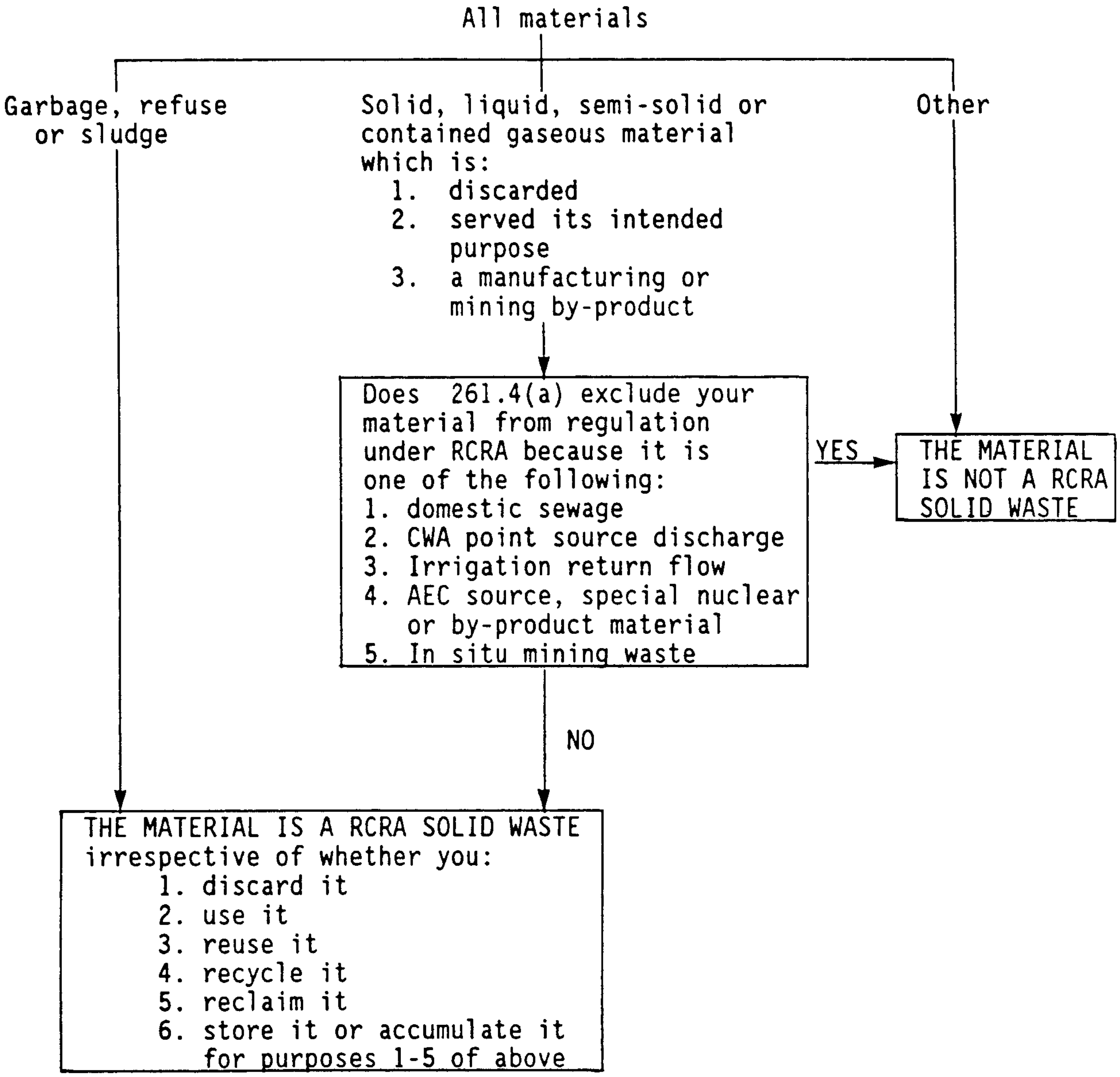
Another factor considered in the evaluation is whether the site is any discernible waste management unit from which hazardous constituents might migrate. This includes containers, tanks, surface impoundments, waste piles, land treatment units, landfills, incinerators, underground injection wells, recycling units, wastewater treatment units, other treatment units, etc.

o <u>Routine, Systematic, and Deliberate Spill/Release</u>

Under certain circumstances, process units, waste lines, and other facility activities or materials management units/systems may potentially be subject to RCRA 3004(u). Spills and/or releases from process units and production areas not associated with regulated discharges or waste management units are potential candidates. In

FIGURE 3-2

DEFINITION OF A SOLID WASTE



general, spills or releases from process/production areas and units which are routine, systematic, and deliberate may be considered further. This evaluation relies on engineering judgment and the "pattern" and history of materials management or spill remediation evident at the facility.

Criteria used in the evaluation include the frequency of spill occurance, the period of time overwhich the practice occurred, the immediacy of remedial action taken (e.g., in repairing active leaks), and the alternative management or mitigation measures applied to prevent environmental contamination. Some examples of routine, systematic, and deliberate spills are: discharging residual wastes from tank cars of railroad cars after the bulk of the waste volume has been transferred; discharging residual product chemicals (e.g., solvents, acids) after unloading the products into process storage tank cars or railroad cars; spreading solvents or waste oils for weed control; allowing line leakage to occur over an extended period of time (months or years) without repairs; allowing line leakage to occur over an extended period of time (months or years) while collecting some of the leakage but not repairing the line. In such cases, the concern is with continued releases to the environment which subsequently provide a "source" for further hazardous constituent release to the environment; if the discharges occurred within a containment structure (such as a concrete trench), then such discharges would not be subject to corrective action although the trench could be so considered. As a whole, this category of "units" excludes accidental spills from process or production areas and excludes one-time or short term (days) spills which would generally be addressed under best management practices or the National Contingency Plan.

o <u>Unit Contained Hazardous Constituents</u>

A solid waste management unit (SWMU) is not considered subject to RCRA 3004(u) corrective action unless it contained hazardous constituents. Hazardous constituents are those identified in 40 CFR

261, Appendix VIII or IX and also include the hazardous waste characteristics of ignitability, corrosivity, reactivity, and EP toxicity (as defined in 40 CFR 261.21-24). If available data are insufficient to determine that a unit contained hazardous constituents, then characterization action must be taken to make that determination.

The sites identified as potential RCRA 3004(u) sites are listed in Appendix D-1. Sites excluded from consideration are those that are active, are part of a unit seeking a Dangerous Waste or Closure Permit, or are out of the scope of this project as identified in the original Request for Proposal. Also included in Appendix D-1 is a list of sites that have been excluded from consideration and the basis for the exclusion. Additional sites listed in the Appendix are those identified as not falling under the jurisdiction of either RCRA or CERCLA.

Approximately 500 units or sites at the Hanford Reservation have been identified as potential RCRA 3004(u) sites. Table 3-1 presents a summary of the sites by Hanford area and by unit type. It should be noted that the numbers on the table represent the number of sites and not necessarily the number of individual units. For instance, a tank farm composed of 16 individual tanks is represented as one site and not as 16 individual units.

The data provided in Table 3-1 indicate that approximately 60 percent of the 3004(u) sites are located in the 200 East and 200 West areas, with approximately equal numbers of sites in each area. The data compilation also indicates that trenches are the most prevalent waste unit followed by cribs, tanks, diversion boxes, burial grounds, and french drains. These six types of sites represent 54 percent of the total number of sites. Section 3.2 provides further refinement of the different types of sites into 15 generic types of sites for subsequent evaluation.

Table 3-1. Summary of 3004(u) Inactive Waste Sites

SITE TYPE	AREA 100 B	AREA 100 B/C	AREA 100 C	AREA 100 D	AREA 100 D/DR	AREA 100 DR	AREA 100 F	AREA 100 H	AREA 100 K	AREA 100 KE	AREA 100 KE/KW	AREA 100 KW	AREA 100 N	AREA 105 KE/KW	AREA 200 E	AREA 200 N	AREA 200 W	AREA 300	AREA 400	AREA 600	AREA 700	AREA 1100	TOTAL
ACCESS AREA																		1					1
ACID SPILL *?*																		1					1
BASIN																	2						2
BASIN TRENCH					1	1																	2
BOX															1		1						2
BURIAL GARDEN *?*																	1						1
BURIAL GROUND		7		3	3		6	4	1						10		9			3			46
B.GROUND/TRENCH																				2			2
BURIAL TUNNEL															1								1
BURIAL VAULT							1								2								3
BURNING PIT		1			1		1	2	1				1										7
COMPARTMENT *?*																	1						1
CONTROL ROD -		1												2									3
STORAGE CAVE *?*																							0
CRIB		6			4		2	2		1		1			21		19	1		3			60
CRIB & TRENCH													1										1
CRIB SANDFILTER		1																					1
CRIB/F. FIELD															1								1
CRIB/TRENCH															1								1
DITCH															3		9						12
DITCH & POND															1								1
DIVERSION BOX															25		22						47
DIVERSION BOX *?*															1								1
DIVERTER STATION															2								2
DRAIN FIELD															1			3					4
DRY WELL	1																2						3
EVAPORATOR															1			1					2
FILTER MONITOR *?*																	1						1
FRENCH DRAIN		1			3		4		2				2		14		3		2				31
GRAVEL PIT																		1					1
GROUND CONTAM. *?*																	1						1
GROUND DISPOSAL																						1	1
GROUND SPILL																	1						1
GROUND SPILL *?*																	2						2
INCINERATOR																	1						1
LANDFILL																				8			8
LEACHING PIT															1								1
LEAK													1										1
LINE LEAK*?*													6				1						7
PIPE TRENCH-																		1					1
SYSTEM																							0
PIT		1					1	2					1		2		3			1		2	13
PIT*?*															2								2
POND																3	5	1	1	1			11
PROCESS LINE*?*																	1						1
PROCESS TANK-																	1						1
VENT LINES*?*																							0
PUMPING STATION					3			1															4
RECEIVING VAULT															2								2
RETENTION BASIN		2			2		1	1	2														8
REVERSE WELL															2								2
SEWER																	1						1
SEWER PIPE																		1					1
SPILL										1													1
SPILL SITE															2								2
SPILL SITE *?*															2								2
STORAGE PAD					1																		1
SUMP		1																					1
SURFACE IMPOUNDMENT																	1						1
TANK			1		1						14				20		23	2	1	4	1	1	68
TANK *?*																	5						5
TANK/CRIB OVERFLOW*?																	1						1
TANK/DRAINFIELD													5										5
TANK/TILEFIELD		4			2		5	3															14
TESTING UNIT																		1					1
TILE FIELD																	1						1
TRANSFER BOX *?*																	1						1
TRANSFER LINE *?*																	1	1					2
TRENCH		1													32	4	25	2	1	9			74
TRENCH & PITS																				1			1
UNDERGROUND TANKS																		2					2
UNDERGROUND TANKS/																		1					1
PIPING																							0
VAULT															1		5						6
WASTE LINE															1		5						6
WASTE LINE *?*																	1						1
WASTE PILE																				1			1
WEIR BOX																	3						3
TOTAL	1	26	1	3	21	1	21	15	6	2	14	1	17	2	152	7	159	20	5	31	1	4	

- A specified site type may contain more than one individual unit. For example, a "tank" site might contain 16 individual tanks.

? - Indicates sites requiring further clarification.

3.2 CHARACTERIZATION STRATEGY

The characterization strategy has been developed based on identification of RCRA 3004(u) corrective action issues. Approximately 500 potential RCRA 3004(u) sites have been identified. These sites have been identified by Hanford area (100 N, 200 east, 600, etc.) as an initial grouping because of the generally distinct geographic distribution of the sites within the Hanford area (see Appendix D-1).

3.2.1 Determining the Need for Remediation

Figure 3-1 presented an overview of the characterization strategy process for evaluating the 3004(u) sites. This approach has been developed based on the 3004(u) requirements outlined in Section 3.1. At a RCRA 3004(u) site, the need for action includes remediation or simply verification of the absence of a problem (past, present, or future release; absence of hazardous constituents; or residual contamination). No further action may also be selected for a given site if no hazardous constituents are present or where no present or future contamination problem is likely. A site will require verification if it needs to be determined that:

- No hazardous constituents are present in the unit
- No release of hazardous constituents has/will occur
- No residual contamination remains from insufficiently documented cleanups or past/present releases.

In each case, the characterization needs will differ largely in terms of the extent of sampling or other information collection that may be needed. Additionally, if sampling during characterization reveals that a problem exists, the site would be shifted to a new characterization category prior to remedial planning activities.

The need for action depends upon a number of factors. These include:

- Containment provided by the waste management unit itself in preventing release to the environment

- o Past, present, or future adequacy of the containment provided by the unit

- o Nature of the wastes disposed (solid, liquid, gas) as an indicator of the likelihood of transport in the subsurface environment

- o Constituents of concern in the wastestream disposed and their behavior in the environment (e.g., subject to subsurface transport or partitioning in the vadose zone)

- o Potential exposure hazards, potential media impacted, and pathways of migration

- o Evidence of past release to the environment and nature of action taken

- o Adequacy of data and documentation to support need for action decisions or to demonstrate the absence of a problem.

Overall, the need for action is a function of the release potential of a unit and the waste constituents present in that unit. These two areas are the basis of the characterization evaluations conducted. This evaluation focused on the development of two matrices: a waste constituents matrix and a need for action matrix. These matrices and the supporting evaluations are described in more detail in the following sections. The purpose of these evaluations is to assess potential characterization needs to establish budgetary needs and timeframes.

3.2.1.1 Waste Constituents Matrix

Each site was evaluated to determine the type of unit involved (function and structure) and the characteristics of the wastes/materials present. The analysis proceeded on a site-by-site basis within a given Hanford area. Tables 3-2 through 3-15 present the waste constituent matrices completed for the inactive RCRA 3004(u) sites that have been identified in the following areas: 100 B/C, 100 D/DR, 100 F, 100 H,

KEY TO TABLES 3-2 TO 3-15

Site Type Code (Column two of the Waste Constituents Matrices)

A - aboveground covered landfill
B - aboveground uncovered landfill
C - belowground covered landfill
D - belowground uncovered landfill
E - surface impoundments
F - ditches
G - underground dispersion systems
H - aboveground tank
I - underground tank
J - spills
K - underground vault
L - burning pit
M - incinerator
N - process sewer
O - other

pH Codes

A = acid
B = base
Y = corrosives present but type could not be determined

Other Codes

? = presumed
ND = no data
NS = not suspected

TABLE 3-2 100 B/C WASTE CONSTITUENTS MATRIX

100 B/C Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	Chemical Components: Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	Nature of Waste: Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
Burial Ground	C	118-B-1	105-B Burial Ground 118-B-1	Y	NO	NO	NO	?	Y	NO	Y	Y	Y	1.00E+06 KG		Y		METALLIC AND REACTOR WASTES
Burial Ground	C	118-C-1	105-C Burial Ground 118-C-1	Y	NO	NO	NO	?	Y	NS	Y		?	1.00E+06 KG		Y		MISC. SOLID WASTE INCLUDING CONTROL RODS, REACTOR HARDWARE, PROCESS TUBES, AND ALUMINUM SPACERS.
Burial Ground	C	118-B-7	111-B Solid Waste Burial Site	NO	NO	NO	NO	NO	NO	NO	NO	NO	?	NO		?		MISC. SOLID WASTES: DECONTAMINATION MATERIALS AND ASSOCIATED MATERIALS
Burial Ground	C	118-B-3	Construction Burial Ground #2	Y	NO	NO	NO	NO	NO	NO	NO	NO	?	4.00E+06 KG		?		SOLID WASTE: FROM EFFLUENT LINE AND REACTOR
Burial Ground	C	118-B-4	105-B Spacer Burial Ground	Y	NO				Y		NO	NO	?	2.00E+05 KG			?	FUEL SPACERS; PRESUMED TO BE STAINLESS STEEL.
Burial Ground	C	118-B-6	108-B Solid Waste Burial Ground	NO		NO	NO	NO	NO	NO		Y	?	1.00E+04 KG			?	TRITIUM WASTES (LABORATORY)
Burial Ground	C	118-B-2	Construction Burial Ground #1	Y	NO	NO	NO	NO	NO	NO	NO	NO	?	8.00E+04 KG		?		DRY WASTE FROM 107-B BASIN REPAIR WORK AND 115-B ALTERATIONS
Burial Ground	C	118-B-5	Ball 3X Burial Ground 118-B-5	Y		NO	NO	NO	NO	NO	NO	NO	?	2.00E+04 KG			?	"HIGHLY CONTAMINATED WASTES"...OLD THIMBLES, STEP PLUGS, ETC.
Burning Pit	C	100B/C	100 B/C Burning Pit	Y	I	Y	Y	Y	NO	NO				NO	Y			NONRADIOACTIVE COMBUSTIBLE MATERIALS: INCLUDES PAINTS AND SOLVENTS
Crib	G	116-B-5	108-B Crib 116-B-5 (9)	Y	NO	?	?	?	?	?	Y	Y	Y	1.00E+07 L		?		FISSION PRODUCT WASTES FROM CONTAMINATED MAINTENANCE SHOP AND DECONTAMINATION PAD
Crib	G	116-B-6-1	111-B Crib #1 116-B-6-1	Y	I	?		Y	Y	NO	Y	Y	Y	5.00E+03 L		Y		DECONTAMINATION WASTES
Crib	G	117-B*	117-B Crib	Y	NO	NO	NO	NO	NO	NO	NO	NO	NO	4.20E+05 L		?		DRAINAGE FROM CONFINEMENT SYSTEM: 117 BLDG. SEAL PITS.
Crib	G	117-C*	117-C Crib	Y	NO	NO	NO	NO	NO		NO	NO	NO	4.80E+05 L		?		DRAINAGE FROM CONFINEMENT SYSTEM IN THE 117 BLDG. SEAL PITS.
Crib	G	116-B-6-2	111-B Crib #2 116-B-6-2	Y	I	?	NO	Y	Y	NO	Y	Y	Y	5.00E+03 L		?		EQUIPMENT DECONTAMINATION WASTES
Crib	G	116-B-3	105-B Pluto Crib 116-B-3	Y	I	NO	NO	Y	?	NO	Y	Y	Y	4.00E+03 L		Y		EFFLUENT FROM REACTOR TUBES; BORON SUSPECTED.
Crib Sandfilter	G	116-C-2-2	105-C Pluto Crib Sandfilter	Y	NO	NO	NO	NO	NO	NO	Y	Y	Y	3.50E+06 L		?		WASTES FROM DECONTAMINATION OF FUEL ELEMENTS
Dry Well	G	116-B-10	108-B Dry Well, Quench Tank	Y	NO	NO	NO	NO	NO	NO	NO	NO	?	5.00E+06 L		?		LIQUID FROM DECONTAMINATION WASTES: TUBE EXAM AND EXPERIMENTAL FACILITY
French Drain	G	116-B-9	104-B-2 French Drain	Y	NO	NO	NO	NO	NO	NO	NO	NO	?	4.00E+05 L		?		WASTE FROM P-10 STORAGE BLDG. DRAIN.
Pit	E	184-B*	184-B Powerhouse Ash Pit (3)	Y	NO				?					NO	Y			COAL ASH SLUICED WITH RIVER WATER. TESTING SHOWS NOT EP TOXIC.
Retention Basin	E	107-B*	107-B Retention Basin	Y	NO	NS	NS	Y	NS	NS	NO	NO	Y	NO			Y	RECEIVED COOLING WATER FROM 105 REACTOR.
Sump Tanks	E	107-C*	107-C Retention Basin	Y	NO	NS	NS	Y	NS	NS	Y	Y	?	NO			Y	COOLING WATER FROM 105 REACTOR.
Sump	E	105-B*	105-B Battery Acid Sump (3)	Y	Y			Y	?					NO	Y			BATTERY ACID
Tank	I	118-C-2	105-C Ball Storage Tank	NO	NO			Y	Y		NO	NO	Y	NO			Y	RADIOACTIVE BORON STEEL BALLS
Tank/Tile Field	I	1607-B3*	1607-B3 Septic Tank (3)	Y	NO	NO	NO	NO	NO	NO				NO	Y			SANITARY SEWAGE FROM 184 B POWERHOUSE. OPERATIONS FEEDING TO THIS SYSTEM NOT SPECIFIED.
Tank/Tile Field	I	1607 B8*	1607-B8 Septic Tank (3)	Y	NO	NO	NO	NO	NO	NO				NO	Y			SANITARY SEWAGE FROM 190 C PUMPHOUSE. OPERATIONS LEADING TO THIS SYSTEM NOT SPECIFIED.
Tank/Tile Field	I	1607 B7*	1607-B7 Septic Tank (3)	Y	NO	NO	NO	NO	NO	NO				NO	Y			SAME AS 1607-B8.
Tank/Tile Field	I	1607 B1*	1607-B1 Septic Tank (3)	Y	NO	NO	NO	NO	NO	NO				NO	Y			SANITARY SEWAGE FROM FIRE STATION, OFFICES, CHANGE ROOMS AND SECURITY CHECKPOINT.
Trench	C	116-B-2	105-B Storage Basin Trench	Y	NO			?			Y	Y	?	4.00E+06 L			?	CONTAMINATED WASTE WATER FROM 105-B STORAGE BASIN; FUEL ELEMENT WASTE; BORON SUSPECTED

KEY:
Y: yes
ND: no data
* = official number not assigned but identified by unit number
blank= no
I= incomplete data

TABLE 3-4 100 F WASTE CONSTITUENTS MATRIX

100 F Waste Constituent Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste: Source Identified	Chemicals Identified	Chemical Components: Organics	Volatiles	Inorganics	Metals	pH	Other Residual: Fission Products	Radionuclides	Radio Activity	Waste Volume Disposed	Nature of Waste: Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
Burial Ground	C	118-F-4	115-F Pit 118-F-4	Y	NO	?	NO	?	NO	NO	NO	NO	?	1.00E+04 KG		?		SILICA GEL FROM FILTERS.
Burial Ground	C	118-F-3	Burial Ground #2 118-F-3	Y	NO	NO	NO	NO	Y	NO	Y	NO	Y	7.00E+03 KG		?		IRRADIATED WASTES (THIMBLES, SEE PLUGS) REMOVED FROM 105-F PILE.
Burial Ground	C	118-F-1	Burial Ground #1 118-F-1	Y	NO	NO	NO	NO	?	NO	Y	NO	Y	1.00E+07 KG		?		MISCELLANEOUS RAD. SOFT WASTES, REACTOR COMPONENTS, AND HARDWARE.
Burial Ground	C	118-F-2	Burial Ground #2 118-F-2	Y	NO	NO	NO	NO	?	NO	Y	?	Y	1.00E+06 KG		?		MISCELLANEOUS RAD. SOFT WASTES, REACTOR COMPONENTS, AND HARDWARE.
Burial Ground	C	118-F-6	PNL Solid Waste Burial Ground	Y	I	?	NO	?	?	NO	Y	NO	Y	1.00E+04 M3		?		ANIMAL AND BIOLOGY LABORATORY WASTES.
Burial Ground	C	118-F-5	PNL Sawdust Repository 118-F-5	Y	Y						Y	Y	?	1.00E+04 M3			Y	LOW LEVEL ACTIVITY SAWDUST FROM PENS.
Burial Vault	R	118-F-7	100F Miscellaneous Hardware	Y	NO	NO	NO	NO	NO	NO	Y	?	Y	1000 FT3 (cap)			?	MISCELLANEOUS REACTOR HARDWARE.
Burning Pit	C	100-F*	100-F Burning Pits #2	Y	I	?	?	?	?	NO				NO	Y			NON RAD. COMBUSTIBLE MATERIALS; PAINT WASTE, CHEMICAL SOLVENTS, OFFICE WASTES.
Crib	G	116-F-4	105-F Pluto Crib 116-F-4 (9)	Y	NO	NO	NO	Y	?	NO	Y	Y	Y	4.00E+03 LITR		?		EFFLUENT FROM TUBES WITH FAILED FUEL ELEMENTS.
Crib	G	116-F-5	Ball Washer Crib 116-F-5	Y	NO	NO	NO	NO	NO	NO	Y	NO	Y	3.00E+03 LITR		?		DECON. WASTE FOR BORON STEEL BALLS.
French Drain	G	116-F-12	146-F French Drain 116-F-12	Y	NO						NO	NO	?	1.00E+04 LITR			?	RECOVERED EFFLUENT PUMP PRIME.
French Drain	G	116-F-11	105-F Cushion Corridor French	Y	NO	NO	NO	NO	NO	NO	NO	NO	?	2.00E+05 LITR		?		CUSHION CORRIDOR DECON WASTE.
French Drain	G	116-F-13	1705-F Experimental Garden	Y	NO	NO	NO	NO	NO	NO	NO	NO	?	1.00E+04 LITR		?		EFFLUENT WATER FROM BOTANY EXPERIMENT.
French Drain	G	116-F-7	117-F Crib 116-F-7	Y	NO	NO	NO	NO	NO	NO	Y	Y	Y	3.00E+05 LITR			?	DRAINAGE FROM CONFINEMENT SEAL PITS.
Pit	E	184-F*	184-F Powerhouse Ash Pit (3)	Y	NO				?					NO	Y			COAL ASH SLUICED WITH RIVER WATER. ASH TESTS AS NOT EP TOXIC.
Pumping Station	O	1608-F*	1608-F Wastewater Pumping	Y	Y	Y		Y		R	?	?	?	NO			Y	BUILDING DRAINS; LOW-LEVEL RAD. AND DECON. CHEMICALS.
Retention Basin	E	107-F*	107-F Retention Basin	Y	NO			?			?	?	Y	NO			?	REACTOR COOLING WATER EFFLUENT.
Tank/Tile Field	G	1607-F6*	1607-F6 Septic Tank	Y	NO									NO	Y			SANITARY WASTE FROM BUILDINGS AND ANIMAL FARMS.
Tank/Tile Field	G	1607-F1*	1607-F1 Septic Tank	Y	NO									NO	Y			SANITARY WASTE FROM FIRE STATION, CHANGE ROOMS, OFFICES.
Tank/Tile Field	G	1607-F5*	1607-F5 Septic Tank	Y	NO									NO	Y			SANITARY WASTE FROM PUMPHOUSE.
Tank/Tile Field	G	1607-F3*	1607-F3 Septic Tank	Y	NO									NO	Y			SANITARY WASTE FROM PUMP STATION, WATER TREATMENT PLANT, AND SUBSTATION.
Tank/Tile Field	G	1607-F4*	1607-F4 Septic Tank	Y	NO									NO	Y			SANITARY WASTE FROM GAS RECIRCULATION BUILDING.

KEY: Y = yes; NO = no data; * = official number not assigned but identified by unit number; blank = no; I = incomplete data

TABLE 3-5 100 H WASTE CONSTITUENTS MATRIX

100 H Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS: Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radionuclides	Residual Radio-Activity	Waste Volume (Disposed)	NATURE OF WASTE: Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
Burial Ground	C	118-H-2	H-I Loop Burial Area, 100-H	ND	ND			ND	Y	ND	Y	ND	Y	1.00E+03 KG		?		CONCRETE VAULTS RECEIVED STEEL TUBE FROM REACTOR AND SMALL AMOUNTS OF CONTAMINATED PIPE(1955-1965).
Burial Ground	C	118-H-3	Construction Burial Ground	Y	ND	ND	ND	ND	Y	ND	Y	ND	Y	3.00E+06 KG		?		BURIAL GROUND RECEIVED CONTAMINATED PIPE, REACTOR HARDWARE AND COMPONENTS(1953-1957).
Burial Ground	C	118-H-4	Ball 3X Burial Ground 118-H-4	Y	ND			ND	Y	ND	Y	ND	Y	1.00E+04 KG		?		BURIAL GROUND RECEIVED IRRADIATED SOLID WASTE EG.,THIMBLES AND GUIDES(1953-1953).
Burial Ground	C	118-H-1	100-H Burial Ground #1 118-H-1	ND	ND	ND	ND	ND	Y	ND	Y	ND	Y	1.06E+06 KG		?		BURIAL GROUND CONTAINING MISC. SOFT WASTES, REACTOR COMPONENTS AND HARDWARE(1949-1965). TRITIUM.
Burning Pit	I	100-H2*	100-H2 Burning Pit for Residua	ND	I	Y	?	?	?	ND				ND	Y			DISPOSAL/COMBUSTION OF OFFICE AND PAINT WASTES, AND CHEMICAL SOLVENTS. RESIDUAL CONTAMINATION /INCOMPLETE COMBUSTION POSSIBLE. 1948-1965
Burning Pit	I	100-H*	100-H Burning Pit	Y	I	Y	?	Y	?	ND				ND	Y			DISPOSAL/BURNING OF NON RADIOACTIVE COMBUSTIBLE WASTE EG., PAINT AND OFFICE WASTES, AND CHEMICAL SOLVENTS(1949-1965)
Crib	U	117-H*	Crib 117-H	Y	ND	ND	ND	ND	ND	ND	ND	ND	?	3.00E+06 L		?		CRIB RECEIVED DRAINAGE FROM CONFINEMENT SYSTEM SEAL PITS(1960-1965). SAMPLING IN 1970: NO CONTAMINATION ABOVE BACKGROUND.
Crib	U	116-H-4	105-H Pluto Crib 116-H-4 (9)	ND		ND	ND	Y	ND	ND	?	?	ND	1.00E+03 L		?		CRIB RECEIVED EFFLUENT FROM TUBES CONTAINING FAILED FUEL ELEMENTS(1950-1952). CRIB EXHUMED IN 1960 AND MOVED TO 118-H-5 BURIAL GROUND.
Pit	C	118-H-5	105-H Thimble Pit 118-H-5	Y	I	ND	ND	Y	Y	ND	Y	ND	Y	1.00E+02 KG		?		BURIAL GROUND RECEIVED THIMBLE ASSEMBLY AND PLUTO CRIB(FROM 105 H). 1953-1961. INCLUDES SODIUM DICHROMATE.
Pit	E	184-H*	184-H Powerhouse Ash Pit (3)	Y	Y	ND	ND	?	?					ND	Y			COAL ASH SLUICED INTO OPEN PITS WITH RAW RIVER WATER. ASH DID NOT EXCEED EP TOXICITY LIMITS. 1940-1965
Pumping Station	U	1608-H*	1608 H Waste Water Pumping	ND		Y	ND	Y	ND	A	ND	ND	?	ND		Y		PUMPING UNIT RECEIVED REACTOR WATER AND DECONTAMINATION CHEMICALS(1949-1965). FACILITY IS INACTIVE AND EMPTY. REFERENCE WITH DATA ON RADIONUCL. INVENTORY NOT AVAILABLE.
Retention Basin	E	107-H*	100-H Retention Basin 107-H	Y	ND	ND	ND	?	ND	ND	?	?	Y	ND			?	CONCRETE-LINED BASIN RECEIVED COOLING WATER FROM REACTOR. BASIN BACKFILLED ONLY TO A DEPTH OF 4 FT. ABOVE FLOOR. SOIL CONTAMINATION SURROUNDING BASIN...WALLS ARE ALSO RADIOACTIVE. UPR ALSO OCCURED. 1949-1965. TRITIUM.
Tank/Tile Field	U	1607-H-4*	1607-H4 Septic Tank	Y	ND	ND	ND	ND	ND					ND	Y			UNIT RECEIVED SANITARY WASTEWATER FROM BACKHOUSE AND FIRE STATION(1948-1968).
Tank/Tile Field	U	1607-H-2*	1607 H2 Septic Tank	Y	ND	?	ND	?	ND	?	NS	NS	NS	ND	Y			UNIT RECEIVED SANITARY WASTEWATER FROM OFFICE AND MAINTENANCE BUILDINGS(1949-1965)
Tank/Tile Field	U	1607-H-3*	1607 H3 Septic Tank	Y	ND	ND	ND	ND	ND		NS	NS	NS	ND	Y			UNIT RECEIVED SANITARY WASTEWATER FROM PUMPHOUSE(1948-1965)

KEY: Y = yes; ND = no data; * = official number not assigned but identified by unit number; Blank = no; I = incomplete data

TABLE 3-6 100 KE/KW WASTE CONSTITUENTS MATRIX

100 KE/KW Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS: Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE: Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
Burial Ground	C	118 K	100-K Burial Ground 118 K	Y	ND	ND	ND	ND	Y	ND	Y	Y	Y	1.00E+04 M3 1.00E+06 KG			?	UNIT COMPRISED OF NUMEROUS PITS, TRENCHES, SILOS. USED FOR RADIOACTIVE SOLID WASTE DISPOSAL INCLUDING STAINLESS STEEL.
Burning Pit	L	100 K*	100-K Burning Pit	?	ND	?	?	?	ND	ND	ND	ND	ND	ND	?			UNIT WAS USED FOR DISPOSAL OF NON RAD. MATERIALS SUCH AS PAINT WASTE, OFFICE WASTES, & CHEMICAL SOLVENTS FROM 55 TO 71. NO DATA ON THE AMOUNT OF WASTE DISPOSED OF.
Crib	G	116-KW-1	115-KW Condensate Crib	ND	ND	ND	ND	ND	ND	ND	Y	Y	Y	8.00E+05 L			?	RECEIVED CONDENSATE AND OTHER WASTE WATER FROM REACTOR GAS PURIFICATION PROCESS. TRITIUM PRESENT.
Crib	G	116-KE-1	115-KE Condensate Crib	ND	ND	ND	ND	ND	ND	ND			Y	8.00E+05 L			?	RECEIVED CONDENSATE AND OTHER WASTE WATER FROM REACTOR GAS PURIFICATION PROCESS. RETIRED IN 71. DOES NOT SEEMS TO HAVE RADIOACTIVE METALS. H-3 AND C-14 ONLY. SOME BETA VALUES.
French Drain	G	116-KW-2	105-KW Storage Basin Fr Drain	Y	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	SITE RECEIVED 105 KW STORAGE BASIN SUBDRAINAGE. RETIRED IN 70. NO INFO ON TYPE OR QUANTITY OF WASTE.
French Drain	G	116-KE-3	105-KE Storage Basin Fr Drain	Y	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	RECEIVED SUBDRAINAGE FROM 105 KE STORAGE BASIN. RETIRED IN 71. NO INFO ON TYPE OR QUANTITY OF WASTE.
Retention Basin	I	107 KE*	107-KE Retention Basin	Y	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	RECEIVED COOLING WTR FROM 105 REACTOR. 80% RAD. INVENTORY IS IN THE SOIL AROUND THE UNIT.
Retention Basin	I	107 KW*	107-KW Retention Basin	Y	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	SAME AS ABOVE.
Tank	H	183-KE*	183-KE Liq. Alum Storage Tank	Y	Y			Y						1.80E+05 gal (cap)	Y			STORAGE OF LIQUID. NO ACTUAL QUANTITY AVAILABLE.
Tank	I	105-KE*	105-KE Emergency Diesel Fuel	Y	Y	Y	?							2.00E+03 gal (cap)	Y			STORAGE OF DIESEL FUEL. TANK IS NOW EMPTY.
Tank	I	166-KW*	166-KW Oil Storage Tank	Y	Y	Y	?							1.65E+06 gal (cap)	Y			1.65 M. GAL CAP. TANK USED FOR STORAGE OF OIL FROM 55 TO 70. 2000 GAL OF HEEL REMAINS IN TANK. (R3-8)
Tank	I	182-K*	182-K Emergency Cooling Flow	Y	Y	Y	?							3.50E+04 gal (cap)	Y			USED FOR STORAGE OF DIESEL OIL FROM 55 TO 71. TANK IS EMPTY NOW.
Tank	H	183-KE1*	183-KE1 Sulfuric Acid Storage	Y	Y			Y		A				1.00E+04 gal (cap)	Y			SULFURIC ACID.
Tank	I	166-KE*	166-KE Oil Storage Tank	Y	Y	Y	?							1.65E+06 gal (cap)	Y			FUEL OIL.
Tank	H	183-KW2*	183-KW2 Sulfuric Acid Storage	Y	Y			Y		A				1.00E+04 gal (cap)	Y			SULFURIC ACID
Tank	H	183-KW1*	183-KW1 Sulfuric Acid Storage	Y	Y			Y		A				1.00E+04 gal (cap)	Y			SULFURIC ACID
Tank	H	183-KE2*	183-KE2 Sulfuric Acid Storage	Y	Y			Y		A				1.00E+04 gal (cap)	Y			SULFURIC ACID
Tank	H	183-KW*	183-KW Sodium Dichromate	Y	Y			Y						ND	Y			SODIUM DICHROMATE
Tank	I	1717-K*	1717-K Waste Oil Storage Tank	Y	Y	Y	?		?					ND	Y			MOTOR OIL
Tank	H	183-KE*	183-KE Sodium Dichromate Tank	Y	Y			Y						ND	Y			SODIUM DICHROMATE
Tank	I	1717-K*	1717-K Gas Storage Tank (3)	Y	Y	Y	Y							ND	Y			GASOLINE STORAGE TANK
Tank	I	105-KW*	105-KW Emergency Diesel Fuel	Y	Y	Y	?							2.00E+05 gal (cap)	Y			DIESEL FUEL
Trench	F	100-KE*3	183-KE Acid Filter Facility	Y	Y			Y		A				ND	Y			SULFURIC ACID SLUDGE-WATER SLURRY FROM ACID STORAGE TANKS. NO INFO ON QUANTITY DISPOSED.

KEY: Y= yes; ND= no data; * = official number not assigned but identified by unit number; blank= no; I= incomplete data

TABLE 3-7 100 N WASTE CONSTITUENTS MATRIX

100 N Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
Burning Pit	1	126-N-1	100-N Burning Pit (128 N 1)	ND	ND	?	ND	?	?	ND	ND	ND	ND	ND	?			NO INFO ON WASTE TYPE DISPOSED OF. WASTE GENERALLY CONSISTED OF NUISANCE VEGETATION AND COMBUSTIBLE WASTE. COMPLETE COMBUSTION IS NOT EXPECTED IN ALL CASES. (1962-86)
French Drain	6	120-N-6	100-N Acid Tank Vent French	Y	Y			Y		A				ND	Y			CONDENSATE FROM SULFURIC TANKS AND LINES. 3 UNITS RECEIVED WASTE FROM 63 TO 87, AND 2 OTHERS FROM 82 TO 87.
French Drain	6	120-N-7	Acid Unloading Facility	Y	Y			Y		A				ND	Y			WASTE FROM RAILROAD CAR UNLOADING FACILITY. INTERMITTENT DISCHARGE OF SULFURIC ACID.
Line Leak	3	UN-116-N-22	184-N Diesel Oil Supply Line	Y	Y	Y	?							1.00E+03 GAL	Y			EXTERNAL CORROSION OF TANK CAUSED RELEASE.
Line Leak	3	UN-116-N-23	184-N Diesel Oil Supply Line	Y	Y	Y	?							2.00E+02 GAL	Y			DIESEL OIL LEAK IN 87.
Pit	6	120-N-3	163-N Neutralization Pit/Drain	Y	ND	ND	ND	Y	ND	Y				ND	Y			(R3-20) RECEIVED CORROSIVE LIQUIDS SUCH AS NAOH & SULFURIC ACID pH NOT DETERMINED, FROM 12/63-3/87. INTERMITTENT DISCHARGES OF UNKNOWN QUANTITIES.
Tank/Drain Field	6	124-N-4	124-N-4 Septic Tank	ND	ND	ND	ND	ND	ND	ND				3.00E+04 GPD	Y			(R3-12) RECEIVED SANITARY SEWAGE FROM 65 TO 87.
Tank/Drain Field	6	124-N-7	124-N-7 Septic Tank	ND	ND	ND	ND	ND	ND	ND				5.20E+03 GPD	Y			(R3-15) RECEIVED SANITARY SEWAGE FROM 84 TO 87
Tank/Drain Field	6	124-N-8	124-N-8 Septic Tank	ND	ND	ND	ND	ND	ND	ND				9.00E+02 GPD	Y			(R3-16) RECEIVED SANITARY SEWAGE FROM 85-87.
Tank/Drain Field	6	124-N-6	124-N-6 Septic Tank	ND	ND	ND	ND	ND	ND	ND				ND	Y			(R3-14) RECEIVED UNKNOWN QUANTITY OF SANITARY SEWAGE FROM 79 TO 84.
Tank/Drain Field	6	124-N-5	124-N-5 Septic Tank	ND	ND	ND	ND	ND	ND	ND				3.80E+03 GPD	Y			(R3-13) RECEIVED SANITARY SEWAGE FROM 81 TO 87.

KEY: Y= yes; ND= no data; # = official number not assigned but identified by unit number; blank= no; I= incomplete data

TABLE 3-8 200 E WASTE CONSTITUENTS MATRIX

200 East Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
bem	I	216-A-524	216-A-524 Control Structure		ND	ND	ND	ND	ND	ND	ND	Y	?	ND		ND	?	RADIOACTIVELY CONTAMINATED PIPING & CEMENT
berial ground	C	218-E-8	218-E-8, 200 East Construction	Y	ND	ND	ND	ND	ND	ND	Y	Y	Y	8.00E+04 CU FT		?		MFP/TRU WASTE, REPAIR AND CONSTRUCTION WASTES.
berial ground	C	218-E-13	218-E-13 Burial Ground		ND	ND	ND	ND	ND	ND	ND	ND	?	ND	ND	ND	?	CONTAMINATED CONCRETE
berial ground	C	218-E-6	218-E-6 Burial Ground	Y	ND	ND	ND	ND	ND	ND	ND	ND		ND		ND	?	CONTAMINATED WOODEN ITEMS; INCLUDED ASHES
berial ground	C	218-E-2	218-E-2, 200 East Industrial		ND	ND	ND	ND	ND	ND	Y	Y	Y	3.10E+05 CU M		?		MIXED MFP/TRU
berial ground	C	218-E-5	218-E-5 Burial Ground		ND	ND	ND	Y	ND	ND	Y	Y	Y	1.10E+05 CU M		?		INDUSTRIAL DRY WASTE, UNH-CONTAMINATED RAILROAD CARS
berial ground	C	218-E-5A	218-E-5A, 200 East Industrial	Y	I	ND	ND	ND	ND	ND	Y	Y	Y	2.20E+05 CU M		?		FAILED EQUIPMENT AND INDUSTRIAL WASTES. WASTE BOXES DAMAGED AND PUSHED INTO TRENCH.
berial ground	C	218-E-3	218-E-3 Burial Ground	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	
berial ground	C	218-E-4	218-E-4, 200 East/Minor No. 4	Y	ND	ND	ND	ND	ND	ND	Y	Y	Y	5.60E+04 CU FT		?		REPAIR AND CONSTRUCTION WASTES. AT ONE TIME CONTAMINATED EQUIPMENT STORED ABOVE GROUND. IT IS UNCLEAR WHETHER THESE WASTES WERE DEPOSITED.
berial ground	C	218-E-1	218-E-1, 200 East Dry Waste		ND	ND	ND	ND	Y	ND	Y	Y	Y	1.10E+05 CU FT		?		RECEIVED MIXED MFP/TRU DRY WASTES. FILLED WITH CINDERS AND TOPPED WITH GRAVEL.
berial ground	C	218-E-12A	218-E-12A, 200 East Dry Waste	Y	I	ND	ND	?	ND	A	Y	Y	Y	ND		Y		ACID SOAKED WASTES; DRY WASTES FROM 200E.
berial tunnel	O	218-E-14	218-E-14 Purex Tunnel No. 1			ND	ND	ND	ND	ND	Y	Y	Y	2.00E+04 CU FT			?	HIGHLY CONTAMINATED MATERIALS STORED ON RAILROAD FLAT CARS IN TUNNEL. LARGE EQUIPMENT.
berial vault	B	216-E-9	216-E-9, Equip. Stor. Area No.3	Y	ND	ND	ND	ND	ND	ND	Y	ND	?	ND			?	REGULATED EQUIPMENT STORAGE; FISSION PRODUCT EQUIPMENT FROM URANIUM RECOVERY PROGRAM.
berial vaults (3)	K	218-E-7	218-E-7, 200 East/222-B Vaults	Y	I	ND	ND	ND	ND	ND	Y	Y	Y	6.00E+03 CU FT		?		LAB WASTES AND MIXED MFP/TRU WASTE IN ONE WOODEN AND TWO CONCRETE VAULTS.
berning pit	L		200 East Burning Pit			Y	Y	?	?	ND				2.50E+03 CU M	Y			CHEMICALS, SOLVENTS, PAINTS, CONSTRUCTION AND OFFICE WASTES, 1950-70.
crib	6	216-A-39	216-A-40 CRIB/TRENCH	Y		ND	ND	Y	ND	ND	Y	ND	Y	2.00E+01 LITERS		?		CRIB AND 2 TRENCHES RECEIVED FLOOR DRAINAGE FROM 241-AX-801-B BLDG(TANK 103AX PRESSURE LEAK) FILLED WITH GRAVEL AND BACKFILLED, 6/66.
crib	6	216-B-47	216-BY-5 CAVERN/CRIB	Y	Y	?	ND	Y	Y	ND	Y	Y	Y	3.71E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221 U BLDG. TRENCH BACKFILLED. 9/55-9/55.
crib	6	216-B-51	216-BY-9 CRIB	Y	I	ND	ND	Y	ND	ND	ND	ND	?	1.00E+03 LITERS	ND	ND	ND	RECEIVED FLUSH DRAINAGE FROM BC CRIB PIPELINE. SITE RETIRED IN 1/58.
crib	6	216-B-15	216-BC-2 Crib	Y	Y	Y	ND	Y	ND	ND	Y	Y	Y	6.32E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221-U BLDG.
crib	6	216-A-10	216-A 10 crib	Y	I	ND	ND	Y	ND	A	Y	Y	Y	2.90E+09 LITERS		Y		UNIT RECEIVED WASTES UNTIL 1987 (MARCH).
crib	6	216-C-5	216-C-5 crib	Y		ND	ND	Y	ND	ND	Y	Y	Y	3.78E+04 LITERS		Y		201-C COLD RUN WASTE
crib	6	216-A-22	216-A-22 French Drain	Y	I	ND	ND	Y	ND	ND	ND	ND	?	1.00E+04 LITERS		?		SUMP WASTE FROM 203 A BLDG, HEATING COOL CONDENSATE, TRUCK LOADING DRAINAGE.
crib	6	216-B-14	216-B-14	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	8.71E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221-U BLDG.
crib	6	216-A-41	216-A-41 Crib	Y	I	ND	ND	Y	ND	A	ND	ND	?	1.00E+04 LITERS		?		296-A-13 STACK DRAINAGE (SLIGHTLY ACIDIC).
crib	6	216-C-6	241-CX Crib	Y		ND	ND	ND	ND	Y	Y	Y	Y	5.30E+05 LITERS		?		
crib	6	216-A-32	216-A-32	Y	I	ND	ND	ND	ND	ND	ND	ND	?	4.00E+03 LITERS		?		202-A CRANE MAINTENANCE FLOOR, SINK, AND SHOWER DRAINAGE.
crib	6	216-C-4	216-C-4 crib	Y	Y	Y	ND	Y	ND	ND	Y	Y	Y	1.80E+05 LITERS		?		RECEIVED CONTAMINATED ORGANIC WASTES FROM 276-C BLDG.
crib	6	216-A-31	216-A-32 Crib	Y	I	Y	ND	Y	ND	B	Y	Y	Y	1.00E+04 LITERS		?		ORGANIC WASTES FROM 202-A BLDG.

KEY:
Y: yes
ND: no data
* - official number not assigned but identified by unit number
blank: no
I: incomplete data

TABLE 3-8 200 E WASTE CONSTITUENTS MATRIX (continued)

200 East Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
crib	6	216-B-100	216-B-100 CRIB, 222-B-2 CRIB	Y	I	ND	ND	Y	ND	A	Y	Y	Y	2.80E+04 LITERS		Y		DECONTAMINATED SHOWER AND SINK WASTE FROM 221-B.
crib	6	216-B-60	216-B-60 Crib	Y		ND	ND	ND	ND	ND	Y	Y	Y	1.09E+04 LITERS		?		221-B BLDG SOLID + LIQUID CELL CLEANOUT WASTE. CRIBS SEALED WITH CONCRETE COVERED BY 225-B FACILITY.
crib	6	216-A-3	216-A-3 Crib	Y	I	ND	ND	Y	ND	?	Y	Y	?	2.80E+06 LITERS		?		SILICA GEL REGENERATION WASTE FROM 203-A, UNH STORAGE PIT DRAINAGE, AND 203-A PUMPHOUSE.
crib	6	216-C-6	216-C-6	Y		ND	ND	Y	ND	A	Y	Y	Y	5.30E+05 LITERS		Y		PROCESS CONDENSATE AND 241-CX VAULT FLOOR DRAINAGE.
crib	6	216-B-19	216-BC-6 Crib	Y	Y	?	ND	Y	ND	ND	Y	Y	Y	6.40E+06 LITERS		?		WASTE FROM 221-U URANIUM RECOVERY (TBP SOLVENT EXTRACTION); CYANIDE.
crib	6	216-B-8	216-B-8 Crib	Y	I	ND	ND	ND	ND	ND	Y	Y	?	2.72E+07 LITERS		?		SECOND CYCLE WASTE AND OTHER LIQUID WASTES.
crib	6	216-B-18	216-BC-5 Crib	Y	Y	?	ND	Y	ND	ND	Y	Y	Y	8.52E+06 LITERS		?		WASTE FROM 221-U URANIUM RECOVERY (TBP SOLVENT EXTRACTION). FILLED WITH GRAVEL FOLLOWING CAVE IN; CYANIDE.
crib	6	216-A-1	216-A-1 Cavern	Y	ND	ND	ND	ND	ND	ND	Y	Y	?	9.04E+04 LITERS			?	DEACTIVATED URANIUM WASTE FROM COLD START-UP IN 202-A.
crib	6	216-A-2	216-A-2 Cavern	Y		Y	ND	Y	ND	ND	Y	Y	Y	2.30E+05 LITERS		?		ORGANIC WASTE FROM 202A (PUREX).
crib	6	216-B-57	216-B-57 Crib	Y	I	ND	ND	Y	ND	ND	Y	Y	Y	8.44E+07 LITERS		?		WASTE STORAGE TANK CONDENSATE FROM THE ITS #2 UNIT IN 241-BY TANK FARM.
crib	6	216-B-17	216-BC-4 Crib	Y	I	ND	ND	Y	ND	ND	Y	Y	Y	3.41E+06 LITERS		?		URANIUM RECOVERY WASTE FROM 221-U (TBP SOLVENT EXTRACTION); CYANIDE.
cribs - 3	6	216-B-12	216-ER-1, 2, 3 cribs, 216-ER	Y	I	?	ND	Y	ND	ND	Y	Y	Y	5.20E+08 LITERS		?		PROCESS CONDENSATE FROM EVAPORATORS.
crib/tile field	6	216-B-9	216-B-361, 241-B-361	Y	I	ND	ND	Y	ND	ND	Y	Y	Y	3.60E+07 LITERS		?		RECEIVED CELL DRAINAGE AND OTHER WASTES VIA TANK 5-6 IN 221-B.
crib/trench	E	216-B-58	216-B-58 TRENCH, 216-B-59 CRIB	Y		ND	ND	Y	ND	ND	Y	Y	Y	4.13E+05 LITERS		?		RECEIVED BATTELLE NW LAB WASTE FROM 300 AREA.
ditch	E	216-A-34	216-A-34 Crib	Y	ND	ND	ND	ND	ND	ND	ND	ND	?	ND			?	CONTACT CONDENSER COOLING WATER
ditch	E	216-B-2-1	216-B-2, B DITCH	Y	ND	ND	ND	ND	ND	ND	Y	Y	?	1.49E+11 LITERS		?		WAS CONTAMINATED BY A COIL FAILURE IN BLDG 221-B. DITCH WAS COVERED WITH CLEAN FILL AND PLASTIC WEED ROOT BARRIER. INCLUDES UPR-200-E-32. USED FOR STEAM CONDENSATE, PROCESS COOLING WATER, AND CHEMICAL SEWER WASTE.
ditch	E	216-B-3-2	216-B-2-2E, B SWAMP DITCH	Y	ND	ND	ND	ND	ND	ND	Y	Y	ND	1.49E+11 LITERS		?		PROCESS VESSEL COOLING WATER, VAULT COOLING WATER, AND CHEMICAL SEWER WASTE.
ditch and pond	E	216-B-3-1	B SWAMP DITCH, 216-B-2	Y	ND	ND	ND	ND	ND	ND	Y	ND	ND	1.49E+11 LITERS		?		SAME AS 216-B-3-2.
diversion box	I	241-B-151	241-B-151 diversion box	N	ND	ND	ND	ND	ND	ND	Y	Y	?	ND		Y		LEAKAGE IDENTIFIED AS UPR-200-E-4 + 73. SOME CONTAMINATED SOILS REMOVED AND REPLACED.
diversion box	I	241-C-252	241-C-252 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	?	ND		Y		ASSOCIATED W/ CATCH TANK 241-301-C
diversion box	I	241-C-154	241-C-154 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	?	ND		Y		
diversion box	I	241-AY-152	241-AY-152 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	?	ND		Y		
diversion box	I	241-BR-152	241-BR-152 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	?	ND		Y		
diversion box	I	241-CR-152	241-CR-152 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	?	ND		Y		
diversion box	I	241-CR-153	241-CR-153 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	?	ND		Y		
diversion box	I	241-BXR-153	241-BXR-153 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	?	ND		Y		
diversion box	I	241-BYR-151	241-BYR-151 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	?	ND		Y		
diversion box	I	241-B-252	241-B-252 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	?	ND		Y		ASSOCIATED W/ CATCH TANK 241-B-301-B

KEY: Y = yes; ND= no data; # = official number not assigned but identified by unit number; blank= no; I= incomplete data

TABLE 3-8 200 E WASTE CONSTITUENTS MATRIX (continued)

Unit Type	Site Code	Official Number	Site Name Description	Waste Source Identified	Chemicals Identified	Organics	Volatiles	Inorganics	Metals	pH	Fission Product	Other Radionuclide	Residual Radioactivity	Waste Volume Disposed	Listed Waste	Mixed Waste	Rad Only	Comments
diversion box	[illegible]	[illegible]	241 ER 151 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		
diversion box	[illegible]	[illegible]	241 C 151 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		CONTAMINATION FROM BOX RECORDED AS UPR 200 E 60. BOX WAS FLUSHED AND SEALED WITH FOAMED ... TO PHYSICALLY FIX RADIATION CONTAMINATION
diversion box	[illegible]	[illegible]	241 B 152 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		ASSOCIATED W/ CATCH TANK 241 B 302 B
diversion box	[illegible]	[illegible]	241 B 152 diversion box	N	ND	ND	ND	ND	ND	ND	Y	Y	Y	ND		Y		LEAKAGE REPORTED AS UPR 200 E ... ON 216 E ..., SOME SOIL REMOVED AND SOME COVERED
diversion box	[illegible]	[illegible]	241 BXR 153 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		
diversion box	[illegible]	[illegible]	241 B 154 diversion box	N	ND	ND	ND	ND	Y	ND	Y	Y	Y	ND		Y		ASSOCIATED W/ CATCH TANK 241 B 302 B. CLEANOUT OPERATIONS CONTAMINATED SURROUNDING AREA. SOME SOILS REMOVED. REPORTED AS UPR 200 E 75. NUMBER LEAKAGE REPORTED AS UPR 200 E 77, SITE COVERED
diversion box	[illegible]	[illegible]	241 C 152 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		ASSOCIATED W/ CATCH TANK 241 ER 311. CONTAMINATION INCIDENT REPORTED AS UPR 200 E 81. COVERED WITH GRAVEL.
diversion box	[illegible]	[illegible]	241 BX 155 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		ASSOCIATED W/ CATCH TANK 241 BX 302 C
diversion box	[illegible]	[illegible]	241 C 153 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		ASSOCIATED W/ CATCH TANK 241 C 301 C
diversion box	[illegible]	[illegible]	241 BX 153 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		ASSOCIATED W/ CATCH TANK 241 BX 302 A
diversion box	[illegible]	[illegible]	241 BXR 152 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		
diversion box	[illegible]	[illegible]	241 BXR 15? diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		
diversion box	[illegible]	[illegible]	241 BX 154 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		ASSOCIATED W/ CATCH TANK 241 BX 302 B
diversion box	[illegible]	[illegible]	241 B 153 diversion box	N	ND	ND	ND	ND	ND	ND	Y	Y	Y	ND		Y		ASSOCIATED W/ CATCH TANK 241 B 301 B. CONTAMINATION REPORTED AS UPR 200 E 75 AND UPR 200 E ... COVERED WITH GRAVEL.
diversion box	[illegible]	[illegible]	241 BYR 154 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		
diversion box	[illegible]	[illegible]	241 B 153 diversion box	N	ND	ND	ND	ND	ND	ND	ND	Y	?	ND		Y		
diverter station	[illegible]	[illegible]	241 BY 15? diverter station	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		
diverter station	[illegible]	[illegible]	241 BZ 151 diverter station	N	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		Y		ASSOCIATED W/ CATCH TANK 241 BZ 151
drain field	[illegible]	[illegible]	sanitary waste drain field	Y	ND	Y	ND	ND	ND	ND			NS	2.?0E+01 CU FT/YR				LAB REAGENTS USED IN BLDG. SUPPORTED BY THIS UNIT
evaporator	[illegible]	[illegible]	242 B Evaporator	Y	I	ND	ND	Y	ND	ND	Y	Y	Y	7.17E+06 GAL.		Y		151 DECON WASTE CYCLE ... OPERATED IN VARIOUS CAPACITIES.
french drain	[illegible]	[illegible]	216 B 26 French Drain	Y	I	ND	ND	Y	ND	ND	ND	ND	Y	1.00E+0? LITERS		Y		291 B ION CONTROL RM FLOOR DRAINAGE
french drain	[illegible]	[illegible]	216 B 16 Dry Well	Y	I	ND	ND	Y	ND	ND	ND	ND	Y	1.22E+05 LITERS		Y		241 B 401 BLDG STACK & FLOOR DRAINAGE
french drain	[illegible]	[illegible]	216 B 17 Dry Well	Y	I	ND	ND	Y	ND	ND	ND	ND	Y	6.00E+04 LITERS		Y		241 B 401 BLDG STACK & FLOOR DRAINAGE
french drain	[illegible]	[illegible]	216 B 35 Dry Well	Y	I	ND	ND	Y	ND	ND	ND	ND	Y	1.00E+04 LITERS			Y	SEAL COOLING WATER FROM 202 A BLDG AIR HANDLER VACUUM PUMPS.
french drain	[illegible]	[illegible]	216 B 33 Dry Well	Y	I	ND	ND	Y	ND	ND	ND	ND	Y	ND			Y	BEARING COOLANT FROM 291 B ... STACK ELECTRIC EXHAUST. UNIT STATE, NO CHEMICALS.
french drain	[illegible]	[illegible]	271 CR vault, 216 C ...	Y	I	ND	ND	Y	ND		ND	ND	Y	1.00E+0? LITERS		Y		221 CR BLDG ION EXCHANGE WASTE
french drain	[illegible]	[illegible]	216 B 12 French Drain	Y	I	ND	ND	Y	ND	ND	ND	ND	Y	1.00E+05 LITERS		Y		202 A BLDG STEAM TRAP PIT & DRAINAGE
french drain	[illegible]	[illegible]	216 B 29? French Drain	Y	I	ND	ND	Y	ND	ND	ND	ND	Y	6.00E+0? LITERS		Y		241 A 401 DEENTRAINER TANK CONDENSATE AND BACK FLUSH.
french drain	[illegible]	[illegible]	216 B 14 French Drain	Y	I	ND	ND	Y	ND	ND	ND	Y	ND	1.00E+0? LITERS		Y		202 A VAC. CLEANER FILTER & BEAKER PIT DRAINAGE
french drain	[illegible]	[illegible]	216 B 29? French Drain	Y	I	ND	ND	Y	ND	ND	ND	ND	Y	6.00E+0?		Y		241 A 401 DEENTRAINER TANK CONDENSATE AND BACK

KEY: Y = yes; ND = no data; * = official number not assigned but identified by unit number; blank = no; I = incomplete data

TABLE 3-3 100 D/DR WASTE CONSTITUENTS MATRIX

Unit Type	OU	Official Number	Site Name/ Description	Waste Source Identified	Chemical Identified	Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radionuclides	Residual Radioactivity	Waste Volume Disposed	Sol/Haz Waste	Mixed Waste	Fed Only	Comments
Basin Trench	[illegible]	[illegible]	105 DR Storage Basin Trench	Y	ND			Y			Y	Y	Y	4.00E+06 L			Y	CONTAMINATED SLUDGE AND WATER FROM FUEL STORAGE BASIN. INCLUDED TRITIUM.
Basin Trench	[illegible]	116-D-10	105 D Storage Basin Trench #1	Y	ND	ND	ND	Y	ND		ND	ND	Y	2.00E+05 L			Y	CONTAMINATED WATER AND SLUDGE FROM 105 D STORAGE BASIN.
Burial Ground	[illegible]	[illegible]	100 D Burial Ground #3 118-D-3	Y	I	ND	ND	ND	Y		Y		Y	7.00E+04 KG		Y		BURIAL GROUND FOR IRRADIATED SOLID METALLIC WASTE INCLUDED TRITIUM AND 100N SOLID WASTE.
Burial Ground	[illegible]	[illegible]	Construction Burial Ground	Y	ND				?		Y	ND	Y	1.00E+07 KG		Y		BURIAL GROUND: CONTAMINATED MATERIAL FROM REACTOR BLDG....COMPONENTS AND HARDWARE
Burial Ground	[illegible]	[illegible]	100 D Burial Ground #1 118-D-1	Y	ND	ND	ND	ND	Y		Y	ND	Y	1.06E+06 KG		Y		BURIAL GROUND FOR IRRADIATED SOLID WASTE AND METALLIC WASTE NOT STATED THAT THE 3 TRENCHES WERE CLOSED ASSUMED SO HOWEVER.
Burial Ground	[illegible]	[illegible]	100 D Burial Ground #2 118-D-2	ND	ND	ND	ND	ND	Y		Y	ND	Y	1.00E+06 KG		?		BURIAL GROUND FOR CONTAMINATED/IRRADIATED SOLID WASTE AND METAL WASTE, 100N WASTE, TOO.
Burial Ground	[illegible]	[illegible]	Ball 3X Burial Ground 118-D-5	Y	ND				Y		Y	ND	Y	6.00E+03 KG			Y	BURIAL GROUND FOR THIMBLES FROM REACTOR BLDG.
Burial Ground	[illegible]	[illegible]	105 DR Gas Loop Burial Ground	Y	ND				Y		Y	ND	Y	1.00E+04 KG			Y	IRRADIATED METAL ASSEMBLIES
Burning Pit	[illegible]	100-D-DR*	100 D/DR Burning Pit	Y	I	Y	Y	Y	?	ND				1.00E+03 M3	Y			BURNING OF PAINT WASTES, SOLVENTS, OTHER CHEMICALS.
Crib	6	[illegible]	117 D Crib	Y	ND	ND	ND	ND	ND	ND	ND	ND		4.20E+05 L		ND	ND	DRAINAGE FROM CONTAINMENT SYSTEM 1970 SAMPLING, NO RADIOACTIVITY ABOVE BACKGROUND
Crib	6	[illegible]	105 DR Fluto Crib 116 DR 4	Y	ND			Y	ND	ND	Y	Y	Y	4.00E+0? L		Y		EFFLUENT FROM TUBES CONTAINING FAILED FUEL ELEMENTS.
Crib	6	[illegible]	117 DR Crib	Y	ND	ND	ND	ND	ND	ND	ND	ND	Y	2.40E+05 L		Y		DRAINAGE FROM CONTAINMENT SYSTEM SEAL PITS
Crib	6	[illegible]	105 D Fluto Crib 116 D 2	Y	I	ND		Y	ND	ND	ND	ND		4.00E+0? L		?		WASTES FROM FAILED FUEL ELEMENTS. SODIUM DICHROMATE ALSO IDENTIFIED
French Drain	6	[illegible]	100-D Crib #3 116-D-3	Y	ND	?	ND	Y	Y	Y	Y	ND	Y	3.00E+05 L		Y		WASTES FROM CONTAMINATED MAINTENANCE SHOP AND CASK DECONT. PAD.
French Drain	6	[illegible]	100 D Crib #4 116 D 4	Y	ND	?	ND	Y	?	Y	Y	ND	Y	3.00E+05 L		?		WASTES FROM CONTAMINATED MAINTENANCE SHOP AND CASK DECONT. PAD
French Drain	6	[illegible]	105 D Cushion Corridor French	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	1.00E+06 L		Y		DOMESTIC WATER FROM CHANGING ROOM, AND WATER FROM MASK DECONT. STATION.
Pumping Station	[illegible]	1608 DR*	1608 DR Waste Water Pumping	Y	Y	Y		Y		H	Y	Y	?	ND		Y		PUMPING UNIT RECEIVING WATER FROM REACTOR BLDG DRAINS...TRACE AMTS OF LOW LEVEL RADIONUCL. AND DECONTAM. CHEMICALS. RADIONUCL. INVENTORY DATA AVAILABLE BUT NOT DETAILED IN SUMMARY.
Pumping Station	[illegible]	1608 D*	1608 D Waste Water Pumping	Y	Y	Y		Y		H	Y	Y	?	ND		Y		PUMPING UNIT RECEIVING WATER FROM REACTOR BLDG DRAINS...LOW LEVEL RADIONUCL., AND DECONTAM CHEMICALS.
Retention Basin	[illegible]	[illegible]	107-D Retention Basin	Y	ND			Y			ND	ND	Y	ND		Y		CONCRETE LINED, ASPHALT COATED BASIN. RECEIVED REACTOR COOLING WATER EFFLUENT PRIOR TO DISCHARGE TO COLUMBIA RIVER.
Retention Basin	[illegible]	[illegible]	107 DR Retention Basin	Y	ND				ND		ND	ND	Y	ND		?		CONCRETE LINED BASIN. RECEIVED REACTOR COOLING WATER EFFLUENT. CONTAMINATED/RADIOACTIVE BASIN WALLS AND SURROUNDING SOIL.
Storage Pad	[illegible]	[illegible]	100 D Cask Storage Pad (3)	ND	ND	?	ND	Y	ND	? H	ND	ND	Y	ND		Y		STORAGE PAD RECEIVED RADIONUCL. AND DECONTAM CHEMICALS. TRACE AMOUNT REMAIN. STORAGE PAD DISCHARGES TO [illegible] PAD CONTAINS ONE CONTAMINATED DRAIN.
Tank	[illegible]	1706 D*	1706 D Gas Storage Tank (3)	Y	Y	Y	Y								Y			STORAGE TANK CONTAINED GASOLINE... HAS EMPTIED AND FILLED WITH WATER. PRESENTLY CONTAINS WATER.
Tank/Tile Field	6	1607 D1*	1607 D1 Septic Tank	Y	ND	ND	ND	ND	ND					ND	Y			SEPTIC TANK RECEIVED SANITARY WASTEWATER FROM SECURITY CHECKPOINT (BADGE HOUSE) AND OTHER BUILDINGS.
Tank/Tile Field	6	1607 D4*	1607 D4 Septic Tank	Y	ND	ND	ND	ND	ND					ND	Y			SEPTIC TANK RECEIVED SANITARY WASTEWATER FROM GAS RECIRCULATION BLDG.

KEY: Y - yes; ND - no data; * - official number not assigned but identified by unit number; blank - no; I - incomplete data

TABLE 3-8 200 E WASTE CONSTITUENTS MATRIX (continued)

200 East Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
														LITERS				FLUSH
french drain	6	216-A-11	216-A-11 French Drain	Y	I	ND	ND	Y	ND	ND	ND		?	1.00E+05 LITERS		?		202-A BLDG TRAP PIT DRAINAGE #1 1/55-1972.
french drain	6	216-A-15	216-A-15 French Drain	Y	I	ND	ND	Y	ND	A	ND		?	1.00E+07 LITERS		?		ACIDIC FILTER AND BLOWER PIT DRAINAGE (202-A BLDG).
french drain	6	216-A-13	216-A-13 French Drain	Y	I	ND	ND	Y	ND	ND	ND		?	1.00E+04 LITERS			?	202-A SEAL WATER FROM AIR SAMPLER VAC. PUMP
french drain	6	216-B-13	291-B CRIB, 216-B-B CRIB	Y	I	ND	ND	Y	ND	?	ND	?	?	2.10E+04 LITERS		?		291-B-1 STACK DRAINAGE. 1945-76.
leaching pit	E	216-C-3	201-C Leaching Pit	Y	Y	ND	ND	Y	ND	A	Y	Y	Y	5.00E+06 LITERS		Y		ACID WASTE FROM 201-C, 215-C, 271-C. (NITRIC ACID) 1/53-3/54.
pit	0		200 Area Construction Waste	Y										ND	?			CONSTRUCTION DEBRIS 1945-55.
pit #7*	D	UPR-200-E-124	UPR-200-E-124, A-13 Pit	Y	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		?		A-13 PIT; CHECK 10-1 WASTE LINE (154 BX DIVERSION BOX).
receiving vault	I	244-CR*	244-CR receiving vault	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		?		ASSOCIATED W/ CATCH TANK 244-CR AND 241-C TANK FARM.
receiving vault	I	244-BXR*	244-BXR receiving vault	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		?		ASSOCIATED W/ CATCH TANK 244-BXR AND 241-BX TANK FARM.
reverse well	6	216-B-11-A & B	242-B-1 CRIB, 216-B-11 CRIB	Y	ND	ND	ND	?	ND	ND	Y	Y	Y	2.96E+07 LITERS		?		242-B EVAPORATOR PROCESS CONDENSATE
reverse well	6	216-B-4	216-B-4 FRENCH DRAIN/DRY WELL	Y	I	ND	ND	Y	ND	A	ND	Y	Y	1.00E+04 LITERS		Y		291-B STACK DRAINAGE, 292-B BLDG FLOOR DRAINAGE
spill site	J	UN-216-E-69	UN-216-E-69 Railroad Car Flush	Y	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		?		RAILROAD BURIAL CAR FLUSH WATER
spill site	C	UN-216-E-72	UN-216-E-72	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		ND	ND	UNCOVERED BURIED WASTE
spill site#7*	J	UPR-200-E-44/103	UPR-200-E-44/103, BCS CRIB LINE	Y	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		ND	ND	BCS CRIB LINE LEAKAGE SOUTH OF A 17 CHANGE HOUSE
tank	I	241-BX-302-B	catch tank 241-BX-302-B	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		Y		ASSOCIATED W/ THE 241-BX-154 DIVERSION BOX
tank	I	241-A-302-B	catch tank 241-A-302-B	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		Y		ASSOCIATED WITH 241-A-152 DIVERSION BOX
tank	I	241-BX-302-A	catch tank 241-BX-302-A	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		Y		ASSOCIATED W/ 241-BX-153 DIVERSION BOX
tank	I	241-AZ-151	catch tank 241-AZ-151	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		Y		ASSOCIATED W/ 241-AZ-151 DIVERTER STATION
tank	I	241-B-301-B	catch tank 241-B-301-B	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		Y		ASSOCIATED W/ 241-B-252 DIVERSION BOX
tank	I	244-CR*	catch tank 244-CR	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		Y		ASSOCIATED W/ 244-CR RECEIVING VAULT
tank	H	270-E*	270-E Condensate neutral.	ND	ND	ND	ND	ND	ND	Y	ND	ND	Y	ND		?		270-E CONDENSATE
tank	I	241-CX-72	241-CX-72 Tank	ND	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND			?	SOLID RADIOACTIVE WASTE
tank	I	244-BXR*	catch tank 244-BXR	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		Y		ASSOCIATED W/ 244-BXR RECEIVING VAULT
tank	I	241-301-C	CATCH TANK 241-301-C	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		Y		
tank	I	241-B-361	241-B-361 settling tank	ND	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		?		SETTLED RAD. CONTAMINATED LIQUID
tank	I	241-BX-302-C	catch tank 241-BX-302-C	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		Y		ASSOCIATED W/ 241-BX-155 DIVERSION BOX
tank	I	241-CX-70	241-CX-70 tank	ND	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		?		RECEIVED RADIOACTIVELY CONTAMINATED SLUDGE
tank	I	241-B-302-B	catch tank 241-B-302-B	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		Y		ASSOCIATED W/ 241-B-154 DIVERSION BOX
tanks	I	241-AX*	241-AX tank farm	Y	ND	Y	ND	?	Y	A	Y	Y	?	ND		Y		PUREX ACID WASTE, CLADDING WASTE, ORGANIC WASH. CONTAMINATION REPORTED AS UPR-200-E-115,119.
tanks	I	241-BY*	241-BY tank farm	Y	ND	ND	ND	?	Y	ND	Y	Y	?	ND		Y		BISMUTH PHOSPATE PROCESS, TRIBUTYL PHOSPHATE, PUREX, ETC. SALT WELLS WERE INSTALLED TO REMOVE LIQUIDS ASSOCIATED WITH SPILLS REPORTED AS UPR-200 E-134, UPR-200-E-135. ADDITIONAL RELEASE REPORTED AS UPR-200-E-110.
tanks	I	241-A*	241-A tank farm	Y	ND	Y	ND	?	Y	A	Y	Y	?	ND		Y		PUREX ACID WASTE, CLADDING WASTE, ORGANIC WASH. CONTAMINATION REPORTED AS UPR-200 E-125,126,48,47.
tanks	I	241-BX*	241-BX tank farm	Y	ND	ND	ND	?	Y	ND	Y	Y	?	ND		Y		BISMUTH PHOSPATE PROCESS, ETC. CONTAMINATION REPORTED AS UPR-200-E-3,5,78,89,131,133.

KEY: Y= yes; ND= no data; * = official number not assigned but identified by unit number; blank= no; I= incomplete data

TABLE 3-8 200 E WASTE CONSTITUENTS MATRIX (continued)

200 East Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS: Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE: Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
tanks	I	241-BX	241-B tank farm	Y	ND	ND	ND	?	Y	ND	Y	Y	?	ND		Y		BISMUTH PHOSPHATE PROCESS, ETC. CONSTRUCTION OF A SALT WELL AND ASPHALTING WERE REPORTED IN UPR-200-E-127-130,108,109.
tanks	I	241-CX	241-C tank farm	Y	ND	Y	ND	Y	ND	ND	Y	Y	?	ND		Y		BISMUTH PHOSPHATE PROCESS, TRIBUTYL PHOS. PUREX, REDOX. CONSTRUCTION OF A SALT WELL AND SOIL REMOVAL WERE REPORTED ASSOCIATED "X" WITH UPR-200-E-16,50,91,136,137 AND UN-216-E-91.
tanks	X	224-BX	224-B CONC. FACILITY (42 TANKS)	ND	Y	Y	ND	?	Y	ND	Y	Y	Y	ND		Y		INACTIVE PRODUCT TREATMENT UNIT WITH RAD. CONTAMINATION AND HAZ. CONST.'S INCLUDING: PCB'S,MERCURY, AND CLEANERS. WASTE RECEIPT PRIOR TO 1976.
tanks	X	205-AX	205-A SILICA GEL FACILITY (9 tanks)	Y	ND	ND	ND	ND	ND	ND	ND	Y	Y	ND		?		INACTIVE RAD. MATERIALS PROCESSING UNIT. WASTE RECEIPT PRIOR TO 1976.
trench	E	216-A-10	216-A-10 Excavation	Y	I	ND	ND	Y	ND	ND	Y	Y	Y	4.88E+05 LITERS			?	DEPLETED URANIUM WASTE FROM 202-A COLD STARTUP. 12/56. PARTIALLY BACKFILLED
trench	E	216-B-38	216-BX-4 Trench	Y	Y	ND	ND	Y	ND	8	Y	Y	Y	1.43E+06 LITERS		?		FIRST CYCLE SUPERNATANT WASTE FROM 221-B BLDG.
trench	E	216-B-28	216-BC-14 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	5.05E+06 LITERS		?		URANIUM RECOVERY WASTE (TBP SOLVENT RECOVERY) FROM 221-U. CYANIDE.
trench	E	216-B-53-B	216-B-53 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	1.51E+04 LITERS		?		BLDG 321 WASTES (HANFORD LABORATORIES OPERATIONS).
trench	E	216-B-31	216-BC-18 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.74E+06 LITERS		?		URANIUM RECOVERY WASTE (TBP SOLVENT RECOVERY) FROM 221-U. CYANIDE.
trench	E	216-B-33	216-BC-20 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.74E+06 LITERS		?		URANIUM RECOVERY WASTE (TBP SOLVENT RECOVERY) FROM 221-U. CYANIDE.
trench	E	216-B-22	216-BC-9 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.74E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221-U BLDG. CYANIDE.
trench	E	216-A-19	216-A-19 Grave/Sump/Test hole	Y		ND	ND	Y	ND	ND	Y	Y	Y	1.10E+08 LITERS		?		RECEIVED 241-A-431 BLDG CONTACT CONDENSER H2O, 202-A BLDG COLD START-UP U WASTE.
trench	E	216-B-42	241-BX-8 Grave,216-BX-8 Trench	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	1.50E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221-U BLDG. TRENCH BACKFILLED. CYANIDE.
trench	E	216-B-54	216-B-54 Trench	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	9.99E+05 LITERS		?		BLDG 321 WASTES (HANFORD LABORATORIES OPERATIONS).
trench	E	216-B-52	216-B-52 Trench	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	8.53E+06 LITERS		?		URANIUM RECOVERY WASTE (TBP SOLVENT RECOVERY) FROM 221-U. CYANIDE.
trench	E	216-B-34	216-BC-21 Trench	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.07E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221-U BLDG. TRENCH BACKFILLED. CYANIDE.
trench	E	216-B-20	216-BC-7 Trench	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.68E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221-U BLDG. CYANIDE.
trench	E	216-B-27	216-BC-14 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.42E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221-U BLDG. CYANIDE.
trench	E	216-B-53A	216-B-53A Trench	ND	ND	ND	ND	ND	ND	ND	Y	Y	Y	5.49E+05 LITERS		?		WASTES FROM 300 AREA OPERATIONS OF THE HANFORD LABORATORIES.
trench	E	216-B-35	216-BX-1 Trench	Y	Y	ND	ND	Y	ND	8	Y	Y	Y	1.06E+06 LITERS		?		FIRST CYCLE SUPERNATANT WASTE FROM 221-B BLDG.
trench	E	216-B-23	216-BC-10 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.52E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221-U BLDG. CYANIDE.
trench	E	216-B-37	216-BX-3 TRENCH	Y	Y	ND	ND	Y	ND	8	Y	Y	Y	4.31E+06 LITERS		?		FIRST CYCLE BOTTOM SUPERNATANT WASTE FROM THE WASTE EVAP. AND 242 B. EVAP.
trench	E	216-B-41	241-BX-7 Grave,216-BX-7 Trench	Y	Y	ND	ND	Y	ND	8	Y	Y	Y	1.44E+06 LITERS		?		FIRST CYCLE SUPERNATANT WASTE FROM 221-B BLDG.
trench	E	216-B-30	216-BC-17 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.78E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221 U BLDG. CYANIDE.
trench	E	216-B-24	216-BC-11 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.70E+06 LITERS		?		TBP SUPERNATANT WASTE FROM 221 U BLDG. CYANIDE.
trench	E	216-A-20	216-A-20 GRAVE/SUMP/TEST HOLE	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	9.61E+05		?		RECEIVED 241-A-431 BLDG CONTACT CONDENSER WATER.

KEY: Y= yes; ND= no data; * = official number not assigned but identified by unit number; blank= no; I= incomplete data

TABLE 3-8 200 E WASTE CONSTITUENTS MATRIX (continued)

200 E Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS: Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radionuclides	Residual Radio Activity	Waste Volume Disposed	NATURE OF WASTE: Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
														LITERS				202-A BLDG. COLD START UP URANIUM WASTE.
trench	E	216-B-35	216-BC-12, 216-B-24	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	5.76E+06 LITERS		?		TOP SUPERNATANT WASTE FROM 221-U BLDG. CYANIDE.
trench	E	216-B-29	216-BC-16 Trench	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.04E+06 LITERS		?		TOP SUPERNATANT WASTE FROM 221-U BLDG. CYANIDE.
trench	E	216-B-26	216-BC-13 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	5.00E+06 LITERS		?		TOP SUPERNATANT WASTE FROM 221-U BLDG. CYANIDE.
trench	E	216-B-32	216-BC-19 TRENCH	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.77E+06 LITERS		?		TOP SUPERNATANT WASTE FROM 221-U BLDG. CYANIDE.
trench	E	216-B-40	241-BX-6 Grave/Trench	Y	Y	ND	ND	Y	ND	B	Y	Y	Y	1.64E+06 LITERS		?		FIRST CYCLE SUPERNATANT WASTE FROM 221-B BLDG. TRENCH BACKFILLED.
trench	C	216-E-28	REG. EQUIP. STORAGE SITE E 28			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ONE DRY WASTE TRENCH AND ABOVE GROUND EQUIPMENT STORAGE. SITE RETIRED & STABILIZED. SERVICE DATES UNKNOWN.
trench	E	216-B-39	241-BX-5 Grave, 216-BX-5 Trench	Y	Y	ND	ND	Y	ND	B	Y	Y	Y	1.54E+06 LITERS		?		FIRST CYCLE SUPERNATANT WASTE FROM 221-B BLDG.
trench	E	216-B-21	216-BX-8 Trench	Y	Y	ND	ND	Y	ND	ND	Y	Y	Y	4.67E+06 LITERS		?		TOP SUPERNATANT WASTE FROM 221-U BLDG. CYANIDE.
trench	E	216-B-36	216-BX-2 Trench/Grave	Y	Y	ND	ND	Y	ND	B	Y	Y	Y	1.94E+06 LITERS		?		FIRST CYCLE SUPERNATANT WASTE FROM 221-B BLDG. TRENCH BACKFILLED.
vault	K	241-CX-72 ?	241-CX-72 Vault	ND	ND	ND	ND	ND	ND	ND	ND	Y	?	ND			?	SOLID RADIOACTIVE WASTE. USED PRIOR TO 1976. DECOMMISSIONED IN SITU IN 1986.
waste line	J	UPR-200-E-NO.1	R-5 waste line	Y		ND	ND	ND	ND	ND	Y	ND	?	ND		ND	ND	B-5 WASTE LINE LEAKAGE (METAL WASTE FROM BLDG. 221 B).
waste line	J	UPR-200-E-7	UPR-200-E-7	Y		ND	ND	ND	ND	ND	ND	ND	?	5.00E+03 GAL.		ND	ND	CELL WASH H2O LEAKED FROM WASTE LINE BETWEEN 221-B BLDG & 241-B-361. CONTAMINATION COVERED AND POSTED "UNDERGROUND CONTAMINATION"

KEY: Y = yes; ND = no data; * = official number not assigned but identified by unit number; blank = no; ?= incomplete data

TABLE 3-9 200 W WASTE CONSTITUENTS MATRIX

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	Chemical Components: Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radionuclides	Residual Radio-Activity	Waste Volume Disposed	Nature of Waste: Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
basin	C	203-S	203-S basin at 203-S uranium	NO	NO	NO	NO	NO	NO	NO	NO	NO	?	NO	NO	NO	NO	
basin	C	204-S	204-S basin at the uranium	NO	NO	NO	NO	NO	NO	NO	NO	NO	?	NO	NO	NO	NO	
box	X	2904-S-160	2904-S-160 Control Structure	NO	NO	NO	NO	NO	NO	NO	NO	NO	?	NO	NO	NO	NO	
burial ground	C	218-W-1A	Industrial Burial Ground No. 1	NO	NO	NO	NO	NO	NO	NO			Y	NO			?	
burial ground	W/C	218-W-11	Solid waste burial and regul-	NO	NO	NO	NO	?	?		?	?	?	NO			?	ABOVE GROUND STORAGE AREA, TRENCHES OF MAIN CONTAIN
burial ground	C		Non Rad Burial Ground	NO	NO	NO	NO	?	?	NO				NO	Y			
burial ground	C	218-W-9	218-W-9	NO	NO	NO	NO	NO	Y	NO	?	?	?	NO		?		
burial ground	C	218-W-0/N	218-W O/N burial ground	NO	NO	NO	NO	?	?	NO	Y	Y	?	8.07E+05		Y		
burial ground	C	218-W-4A	218-W-4A and UPR-200-W-72	NO	NO	NO	NO	?	Y	NO	Y	Y	Y	6.3E5 FT3		Y		DRY WASTE CONT. RAD & POSSIBLY OTHER SOLID WASTE; INCLUDES UPR 200-W-72; LAB WASTE DISPOSED.
burial ground	C	218-W-1	218-W-1	NO	NO	NO	NO	NO	?	NO	Y	Y	Y	2.5E5 FT3			?	DRY WASTE CONT. RAD & POSSIBLY OTHER SOLID WASTE
burial ground	C	218-W-1B	Industrial Waste Burial Ground	NO	NO	NO	NO	?	?	NO	Y	Y	Y	4.0E10 FT			?	DRY WASTE CONT. RAD & POSSIBLY OTHER SOLID WASTE
burial ground	C	218-W-2	218-W-2	NO	NO	NO	NO	NO	NO	NO	Y	Y	Y	2.9E5 FT3			?	DRY WASTE CONT. RAD & POSSIBLY OTHER SOLID WASTE
burial ground	C	218-W-3	218-W-3	NO	NO	NO	NO	NO	NO	NO	Y	Y	Y	3.9E5 FT3	NO	NO	NO	DRY WASTE CONT. RAD & POSSIBLY OTHER SOLID WASTE
compartment	I	UPR-200-W-137	UPR-200-W-137	NO	I	?	NO	?	?	NO	NO	NO	?	NO		?		NEED MORE INFO - COMPARTMENT
crib	6	216-T-18	216-T-18 crib	Y	Y			Y			Y	Y	Y	1.0E6 LIT		?		FIRST CYCLE SCAVENGED WASTE
crib	6	231-Z-6	231-W-4 Crib, 216-W-4,	Y	I			Y		B	Y	Y	Y	9.0E4 LIT		Y		
crib	6	216-T-24	216-T-24	Y	Y			Y	NO	N	NO	NO	?	7.4E4 LIT		?		
crib	6	216-S-23	216-S-23 crib	Y	I	NO	NO	Y		B	Y	Y	Y	3.4E7 LIT		Y		STATED NEUTRAL\BASIC BUT NITRIC ACID SHOW UP?
crib	6	216-Z-12	216-Z-12	Y	Y	?		?	?	B	Y	Y	Y	2.01E8 LIT		?		
crib	6	216-T-36	216-T-36	NO	Y			Y	?	B	Y	Y	Y	5.22E5 LIT		Y		
Crib	6	216-Z-3	216-Z-3 culvert, 234-5 #3	NO	Y	Y		Y	NO	NO	Y	Y	?	9.69E3 LIT		Y		
crib	6	216-T-35	216-T-35	Y	I	?	NO	Y	?	NO	Y	Y	Y	5.7E6 LIT		Y		
crib	6	216-T-27	216-T-27	Y	I	?	NO	Y	?	B	Y	Y	Y	7.2E6 LIT		Y		
crib	6	216-T-34	216-T-34	Y	I	?	NO	Y	?	B	Y	Y	Y	1.7E7 LIT		Y		
crib	6	216-T-32	216-T-32	I	Y			Y	NO	B	Y	Y	Y	2.97E7 LIT		Y		NEED MORE INFO WITH 5/4/62
crib	6	216-T-33	216-T-33	Y*	I	NO	NO	Y	NO	B	Y	Y	Y	1.9E6 LIT		Y		DECONT. WASTE FROM 2706-T
crib	6	216-S-13	216-S-13 crib	Y	Y	Y	Y	Y	?	B	Y	Y	Y	5E6 LITR		Y		
crib	6	216-Z-16	cribs 216-Z-16	Y	NO	NO	NO	NO	NO	B		Y	?	1.02E8 LIT			?	WASTE NEUTRAL\BASIC BUT NO CHEM DISCHARGE TO SITE
crib	6	216-U-10	216-U-10 crib	Y	I	NO	NO	NO	NO	NO	Y	Y	?	1.21E11		?		ALDRICH (86) FOR RAD. DATA
crib	6	216-T-6	216-T-6 crib	Y	Y	NO	NO	Y	NO	B	Y	Y	Y	4.5E7 LIT		Y		
crib	6	216-T-26	216-T-26	Y	Y	?	NO	Y	NO	B	Y	Y	Y	1.2E7 LIT		Y		
crib	6	216-Z-5	216-Z-5, 231-W-1-2 cribs	Y	Y	NO	NO	Y	NO		Y	Y	Y	3.0E7 LIT		Y		CARBON TET
crib	6	216-S-22	216-S-22 crib	Y	I			Y	NO	A	Y	Y	?	98400 LIT		Y		~0.5M HNO3
Cribs -3	6	216-U-8	216-WR-1, 2, 3 Cribs, 216-U-9	Y	Y			Y	?	A	Y	Y	Y	3.78E8 LIT		Y		
Cribs -5	6	216-Z-18	cribs - 5 parallel	NO	Y	Y	Y	Y	NO	A		Y	Y	3.86E6 LIT		Y		CARBON TET
ditch	F	216-T-4-2 (D)	216-T-4-2 (D)	Y	I	Y	NO	Y	?		?	?	?	NO		Y		
Ditch	E	216-Z-1D	216-Z-1D Ditch or Trench	Y	NO	NO	NO	?	?	B		Y	Y	3.67E7 LIT		?		TRENCH-WASTE IS NEUT\BASIC BUT NO CHEM DISCHARGE TO SITE
ditch	F	UPR-200-W-139	UPR-200-W-139	NO	NO	NO	NO	NO	NO	NO	NO	NO	?	NO		?		
ditch	F	216-Z-19	216-Z-19 ditch	Y	NO	NO	NO	?	?	?	Y	Y	Y	1.21E11 L		?		AREA 200 LIQUID DISCH REPT FOR RAD DATA
Ditch	F	216-U-9	216-U-6 U Swamp 5	Y	NO	NO	NO	?	?	?	Y	Y	Y	NO		?		REF TO POND 216-U-10, INCLUDES UPR 200-W-16.

KEY: Y- yes; ND- no data; # - official number not assigned but identified by unit number; blank- no; I- incomplete data

TABLE 3-9 200 W WASTE CONSTITUENTS MATRIX (continued)

200 WEST AREA WASTE CONTAMINATION MATRIX

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS: Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE: Solid/Haz. Waste	Mixed Waste	Rad. Only	COMMENTS
Ditch	F	216-Z-11	216-Z-1 ditch, Z plant ditch	Y	ND	ND	ND	?	?	ND		Y	Y	ND		?		REF TO POND 216-U-10
Ditch	F	216-Z-1 (D)	Drain Ditch to U-Swamp, Z	Y	ND	ND	ND	?	?	ND		Y	Y	ND		?		
ditch	F	216-T-4-1 (D)	216-T-4-1 (D)	Y	ND	ND	ND	?	?	ND	Y	?	Y	4.9E10 LI		?		EXHUMED FROM SWAMP 216-T- DITCH BACKFILLED
diversion box	I	241-TX-153	241-TX-153 incl. UPR	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		INCLUDES UPR 200-W-39, 126.
diversion box	I	241-UR-152	241-UR-152 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		VERY GENERAL NEED MORE INFO
diversion box	I	241-UR-154	241-UR-154 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		DIVERSION BOX - PROCESS,SOURCE, STRUC + TYPE
diversion box	I	241-U-153	241-U-153 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		DIVERSION BOX - PROCESS,SOURCE, STRUC + TYPE
diversion box	I	241-U-252	241-U-252 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		
diversion box	I	241-SX-151	241-SX-152 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		INCLUDES UPR-200-W-114
diversion box	I	241-UR-153	241-UR-153 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		
diversion box	I	241-SX-152	241-SX-151 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		INCLUDES UPR-200-W-114
diversion box	I	241-T-152	241-T-152 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		INCLUDES UPR-200-W-7
diversion box	I	241-TY-153	241-TY-153 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		
diversion box	I	240-S-151	240-S-151 (waste transfer)	Y	I	ND	ND	Y	Y	ND	ND	Y	Y	50000GAL/ YR		Y		1950-87 PASS-THROUGH; INCLUDES UPR-200-W-20, 51, 52; WATER ADDED FOR CONTAMINATION CLEANUP
diversion box	I	241-TXR-155	241-TXR-155 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		
diversion box	I	241-T-151	241-T-151 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		INCLUDES UPR-200-W-7
diversion box	I	241-TXR-151	241-TXR-151 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		
diversion box	I	241-TR-152	241-TR-152 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		
diversion box	I	241-TXR-244	241-TXR-244 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		
diversion box	I	240-S-152	240-S-152 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		MAY INCLUDE UPR-200-W-52
diversion box	I	241-TXR-152	241-TXR-152 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		
diversion box	I	241-TR-153	241-TR-153 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		
diversion box	I	241-S-152	241-S-152 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		
diversion box	I	241-TXR-153	241-TXR-153 (waste transfer)	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		ND		
dry well	6	241-SX-402	dry well at 241-SX-402	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND	ND	ND	ND	DRYWELL IN THE BUILDING
dry well	6	241-SX-401	dry well at 241-SX-401	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND	ND	ND	ND	DRYWELL IN THE BUILDING
filter monitor	0	2718-S*	2718-S sand filter monitor	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND	ND	ND	ND	APP. E FOR RELEASE + ASSESSMENT INFO
french drain	6	216-U-7	216-U-7	Y	I			Y	ND	ND	ND	ND	?	7000LITR		?		
french drain	6	216-T-31	216-T-31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	WASTE EXHUMED DISPOSED IN 200W DRYWASTE BURL GRND
French Drain	6	216-Z-8	216-Z-8 Crib, 234-5 Recuplex	ND	Y	Y		Y	Y	ND		Y	Y	9590 LITR		Y		
ground contam.	6	UPR-200-W-135	UPR-200-W-135	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND	ND	ND	ND	
ground spill	J	UPR-200-W-117	UPR-200-W-117	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	CONTAMINATION DECAYED TO BACKGROUND LEVELS
ground spill	J	UPR-200-W-69	UPR-200-W-69	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND	ND	ND	ND	
incinerator	H	232-Z*	232-Z waste incineration	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
pit	E	UPR-200-W-30	UPR-200-W-30	Y	ND	ND	ND	?	?	ND	Y	?	Y	ND		?		
pit	L		200 West burning pit	ND	ND	?	?	?	?	?				ND	?			
pit	E	216-T-20	Disposal Trench/Pit	Y	Y			Y		ND	Y	Y	?	1.09E4 LI		Y		SAME AS 216-1-27, P 519 R9
pond	E	216-S-15	216-S-15	Y	I	ND	ND	Y	?	ND	?		?	ND		?		
pond	E	216-U-10	216-U-10 pond	Y	ND	ND	ND	?	?	ND	Y	Y	?	1.21E11 L		?		INCLUDES UPR-200-W-107
pond	E	216-S-11	216-S-11 pond	Y	I	?	ND	?	?	ND	Y	Y	Y	3.22E10 L		Y		

KEY: Y: yes; ND: no data; * : official number not assigned but identified by unit number; blank= no; I: incomplete data

TABLE 3-9 200 W WASTE CONSTITUENTS MATRIX (continued)

200 WEST AREA WASTE CONTAMINATION MATRIX

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radionuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE Solid/Haz. Waste	Mixed Waste	Rad. Only	COMMENTS
pond	E	216-T-4A	216-T-4A	Y	ND	?	ND	?	?	?	Y	Y	?	4.25E10LI		?		WASTE EXHUMED DISPOSED IN 218-W-2A TRENCH 7
pond	E	216-S-19	216-S-19 pond	Y	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	DOE RL 86
proc. tnk vent lines	J	UPR-200-W-102	UPR-200-W-102	Y	ND	ND	ND	?	?	ND	ND	Y	Y	ND		?		DRUMS W/ SOIL CONTAINING 790 PU DISPOSL LOCAT UNKNWN
sewer	H		REDOX chemical sewer at 203-S,	ND	ND	ND	ND	ND	ND	ND	Y	Y	?	ND		?		REDOX CHEMICAL SEWER; ANN SOLUTION, OTHER WASTES NOT SPECIFIED.
surface impoundment	E	207-S*	207-S retention basin (3)	Y	ND	ND	ND	?	?	ND	ND	ND	Y	ND		?		CONCRETE BASIN BACKFILLED - SOIL & HERBICIDE
tank	I	241-S*	241-S tank farm	Y	I	?		?	?	ND	Y	Y	Y	ND		?		INCLUDES UPR-200-W-80,81; CYANIDES, METALS, ORGANICS, INORGANICS
tank	I	241-T*	241-T tank farm	Y	I	?		?	?	ND	Y	Y	Y	ND		?		INCLUDES UPR-200-W-140; CYANIDES, METALS, ORGANICS, INORGANICS.
tank	H	241-SX-402	241-SX-402 condenser shield-	ND	ND	ND	ND	?	?	ND	Y	Y	?	ND		?		INCLUDES 2 TANKS AND A DRY WELL. LOCATED IN 241-SX TANK FARM.
tank	E	276-U*	276-U solvent handling	ND	ND	Y	Y	ND	ND	ND	Y	Y	?	ND	ND		ND	BASIN OF 3 TANKS & PIPE; CYANIDES, METALS, ORGANICS, INORGANICS.
tank	I	276-S-142	underground tank 276-S-142	Y	I	Y	Y	Y			?	?	Y	12.7E3 GA		Y		2Ci - ORIGINAL
tank	I	241-U-361	241-U-361 settling tank	ND	ND	ND	ND	ND	ND	ND	?	Y	Y	27.5E3 GA		?		CONTAMINATED LIQUID AND SLUDGE
tank	I	241-SX	241-SX tank farm	Y	I	?		?	?	ND	Y	Y	Y	ND		?		INCLUDES UPR-200-W-49, 50, 114, 80, 81; CYANIDES, METALS, ORGANICS, INORGANICS.
tank	I	241-TY-302-B	catch tank 241-TY-302-B at	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		?		DIVERSION BOX - PROCESS,SOURCE, STRUC + TYPE
tank	I	241-TX-302-A	catch tank 241-TX-302-A at	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		?		DIVERSION BOX - PROCESS,SOURCE, STRUC + TYPE
tank	I	241-TX-302-B	catch tank 241-TX-302-B at	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		?		DIVERSION BOX - PROCESS,SOURCE, STRUC + TYPE
tank	I	241-U-301	catch tank 241-U-301 at	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		?		CATCH TANKS TABLE 1
tank	I	241-301-B	catch tank 241-301-B at tank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		?		
tank	I	240-S-302	catch tank 240-S-302 at	Y	I	ND	ND	Y		ND		Y	?	5E4 G/YR		?		FROM 1950 - 1987
tank	I	241-TX*	241-TX tank farm	Y	I	?		?	?	ND	Y	Y	Y	ND		?		INCLUDES UPR-200-W-149, 100; CYANIDES, METALS, ORGANICS, INORGANICS.
tank	I	276-S-141	underground tank 276-S-141	ND	Y	Y	Y	Y			?	?	Y	10E3 GAL		Y		2Ci - ORIGINAL
tank	I	241-TY*	241-TY tank farm	Y	I	?		?	?	ND	Y	Y	Y	ND		?		INCLUDES UPR-200-W-150, 153, 151, 152; CYANIDES, METALS, ORGANICS, INORGANICS.
tank	I	241-T-361	241-T-361 Settling Tank	ND	ND	ND	ND	ND	ND	ND	?	Y	Y	20E3 GAL		?		CONTAMINATED LIQUID AND SLUDGE
tank	I	241-Z-361	241-Z-361 settling tank	ND	ND	ND	ND	ND	ND	ND	?	Y	Y	32E3 GAL		?		
tank	I	241-SX-302	catch tank 241-SX-302 at	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		?		
tank	H	241-SX-401	241-SX-401 condenser shield-	ND	ND	ND	ND	?	?	ND	ND	ND	?	ND		?		INCLUDES 2 TANKS AND A DRY WELL. IN 241-SX TANK FARM.
tank	I	241-TY-302-A	catch tank 241-TY-302-A at	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		?		
tank	I	241-U*	241-U tank farm	Y	I	?		?	?	ND	Y	Y	Y	ND		?		INCLUDES UPR-200-W-154, 155, 156, 157; CYANIDES, METALS, ORGANICS, INORGANICS.
tank(s)	H	242-T*	242-T Evaporator (batch then	Y	I	ND	ND	Y	?	FI	Y	Y	?	3.37E+07 GAL		?		GALLONS; INCLUDES UPR-200-W-12.
tanks	H	276-S*	276-S Solvent Handling Facility	Y	ND	?	?	ND	ND	ND	?	?	Y	ND		Y		
Tile Field	G	216-Z-1A	234-5 tile field, 216-Z-7;	Y	I	ND	ND	Y	ND	FI	Y	Y	?	1.E6 LIT		?		
trench	C	UPR-200-W-110	UPR-200-W-110	ND	I	ND	ND	ND	Y	ND	ND	Y	?	ND			?	
trench	E	216-S-12	216-S-12	Y	Y			Y	ND	ND	Y	Y	?	6.81E4 LI		?		
trench	E	216-S-8	216-S-8	Y	I	ND	ND	Y	ND	ND	Y	Y	Y	1E7 LITR		Y		
trench	E	216-T-11	Equipment Decontamination	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	EXHUMED, TRANSF TO 216 T-13, NO RAD OR CHEM BUILDUP
trench	E	216-S-14	216-S-14	Y	Y	Y	Y	ND	ND	ND	ND	ND	?	ND		Y		HEXONE (CONTAM.) NO DATA ON RAD COMPONENT

KEY:

Y: yes
ND: no data

* = official number not assigned
but identified by unit number

blank= no
I= incomplete data

TABLE 3-9 200 W WASTE CONSTITUENTS MATRIX (continued)

[illegible]

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radionuclides	Residual Radio-Activity	Waste Volume Disposed	Solid/Haz. Waste	Mixed Waste	Rad. Only	COMMENTS
						CHEMICAL COMPONENTS									NATURE OF WASTE			
trench	E	216-T-12	216-T-12	Y	ND	ND	ND	?	?	B	Y	Y	Y	5E7 LITR		?		SLUDGE REMOVED FROM RETENTION POND 207-T
trench	E	216-T-10	216-T-10	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	EXHUMED TRANSFER TO 216-T-13
trench	E	216-T-14	216-T-14	Y	Y			Y		B	Y	Y	Y	1E6 LITR		Y		OUO- SAME CHEM AS IN 216-T-15,16
trench	E	216-T-9	216-T-9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	EXHUMED, TRANSFER TO 216-T-13. NO RAD OR CHEM [illegible]
trench	E	216-T-16	216-T-16	Y	Y			Y		B	Y	Y	Y	1E6 LITR		Y		COMMENTS ON 216-T-14
Trench	E	216-T-22	241-TX-2 Trench, 216-TX-2 Grave	Y	Y			Y		B	Y	Y	Y	1.5E6 LI		Y		SAME CHEM COMP AS 216-T-24
trench	E	216-T-21	241-TX-1 trench, 216-TX-1 grave	Y	Y			Y		B	Y	Y	Y	4.1E5LIT		Y		
trench	E	216-T-5	216-T-5	Y	Y			Y	Y	B	Y	Y	Y	2.6E6 LIT		Y		
trench	E	216-T-25	216-T-25	Y	Y			Y		B	Y	Y	Y	1.2E7 LIT		Y		
Trench	E	216-T-24	241-TX-4 Trench, 216-TX-4 Grave	Y	Y			Y	Y	B	Y	Y	Y	1.5E6 LI		Y		COMMENTS ON 216-T22
trench	C	UPR-200-W-111	UPR-200-W-111	Y	ND	ND	ND	?	?	A	ND	Y	?	27 YD3		?		SLUDGE FROM RETENTION BASIN 207-U (WHAT TRENCH?)
Trench	E	216-T-23	241-TX-3 Trench, 216-TX-3 Grave	Y	Y			Y		B	Y	Y	Y	1.9E6 LI		Y		
trench	E	216-T-13	216-T-13	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	EXHUMED, NO INFO ON WASTE TRANSFER TO?
Trench	E	216-U-6	216-U Cold U Trench #1	Y	I	ND	ND	Y	Y	ND	Y	Y	Y	2.25E6 LI		Y		COMMENTS ON 216-U-5
trench	E	216-T-17	216-T-17	Y	Y			Y		B	Y	Y	Y	7.05E5LIT		Y		
trench	E	216-Z-4	216-Z-4	Y	I	ND	ND	Y	Y	N	Y	Y	Y	1.1E4LIT		Y		
trench	E	216-S-18	216-S-18	ND	ND	ND	ND	ND	ND	ND	Y	Y		ND	ND	ND	ND	
trench	E	UPR-200-W-112	UPR-200-W-112	Y	I	ND	ND	?	?	N	ND	Y	?	ND		?		SLUDGE FROM RETENTION BASIN 207-U (WHAT TRENCH?)
Trench	E	216-Z-9	216-Z-9 Cavern, 234-5 Re-uplex	Y	Y	Y		Y	Y	N	Y	Y	?	4.1E6LIT		Y		ORGANICS INCLUDING CARBON TETRACHLORIDE, TBP, DBBP
trench	E	216-T-15	216-T-15	Y	Y			Y		B	Y	Y	Y	1E6 LITR		Y		COMMENTS ON 216-T-14
Trench	E	216-U-5	221-U Cold U Trench #2	Y	I	ND	ND	Y		ND	Y	Y	Y	2.25E6 LI		Y		SAME CHEMICAL AMOUNT AS 216-U-6
Trenches	E	216-U-13	241-UR Steam Cleaning Pit,	ND	ND	ND	ND	Y	ND	N	Y	Y	?	ND		?		SITE EXHUMED, WASTE TRANS TO 216-T-13, 200W BUR GRND
vault	K	218-W-8	218-W-8	Y	I	?	ND	?	?	ND	Y	Y	Y	2.4E3 FT3		?		LABORATORY WASTES
vault	K	218-W-7	218-W-7	Y	ND	ND	ND	?	?	ND	Y	Y	Y	ND		?		
vault	K	206-SV	206-S vault at the uranium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
vault	K	244-URV	244-UR vault	ND	ND	ND	ND	?	?	ND	ND	ND	Y	ND		?		INCLUDES UPR-200-W-24; INCLUDES CONCRETE BASIN WITH STAINLESS STEEL TANKS.
vault	K	241-WRV	241-WR vault	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND		Y		INCLUDES CONCRETE BASIN WITH STAINLESS STEEL TANKS.
waste line	J	UPR-200-W-2	UPR-200-W-2	ND	ND	ND	ND	ND	ND	ND	ND	ND	?	ND		?		
waste line	J	UPR-200-W-113	UPR-200-W-113	ND	ND	ND	ND	Y	ND	N	ND	ND	?	ND		?		NITRIC ACID SPILL & OTHER LEAK
weir box	I	2904-S-171	2904-S-171 weir box	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND	ND	ND	ND	
weir box	I	2904-S-170	2904-S-170 weir box	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND	ND	ND	ND	
weir box	I	216-S-172	216-S-172 weir box	ND	ND	ND	ND	ND	ND	ND	ND	ND	Y	ND	ND	ND	ND	

KEY: Y- yes; ND- no data; * = official number not assigned but identified by unit number; blank- no; I= incomplete data

TABLE 3-10 200 N WASTE CONSTITUENTS MATRIX

Unit Type	Site Code	Official Number	Site Name Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS: Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radionuclides	Residual Radioactivity	Waste Volume Disposed	NATURE OF WASTE: Solid/Haz. Waste	Mixed Waste	Rad. Only	Comments
Trench	I	[illegible]	[illegible] trench, 212 N [illegible] trench (9)	Y				?	NS		Y			7.57E+06 liters			Y	basin water and sludge from 21[illegible] N building; boron presumed; fuel storage
Pond	I	216-N-1	212 N Swamp, 216 N-1 Swamp, 216 N 1 covered Pond (9)	Y				?	NS		Y			9.50E+06 liters			Y	basin overflow from 21[illegible] N building; fuel storage; boron presumed
Trench	I	216-N-2	216 N 1 Trench, 216 N 2 trench (9)					?	NS		Y			7.57E+06 liters			Y	basin water and sludge; fuel storage; boron presumed
Pond	I	216-N-4	212 P swamp, 216-N-4 swamp (9)	Y				?	NS		Y			9.46E+06 liters			Y	basin water and sludge from 212 N building; boron presumed
Trench	I	216-N-5	212 P trench, 216 N 5 trench (9)	Y				?	NS		Y			7.57E+06 liters			Y	basin water and sludge from 212 N building; fuel storage; boron presumed
Pond	I	216-N-6	212 R Swamp, 216 N-6 Swamp (9)	Y				?	NS		Y			9.46E+06 liters			Y	overflow from 212 R basin; fuel storage; boron presumed
Trench	I	216-N-7	212 R trench, 212 N 7 trench (9)	Y				?	NS		Y			7.57E+06 liters			Y	basin water and sludge cleanout waste from 212-R basin; fuel storage; boron presumed

KEY: Y = yes; ND = no data; * = official number not assigned but identified by unit number; blank = no; I = incomplete data

TABLE 3-11 300 AREA WASTE CONSTITUENTS MATRIX

[illegible]

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemical Identified	Organics	Volatiles	Inorganics	Metal	pH	Fission Products	Other Radionuclides	Residual Radio Activity	Waste Volume Disposed	Sol/Haz. Waste	Mixed Waste	Rad. Only	Comments
acid spill	3		Uranium Acid Waste (Bldg [illegible])	Y	Y			Y	Y	H	Y	Y	Y	ND		Y		Wastewater. Nitric and sulfuric acid with uranium in solution. Waste etch acid: nitric, hydrofluoric, and chromic acids with uranium, copper, and zirconium metals in solution.
crib	6	[illegible]	300 North Crib	Y	Y	Y	Y	Y		ND	ND	Y	Y	2.00E+05 lit		Y		Water contaminated with benzene bearing uranium wastes and other uranium bearing wastes from 321 building.
drain field	6		331 Life Sciences Laboratory	ND	ND	ND	ND	ND	ND	ND				[illegible] gal/hr	Y			Sanitary wastewater.
drain field	6		Retired 335 Sanitary Drain	ND	ND	ND	ND	ND	ND	ND				ND	Y			Sanitary wastewater from office buildings.
drain field	6		Retired 335/336 Sanitary	ND	ND	ND	ND	ND	ND	ND				ND	Y			Sanitary wastewater from office buildings.
gravel pit	1		300 Area Interim Filter	Y	I	ND	ND	Y	ND	ND				[illegible]E+05 gal	Y			Water and nonhazardous alum from backwashing filters used to filter water for sanitary and process use. Analysis shows backwash to be nonhazardous; test results not provided in report.
pipe trench system	2	[illegible]	Pipe Trench System, 311	ND	Y			Y	Y	H	ND	Y	Y	ND		Y		Spill of uranium bearing acid waste containing nitric, sulfuric, hydrofluoric, and chromic acids with copper, uranium, and zirconium in solution.
pond	1		Retired Filter Backwash Pond	Y	Y			Y						[illegible].00E+06 gal/yr	Y			Water and nonhazardous alum from backwashing filters. Backwash analysis is nonhazardous.
sewer line	6		Retired Liq. Waste Sewer	Y	Y	Y	Y	Y	Y	H,B	ND	ND	Y	ND		Y		Radioactive waste from fuel fabrication and research and development laboratories: laboratory chemicals, decontamination solutions, acids and bases, and fuel fabrication aqueous solutions.
tank	6		339 Tank Farm Waste Acid Tank	Y	Y	ND	ND	Y	ND	H	ND	Y	Y	ND		Y		Waste acids from fuel fabrication process containing nonrecoverable uranium. Previously used for incoming chemical storage (unspecified).
tanks	6		324 Tanks (4)	ND	Y	ND	ND	Y	ND	H	ND	Y	Y	ND		Y		Uranium contaminated water and acid solutions from reprocessing research and development. Small volume of liquid may remain in one tank.
testing unit	6		In Situ Vitrification Test	ND	I	ND	ND	ND	ND	ND	Y	Y		ND			Y	Vitrification test on wastes containing radionuclides. Contaminated soil removed to background levels.
transfer line	3	[illegible] 300-1	Transfer Line Leak	Y	ND	ND	ND	Y	ND		Y	Y	Y	ND			Y	Waste transfer line from retention basins to crib waste system.
trench	6		331 Life Sci. Lab. ([illegible])	Y	ND	ND	ND	ND	ND	ND				8.[illegible]E+00 gal/hr	Y			Sanitary wastewater from 331 Life Sciences Lab.
trench	6		331 Life Sci. Lab. ([illegible])	Y	ND	ND	ND	ND	ND	ND				5.00E+00 gal/hr	Y			Sanitary wastewater from 331 Life Sciences Lab.
underground tank	1		Methanol Storage (313 Bldg)	Y	Y	Y	Y							ND	Y			Aqueous solution of methanol ([illegible]). 600 gal remain in tank.
underground tank	1		Methanol Stor. (311 Tank Farm)	Y	Y	Y	Y							ND	Y			Aqueous solution of methanol (up to [illegible]) used to clean aluminum. 10,000 gal remain.
underground tank	1		305 TR Tanks (3)	Y	I	ND	ND	ND	ND	ND	Y	Y	Y	4.00E+03 to 5.00E+03 gal (cap)		Y		Aqueous nonhazardous radioactive wastes from plutonium recycle test reactor. Tanks are empty. Residual radioactive contamination remains.

KEY: Y - yes; ND - no data; * - official number not assigned but identified by unit number; blank - no; I - incomplete data

TABLE 3-12 400 AREA WASTE CONSTITUENTS MATRIX

400 AREA Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE Solid/Haz. Waste	Mixed Waste	Rad. Only	COMMENTS
french drains	G		French Drain South of 4722-C	Y	Y	?	?	?	?					2.00E+03 gal/yr	Y			latex paint
french drains	G		400 Retired French Drains	ND	ND	ND	ND	ND	ND	ND				ND	Y			washwater from construction component cleaning
ponds	E		400 Area Retired Sanitary Pond	Y	ND	ND	ND	ND	ND	ND				1.20E+04 gal/day	Y			
tank	M		Retired Septic Tanks (3)	ND	ND	ND	ND	ND	ND	ND				ND	Y			Sanitary wastes from offices. Verify if aboveground or belowground.
trench	E		400 Area Retired Sand Trench		ND	ND	ND	?	?	ND				ND	Y			cooling tower blowdown

KEY: Y= yes; ND= no data; * = official number not assigned but identified by unit number; blank= no; I= incomplete data

TABLE 3-13 600 AREA WASTE CONSTITUENTS MATRIX

600 Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE Solid/Haz. Waste	Mixed Waste	Rad. Only	COMMENTS
burial ground	C	618 11	300 Wye Burial Ground	NO	NO	NO	NO	NO	NO		Y	Y	?	NO		?		INCLUDES ACCIDENTAL RELEASE UPR-600-6 10. INCLUDES RADIOCHEMISTRY WASTES.
burial ground	C		J.A. Jones No. 2 (9)	NO	NO	NO	NO	NO	NO					NO	Y (s)			SITE EXHUMED; MOVED TO BURIAL GROUND IN 1971.
burial ground	C	618 10	300 North SW Burial Ground	Y	NO	NO	NO	NO	NO		Y	Y	?	NO			?	FIRE OCCURED AT 618 10 BURIAL GROUND. CONTAMINATION SPREAD 300 YARDS OUTSIDE BURIAL GROUND.
burial ground	C		Army Munitions Burial Site	Y	NO	NO	NO	NO	NO					NO	Y			SITE EXHUMED; CONTENTS TRANSPORTED TO YAKIMA FIRING RANGE FOR DESTRUCTION.
burial ground	C	USBR 2, 4 D*	USBR-2, 4-D burial ground	Y	Y	Y			Y	P				50 YD3	Y			900 GALLONS OF 2,4-D LEAKED INTO 50 YD3 OF SOIL. 10 LEAKING TANKS FLATTENED AND BURIED THERE.
burning pit	C	618-5	Burial Ground No. 5	Y	I	NO	NO	NO	NO	NO	NO	Y	?	NO			?	URANIUM-BEARING TRASH AND NON-RADIOACTIVE TRASH.
crib	G	P-11	116-F-6 Crib	Y	NO	NO	NO	NO	NO		NO	Y		NO		?		SITE EXHUMED.
crib	G	213-J and K	Gable Mountain Cribs	NO	NO	NO	NO	NO	NO		NO	NO	NO			?		UNIDENTIFIED RADIOACTIVE LIQUIDS.
crib	G		Pickling Acid Crib (9)	Y	Y	NS	NS	Y	?	A				NO	Y			NITRIC AND HYDROFLOURIC ACID TO PICKLE GALVANIZED PIPING FOR CONSTRUCTION.
landfill	C		Hanford Trailer Camp (5)	Y	I	?	NO	?	?	NO				NO	Y			DOMESTIC WASTES USED IN CONSTRUCTION OF HANFORD FACILITIES. COULD EXPECT METALS, SOME CHEMICALS, AND GENERAL REFUSE.
landfill	C		Horn Rapids Disposal	Y	I	Y	Y	Y	?	NO				NO	Y			PAPER, OFFICE, AND MINOR CONSTRUCTION WASTES (SOLVENTS, PAINT CANS, OILS)
landfill	C		Sodium Dichromate Barrel	Y	Y			Y	Y					NO	Y			SODIUM DICHROMATE
landfill	C		White Bluffs City Landfill	Y	I	?	?	?	?	?				NO	Y			COMMERCIAL AND DOMESTIC WASTES TYPICAL OF PERIOD 1850-1943. CAN EXPECT BROAD SPECTRUM OF CHEMICAL WASTES.
landfill	C		J.A. Jones No. 1 (9)	Y	I	NO	NO	NO	NO	NO				NO	Y (s)			WOOD SCRAPS, CONCRETE, MISCELLANEOUS CONSTRUCTION WASTES.
landfill	C		City of Hanford Landfill	Y	I	?	?	?	?	?				NO	Y			SAME AS WHITE BLUFFS CITY LANDFILL.
landfill	C		Midway Landfill No. 1 (9)	Y	I	?	?	?	?	?				NO	Y			HOUSEHOLD REFUSE. CAN EXPECT BROAD RANGE OF CHEMICALS.
landfill	C		East White Bluffs City Landfill	Y	I	?	?	?	?	?				NO	Y			SAME AS WHITE BLUFFS CITY LANDFILL.
landfill	C		Midway Landfill No. 2 (9)	Y	I	?	?	?	?	?					Y			HOUSEHOLD REFUSE. MAY INCLUDE SPENT SOLVENTS, EMPTY HERBICIDE CONTAINERS, AND CAPACITORS (PCBs?).
pits	C	618 4	Burial Ground No. 4	NO	NO	NO	NO	NO	NO	NO	NO	Y	?	NO		NO	NO	INCLUDES UPR-600-15.
pond	C	618 12	North Process Pond Scraping Disposal Area	Y	I	NO	NO	NO	NO	NO	NO	Y	?	NO		NO	NO	URANIUM-CONTAMINATED SOIL FROM 316-2 AND FROM 321 BUILDING.
tank	I	6652-G*	6652-G ALE Field Storage	NO	NO	NO	NO	NO	NO	NO				NO	Y			SANITARY SEWAGE FROM "ARMY FACILITIES."
tank	I		Army Bunkers Septic Tank (3)	NO	NO	NO	NO	NO	NO	NO				NO	Y			SOURCES NOT SPECIFIED. MAY/MAY NOT BE SOLELY SANITARY WASTE.
tank	I	6652-C*	6652-C Space Science Lab.	NO	I	NO	NO	NO	NO	NO				NO	Y			SANITARY SEWAGE FROM "ARMY FACILITIES."
trench	D	618-6	Burial Ground No. 6	Y	NO	NO	NO	NO	NO	NO	NO	Y				NO	NO	URANIUM WASTE (SOLID).
trench	C	618-3	Burial Ground No. 3	Y	NO	NO	NO	NO	NO	NO	NO	Y	?	NO		?		CONTAMINATED BUILDING MATERIAL.
trench	C	618 9	300 West Burial Ground	Y	I	Y	?	NO	NO	NO	NO	Y	?	5.0E3 gal		Y		DRUMS OF URANIUM-CONTAMINATED ORGANIC SOLVENT.
	C	618 8	Early Waste Burial Ground	Y	NO	NO	NO	NO	NO	NO	NO	Y	?	NO		?		URANIUM CONTAMINATION. SW FROM REACTOR FUELS MANUFACTURING.
trench	C	618-7	Burial Ground No. 7	Y	I	NO	NO	NO	Y	N	Y	Y	?	NO		Y		MATERIALS FROM FUEL ELEMENT MANUFACTURING.

KEY: Y= yes; NO= no data; * = official number not assigned but identified by unit number; blank= no; I= incomplete data

TABLE 3-13 600 AREA WASTE CONSTITUENTS MATRIX (continued)

600 Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE Solid/Haz. Waste	Mixed Waste	Rad. Only	COMMENTS
trench	C		Original Central Landfill (9)	Y	I	?	ND	?	?	ND				ND	Y			GENERAL OFFICE WASTES, GLASS, ELECTRICAL, AND SOME METAL WASTES.
trench	C	618-2	SW Burial Ground No. 2	Y	I	ND	ND	ND	ND	ND	Y	Y	Y	ND			?	URANIUM-CONTAMINATED. EQUIPMENT AND MATERIALS; INCLUDES URANIUM OXIDE CUTTINGS.
trench and pits	C	618-1	SW Burial Ground No. 1	Y	I	?	ND	?	?	ND	Y	Y	Y	ND		?		FUEL FABRICATION AND LAB WASTES (SM).
waste pile	A	618-13	303 Area Contaminated Soil	Y	I	ND	ND	ND	ND	ND	ND	?	?	ND			?	TOP SOIL FROM 303 AREA.

KEY: Y= yes; ND= no data; A = official number not assigned but identified by unit number; blank= no; I= incomplete data

TABLE 3-14 700 AREA WASTE CONSTITUENTS MATRIX

700 AREA Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemical Identified	CHEMICAL COMPONENTS: Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio-nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE: Solid Haz. Waste	Mixed Waste	Rad. Only	COMMENTS
Tank	1		Underground Waste Sale Tank		Y	Y			I					5.00E+02 gal	Y			[illegible], EP toxic, combustible solution

KEY: Y= yes; ND= no data; # = official number not assigned but identified by unit number; blank= no; I= incomplete data

TABLE 3-15 1100 AREA WASTE CONSTITUENTS MATRIX

1100 Area Waste Constituents Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Waste Source Identified	Chemicals Identified	CHEMICAL COMPONENTS: Organics	Volatiles	Inorganics	Metals	pH	Fission Products	Other Radio nuclides	Residual Radio-Activity	Waste Volume Disposed	NATURE OF WASTE: Solid/Haz. Waste	Mixed Waste	Rad. Only	COMMENTS
ground disposal	3	UPR-1100-2	disposal onto railroad tracks	Y	I	Y	Y	?	Y					1.00E+02 gal/yr	Y	,		paint thinners and solvents
pit	E	UPR-1100-1	sand pit	Y	Y				Y	A				ND	Y			battery acid
pit	E	UPR-1100-3	sand pit	Y	I	Y	Y	ND	ND	ND				ND	Y			antifreeze, degreaser solvents, wash water from engine cleaning
tank	I	UPR-1100-4	underground disposal tank	Y	Y	Y	.							ND	Y			antifreeze in unknown quantity

KEY: Y= yes
ND= no data
* = official number not assigned but identified by unit number
blank= no
I= incomplete data

100 KE/KW, 100 N, 200 North, 200 West, 200 East, 300, 400, 600, 700, and 1100. The codes used in the matrices are presented in a key preceding 14 tables and on the matrices. These data are subsequently used to evaluate release potential and to identify potential remediation/characterization needs for each site.

The waste constituents matrices completed include the identification of a general type of designation for each site listed as a potential RCRA 3004(u) site (i.e., landfill, surface impoundment, underground dispersion system, aboveground tank, etc.). This preliminary determination was made to enable later site groupings, and to develop generalized units descriptions for each unit type to enable remediation and characterization costings to be performed. The waste constituents analysis focused on the type of waste placed in the unit. This included "checkoffs" for whether the waste source and constituent chemicals were specifically identified; identification of chemical components (organics, volatiles, inorganics, metals, pH); identification of radionuclide components (fission products, other radionuclides, residual radioactivity); waste volume disposed; and identification of the nature of the waste (solid/hazardous waste, mixed waste, or radioactive only waste). These data serve to identify the nature of the wastes disposed/released and, in a broad sense, a summary of their potential behavior in the environment.

In evaluating the waste constituent matrices, nonradioactive chemical characteristics were evaluated separately from radionuclides. The chemical characteristics focused on identifying basic components of the wastes managed and disposed that move differently or "behave" differently in the environment. As mentioned above, these components are: organics, volatiles, incorganics, metals, and pH. Metals (as a chemical component) did not include radionuclides that are also metals (e.g., uranium). Radioactive components were addressed in a separate analysis. pH was included in the evaluation because the disposal of acidic or basic materials can substantially alter behavior of other components in the environment (e.g., metals mobility). Radionuclides were identified as being fission products or other radionuclides. Fission products included strontium, cobalt, and cesium while other radionuclides included uranium and plutonium. The comments section of the matrices notes where tritium is included as "other" radionuclides.

Exhumed sites were evaluated as if the wastes were still present for the purposes of waste characterization. The release potential evaluation conducted subsequent to this step considers the fact that the wastes, as a source of continuing release to the environment, have been removed.

3.2.1.2 Release Potential and Need for Action Matrix

Each site was evaluated for its release potential, i.e., the past, present, or future potential for release of hazardous constituents to the environment from the unit in question. This evaluation addresses releases to soil, groundwater, surface water, and air as well as the generation of subsurface gas (toxic or methane). This information serves as the basis for determining the need for action as well as site groupings. Sites that are in the same vicinity and affecting the same pathways could be grouped together.

The release potential analysis is a best professional judgement analysis that considers the following factors:

o Unit Characterizations

- type
- design features
- past and present operating practices
- period of operation
- age of unit
- location of unit
- general physical conditions
- method(s) used to close the unit

o Waste Characteristics

- type of wastes/materials placed in the unit
- migration and dispersal characteristics
- physical and chemical characteristics

- o Migration Pathways

  - geologic setting
  - hydrogeologic setting
  - atmospheric conditions
  - topographic characteristics

- o Evidence of Release.

Under RCRA 3004(u) programs, exposure potential is considered only in determining if immediate action should be taken. In accordance with the Statement of Work, the characterization assessment proceeded on the basis of approximately 2000 pages of information from the Draft Phase I Installation Assessment Report and the Waste Management Units Report.

Tables 3-16 through 3-31 present the release potential and need for action matrices for the following areas: 100 B/C, 100 D/DR, 100 F, 100 H, 100 KE/KW, 100 N, 200 North, 200 West, 200 East, 300, 400, 600, 700, and 1100. The codes identified on the matrices are defined in the key associated with each matrix. The comments column presents a brief summary of key information or technical issues that affected the decisions presented in the matrix.

A preliminary assessment of the need for action at each site has been performed to provide a basis for the costing analysis. A final determination on remedial action cannot be made until the completion of the formal remedial investigation/feasibility study process. The need for action is defined for each site. There are five categories of action identified for the inactive 3004(u) sites: remediation, verify no release, verify no hazardous constituents, verify no residual contamination, and no further action. Remediation is selected where the waste constituents are particularly toxic, are affecting a broad spectrum of media, are continuing to be released in the environment, or pose a hazard which may be eliminated or reduced by taking action. This will involve characterization of the site in question and will generally follow the RI/FS process for CERCLA sites except that cost will not be a factor of the analysis for the RCRA sites. Verification of no release is selected where wastes remain in place but no release to the environment is believed to have occured either through the

KEY TO TABLES 3-16 TO 3-29

The three-digit codes shown in Column Two (Site Code) of the Release Potential and Need for Action Matrices represents the following:

First digit - Need for Action code

1 - **Remediation**
2 - **Verify No Release**
3 - **Verify No Hazardous Constituents**
4 - **Verify No Residual Contamination**

Second digit - Type Type Code

A - **aboveground covered landfill**
B - **aboveground uncovered landfill**
C - **belowground covered landfill**
D - **belowground uncovered landfill**
E - **surface impoundments**
F - **ditches**
G - **underground dispersion systems**
H - **aboveground tank**
I - **underground tank**
J - **spills**
K - **underground vault**
L - **burning pit**
M - **incinerator**
N - **process sewer**
O - **other**

Third digit - Waste Types

Q - **Solid Waste/Hazardous Wastes**
M - **Mixed Radioactive/Chemical Wastes**
R - **Radioactive Waste Only**

TABLE 3-16 100 B/C RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

100 B/C Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	Release Potential: Soil	Release Potential: Ground Water	Release Potential: Surface Water	Release Potential: Subsurface Gas	Release Potential: Air	Residual Radioactive Structures	Remediation	Need for Action: Verify No Release	Need for Action: Verify No Hazardous Constituents	Need for Action: Verify No Residual Contamination	Need for Action: No Further Action Required	Comments
Burial Ground	2CM	118-B-1	105-B Burial Ground 118-B-1	1973	SS	NS	NS	ND	ND			X				GENERAL REACTOR AND METALLIC WASTES BURIED IN TRENCHES/SPLINE SILOS
Burial Ground	2CM	118-C-1	105-C Burial Ground 118-C-1	1969	?-SS	NS	NS	NS	ND			X				MISC. SOLID WASTE(MIXED WASTE)
Burial Ground	4CM	118-B-7	111-B Solid Waste Burial Site	1960	?-SS	ND	ND	ND	ND					X		MISC. SOLID WASTES/DECONTAMINATION MATERIALS
Burial Ground	3CM	118-B-3	Construction Burial Ground #2	1960	?-SS	NS	NS	ND	NS				X			REACTOR GENERATED SOLID WASTES.
Burial Ground	5CR	118-B-4	105-B Spacer Burial Ground	1960	NS	NS	NS	NS	NS						X	DISPOSAL OF FUEL SPACERS, STAINLESS STEEL UNLIKELY TO DECOMPOSE - RADIOACTIVITY WOULD REMAIN IN SPACER.
Burial Ground	4CR	118-B-6	100-B Solid Waste Burial Groun	1953	?-SS	ND	NS	ND	NS					X		TRITIUM BURIED IN CONCRETE PIPES, LIGHT METAL CAPS OVER PIPES.
Burial Ground	3CM	118-B-2	Construction Burial Ground #1	1956	?-SS	NS	NS	ND	NS				X			DRY WASTES FROM BASIN REPAIR AND CONSTRUCTION. COVERED WITH SOIL.
Burial Ground	4CR	118-B-5	Ball 3X Burial Ground 118-B-5	1953	?-SS	NS	NS	ND	ND					X		CONTAMINATED THIMBLES, PLUGS, ETC. FROM BLDG. 105-B. COVERED WITH 5 FT. OF SOIL.
Burning Pit	5LO	100B/C*	100 B/C Burning Pit	1960	S	ND	NS	NS	P			X				COMBUSTIBLE MATERIALS: PAINT WASTE, CHEMICAL SOLVENTS; COVERED OVER IN 1970.
Crib	4CM	116-B-5	100 B Crib 116 B-5 (9)	1967	SS	?	?	ND	NS					X		
Crib	4CM	116-B-6-1	111-B Crib #1 116-B-6-1	1960	SS	?	?	ND	ND					X		PAST RELEASE OF LIQUID RADIOACTIVE WASTES TO SOIL
Crib	4CM	117-B*	117 B Crib	1960	SS	?	?	ND	ND					X		RELEASED FROM RADIATION ZONE STATUS. POTENTIAL CHEMICAL CONTAMINATION NOT ADDRESSED.
Crib	4CM	117-C*	117 C Crib	1969	SS	?	?	NS	NS					X		DRAINAGE FROM CONTAINMENT SYSTEM. SAMPLED IN 1970 - CONTAM. BELOW BACKGROUND. POTENTIAL CHEM. CONTAMINATION NOT ADDRESSED.
Crib	4CM	116-B-6-2	111-B Crib #2 116-B-6-2	1953	SS	?	?	NS	NS					X		NOT USED IN 34 YEARS.
Crib	4CM	116-B-3	105-B Pluto Crib 116-B-3	1952	SS	?	?	NS	NS					X		NOT USED IN 35 YEARS.
Crib Sandfilter	4CM	116-C-2-2	105-C Pluto Crib Sandfilter	1969	SS	?	?	NS	NS	Y				X		CONCRETE BOX WITH OPEN BOTTOM COVERED WITH SAND. COVERED WITH CONCRETE LIDS.
Dry Well	4CM	116-B-10	100-B Dry Well, Quench Tank	1960	SS	?	?	ND	P	Y				X		DRAIN TILE MOUNTED ON CONCRETE PAD.
French Drain	4CM	116-B-9	104-B-2 French Drain	1954	SS	?	?	ND	ND					X		
Pit	5LO	184-B*	184 B Powerhouse Ash Pit (3)	1969	?-SS	?	?	NS	NS						X	COAL ASH SHIPPED TO DISPOSAL SITE. TESTS AS NOT EP TOXIC. ASSUMES AT REPRESENTATIVE SAMPLE TAKEN OF WASTES AND SOIL.
Retention Basin	1ER	107-B*	107-B Retention Basin	1960	D-SS	?	?	ND	P	Y	X					CONTAMINATED CONCRETE RECEIVING BASINS AND SURROUNDING SOIL. RELEASED TO THE COLUMBIA RIVER. PAST LEAKAGE FROM EFFLUENT LINES AND BASIN BREAKS. BACKFILLED WITH SOIL. 80% OF RAD. INVENTORY IN NEARBY SOIL.
Sump Tanks	4E0	107-C*	107-C Retention Basin	1969	D-SS	?	?	ND	ND	Y	X					CONTAMINATED TANKS AND SURROUNDING SOIL. RELEASED TO THE COLUMBIA RIVER. 80% RAD. INVENTORY IN SOILS AROUND BASIN. LARGE LEAKS (5-10,000 GAL/MIN). TANKS BACKFILLED WITH SOIL TO 4 FEET.
Sump	2EO	105-B*	105-B Battery Acid Sump (3)	1969	?-SS	ND	ND	NS	NS			X				CONCRETE SUMP. CLEANED AND NEUTRALIZED 1966. ANY CRACKS? LEAKAGE.
Tank	5IR	110-C-2	105-C Ball Storage Tank	1969	P	ND	NS	ND	NS	?					X	IRRADIATED BORON STEEL BALLS PRESENTLY BURIED IN UNDERGROUND TANKS. NEED TO SET SCHEDULE FOR WHEN WASTE IS DECAYED AND SUITABLE FOR REMOVAL.
Tank/Tile Field	3IO	1607 B3*	1607 B3 Septic Tank (3)	1974	SS	?	?	?	ND				X			INCLUDES TILE FIELD. IF NO HAZARDOUS CONSTITUENTS, THEN NO FURTHER ACTION REQUIRED.
Tank/Tile Field	3IO	1607 B8*	1607 B8 Septic Tank (3)	1969	SS	?	?	?	ND				X			SAME AS 1607 B3.
Tank/Tile Field	3IO	1607 B7*	1607 B7 Septic Tank (3)	1969	SS	?	?	?	ND				X			SAME AS 1607 B3.
Tank/Tile Field	3IO	1607 B1*	1607 B1 Septic Tank (3)	1960	SS	?	?	?	ND				X			FIRE STATION MAY HAVE BEEN SOURCE OF CHEMICALS. OTHERWISE, SAME 1607-B3.
Trench	4CR	116-B-2	105-B Storage Basin Trench	1946	S,SS	?	?	NS	P	NS				X		WASTEWATER FROM FUEL ELEMENT STORAGE BASIN. PAST RELEASE TO SOIL. FILLED IN WITH 6-15 FEET OF SOIL IN 1946.

KEY: * - official number not assigned but identified by unit number; D - documented; ? - suspected; ND - no data; NS - not suspected; SS - subsurface soil; S = surface soil; P = past air release; C = current air release; F - future air release; X - yes; Blank - no

TABLE 3-17 100 D/DR RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

100 D/DR Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	RELEASE POTENTIAL Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	Remedi-ation	NEED FOR ACTION Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
Basin Trench	4ER	116-DR-3	105-DR Storage Basin Trench	1955	?-SS	?	?	NS	P					X		DISPOSAL OF CONTAMINATED SLUDGE AND WATER ...STOPPED IN 1955. ANY RESIDUAL SOIL-BOUND CONTAMINATION?
Basin Trench	4CR	116-D-1A	105-D Storage Basin Trench #1	1952	?-SS	?	?	NS	P					X		COVERED WITH 6 FT OF SOIL.
Burial Ground	2CM	118-D-3	100 D Burial Ground #3 118-D-3	1973	?-SS	ND	ND	ND	ND			X				DISPOSAL OF IRRADIATED SOLID WASTE... DISCONTINUED IN 1973.
Burial Ground	2CM	118-D-4	Construction Burial Ground	1967	?-SS	ND	ND	ND	ND			X				DISPOSAL CONTAMINATED REACTOR BLDG. COMPONENTS AND HARDWARE. NEED TO DETERMINE IF RELEASE OF RADIOACTIVE ELEMENTS TO SOIL IS STILL OCCURING.
Burial Ground	2CM	118-D-1	100 D Burial Ground #1 118-D-1	1967	?-SS	ND	NS	NS	NS			X				DISPOSAL OF IRRIDATED SOLID WASTE...NEED TO DETERMINE IF MATERIAL IS STILL RADIOACTIVE OR METALS LEACHING. WHAT OTHER MATERIALS PRESENT?
Burial Ground	2CM	118-D-2	100 D Burial Ground #2 118-D-2	1970	?-SS	ND	NS	ND	ND			X				DISPOSAL OF IRRIDATED SOLID WASTE...NEED TO DETERMINE IF MATERIAL IS STILL RADIOACTIVE OR METALS LEACHING. WHAT OTHER MATERIALS PRESENT?
Burial Ground	2CR	118-D-5	Ball 3X Burial Ground 118-D-5	1954	?-SS	ND	NS	ND	ND			X				BURIAL OF THIMBLES FROM REACTOR BLDG. NEED TO DETERMINE IF MATERIALS ARE STILL RADIOACTIVE OR IF METALS LEACHING.
Burial Ground	2CM	118-DR-1	105-DR Gas Loop Burial Ground	1964	?-SS	ND	NS	ND	ND			X				BURIAL OF IRRIDATED METAL ASSEMBLIES. NEED TO DETERMINE IF MATERIALS ARE STILL RADIOACTIVE OR METAL RELEASE TO ENVIRONMENT.
Burning Pit	4CB	100-D/DR*	100 D/DR Burning Pit	1967	?-S,SS	ND	NS	ND	P,C?					X		DISPOSAL OF PAINT WASTES, SOLVENTS, AND OTHER CHEMICALS. NEED TO DETERMINE IF CHEMICAL CONTAMINANTS ARE STILL PRESENT.
Crib	[illegible]	117-D*	117-D Crib	1967	Y-SS	?	?	ND	NS					X		DISPOSAL OF DRAINAGE FROM CONFINEMENT SYSTEM. SHOULD ALSO EVALUATE IF CHEMICAL CONTAMINANTS ARE STILL PRESENT. FILLED WITH GRAVEL, COVERED TO GRADE WITH CLEAN SOIL.
Crib	4GM	116-DR-4	105-DR Pluto Crib 116-DR-4	1953	Y-SS	?	?	NS	NS					X		DISPOSAL OF EFFLUENT FROM TUBES CONTAINING FAILED FUEL ELEMENTS. NEED TO DETERMINE IF RESIDUAL RADIOACTIVITY REMAINS. SAMPLING SHOULD ALSO BE CONDUCTED FOR CHEMICAL CONTAMINANTS. COVERED TO GRADE WITH CLEAN SOIL.
Crib	4GM	116-DR-8	117-DR Crib	1964	Y-SS	?	?	ND	NS					X		DISPOSAL OF DRAINAGE FROM CONFINEMENT SEAL PITS. NEED TO DETERMINE IF RESIDUAL RADIOACTIVITY REMAINS. ALSO,..DID CRIB RECEIVE CHEMICAL CONTAMINANTS WHICH REMAIN IN SURROUNDING SOIL?
Crib	4GM	116-D-2	105-D Pluto Crib 116-D-2	1956	Y-SS	?	?	ND	NS					X		DISPOSAL OF INORGANIC CHEMICALS AND WASTES FROM FAILED FUEL ELEMENTS. NEED TO EVALUATE PRESENCE OF RESIDUAL CONTAMINATION (CHEM/RAD).
French Drain	4GM	116-D-3	108-D Crib #1 116-D-3	1967	Y-SS	?	?	?	NS					X		DISPOSAL OF WASTES FROM CONTAMINATED MAINTENANCE SHOP AND CASK DECONTAMINATION PAD. NEED TO EVALUATE IF CHEMICAL AND RADIOACTIVE MATERIALS REMAIN AT SITE.
French Drain	4GM	116-D-4	108-D Crib #2 116-D-4	1957	Y-SS	?	?	?	NS					X		DISPOSAL OF WASTES FROM CONTAMINATED MAINTENANCE SHOP AND CASK DECONTAMINATION PAD. NEED TO EVALUATE IF CHEMICAL AND RADIOACTIVE MATERIALS REMAIN AT SITE.
French Drain	4GM	116-D-6	105-D Cushion Corridor French Drain	1967	Y-SS	?	?	ND	ND					X		DISPOSAL OF DOMESTIC WATER FROM CHANGING ROOM, AND EFFLUENT FROM MASK DECONTAMINATION STATION. NEED TO EXAMINE THE DRAIN/SITE FOR RESIDUAL RADIOACTIVITY AND CHEMICAL CONTAMINATION.
Pumping Station	2GM	1608-DR*	1608-DR Waste Water Pumping	1964	?	ND	ND	NS	ND	?		X				INACTIVE AND EMPTY. PUMPED TO EFFLUENT LINES TO COLUMBIA RIVER. NO DATA ON UNIT LEAKAGE IF ANY.
Pumping Station	5GM	1608-D*	1608-D Waste Water Pumping	1965	?	ND	ND	NS	ND						X	FACILITY DEMOLISHED IN SITU BY 100 AREA DECOMMISSIONING PROGRAM.
Retention Basin	1EM	107-D*	107-D Retention Basin	1967	D-S,SS	?	?	ND	?P,C	Y	X					70% RADIATION INVENTORY IN SURROUNDING SOIL. CONCRETE WALLS. CONTAMINATED/ RADIOACTIVE BASIN WALLS AND SURROUNDING SOIL. UPR EARLY IN 1950S CONTAMINATED EFFLUENT REACHED SURFACE.

KEY:
* - official number not assigned but identified by unit number
D= documented
?= suspected
ND= no data
NS= not suspected
SS= subsurface soil
S= surface soil
P= past air release
C= current air release
F= future air release
X= yes
Blank= no

TABLE 3-17 100 D/DR RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

100 D/DR Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	NEED FOR ACTION: Remedi-ation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
Retention Basin	1EM	107-DR*	107-DR Retention Basin	1964	D-S,SS	?	?	NO	?	Y	X					CONTAMINATED RETENTION BASIN (WALLS) AND SURROUNDING SOIL. CONCRETE WALLS. 70% RADIATION INVENTORY IN SURROUNDING SOIL.
Storage Pad	40M	100-D*	100-D Cask Storage Pad (3)	1975	?-S,SS	NO	NO	NO	NO	Y				X		PAD IS EMPTY. SURFACE CONTAMINATION IS FIXED SOIL AND CHEMICAL CONTAMINATION NOT ADDRESSED.
Tank	210	1706 D*	1706-D Gas Storage Tank (3)	1968	?-SS	NO	NO	NO	NO			X				STORAGE TANK ORIGINALLY FILLED WITH GASOLINE NOW CONTAINS WATER. NEED TO DETERMINE IF HAZARDOUS CONSTITUENTS REMAIN. TANK LEAKED IN PAST. WASTES COULD CONTINUE SEEPAGE.
Tank/Tile Field	360	1607 D1*	1607-D1 Septic Tank	1965	D-SS	?	NO	?	NO				X			SEPTIC TANK RECEIVED SANITARY WASTEWATER FROM BADGEHOUSE/CHECKPOINT, 1701-D BUILDING, AND 1709-D BUILDING.
Tank/Tile Field	360	1607-D4*	1607-D4 Septic Tank	1968	D-SS	?	NO	?	NO				X			

KEY:
* - official number not assigned but identified by unit number
D= documented
?= suspected
NO= no data
NS= not suspected
SS= subsurface soil
S= surface soil
P= past air release
C= current air release
F= future air release
X= yes
Blank= no

TABLE 3-18 100 F RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

100 F Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	Remedi-ation	NEED FOR ACTION: Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
Burial Ground	4-R	118-F-4	115-F Pit 118-F-4	1949	?-SS	NS	NS	NS	NS					X		COVERED WITH 6 FT. SOIL IN 1949. SILICA GEL MAY HAVE DECOMPOSED.
Burial Ground	2-M	118-F-3	Burial Ground #2 118-F-3	1952	?-SS	NS	NS	NS	NS			X				
Burial Ground	2-M	118-F-1	Burial Ground #1 118-F-1	1965	?-SS	NS	NS	NS	NS			X				
Burial Ground	2-M	118-F-2	Burial Ground #2 118-F-2	1965	?-SS	NS	NS	NS	NS			X				
Burial Ground	2-M	118-F-6	PNL Solid Waste Burial Ground	1973	?-SS	NS	NS	?	ND			X				PROXIMATE TO 118 F 1. NATURE OF CHEMICALS NOT AVAILABLE.
Burial Ground	5-R	118-F-5	PNL Sawdust Repository 118 F-5	1975	?-SS	NS	NS	NS	NS						X	NEED TO DETERMINE SOIL COVER DEPTH.
Burial Vault	1-R	118-F-7	100F Miscellaneous Hardware	1965	ND	ND	ND	ND	ND	Y	X					CONCRETE VAULT WITH WOODEN COVER. TEMPORARY WASTE STORAGE. WASTE STILL PRESENT AFTER 20 YRS. NEED TO REMOVE WASTES.
Burning Pit	4-U	100-F*	100-F Burning Pits #2	1965	SS	?	ND		? P					X		SITE NOT USED IN 20 YEARS.
Crib	4-R	116-F-4	105-F Pluto Crib 116-F-4 (9)	1952	D-SS	?	?	ND	ND					X		COVERED TO GRADE WITH SOIL IN 1952. CHEMICALS NOT ADDRESSED.
Crib	4-R	116-F-5	Ball Washer Crib 116-F-5	1964	D-SS	?	?	ND	ND					X		CHEMICALS NOT ADDRESSED.
French Drain	4-R	116-F-12	140-F French Drain 116-F 12	1964	D-SS	?	?	ND	ND					X		
French Drain	4-R	116-F-11	105-F Cushion Corridor French	1965	D-SS	?	?	ND	ND					X		
French Drain	3-R	116-F-13	1705 F Experimental Garden	1976	D-SS	?	?	ND	ND				X			
French Drain	4-R	116-F-7	117-F Crib 116-F-7	1965	D-SS	?	?	ND	ND					X		
Pit	5-U	184-F*	184-F Powerhouse Ash Pit (3)	1965	S,SS	?	?	ND	ND						X	ASH TESTS AS NOT EP TOXIC. ASSUME 21 REPRESENTATIVE SAMPLE TAKEN OF ASH AND SOIL.
Pumping Station	2-M	1608 F*	1608-F Wastewater Pumping	1965	?	ND	ND	ND	? P			X				INACTIVE AND EMPTY.
Retention Basin	1-R	107-F*	107-F Retention Basin	1965	S,SS	?	?		? P	Y	X					CONCRETE BASIN. BACKFILLED TO 5 FT. SOIL FILLED TO COVER WALLS. RELEASES OCCURED DURING USE. 70% RADIATION INVENTORY IN SOILS.
Tank/Tile Field	3-U	1607 F6*	1607-F6 Septic Tank	1975	SS	?	?	?	ND				X			IF NO HAZ. CONSTIT., THEN NO FURTHER ACTION.
Tank/Tile Field	3-U	1607 F1*	1607-F1 Septic Tank	1950	SS	?	?	?	ND				X			IF NO HAZ. CONSTIT., THEN NO FURTHER ACTION.
Tank/Tile Field	3-U	1607 F5*	1607 F5 Septic Tank	1965	SS	?	?	?	ND				X			IF NO HAZ. CONSTIT., THEN NO FURTHER ACTION.
Tank/Tile Field	3-U	1607 F3*	1607 F3 Septic Tank	1965	SS	?	?	?	ND				X			IF NO HAZ. CONSTIT., THEN NO FURTHER ACTION.
Tank/Tile Field	3-U	1607 F4*	1607-F4 Septic Tank	1965	SS	?	?	?	ND				X			IF NO HAZ. CONSTIT., THEN NO FURTHER ACTION.

KEY: * = official number not assigned but identified by unit number; D= documented; ?= suspected; ND= no data; NS= not suspected; SS= subsurface soil; S= surface soil; P= past air release; C= current air release; F= future air release; X= yes; Blank= no

TABLE 3-19 100 H RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

100 H Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	Release Potential: Soil	Release Potential: Ground Water	Release Potential: Surface Water	Release Potential: Subsurface Gas	Release Potential: Air	Residual Radio-active Structures	Need for Action: Remedi-ation	Need for Action: Verify No Release	Need for Action: Verify No Hazardous Constituents	Need for Action: Verify No Residual Contamination	Need for Action: No Further Action Required	Comments
Burial Ground	2CH	118-H-2	H-1 Loop Burial Area, 100-H	1965	?-SS	ND	ND	ND	ND	Y		X				CONCRETE VAULTS RECEIVED RADIOACTIVE STEEL TUBES, AND PIPES. NEED TO EVALUATE RESIDUAL RADIOACTIVITY. INCLUDES TWO CONCRETE VAULTS.
Burial Ground	2CH	118-H-3	Construction Burial Ground	1957	?-SS	ND	ND	ND	ND			X				BURIAL GROUND RECEIVED CONTAMINATED HARDWARE. NEED TO EVALUATE RESIDUAL RADIOACTIVITY. COVERED WITH 6 FT. SOIL.
Burial Ground	2CH	118-H-4	Ball 3X Burial Ground 118-H-4	1953	?-SS	ND	ND	ND	ND			X				BURIAL GROUND RECEIVED IRRADIATED SOLID WASTE. NEED TO EXAMINE RESIDUAL RADIOACTIVITY.
Burial Ground	2CH	118-H-1	100 H Burial Ground #1 118-H-1	1965	?-SS	ND	ND	ND	ND			X				BURIAL GROUND RECEIVED REACTOR COMPONENTS, AND HARDWARE.
Burning Pit	4LB	100-H2#	100-H2 Burning Pit for Residue	1965	?-S	ND	ND	ND	? P					X		BURNING/DISPOSAL OF PAINT AND OFFICE WASTES, AND CHEMICAL SOLVENTS. NEED TO EXAMINE RESIDUAL SOIL CONTAMINATION.
Burning Pit	4LB	100-H#	100 H Burning Pit	1965	D-S	?	?	ND	? P					X		BURNING/DISPOSAL OF PAINT AND OFFICE WASTES, AND CHEMICAL SOLVENTS. NEED TO EXAMINE RESIDUAL SOIL CONTAMINATION.
Crib	4BH	117-H#	Crib 117-H	1965	D-SS	?	?	ND	ND					X		CRIB RECEIVED DRAINAGE FROM CONFINEMENT SEAL PITS. MONITORING IN 1970 INDICATED NO RADIO-ACTIVITY ABOVE BACKGROUND. MUST EVALUATE HOWEVER, IF CHEMICAL CONTAMINATION REMAINS IN SURROUNDING SOIL. REMOVED FROM RADIATION ZONE STATUS.
Crib	4BH	116-H-4	105-H Pluto Crib 116-H-4 (C)	1952	D-SS	?	?	ND	ND					X		CRIB EXHUMED IN 1960 AND MOVED TO 118-H-5 BURIAL GROUND. USED FOR ONLY 2 YEARS THEN COVERED WITH SOIL.
Pit	2CH	118-H-5	105-H Thimble Pit 118-H-5	1961	?-SS	?	?	ND	ND			X				BURIAL GROUND RECEIVED THIMBLE ASSEMBLY AND PLUTO CRIB. NEED TO DETERMINE IF THERE IS RESIDUAL RADIOACTIVITY/CHEMICALS.
Pit	3EB	184-H#	184-H Powerhouse Ash Pit (C)	1965	D-SS	?	?	ND	ND				X			COAL ASH SLUICED WITH RAW RIVER WATER. ASH DID NOT EXCEED EP TOX. LIMITS. STILL NEED TO EVALUATE IF OTHER CHEMICAL CONTAMINANTS REMAIN IN SOIL. ASSUME >1 REPRESENTATIVE SAMPLE TAKEN OF WASTE AND SOIL.
Pumping Station	2DH	1608-H#	1608-H Waste Water Pumping	1965	ND	ND	ND	ND	ND	?		X				PUMPING UNIT RECEIVED REACTOR WASTE AND DECON. CHEMICALS. PRESENTLY INACTIVE AND EMPTY, BUT MUST EVALUATE RESIDUAL RADIOACTIVITY. DID UNIT LEAK?
Retention Basin	1EB	107-H#	100-H Retention Basin 107-H	1965	D-S,SS	?	?	ND	?	Y	X					RECEIVING BASIN AND SURROUNDING SOIL ARE RADIOACTIVE. EXPOSURE POTENTIAL SIGNIFICANT. SITE REMEDIATION/DECONTAMINATION IS NECESSARY. FOR RADIATION INVENTORY IN SOIL. LEAKAGE IN PAST UP TO 5000-10000 GPM.
Tank/Tile Field	3BB	1607-H-4#	1607-H4 Septic Tank	1960	D-SS	?	?	?	ND				X			SEPTIC TANK RECEIVED SANITARY WASTEWATER FROM BADGEHOUSE AND FIRE STATION. NEED TO EXAMINE IF HAZARDOUS CHEMICALS ARE PRESENT IN SURROUNDING SOIL.
Tank/Tile Field	3BB	1607-H-2#	1607-H2 Septic Tank	1965	D-SS	?	?	?	ND				X			RECEIVED SANITATY WASTEWATER FROM OFFICE AND MAINTENANCE BUILDINGS. NEED TO DETERMINE IF HAZARDOUS CHEMICALS PRESENT IN SURROUNDING SOIL.
Tank/Tile Field	3BB	1607-H-3#	1607-H3 Septic Tank	1965	D-SS	?	?	?	ND				X			RECEIVED SANITARY WASTEWATER FROM PUMPHOUSE. NEED TO DETERMINE IF HAZARDOUS CHEMICALS PRESENT IN SURROUNDING SOIL.

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TABLE 3-20 100 KE/KW RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

100 KE KW Release Potential & Need for Action Matrix

Unit Type	Site Code	Official Name	Site Name Description	Date Last Used	Release Potential: Soil	Ground Water	Surface Water	Air Gas	Air	Residual Radioactive Structures	Need for Action: Remediation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
Burial Ground	[illegible]	[illegible]	100 K Burial Ground [illegible]	75	[illegible]	ND	ND					X				NEED TO DETERMINE IF WASTE IS MIGRATING [illegible] WASTE IN THE 100 AREAS [illegible] TO GROUND WATER [illegible] SINCE 100 AREAS ARE LOCATED ALONG THE BANK OF THE RIVER, RELEASE FROM GRD WTR TO SURFACE WTR COULD ALSO BE POSSIBLE.
Burning Pit	[illegible]	[illegible]	100 K Burning Pit	71	[illegible]	?	?		P					X		BURNING OF WASTE PAINT AND CHEMICAL SOLVENT MAY NOT BE COMPLETE. RESIDUAL CONTAMINATION COULD REMAIN WITH THE ASH. PAST RELEASE TO AIR DURING BURNING.
Crib	[illegible]	[illegible]	115 KW Condensate Crib	70	D,SS	?	?		[illegible]		X					REMEDIATION MAY BE NEEDED FOR THIS UNIT SINCE WASTE CONSTITUENTS MAY STILL REMAIN IN THE SOIL. RELEASE TO AIR CAN ALSO OCCUR SINCE THERE IS A PRESENCE OF TRITIUM.
Crib	[illegible]	[illegible]	115 KE Condensate Crib	71	SS	?	?		C		X					MAY HAVE RELEASE TO AIR AS EXPLAINED ABOVE. NO CHEMICAL DATA.
French Drain	[illegible]	[illegible]	105 KW Storage Basin Fr. Drain	70	SS	?	?				X					NO INFO ON TYPE OR QUANTITY OF WASTE. REMEDIAL ACTION MAY BE NEEDED SINCE THE WASTE IS RECENTLY DISPOSED OF.
French Drain	[illegible]	[illegible]	105 KE Storage Basin Fr. Drain	71	SS	?	?				X					SAME AS ABOVE
Retention Basin	[illegible]	[illegible]	107 KE Retention Basin	71	SS,S	?	?			Y	X					SURROUNDING SOIL IS KNOWN TO BE CONTAMINATED. CARBON STEEL TANKS 30 YEARS OLD, BACKFILLED WITH SOIL TO 4 FT. DEEP, CONCRETE WALLS MENTIONED. LEAKS FROM THE BASIN & EFFLUENT LINE TO ADJACENT TRENCH COULD AMOUNT TO 5000 TO [illegible] GPM. LEAKAGE DIVERTED TO OPEN CANAL & DISPOSED TO RIVER.
Retention Basin	[illegible]	[illegible]	107 KW Retention Basin	70	SS,S	?	?			Y	X					SAME AS ABOVE
Tank	[illegible]	[illegible]	10? KE Liquid Nitrogen Storage Tank	71	?	ND	ND	ND	ND			X				NEED TO DETERMINE IF THERE STILL IS [illegible] CHEMICAL IN THE TANK. IF THERE IS, IT SHOULD BE REMOVED.
Tank	[illegible]	[illegible]	105 KE Emergency Diesel Fuel	71	?	ND	ND	ND	ND			X				TANK IS EMPTY. NEED TO VERIFY THAT THERE HAS BEEN NO RELEASE.
Tank	[illegible]	[illegible]	166 KW Oil Storage Tank	70	?	ND	ND	ND	ND		X					NEED TO REMOVE 2000 GAL OIL LEFT IN THE TANK, AND VERIFY THAT THERE HAS BEEN NO RELEASE TO SOIL.
Tank	[illegible]	[illegible]	182 K Emergency Cooling Flow	71	ND	ND	ND	ND	ND			X				TANK IS EMPTY. NEED TO VERIFY FOR NO RELEASE FROM TANK AND NO RESIDUAL MATERIALS.
Tank	[illegible]	[illegible]	183 KE1 Sulfuric Acid Storage	71	D,SS	?								X		TANK IS EMPTY AND NEUTRALIZED, HAD PAST LEAKAGE. SOME SOIL WAS NEUTRALIZED. NEED TO VERIFY NO RESIDUAL CONTAMINATION DUE TO UNDERGROUND LEAKS.
Tank	[illegible]	[illegible]	166 KE Oil Storage Tank	71	?	ND			ND		X					NEED TO REMOVE 2000 GAL OIL LEFT FROM THE TANK, AND VERIFY FOR NO RELEASE.
Tank	2HW	[illegible]	183 KW2 Sulfuric Acid Storage	70	?	ND						X				TANK IS EMPTY AND NEUTRALIZED. NEED TO VERIFY THAT THERE WAS NO RELEASE FROM TANK.
Tank	[illegible]	[illegible]	183 KW1 Sulfuric Acid Storage	70	D,SS	?								X		LEAKAGE DURING OPERATION. TANK IS EMPTY, AND SOME SOILS WERE NEUTRALIZED. NEED TO VERIFY FOR NO RESIDUAL CONTAMINATION. TANK NOT NEUTRALIZED.
Tank	[illegible]	[illegible]	183 KE2 Sulfuric Acid Storage	71	?	ND						X				TANK IS EMPTY. NEED TO VERIFY FOR NO RELEASE. TANK NOT NEUTRALIZED.
Tank	[illegible]	[illegible]	183 KW Sodium Dichromate Tank	71	D,SS,S	?								X		TANK WAS DRAINED AND REMOVED FROM THE SITE TO 200 AREAS FOR REUSE. NEED TO VERIFY THAT RESIDUAL CONTAMINATION DUE TO SPILLS IS WITHIN ACCEPTABLE CONCENTRATION.
Tank	[illegible]	[illegible]	1717 K Waste Oil Storage Tank	7?	ND	ND			ND		X					MOTOR OIL LEFT NEED TO BE REMOVED FROM TANK. VERIFY NO RELEASES FROM TANK.
Tank	[illegible]	[illegible]	183 KE Sodium Dichromate Tank	71	D,SS,S	?								X		SAME COMMENTS FOR 183 KW UNIT.
Tank	[illegible]	[illegible]	1717 K Gas Storage Tank [illegible]	7?	ND	ND			ND			X				TANK DRAINED AND FILLED WITH WATER. NEED TO VERIFY FOR NO PAST RELEASE. IF TANK LEAKS, WATER MAY SPREAD PAST LEAKAGE.

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[illegible]

TABLE 3-20 100 KE/KW RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

[illegible]

Unit Type	Site Code	Site Name Description	Date Last Used	Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radioactive Structures	Remediation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
[illegible]	[illegible]	105-KW Emergency Diesel Fuel	70	NO	NO			NO			X				NO INFO ON THE PRESENT STATUS OF THE TANK. NEED TO VERIFY FOR NO RESIDUAL CONTAMINATION IN THE TANK OR RELEASE TO GROUND.
[illegible]	[illegible]	Diesel Filter Water Facility	70	SS	[illegible]					X					NO INFO ON QUANTITY OF WASTE DISPOSED OF. HOWEVER ACID SLUDGE WATER SLURRY MAY STILL REMAIN AT THE BOTTOM OF THE TRENCH AND IN THE SURROUNDING SOIL. REMEDIATION IS RECOMMENDED.

[illegible] D = documented; ? = suspected; ND = no data; NS = not suspected; SS = subsurface soil; S = surface soil; P = past air release; C = current air release; F = future air release; X = yes; [illegible]

TABLE 3-21 100 N RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

100 N Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	Release Potential: Soil	Release Potential: Ground Water	Release Potential: Surface Water	Release Potential: Subsurface Gas	Release Potential: Air	Residual Radio-active Structures	Need for Action: Remediation	Need for Action: Verify No Release	Need for Action: Verify No Hazardous Constituents	Need for Action: Verify No Residual Contamination	Need for Action: No Further Action Required	Comments
Burning Pit	100	120-N-1	100-N Burning Pit (128-N-1)	86	S, ? SS	ND	ND		P,C,F		X					WASTE CONSTITUENTS ARE NOT DEFINED AND USED FOR MORE THAN 20 YEARS.
French Drain	100	120-N-6	108-N Acid Tank Vent French	87	SS	?	?				X					WASTE IS CORROSIVE. LAST USED IN 87 ALTHOUGH DISCHARGE IS ABOUT 1 GAL EACH TIME, HOWEVER, NO INFO ON THE TOTAL NUMBER OF DISCHARGES. ASSUME SULFATE FORMATION AND PH ALTERATION IN SOIL. OTHER DISCHARGES? TO BE CHARACTERIZED 5/87.
French Drain	100	120-N-7	Acid Unloading Facility	87	SS	?	?				X					SAME AS ABOVE
Line Leak	110	UN 116-N-22	184-N Diesel Oil Supply Line	86	D,SS	D	?				X					PIPE LEAK DISCHARGING DIESEL OIL. SHOW UP IN GROUNDWATER WELL SAMPLE. OCCURED IN '86. GW PUMPING HAS BEEN PERFORMED.
Line Leak	130	UN-116-N-23	184-N Diesel Oil Supply Line	87	D,SS	D	?				X					CONTAMINATION APPEARS IN GRD WTR SAMPLE. GW PUMPING HAS BEEN PERFORMED. NEED PERMANENT REMEDIATION. LEAK CAUSED BY CORROSION. LEAK LOCATED AND EXHUMED.
Pit	100	120-N-3	163-N Neutralization Pit/Drain	87	SS	?	?	?			X					WASTE IS DISPOSED FOR 24 YEARS. CORROSIVE SOLUTIONS THAT SHOULD REACT TO FORM SULFATES AND OTHER SALTS. WASTE SHOULD STILL BE IN THE GROUND. PH ALTERATION.
Tank/Drain Field	300	124-N-4	124-N-4 Septic Tank	87	SS	?	?	?					X			FOR SEPTIC TANKS AND DRAIN FIELDS, IT IS ASSUMED THAT WASTE IS MOSTLY SEWAGE TYPE. NEED ONLY TO CONFIRM THAT THERE IS NO HAZARDOUS OR RADIOACTIVE CONTAMINATION. IF THIS IS TRUE, THEN NO FURTHER ACTION IS REQUIRED.
Tank/Drain Field	300	124-N-7	124-N-7 Septic Tank	87	SS	?	?	?					X			SAME AS ABOVE
Tank/Drain Field	300	124-N-8	124-N-8 Septic Tank	87	SS	?	?	?					X			SAME AS ABOVE
Tank/Drain Field	300	124-N-6	124-N-6 Septic Tank	84	SS	?	?	?					X			SAME AS ABOVE
Tank/Drain Field	300	124-N-5	124-N-5 Septic Tank	87	SS	?	?	?					X			SAME AS ABOVE

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D= documented
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ND= no data
NS= not suspected
SS= subsurface soil
S= surface soil
P= past air release
C= current air release
F= future air release
X= yes
Blank= no

TABLE 3-22 200 E RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

200 East Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Site Name/Description	Date Last Used	Release Potential: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radioactive Structures	Remediation	Need for Action: Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
box	11	216-A-524	216-A-524 Control Structure	1976	?S,?SS	ND	NS	NS	NS	Y	X					REMEDIATE CONTAMINATED STRUCTURES AND VERIFY IF RELEASE(S) HAS OCCURRED
burial ground	4G	218-E-8	218-E-8, 200 East Construction	1959	?-SS	ND	NS	?	?P					X		RETIRED AND BACKFILLED.
burial ground	4G	218-E-13	UN-218-E-13 Burial Ground	1960	?-SS	NS	NS	NS	?P					X		
burial ground	4G	218-E-6	218-E-6 Burial Ground	1955	?-SS	ND	NS	NS	NS					X		SITE EXHUMED.
burial ground	4G	218-E-2	218-E-2, 200 East Industrial	1953	?-SS	ND	NS	NS	?P					X		RETIRED AND STABILIZED (1960); CAVING IN NOTED. CONTAMINATED TUMBLEWEEDS.
burial ground	4G	218-E-5	218-E-5 Burial Ground	1956	?SS	NS	NS	ND	NS					X		SITE BACKFILLED AND STABILIZED IN 1979. SOME SINKAGE OF SURFACE.
burial ground	4G	218-E-5A	200 East Industrial Waste 05A	1959	?SS	ND	NS	ND	?P					X		NO DATA ON COMPOSITION OF THE BURIAL BOXES. SITE RECEIVED D-2 COLUMN FROM PUREX K CELL.
burial ground	4G	218-E-3	218-E-3 Burial Ground	1954	NS	NS	NS	NS	?P					X		SITE HAS BEEN EXHUMED, VERIFY THAT THERE IS NO CHEMICAL OR RAD. RESIDUALS REMAINING
burial ground	4G	218-E-4	218-E-4, 200 East/Minor No. 2	1956	?SS,?S	NS	NS	?	?P					X		CONTAMINATED EQUIP. STORED ABOVE GROUND MAY HAVE CONTAMINATED SURFACE SOILS & AIR. REPAIR AND CONSTRUCTION WASTES MAY CONTAIN ORGANICS (EG., PAINTS AND SOLVENTS)
burial ground	4G	218-E-1	218-E-1, 200 East Dry Waste	1953	D-SS	ND	NS	NS	?P					X		
burial ground	4GM	218-E-12B	218-E-12B, 200 East Dry Waste	1967	?S,SS	ND	NS	?	?P					X		WASTE HAS VISIBLE AT SURFACE IN THE PAST. CONTAIN ACID SOAKED WASTES AND DRY WASTES FROM CODE AREA. BACKFILLED, COVERED WITH POWER PLANT ASH & GRAVEL.
burial tunnel	2G	218-E-14	218-E-14 PUREX TUNNEL NO. 1	1964	ND	NS	NS	NS	ND	Y		X				DETERMINE NEED TO REMOVE WASTES.
burial vault	2G	218-E-9	218-E-9, 200 East Regulated	1959	?-S	NS	NS	NS	ND			X				REGULATED EQUIPMENT STORAGE.
burial vaults (3)	4G	218-E-7	218-E-7, 200 East/222-B	1952	D-SS	ND	ND	?	NS	Y				X		UNSPECIFIED LAB WASTES AND MIXED [illegible] WASTES. 2 WOODEN VAULTS AND 1 CONCRETE VAULT. WOODEN VAULTS WERE OPEN AT BOTTOM.
burning pit	4G		200 East Burning Pit	1970	?-SS	ND	NS	NS	D-P					X		A VARIETY OF NON RAD. WASTES BURNED INCLUDING PAINTS AND SOLVENTS. NO REMEDIATION OR MONITORING NOTED.
crib	4G	216-A-[illegible]	216-A-[illegible] CRIB/TRENCH	1966	D-SS,S	NS	NS	NS	D-P					X		BACKFILLED.
crib	1G	216-B-47	216-BY-5 CAVERN/CRIB	1955	D-SS	?	ND	NS	NS		X					COVERED WITH PLASTIC AND SAND.
crib	4G	216-B-51	216-BY-9 CRIB	1958	D-SS	ND	NS	NS	NS					X		HAS WOOD COVER WITH VENT HOLES.
crib	1G	216-B-15	216-BC-2 Crib	1957	D-SS,S	?	NS	NS	NS		X					CRIB MAY COLLAPSE, CONTAMINATED RABBIT DROPPINGS (RADIOACTIVE) ON SURFACE.
crib	1GM	216-A-10	216-A-10 crib	1987	D-SS	?	NS	NS	NS		X					UNIT USED TO DISPOSE MIXED WASTES UNTIL 3/87. ACIDITY MOBILIZING Sr WHICH HAS BEEN DETECTED IN GROUNDWATER.
crib	4GM	216-C-5	216-C-5 crib	1955	D-SS	ND	NS	NS	NS					X		
crib	4G	216-A-2?	216-A-2? French Drain	1950	D-SS	NS	NS	NS	NS					X		BACKFILLED.
crib	1G	216-B-14	216-B-14	1956	D-SS,S	?	ND	NS	NS		X					CRIB STRUCTURE MAY COLLAPSE, RECEIVED GREATEST AMOUNT OF RADIOACTIVITY OF ANY SITE AT HANFORD.
crib	4G	216-A-41	216-A-41 Crib	1974	D-SS	NS	NS	NS	NS					X		BACKFILLED.
crib	4G	216-A-32	216-A-32	1972	D-SS	NS	NS	NS	NS					X		202-A CRANE MAINTENANCE FLOOR, SINK, AND SHOWER DRAINAGE. NO KNOWN CONSTITUENTS BUT RAD. WASTE MAY HAVE BEEN DISPOSED. BACKFILLED.
crib	4G	216-C-4	216-C-4 crib	1965	D-SS	ND	NS	?	NS					X		CONTAMINATED ORGANIC WASTES.
crib	4G	216-A-31	216-A-31 Crib	1966	D-SS	NS	NS	?	NS					X		ORGANIC WASTES FROM 202-A.
crib	1GM	216-B-10B	216-B-10B	1973	D-SS	ND	NS	NS	NS		X					CRIB STRUCTURE MAY COLLAPSE.
crib	4G	216-B-60	216-B-60 Crib	1967	D-SS	NS	NS	NS	NS					X		CRIBS WERE SEALED WITH CONCRETE AND SITE IS COVERED BY 225-B ENCAPSULATION FACILITY.
crib	4G	216-A-3	216-A-3 CAVERN	1967	D-SS	?	ND	NS	NS					X		SILICA GEL REGENERATION WASTE, ANN STORAGE PIT DRAINAGE AND 203-A PUMPHOUSE LIQUID WASTE.
crib	4GM	216-C-6	216-C-6	1964	D-SS	?	ND	NS	NS					X		

KEY: * - official number not assigned but identified by unit number; D- documented; ?- suspected; ND- no data; NS- not suspected; SS- subsurface soil; S= surface soil; P= past air release; C= current air release; F- future air release; Y- yes; Blank - no

TABLE 3-22 200 E RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

[illegible] Release Potential and Need for Action Matrix

Unit Type	Site Code	Historical Number	Site Name/Description	Date Last Used	Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radioactive Structures	Remediation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
crib	[illegible]	216-B-[illegible]	216-B-[illegible] Crib	195[illegible]	D SS,S	?	ND	NS	NS		X					CRIB STRUCTURE MAY COLLAPSE. CONTAMINATED DROPPINGS ALONG SURFACE
crib	[illegible]	216-B-8	241-B-3 CRIB	195[illegible]	D SS	?	ND	NS	NS		X					CRIB STRUCTURE MAY COLLAPSE.
crib	[illegible]	216-B-10	216-BC-5 Crib	1956	D S,SS	?	NS	NS	? P		X					LARGE VOLUME OVER SHORT PERIOD RESULTED IN CAVE IN. WAS THEN FILLED W/ GRAVEL. CRIB COLLAPSE EXPECTED TO OCCUR. CONTAMINATED DROPPINGS ALONG SURFACE.
crib	[illegible]	216-B-1	216-B-1 Cavern	1955	D SS	ND	NS	NS	NS		X					BACKFILLED.
crib	[illegible]	216-B-2	216-B-2 Cavern	1965	D SS	?	NS	[illegible]	NS		X					ORGANIC WASTE FROM 202-A (PUREX) MAY HAVE DEGRADED. GROUND CONTAMINATION FOUND 15 TO 55 FT BELOW SURFACE. 1966 STUDY FOUND CONC. LEVEL RADIONUCLIDES AT 150-250 FT ABOVE WATERTABLE. CONTAM DROPPINGS ON SURFACE.
crib	[illegible]	216-B-5[illegible]	216-B-57 Crib	1973	D SS	?	ND	NS	NS					X		
crib	[illegible]	216-B-[illegible]	216-BC-4 Crib	1956	D SS,SS	?	ND	NS	NS		X					CRIB STRUCTURE MAY COLLAPSE. CONTAMINATED DROPPING ON SURFACE.
cribs	[illegible]	216-B-[illegible]	216-LR-1, 2, 3 cribs, [illegible]	197[illegible]	D SS,S	D	ND	NS	? P		X					THREE CRIBS, ONE COLLAPSED AND HAS BACKFILLED. COVERED WITH PLASTIC AND STABILIZED. GROUNDWATER SAMPLES IN 1974 SHOWED CONTAMINATION.
crib/tile field	[illegible]	216-B-9	216-B-9CL, 241-B-[illegible]	1951	D SS	?	ND	NS	NS		X					CRIB STRUCTURE MAY COLLAPSE.
crib/trench	[illegible]	216-B-56	216-B-56 TRENCH, 216-B-55 CRIB	1967	D SS,S	ND	NS	NS	? P					X		LABORATORY WASTES.
ditch	[illegible]	216-A-34	216-A-34 Crib	1957	D SS	ND	ND	NS	ND					X		CONTACT CONDENSER COOLING WATER; SITE BACKFILLED.
ditch	[illegible]	216-B-2-1	216-B-2, B DITCH	1963	D SS,S	?	ND	NS	? P		X					WASTES MANAGED INCLUDED CHEMICAL SEWER. WAS CONTAMINATED BY A COIL FAILURE IN 221-B BLDG. DITCH COVERED W/ CLEAN FILL & PLASTIC AND ROOT BARRIER. DITCH AREA SCRAPED BEFORE COVERED. LAST 1000 FT IS COMMON WITH 216-B-2-2 DITCH (PARALLEL, CERCLA)
ditch	[illegible]	216-B-3-2	216-B-2-2[illegible], B SWAMP DITCH	1970	D SS,S	?	ND	NS	? P					X		DITCH WAS BACKFILLED WITH CLEAN SOIL, COVERED WITH 10 MILS. PLASTIC SHEETING, SOIL AND GRAVEL. MAJOR CONTAMINATION INCIDENT IN 1970.
ditch and pond	[illegible]	216-B-3-1	216-B-2, B SWAMP DITCH	1964	D SS,S	?	ND	NS	? P					X		DITCH WAS BACKFILLED AND COVERED W/ PLASTIC ROOT BARRIER, SAND & GRAVEL. DITCH FEEDS SWAMP.
diversion box	41B	241-B-151	241-B-151 diversion box	1984	D SS,S		NS	NS	? P	Y				X		LEAKAGE RESULTED IN SOME SOIL BEING REMOVED AND ADDITION OF NEW SOIL COVER. VERIFY IF ANY CONTAMINATION REMAINS.
diversion box	21B	241-C-252	241-C-252 diversion box	1985	? SS	?	NS	NS	ND	Y		X				
diversion box	21B	241-C-154	241-C-154 diversion box	1985	? SS	?	NS	NS	ND	Y		X				
diversion box	21B	241-HY-152	241-HY-152 diversion box	1985	? SS	?	NS	NS	ND	Y		X				
diversion box	21B	241-UR-152	241-UR-152 diversion box	1984	? SS	?	NS	NS	ND	Y		X				
diversion box	21B	241-CR-152	241-CR-152 diversion box	1985	? SS	?	NS	NS	ND	Y		X				
diversion box	21B	241-CR-153	241-CR-153 diversion box	1985	? SS	?	NS	NS	ND	Y		X				
diversion box	21B	241-BXR-153	241-BXR-153 diversion box	1984	? SS	?	NS	NS	ND	Y		X				
diversion box	21B	241-BYR-151	241-BYR-151 diversion box	1984	? SS	?	NS	NS	ND	Y		X				
diversion box	21B	241-B-252	241-B-252 diversion box	1984	? SS	?	NS	NS	ND	Y		X				
diversion box	21B	241-ER-151	241-ER-151 diversion box	ND	? SS	?	NS	NS	ND	Y		X				
diversion box	21B	241-C-151	241-C-151 diversion box	1985	D SS,S	?	NS	NS	D P	?		X				IN 1985 A SPILL RESULTED IN THIS UNIT BEING FLUSHED AND SPRAYED W/ TURCO PAINT FILM TO PHYSICALLY FIX CONTAMINATION. VERIFY THAT NO FURTHER RELEASE HAS OR WILL OCCUR.
diversion box	21B	241-B-152	241-B-152 diversion box	1980	? SS	?	NS	NS	ND	Y		X				
diversion box	41B	241-B-152	241-B-152 diversion box	1984	D SS,S	?	NS	NS	? P	Y				X		LEAKAGE RESULTED IN SOME SOIL BEING REMOVED AND ADDITION OF NEW SOIL COVER. VERIFY IF ANY CONTAMINATION REMAINS.
diversion box	21B	241-BXR-153	241-BYR-153 diversion box	1984	? SS	?	NS	NS	ND	Y		X				
diversion box	41B	241-B-154	241-B-154 diversion box	1984	D SS,S	?	NS	NS	? P	Y				X		LEAKAGE RESULTED IN SOME SOIL BEING REMOVED AND ADDITION OF NEW SOIL COVER. VERIFY IF ANY

KEY: * = official number not assigned but identified by unit number; D: documented; ?: suspected; ND: no data; NS: not suspected; SS: subsurface soil; S: surface soil; P: past air release; C: current air release; F: future air release; X: yes; Blank: no

TABLE 3-22 200 E RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

200 East Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radioactive Structures	Remediation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
																CONTAMINATION REMAINS.
diversion box	11M	241-C-152	241-C-152 diversion box	1985	D-SS	?	NS	NS	?-P	Y	X					CONTAMINATION REPORTED BUT NO REMEDIATION NOTED.
diversion box	21M	241-BX-155	241-BX-155 diversion box	1984	?-SS	?	NS	NS	NO	Y		X				
diversion box	21M	241-C-153	241-C-153 diversion box	1985	?-SS	?	NS	NS	NO	Y		X				
diversion box	21M	241-BX-153	241-BX-153 diversion box	1983	?-SS	?	NS	NS	NO	Y		X				
diversion box	21M	241-BYR-152	241-BYR-152 diversion box	1984	?-SS	?	NS	NS	NO	Y		X				
diversion box	21M	241-BXR-152	241-BXR-152 diversion box	1984	?-SS	?	NS	NS	NO	Y		X				
diversion box	21M	241-BX-154	241-BX-154 diversion box	1985	?-SS	?	NS	NS	NO	Y		X				
diversion box	11M	241-B-153	241-B-153 diversion box	NO	D-SS,S	?	NS	NS	?-P	Y	X					CONTAMINATION REPORTED BUT NO REMEDIATION NOTED.
diversion box	21M	241-BYR-154	241-BYR-154 diversion box	1984	?-SS	?	NS	NS	NO	Y		X				
diversion box	21M	241-H-153	241-H-153 diversion box (?)	1985	?-SS	?	NS	NS	NO	Y		X				
diverter station	21M	241-HY-152	241-HY-152 diverter station	NO	?-SS	?	NS	NS	NO	Y		X				
diverter station	21M	241-HZ-151	241-HZ-151 diverter station	NO	?-SS	?	NS	NS	NO	Y		X				
drain field	3G		sanitary waste drain field	1963	D-SS	NO	NS	NO	NS				X			LABORATORY REAGENTS USED IN FACILITY SUPPORTED BY THIS UNIT. VERIFY THAT UNIT RECEIVED NO HAZARDOUS CONSTITUENTS.
evaporator	10M	242-B*	242-B Evaporator	1987	NO	NO	NS	NS	?-P,C	Y	X					NO DECONTAMINATION OF UNIT NOTED.
french drain	1G	216-H-26	216-H-26 French Drain	1965	D-SS	NS	NS	NS	NS		X					DRAIN ENCASEMENT REMOVED IN 1965.
french drain	4G	216-H-16	216-H-16 Dry Well	1969	D-SS	NO	NS	NS	NS					X		
french drain	4G	216-H-17	216-H-17 Dry Well	1969	D-SS	NS	NS	NS	NS					X		
french drain	4G	216-H-35	216-H-35 Dry Well	1966	D-SS	NS	NS	NS	NS					X		
french drain	4G	216-H-33	216-H-33 Dry Well	1964	SS	NO	NO	NS	NS					X		
French Drain	4G	216-C-8	271-CR crib, 216-C-8 crib	1965	D-SS	NS	NS	NS	NS					X		
french drain	4G	216-H-12	216-H-12 French Drain	1972	D-SS	NO	NS	NS	NS					X		
french drain	4G	216-H-20A	216-H-20A French Drain	1969	D-SS	NS	NS	NS	NS					X		
french drain	4G	216-H-14	216-H-14 French Drain	1972	D-SS	NS	NS	NS	NS					X		
french drain	4G	216-H-20B	216-H-20B French Drain	1969	D-SS	NS	NS	NS	NS					X		
french drain	4G	216-H-11	216-H-11 French Drain	1972	D-SS	NO	NS	NS	NS					X		
french drain	4G	216-H-15	216-H-15 French Drain	1972	D-SS	NO	NO	NS	NS					X		
french drain	4G	216-H-13	216-H-13 French Drain	1962	D-SS	NS	NS	NS	NS					X		
french drain	4G	216-B-13	216-B-13	1976	D-SS	NO	NS	NS	NS					X		FILLED WITH CRUSHED LIMESTONE.
leaching pit	4GM	216-C-3	216-C-3, 201-C Leaching Pit	1954	D-SS	NO	NS	NS	NS					X		
pit	3D		200 Area Construction Waste	1955	NS	NS	NS	NS	NS				X			GRAVEL PIT USED FOR CONSTRUCTION DEBRIS DISPOSAL.
pit	1D	UPR-200-E-85/124	UPR-200-E-85/124, R-13 Pit	1972	D-SS,S	NO	NS	NS	NO		X					RAD. CONTAMINATION NOTED BUT NO INDICATION THAT REMEDIATION WAS COMPLETED. NO CHEMICAL DATA.
receiving vault	21	244-CR*	244-CR receiving vault	NO	NO	NO	NS	NS	NS	?		X				
receiving vault	21	244-BXR*	244-BXR receiving vault	1985	NO	NO	NS	NS	NS	?		X				
reverse well	4G	216-B-11 A/B	216-B-11 CRIB, 242-B-1 CRIB	1954	D-SS	?	NO	NS	NS					X		
reverse well	4GM	216-B-4	216-B-4	1949	D-SS	NS	NS	NS	NS					X		
spill site	1E	UN-216-E-69	UN-216-E-69 Railroad Car Flush	1984	D-S,SS	NO	NO	NS	?-P		X					DETERMINE CONSTITUENTS OF CONCERN & REMEDIATE
spill site	1E	UN-216-E-72	UN-216-E-72 (UNCOVERED WASTE)	1985	D-SS,S	NO	NO	NO	?-P		X					CONTAMINATION SOURCE HAS STABILIZED WITH FABRI-FILM IN PLACE. DETERMINE IF ADDITIONAL ACTION IS REQUIRED & WHAT WASTES ARE.
spill site	2E	UPR-200-E-44/103	UPR-200-E-44/103/121 BCS LINE	1972	D-SS,S	NO	NS	NS	?-P,C		X					CRIB LINE LEAKAGE RESULTED IN A CAVE-IN. NO REMEDIATION OF CONTAMINATED AREA IS NOTED.
tank	11M	241-BX-302-B	catch tank 241-BX-302-B	1985	NO	NO	NS	NS	NS	Y	X					

KEY:

* Official number not assigned but identified by unit number	D- documented	NO- no data	SS- subsurface soil	P- past air release	F- future air release	Blank- no
	?- suspected	NS- not suspected	S- surface soil	C- current air release	X- yes	

TABLE 3-22 200 E RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

Table 3-22 Release Potential and Need for Action Matrix

Unit Type	Site Code	Original Number	Site Name Description	Date Last Used	Release Potential: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radioactive Structures	Remediation	Need for Action: Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
tank	11R	241-B-302-B	catch tank 241-B-302-B	ND	ND	ND	NS	NS	NS	Y	X					
tank	11R	241-BX-302-A	catch tank 241-BX-302-A	1985	ND	ND	NS	NS	NS	Y	X					
tank	11R	241-AZ-151	catch tank 241-AZ-151	ND	ND	ND	NS	NS	NS	Y	X					
tank	11R	241-B-301-B	catch tank 241-B-301-B	1984	ND	ND	NS	NS	NS	Y	X					
tank	11R	244-CR	catch tank 244 CR	ND	ND	ND	NS	NS	NS	Y	X					
tank	11	270-E	270-E Condensate neutral.	1976	ND	NS	NS	NS	ND	Y	X					TANK CONTAINS 3,000 GAL. OF CONTAMINATED SLUDGE.
tank	11	241-CX-72	241-CX-72 Tank	1976	ND	ND	NS	NS	NS	Y	X					UNIT WAS DECOMMISSIONED IN SITU IN 1986. VERIFY THAT NO RESIDUAL CONTAMINATION REMAINS. ASSUME TANK CONTAINED LIQUID NOT SOLID WASTE.
tank	11R	244-BXR	catch tank 244 BXR	ND	ND	ND	NS	NS	NS	Y	X					
tank	11R	241-B-301-C	catch tank 241-B-301-C	ND	ND	ND	NS	NS	NS	Y	X					
tank	11	241-B-361	241-B 361 settling tank	1976	ND	ND	NS	NS	NS	Y	X					TANK CONTAINS AN ESTIMATED 32,000 GAL. OF SLUDGE. CONCRETE CONSTRUCTION. WASTE SHOULD BE REMOVED.
tank	11R	241-BX-302-C	catch tank 241-BX-302-C	1985	ND	ND	NS	NS	NS	Y	X					
tank	11	241-CX-70	241-CX-70 tank	1976	ND	ND	NS	NS	NS	Y	X					STAINLESS STEEL TANK CONTAINS 4.75 FT. OF SLUDGE. INCLUDED IN THE STRONTIUM SEMIWORKS DECOMMISSIONING PROJECT. WASTE SHOULD BE REMOVED.
tank	11R	241-B-302-B	catch tank 241-B-302-B	1985	ND	ND	NS	NS	NS	Y	X					
tanks	11R	241-AX*	241-AX tank farm	1977	D SS,S	?	ND	NS	NS	Y	X					INCLUDES UPR 200 E-115,119. AT LEAST ONE TANK IS LEAKER.
tanks	11R	241-BY*	241-BY tank farm	1977	D SS,S	?	ND	NS	NS	Y	X					AN UNDETERMINED NUMBER OF SALT WELLS HAVE BEEN INSTALLED TO REMOVE SPILLED LIQUIDS. INCLUDES UPR-200-E 110,134,135. TANKS HAVE LEAKED.
tanks	11R	241-A*	241-A tank farm	1977	D SS,S	?	ND	NS	NS	Y	X					INCLUDES UPR-200 E-125,126,48,47. TANKS LEAKED >1500 GALLONS.
tanks	11R	241-BX*	241-BX tank farm	1980	D SS,S	?	ND	NS	NS	Y	X					INCLUDES UPR 200 E-3,5,70,89,131,133. TANKS LEAKED 10,000 GALLONS.
tanks	11R	241-B*	241 B tank farm	1977	D SS,S	ND	NS	NS	NS	Y	X					AN UNDETERMINED NUMBER OF SALT WELLS HAVE BEEN INSTALLED TO REMOVE SPILLED LIQUIDS. ASPHALTING OF SURFACES IS ALSO REPORTED. INCLUDES UPR-200-E-127,130,108,109.
tanks	11R	241-C*	241 C tank farm	1979	D SS,S	ND	NS	NS	NS	Y	X					CONSTRUCTION OF A SALT WELL AND SOIL REMOVAL ARE REPORTED. INCLUDES UPR 200-E-16,50,91,136,137 AND UN 216-E-91. TANKS LEAKED >20,000 GAL.
tank	11R	224-B*	224 B CONC. FACILITY	1976	ND	ND	ND	NS	ND	Y	X					INACTIVE PRODUCT TREATMENT UNIT.
tanks	11	205-A	205 A SILICA GEL FACILITY	1976	ND	ND	ND	NS	ND	Y	X					INACTIVE RAD. MATERIALS PROCESSING UNIT.
trench	4I	216-A-10	216-A-10 Excavation	1956	D-SS	ND	NS	NS	?-P					X		TRENCH PARTIALLY BACKFILLED.
trench	4I	216-B-30	216-BX-4 Trench	1954	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED.
trench	4I	216-B-20	216-BC-14 TRENCH	1957	D-SS,S	?	ND	NS	?-P					X		TRENCH BACKFILLED AND BLACKTOPPED. CONTAMINATION NEAR SURFACE. BLACKTOP CRACKED. HERBICIDES APPLIED.
trench	4I	216-B-53A	216-B-53 TRENCH	1963	D SS,S	ND	ND	NS	?-P					X		TRENCH BACKFILLED INCLUDING SAND W/ GRAVEL COVER. HERBICIDE APPLIED.
trench	4I	216-B-31	216-BC-18 TRENCH	1957	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED WITH SAND AND GRAVEL. HERBICIDE APPLIED.
trench	4I	216-B-33	216-BC-20 TRENCH	1957	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED WITH SAND AND GRAVEL. HERBICIDE APPLIED.
trench	4I	216-B-22	216-BC-9	1956	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED W/ GRAVEL, HERBICIDES APPLIED.
trench	4I	216-A-19	216-A-19 Grave/Sump/Test hole	1956	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED.
trench	4I	216-B-42	241-BX-B Grave,216-BX-B Trench	1955	D-SS	ND	NS	NS	?-P					X		TRENCH BACKFILLED.
trench	4I	216-B-54	216-B-54 Trench	1965	D-SS	ND	NS	NS	?-P					X		TRENCH BACKFILLED INCLUDING SAND W/ GRAVEL COVER. HERBICIDE APPLIED.
trench	4I	216-B-52	216-B-52 Trench	1958	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED INCLUDING SAND W/ GRAVEL COVER. HERBICIDE APPLIED.

KEY: *: initial number not assigned but identified by unit number; D: documented, ?: suspected; ND: no data, NS: not suspected; SS: subsurface soil, S: surface soil; P: past air release, C: current air release; F: future air release, X: yes; Blank: no

TABLE 3-22 200 E RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

200 East Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	Remedi-ation	NEED FOR ACTION: Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
trench	4E	216-B-34	216-BC-21 Trench	1957	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED INCLUDING SAND W/ GRAVEL COVER. HERBICIDE APPLIED.
trench	4E	216-B-20	216-BC-9 Trench	1957	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED W/ GRAVEL. HERBICIDE APPLIED.
trench	4E	216-B-27	216-BC-14 TRENCH	1957	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED WITH SAND & GRAVEL COVER, HERBICIDES APPLIED.
trench	4E	216-B-53A	216-B-53A Trench	1966	D-SS	ND	NS	NS	?-P					X		TRENCH BACKFILLED WITH SAND & GRAVEL COVER, HERBICIDES APPLIED. CONTAIN PIPING FROM TRENCHES BURIED BETWEEN 216-B-29 AND 216-B-53A.
trench	4E	216-B-35	216-BX-1 Trench	1954	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED.
trench	4E	216-B-23	216-BC-18 TRENCH	1956	D-SS	ND	NS	NS	?-P					X		TRENCH BACKFILLED WITH SAND & GRAVEL COVER. HERBICIDES APPLIED.
trench	4E	216-B-37	216-BX-3 Trench	1954	D-SS	ND	NS	NS	?-P					X		TRENCH BACKFILLED.
Trench	4E	216-B-41	241-BX-7 Grave,216-BX-7 Trench	1954	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED.
trench	4E	216-B-30	216-BC-17 TRENCH	1957	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED WITH SAND & GRAVEL COVER. HERBICIDES APPLIED.
trench	4E	216-B-24	216-BC-11	1956	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED WITH SAND & GRAVEL COVER. HERBICIDES APPLIED.
trench	4E	216-A-20	216-A-20 Grave/Sump/Test hole	1956	D-SS	ND	NS	NS	?-P					X		TRENCH BACKFILLED.
trench	4E	216-B-25	216-BC-12, 216-B-24	1956	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED WITH SAND AND GRAVEL COVER. HERBICIDE APPLIED. CONTAMINATED PIPING FROM TRENCHES BURIED BETWEEN 216-B-29 & 216-B-53A.
trench	4E	216-B-29	216-BC-16 Trench	1957	D-SS	?	ND	NS	?-P					X		SAME
trench	4E	216-B-26	216-BC-13 TRENCH	1957	D-SS	?	ND	NS	?-P					X		SAME
trench	4E	216-B-32	216-BC-19	1957	D-SS	?	ND	NS	?-P					X		SAME
Trench	4E	216-B-40	241-BX-6 Grave/Trench	1954	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED.
trench	4E	216-E-28	Reg. Equipment Storage	ND	D-SS	?	NS	NS	?-P					X		TRENCH BACKFILLED BUT HAS SINK HOLES.
Trench	4E	216-B-39	241-BX-5 GRAVE,216-BX-5 TRENCH	1954	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED.
trench	4E	216-B-21	216-BC-8 Trench	1956	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED WITH GRAVEL. HERBICIDES APPLIED.
trench	4E	216-B-36	216-BX-2 Trench/Grave	1954	D-SS	?	ND	NS	?-P					X		TRENCH BACKFILLED.
vault	4E	241-CX-72	241-CX-72 Vault & Tank	1976	ND	ND	NS	NS	NS	Y				X		DECOMMISSIONED IN 1976.
waste line	4J	UPR-200-E-88/1	B-3 waste line	ND	D-SS,S	ND	ND	NS	?-P					X		MOST OF THE CONTAMINATED SOIL REMOVED.
waste line	4J	UPR-200-E-7	Waste Line	1954	D-SS,S	ND	ND	NS	?-P					X		AREA COVERED AND POSTED AS CONTAMINATION ZONE.

KEY: * = official number not assigned but identified by unit number; D= documented; ?= suspected; ND= no data; NS= not suspected; SS= subsurface soil; S= surface soil; P= past air release; C= current air release; F= future air release; Y= yes; Blank= no

TABLE 3-23 200 W RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

[illegible] RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

Site Type	Site Code	Official Number	Date Last Used	Site Name Description	Soil (Release Potential)	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radioactive Structures	Remediation	Verify No Release (Need for Action)	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
[illegible]	[illegible]	[illegible]	7[illegible]	[illegible]	SS	?				?			X			SITE IS BELOW GROUND WITH [illegible] SOIL. GROUNDWATER VERY LOW, LITTLE CHANCE FOR MIGRATION.
[illegible]	[illegible]	[illegible]	76	[illegible]	SS	?				?			X			SAME AS ABOVE
[illegible]	[illegible]	[illegible]	76	[illegible] Control Structure	SS	?				Y	X					SOIL IS CONTAMINATED
Burial Ground	[illegible]	216-W-10	53	Industrial Burial Ground No. 1	?SS,?	ND	ND	ND	ND	Y				X		
Burial Ground	[illegible]	216-W-11	60	Solid waste burial and repair	SS,S	NS	NS	NS	P		X					[illegible] HAS BEEN [illegible] FROM [illegible] PART OF GROUP ASSOCIATED WITH 216-W-[illegible]
Burial Ground	[illegible]		50	Non Rad Burial Ground	?	NS	NS	NS	NS				X		X	SCRAP METAL POSSESSES ASBESTOS.
Burial ground	[illegible]	218-W-9	54	218-W-9	?SS	NS	NS	NS	NS			X				NATURE OF WASTE NOT KNOWN. SITE HAS BEEN STABILIZED HOWEVER, TECHN. NOT KNOWN.
Burial ground	[illegible]	218-W-[illegible]	85	218-W-[illegible] burial ground	?SS	NS	NS	NS	NS			X				SUSPECT OF HW AND RA MIGRATION, IF SITE NOT [illegible] CORRECTLY. INCLUDES CONTAMINATED SOIL FROM 216-T-4 [illegible] POND.
Burial ground	[illegible]	218-W-4B	63	218-W-4B, UPR 200-W-22	SS,S	NS			P,?,?		X					PART OF SITE COVERED WITH [illegible] WITH 18 INCHES GRAVEL AND SAND. SUNKEN HOLES FOUND AND FILLED IN. WASTES WITHIN [illegible] INCHES OF SURFACE ([illegible] REQUIRED).
Burial ground	[illegible]	218-W-[illegible]	5[illegible]	218-W-[illegible]	?SS	?					X					WASTES WITHIN 18 INCHES OF SURFACE; CONTAMINATED WEEDS ASSOCIATED WITH 218-W-4B.
Burial Ground	[illegible]	216-W-18	54	Industrial Waste Burial Ground	?SS	?						X				BOXES HOLDING WASTES IN GROUND HAVE COLLAPSED. METHOD OF STABILIZATION NOT SPECIFIED.
Burial ground	[illegible]	218-W-2	56	218-W-2	?SS	?					X					WASTES WITHIN 18 INCHES OF SURFACE ASSOCIATED WITH 218-W-4B
Burial ground	[illegible]	218-W-3	61	218-W-3	?SS	?					X					WASTES SUSPECTED TO BE WITHIN [illegible] INCHES OF SURFACE, ASSOC WITH 218-W-4B.
[illegible]	[illegible]	UPR-200-W-1[illegible]	60	UPR 200-W-1[illegible]	?SS	?						X				NO ACTION TAKEN
Crib	[illegible]	216-T-10	51	216-T-1[illegible] crib	D-SS	?	NS	NS	N[illegible]	?				X		
Crib	[illegible]	216-[illegible]-6	45	[illegible] Crib, 216-W-[illegible]	D-SS	?				?	X					SITE HAS BEEN REFERRED FOR [illegible] ACTION, BUT CRIB STRUCTURE BELIEVED READY TO COLLAPSE. CONTAMINATION MAY REACH GROUND WATER BY [illegible]. SINCE RELEASE TO SOIL IS CERTAIN, THERE IS [illegible] FOR VERIFYING THAT THERE IS NO RESIDUAL CONTAM., AND IF THERE IS, REMEDIATION IS NEEDED.
Crib	[illegible]	216-T-2[illegible]	64	216-T-29	SS	?				?				X		SAME AS ABOVE
Crib	[illegible]	216-[illegible]-2[illegible]	7[illegible]	216-S-23 crib	SS	?				?				X		SAME AS ABOVE
Crib	[illegible]	216-[illegible]-1[illegible]	73	216-Z-12	SS	?				?				X		50 FOOT SAMPLE SHOWED TRACE ALPHA
Crib	[illegible]	216-T-36	63	216-T-36	SS	?				?				X		
Crib	[illegible]	216-[illegible]-3	53	216-Z-3 culvert, [illegible]	SS	?				?				X		
Crib	[illegible]	216-T-35	67	216-T-35	SS	?				?				X		
Crib	[illegible]	216-T-2[illegible]	65	216-T-27	SS	?				?	X					CONTAMINATION AT 120 FT; SURFACE CONTAMINATION REMOVED.
Crib	[illegible]	216-T-34	67	216-T-34	SS	?				?				X		SAME AS ABOVE, UNLOADING STATION NEAR CRIB SHOWS CONTAMINATION.
Crib	[illegible]	216-T-32	6[illegible]	216-T-32	SS	?				?	X					CONTAMINATION FROM 35 TO [illegible] FEET, CRIB STRUCTURE BELIEVED READY TO COLLAPSE.
Crib	[illegible]	216-T-31	63	216-T-31	SS					?	X					WASTE MAY HAVE REMAINED IN CRIB OR CRIB [illegible]
Crib	[illegible]	216-S-11	72	216-S-13 crib	SS	?				?	X					CRIB STRUCTURE BELIEVED READY TO COLLAPSE.
Crib	[illegible]	216-T-3[illegible]		216-T-32	SS	?				?				X		
Crib	[illegible]	216-Z-1[illegible]	72	Crib 216-Z-1[illegible]	SS	?				?				X		
Crib	[illegible]	216-[illegible]-10	67	216-[illegible]-10 crib	?SS?	?			P,?,?	?	X					SINCE THE WASTE IS NEW AND CONTAINS [illegible]

[illegible] ... [illegible] D = documented; ? = suspected; ND = no data; NS = not suspected; SS = subsurface soil; S = surface soil; P = past air release; C = current air release; F = future air release; X = yes; Blank = [illegible]

TABLE 3-23 200 W RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

200 WEST AREA RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

Unit Type	Site Code	Official Number	Date Last Used	Site Name/ Description	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	NEED FOR ACTION: Remedi-ation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
crib	4GM	216-T-6	81	216-T-6 crib	SS	?				?				X		EVAPOTRANSPIRATION MAY BE SUSPECTED AS AIR RELEASE SEE COMMENTS ON SITE 216-Z-6 (EXCEPT CRIB STRUCTURE).
crib	10M	216-T-26	56	216-T-26	SS	?				?	X					CONTAMINATION DETECTED TO 120 FT. LATERAL WASTE SPREAD BELIEVED TO HAVE OCCURRED.
crib	10M	216-Z-5	47	216-Z-5, 231-W-1-2 cribs	SS,S	?				?	X					STRUCTURE BELIEVED READY TO COLLAPSE. WASTE MAY REMAIN WITHIN CRIB DUE TO PLUGGING BY SLUDGE.
crib	4GM	216-S-22	67	216-S-22 crib	SS	?				?				X		
Cribs - 3	1GM	216-U-8	60	216-UR-1, 2, 3 Cribs, 216-U-9	SS	?				?	X					STRUCTURE BELIEVED READY TO COLLAPSE. PAST SINK HOLE PROBLEM. PART OF GROUP ASSOCIATED WITH 216-Z-6.
Cribs -5	1GM	216-Z-18	73	cribs - 5 parallel	SS	?				?	X					SAME AS ABOVE. 75% CARBON TET.
ditch	4FN	216-T-4-2 (D)	78	216-T-4-2 (D)	SS	?	NS	?	P					X		POSSIBLE LOCAL AREA CONTAMINATION. ALSO, VEGETATION UPTAKE COULD BE ANOTHER RELEASE POTENTIAL.
Ditch	1FN	216-Z-17	68	216-Z-17 Ditch or Trench	SS	?	NS							X		SAME AS ABOVE, PART OF GROUP ASSOC WITH 216-Z-6.
ditch	4FN	UPR-200-W-139	53	UPR-200-W-139	0,S,SS	?			P		X					
ditch	1FN	216-Z-19	81	216-Z-19 ditch	SS,S	?		NS	P,C		X					
Ditch	1FN	216-U-9	54	216-U-6 U-Swamp 5	SS,S	?		NS	P		X					CONSIDER AGE OF UNIT. SAME AS ABOVE, PART OF GROUP ASSOC WITH 216-Z-19.
Ditch	1FN	216-Z-11	71	216-Z-1 ditch, 2 plant ditch	SS	?					X					SAME AS ABOVE, PART OF GROUP ASSOC WITH 216-Z-19.
Ditch	1FN	216-Z-1 (D)	59	Drain Ditch to U-Swamp, 2	SS	?					X					SAME AS ABOVE, PART OF GROUP ASSOC WITH 216-Z-19.
ditch	1FN	216-T-4-1 (D)	72	216-T-4-1 (D)	SS	?					X					RESIDUAL CONTAMINATION POSES PLANT UPTAKE PROBLEM.
diversion box	11N	241-TX-153	82	241-TX-153 incl. UPR	?-SS,S	?	NS		P	Y	X					
diversion box	21N	241-UR-152	83	241-UR-152 (waste transfer)	? SS	?				Y		X				DIVERSION BOXES ARE ASSUMED TO BE OF CONCRETE BOX STRUCTURES WITH INLET AND OUTLET PIPING, BURIED IN THE GROUND. LEAKS CAN OCCUR FROM THE PIPING, AND THE BOX STRUCTURE. MAIN CONCERN IS LEAKAGE FROM THE UNIT TO SUBSURFACE SOIL, EVENTUALLY TO GROUNDWATER. SINCE THEY ARE WEATHER COVERED VEGETATION UPTAKE MAY NOT BE A POTENTIAL RELEASE PATH. REC: VERIFY NO RELEASE FOR ALL OF THEM EXCEPT THOSE THAT ARE CONFIRMED LEAKER. THESE WILL EITHER REQUIRE REMEDIATION OR CONFIRMATION FOR NO RESID. CONTAMINATION. (COMMENT 1)
diversion box	21N	241-UR-154	82	241-UR-154 (waste transfer)	? SS	?				Y		X				SEE COMMENT (1)
diversion box	21N	241-U-153	81	241-U-153 (waste transfer)	? SS	?				Y		X				SEE COMMENT (1)
diversion box	21N	241-U-252	83	241-U-252 (waste transfer)	? SS	?				Y		X				SEE COMMENT (1)
diversion box	11N	241-SX-151	83	241-SX-152 (waste transfer)	0,SS	?	NS	NS	NS	Y	X					UPR-200-W-80,81,114. CONTAMINATION STILL REMAIN. NEED REMEDIAL ACTION
diversion box	21N	241-UR-153	83	241-UR-153 (waste transfer)	? SS	?	NS			Y		X				SEE COMMENT (1)
diversion box	11N	241-SX-152	81	241-SX-151 (waste transfer)	0,SS	?	NS	NS	NS	Y	X					UPR-200-W-80,81,114. SEE COMMENTS ON 241-SX-151
diversion box	11N	241-T-152	83	241-T-152 (waste transfer)	0,SS	?				Y	X					UPR-200-W-7. SEE COMMENTS ON 241-SX-151
diversion box	21N	241-TY-153	83	241-TY-153 (waste transfer)	? SS	?				Y		X				SEE COMMENT (1)
diversion box	11N	240-S-151	87	240-S-151 (waste transfer)	0,SS,S	?				Y	X					UPR-200-W-20,51,80. SEE COMMENTS ON 241-SX-151
diversion box	21N	241-TXR-155	80	241-TXR-155 (waste transfer)	? SS	?				Y		X				SEE COMMENT (1)
diversion box	11N	241-T-151	80	241-T-151 (waste transfer)	0,SS	?				Y	X					UPR-200-W-7. SEE COMMENTS ON 241-SX-151
diversion box	21N	241-TXR-151	80	241-TXR-151 (waste transfer)	? SS	?				Y		X				SEE COMMENT (1)
diversion box	11N	241-TR-152	82	241-TR-152 (waste transfer)	? SS	?				Y	X					SEE COMMENT (1), PART OF GROUP ASSOC W/ 241-T-152.
diversion box	21N	241-TXR-244	81	241-TXR-244 (waste transfer)	? SS	?				Y		X				SEE COMMENT (1)

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D= documented
?= suspected
ND= no data
NS= not suspected
SS= subsurface soil
S= surface soil
P= past air release
C= current air release
F= future air release
X= yes
Blank= no

TABLE 3-23 200 W RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

200 WEST AREA RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

Unit Type	Site Code	Official Number	Date Last Used	Site Name/ Description	Release Potential: Soil	Release Potential: Ground Water	Release Potential: Surface Water	Release Potential: Subsurface Gas	Release Potential: Air	Residual Radioactive Structures	Need for Action: Remediation	Need for Action: Verify No Release	Need for Action: Verify No Hazardous Constituents	Need for Action: Verify No Residual Contamination	Need for Action: No Further Action Required	Comments
diversion box	11A	240-S-152	80	240-S-152 (waste transfer)	D,SS	?				Y	X					UPR-200-W-80,81. SEE COMMENTS ON 241-SX-151
diversion box	21A	241-TXR-152	80	241-TXR-152 (waste transfer)	?,SS	?				Y		X				SEE COMMENT (1)
diversion box	21A	241-TY-151	81	241-TY-151 (waste transfer)	?,SS	?				Y		X				SEE COMMENT (1)
diversion box	11A	241-TR-153	83	241-TR-153 (waste transfer)	?,SS	?				Y	X					SEE COMMENT (1), PART OF GROUP ISSUE W/ 241-T-152.
diversion box	11A	241-S-152	80	241-S-152 (waste transfer)	D,SS	?				Y	X					UPR-200-W-52. SEE COMMENTS ON 241-SX-151
diversion box	21A	241-TXR-153	80	241-TXR-153 (waste transfer)	?,SS	?				Y		X				SEE COMMENT (1)
dry well	3C	241-SX-402	76	dry well at 241-SX-402	SS	?							X			DRY WELL INSIDE BUILDING. WASTE MIGHT NOT MIGRATE
dry well	3C	241-SX-401	76	dry well at 241-SX-401	SS	?							X			SAME AS ABOVE
filter manifold	4U	2718-SA	76	2718-S sand filter manifold	ND	ND			ND					X		UNIT CONTAIN CONTAMINATED SOLID WASTE. NEED MORE INFO TO DECIDE REMEDIAL ACTION
french drain	40A	216-U-7	57	216-U-7	SS	?								X		
french drain	4G	216-T-31	53	216-T-31	SS,S	?								X		WASTE REMOVED. NEED TO CONFIRM NO RES. RAD.
French Drain	20A	216-Z-8	62	216-Z-8 Crib, 234-5 Recuplex	SS	?						X				CONTAMINATED SOIL/GRAVEL REMOVED.
ground contam	16	UPR-200-W-135	54	UPR-200-W-135	D,S,SS	?			P,C,F		X					SITE HAS CONTAMINATED. NO INFO ON PRESENT COND. ASSUME SITE STILL CONTAMINATED. REMEDIATION NEEDED
ground spill	53	UPR-200-W-117	50	UPR-200-W-117	D,S,SS	NS			P						X	RAD. DECAYED TO BACKGROUND LEVEL. LIQUID AND PARTICULATE MATTER DROPPED FROM RAILROAD CARS.
ground spill	11	UPR-200-W-69	73	UPR-200-W-69	D,S,SS	?			P,C,F		X					SEE COMMENT ON UPR-200-W-135
incinerator	2A	232-Z*		232-Z waste incineration	?,S	NS			P	Y		X				VERIFY NO RELEASE FROM BUILDING. CONTAMINATION OF SOIL AND DISPERSE THROUGH AIR MAY BE POSSIBLE.
pit	40A	216-U-15	57	216-U-15, 388-U dumping	SS	?								X		SITE HAS BEEN RETIRED FOR A LONG TIME. BACKFILLED IMMEDIATELY AFTER ONE USE. LATER CORINGS SHOWED NO INDICATION CONTAMINATION. NEED TO VERIFY THE NO RESIDUAL CONTAMINATION TO DETERMINE WHETHER OR NOT REMEDIATION IS NEEDED.
pit	4U		ND	200 West burning pit	?,S	ND	ND	ND	P					X		NO INFO AVAIL. FOR THIS UNIT
pit	40A	216-T-20	52	disposal trench/pit	SS		NS	NS	NS					X		
pit	40A	UPR-200-W-30	54	UPR-200-W-30 covered pit	SS	?								X		WASTE BURIED IN THE PIT IS SUSPECTED TO MIGRATE. HOWEVER, IT WAS SUCH A LONG TIME AGO THAT VERIFICATION FOR RESIDUAL CONTAMINATION IS NEEDED BEFORE MAKING DECISION FOR REMEDIATION.
pond	40A	216-S-15	52	216-S-15	SS	?								X		POND WAS DEACTIVATED A LONG TIME AGO. BACKFILLED WITH SOIL. HOWEVER, NEED TO VERIFY THE EXTENT OF RESIDUAL CONTAMINATION TO DETERMINE WHETHER OR NOT REMEDIATION IS NEEDED.
pond	11A	216-U-10	85	216-U-10 pond	D,S,SS	?			P		X					UPR-200-W-107. POND OVERFLOWED. NEED TO REMEDIATE SITE.
pond	40A	216-S-11	65	216-S-11 pond	D,S,SS	?								X		SEE COMMENTS FOR 216-S-15 POND (ONLY ONE POND COVERED).
pond	40A	216-T-4A	72	216-T-4A	?,SS	?								X		SITE HAS BEEN EXHUMED. NEED TO VERIFY THAT THERE IS NO RESIDUAL CONTAMINATION
pond	11	216-S-19	84	216-S-19 pond	?,SS	?					X					SITE IS NEWLY DEACTIVATED. RELEASE IS EXPECTED TO REMAIN IN THE SOIL, AND PROBABLY MOVE TO GRD WATER
proc. tnk. vent lines	13A	UPR-200-W-102	72	UPR-200-W-102	D,S,SS	NS					X					SITE IS MARKED FOR UNDERGRD. CONTAMINATION. 139 DRUMS OF SOIL REMOVED.
sewer	19A			REDOX chemical sewer at 203-S,	?,SS						X					CHEMICAL SEWER SYSTEMS GENERALLY REQUIRE REMEDIATION.
surface impoundment	40A	207-S	54	207-S retention basin (3)	?,SS	NS				Y				X		CONCRETE BASIN. NEED TO DETERMINE IF LEAKED OR SPILLED. RESIDUAL CONTAMINATION REMAINS. UNIT BACKFILLED.

KEY:

*: official number not assigned but identified by unit number
D: documented
?: suspected
ND: no data
NS: not suspected
SS: subsurface soil
S: surface soil
P= past air release
C= current air release
F: future air release
X: yes
Blank: no

TABLE 3-23 200 W RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

[illegible] RELEASE POTENTIAL [illegible] NEED FOR ACTION MATRIX

Unit Type	Site Code	Site Number	Date Last Used	Site Description	Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radioactive Structures	Remediation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
					RELEASE POTENTIAL						NEED FOR ACTION					
[illegible]	11N	[illegible]	80	241 S tank farm	D,?	?			P	Y	X					UNDERGROUND TANK FARM. TANKS STILL CONTAIN WASTE. THEY MAY NOT RELEASE WASTE AT PRESENT. EVENTUALLY WASTE WILL LEAK FROM THE CONTAINERS (AS SHOWN BY RELATED UNPLANNED RELEASE EVENTS). RECOMMEND UNDERGROUND STORAGE TANKS BE REMEDIATED NOW TO RESOLVE PAST RELEASE & TO AVOID FUTURE PROBLEMS. STABILIZATION INVOLVING WASTE CRYSTALLIZATION AND LIQUID REMOVAL IS UNDERWAY. (SEE COMMENT 2)
[illegible]	11N	[illegible]	[illegible]	241 T tank farm	D,?	?				Y	X					UPR 200 W 140. SEE COMMENT (2). LEAKED > 115,000 GAL.
tank	20N	[illegible]	76	241 SX 402 condenser shield	[illegible]					Y		X				SEE COMMENT (2).
tank	20N	[illegible]	76	276 U solvent handling	?,SS					Y		X				SEE COMMENT (2)
tank	21N	[illegible]	69	underground tank 276 S 14?	?					Y		X				TANKS TESTED IN 1976. NO RELEASE SHOULD BE VERIFIED AND CONTENTS REMOVED.
tank	1N	[illegible]	76	241 U 361 settling tank	?,?					Y		X				CONCRETE TANK. WASTES REMAIN.
tank	11N	[illegible]	79	241 SX tank farm	D,SS,S	?			P,C,F	Y	X					UPR 200 W 49,50,114. SEE COMMENT (2). LEAKED > 100,000 GAL.
tank	11N	241 TY 302 B	81	catch tank 241 TY 302 B at	?,SS	?				Y	X					SEE COMMENT (2)
tank	11N	241 TX 302 A	82	catch tank 241 TX 302 A at	?,SS	?				Y	X					SEE COMMENT (2)
tank	11N	241 TX 302 B	82	catch tank 241 TX 302 B at	?,SS	?				Y	X					SEE COMMENT (2)
tank	11N	241 U 301	ND	catch tank 241 U 301 at	?,SS	?				Y	X					SEE COMMENT (2)
tank	11N	[illegible]	83	catch tank 241 [illegible] 301 B at tank	?,?	?				Y	X					SEE COMMENT (2)
tank	11N	240 S 302	87	catch tank 240 S 302 at	?,SS,S	?				Y	X					SEE COMMENT (2)
tank	11N	241 TX	79	241 TX tank farm	D,SS,S	?			C,F	Y	X					UPR 200 W 41,100. SEE COMMENT (2) LEAKED > 2,500 GAL.
tank	21N	270 S 141	69	underground tank 276 S 141	?					Y		X				TANKS TESTED IN 1976. NO RELEASE SHOULD BE VERIFIED AND CONTENTS REMOVED.
tank	11N	241 TY	73	241 TY tank farm	D,S	?				Y	X					UPR 200 W 150,151,152,153. SEE COMMENT (2) LEAKED > 60,000 GAL. DIATOMACEOUS EARTH ADDED TO STABILIZE ONE TANK.
tank	21N	241 T 361	76	241 T 361 settling tank	?,SS					Y		X				CONCRETE TANK. WASTES REMAIN.
tank	21N	241 Z 361	76	241 Z 361 settling tank	?,SS					Y		X				CONCRETE TANK WITH STEEL LINER. WASTES REMAIN.
tank	11	241 SX 302	83	catch tank 241 SX 302 at	?,SS	?				Y	X					SEE COMMENT (2)
tank	20N	241 SX 401	76	241 SX 401 condenser shield	?,SS					Y		X				SEE COMMENT (2)
tank	11N	241 TY 302 B	81	catch tank 241 TY 302 B at	?,SS	?				Y	X					SEE COMMENT (2)
tank	11N	241 U	80	241 U tank farm	D,SS	?				Y	X					UPR 200 W 154,155,156,157. SEE COMMENT (2) LEAKED > 94,000 GAL. DIATOMACEOUS EARTH ADDED TO STABILIZE ONE TANK.
[illegible]	20N	[illegible]	85	242 T Evaporator (Batch then	?				P	Y		X				RESIDUAL WASTES, IF ANY, SHOULD BE DISPOSED. EVENT RELATED TO UNIT 241 U.
tanks	10N	[illegible]	76	tanks in 276 S Solvent Facilit	ND	ND			ND	*	X					NO INFO ON THIS UNIT. REMEDIAL ACTION MAY BE NEEDED FOR REMOVAL OF THE TANKS.
tile field	10N	216 Z [illegible]	69	2?4 S tile field, 216 Z ?;	SS	?					X					CONTAMINATION DETECTED TO 31 FEET.
trench	20N	UPR 200 W 110	71	UPR 200 W 110	D,SS	?	NS	NS	NS			X				BACKFILLED TRENCH CONTAINING CONTAMINATED SOIL. VEGETATION UPTAKE COULD BE A POTENTIAL RELEASE
trench	4?N	216 [illegible]	54	216 S 12?	?,SS	?								X		FOR WASTE THAT WAS DISPOSED IN TRENCHES, MOST WERE OF LIQUID FORM. MOST OF THESE TRENCHES WERE RETIRED A LONG TIME AGO. WASTE HAS PROBABLY MIGRATED IN THE SOIL AND REACHED GROUNDWATER. THEREFORE, IT IS RECOMMENDED TO VERIFY FOR RESIDUAL CONTAMINATION

KEY: * [illegible] not identified by [illegible]; D documented; ? suspected; ND no data; NS not suspected; SS subsurface soil; S surface soil; P past air release; C current air release; F future air release; X yes; Blank no

TABLE 3-23 200 W RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

200 WEST AREA RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

Unit Type	Site Code	Official Number	Date Last Used	Site Name/ Description	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	NEED FOR ACTION: Remedi-ation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
																TO DETERMINE WHETHER OR NOT REMEDIATION IS REQUIRED. (COMMENT 3) UNIT HAS BEEN BACKFILLED.
trench	4EH	216-S-8	52	216-S-8	D-SS	?	NS	NS	NS					X		SEE COMMENT (3) UNIT HAS BEEN BACKFILLED.
Trench	4E	216-T-11	54	Equipment Decontamination	? SS	?								X		WASTE HAS BEEN EXHUMED; RELEASED FROM RADIATION ZONE STATUS.
trench	4EH	216-S-14	52	216-S-14	? SS	?								X		SEE COMMENT (3)
trench	4EH	216-T-12	54	216-T-12	? SS	?								X		SEE COMMENT (3); BACKFILLED.
trench	4E	216-T-10	54	216-T-10	? SS	?								X		EXHUMED AND RELAEASED FROM RADIATION ZONE STATUS.
trench	1EH	216-T-14	54	216-T-14	? SS	?					X					CONTAMINATION FOUND AT 30 FEET; HERBICIDES APPLIED TO SURFACE.
trench	4E	216-T-9	54	216-T-9	? SS	?								X		EXHUMED AND RELAEASED FROM RADIATION ZONE STATUS.
trench	1EH	216-T-16	54	216-T-16	? SS	?					X					CONTAMINATION FOUND AT 30 FEET. BACKFILLED; HERBICIDES APPLIED TO SURFACE.
Trench	1EH	216-T-22	54	241-TX-2 Trench, 216-TX-2 Grav	? SS	?					X					SEE COMMENT (3); BACKFILLED, ASSOC WITH 216-T-21.
trench	1EH	216-T-21	54	241-TX-1 trench, 216-TX-1 grav	? SS	?					X					SEE COMMENT (3); BACKFILLED; SURFACE TREATED WITH HERBICIDES. SELF-CONTAMINATION AT 35,55 AND 100 FEET.
trench	4EH	216-T-5	55	216-T-5	? SS	?								X		SEE COMMENT (3)
trench	1EH	216-T-25	54	216-T-25	? SS	?					X					SEE COMMENT (3); BACKFILLED; SURFACE TREATED WITH HERBICIDES. ASSOCIATED WITH 216-T-21.
Trench	1EH	216-T-24	54	241-TX-4 Trench, 216-TX-4 Grav	? SS	?					X					SEE COMMENT (3); BACKFILLED; SURFACE TREATED WITH HERBICIDES. ASSOCIATED WITH 216-T-21.
trench	2EH	UPR-200-W-111		UPR-200-W-111	? SS	?						X				SLUDGE FROM RETENTION BASIN 207-U WAS PLACED IN THIS TRENCH AND COVER WITH 4' OF CLEAN SOIL. VEGETATION UPTAKE COULD BE A POTENTIAL RELEASE
Trench	1EH	216-T-23	54	241-TX-3 Trench, 216-TX-3 Grav	? SS	?					X					NEED REMEDIATION SINCE PART OF GROUP ASSOCIATED WITH 216-T-21
trench	4E	216-T-13	72	216-T-13	? SS	?								X		WASTE HAS BEEN BACKFILLED AND RELEASED FROM RADIATION ZONE STATUS.
Trench	4EH	216-U-6	52	216-U Cold U Trench #1	? SS	?								X		SEE COMMENT (3); HAS BEEN BACKFILLED.
trench	1EH	216-T-17	54	216-T-17	? SS	?					X					SEE COMMENT (3); HERBICIDES APPLIED TO SURFACE. PART OF GROUP ASSOCIATED WITH 216-T-14, 216-T-16.
trench	1EH	216-Z-4	45	216-Z-4, 231-W-3	? SS	?					X					SEE COMMENT (3); HAS BEEN BACKFILLED. PART OF GROUP ASSOCIATED WITH 216-Z-6.
trench	4E	216-S-10	54	216-S-10	? SS	?								X		SEE COMMENT (3); EXHUMED AND REMOVED FROM RADIATION ZONE STATUS.
trench	2EH	UPR-200-W-112		UPR-200-W-112	? SS	?						X				SEE COMMENT ON UPR-200-W-111.
Trench	1EH	216-Z-9	62	216-Z-9 Cavern, 234-5 Recuplex	? SS	?					X					EST. 95% PU ACTIVITY IN FIRST 12" OF SOIL; CHEMICAL CONTAMINATION NOT ADDRESSED; MINING OF PLUTONIUM PROPOSED IN 1970'S.
trench	1EH	216-T-15	54	216-T-15	? SS	?					X					SEE COMMENT (3); HERBICIDE'S APPLIED TO SURFACE. PART OF GROUP ASSOCIATED WITH 216-T-14, 216-T-16.
Trench	4EH	216-U-5	52	221-U Cold U Trench #2	? SS	?								X		SEE COMMENT (3)
Trenches	4EH	216-U-13	56	241-UR Steam Cleaning Pit.	? SS	?								X		SEE COMMENT (3)
vault	2EH	218-W-8	52	218-W-8	? SS					Y		X				VAULTS THAT CONTAIN SOLID WASTE ARE NOT EXPECTED TO RELEASE WASTE TO THE ENVIRONMENT, UNLESS THERE IS BREACH OF THE CONTAINER. RECOMMEND TO VERIFICATION OF NO RELEASE FROM THESE UNITS. IF THE STRUCTURES ARE WELL ENGINEERED FOR PERMANENT WASTE STORAGE (WITH NO POSSIBLE FUTURE WASTE RELEASE), THEN NO FURTHER ACTION IS REQUIRED.

KEY: # = official number not assigned but identified by unit number; D= documented; ?= suspected; ND= no data; NS= not suspected; SS= subsurface soil; S= surface soil; P= past air release; C= current air release; F= future air release; X= yes; Blank= no

TABLE 3-23 200 W RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

200 WEST AREA RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

Unit Type	Site Code	Official Number	Date Last Used	Site Name/ Description	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	NEED FOR ACTION: Remedi-ation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
																(COMMENT 4) HOWEVER, THIS UNIT WAS MADE OF WOODEN PLANKS. THERE IS A POSSIBILITY THAT THE WOOD HAS DECAYED AWAY, AND RELEASE OF WASTE TO SOIL IS EXPECTED. SUBJECT TO SINK HOLE FORMATION.
vault	200W	210-W-7	60	210-W-7	? SS	?				Y		X				SEE COMMENT (4)
vault	2K	205-S*	76	205-S vault at the uranium	ND					?		X				SEE COMMENT (4)
vault	40W	244-UR*	76	244-UR vault	S	NS				Y				X		SEE COMMENT (4)
vault	200W	241-WR*	76	241-WR vault	ND	NS				Y		X				SEE COMMENT (4)
waste line	4JW	UPR-200-W-2	47	UPR-200-W-2	D,S,SS				? P					X		NEED TO VERIFY FOR RESIDUAL CONTAMINATION TO DETERMINE WHETHER OR NOT REMEDIATION IS REQUIRED
waste line	4JW	UPR-200-W-113	MID 50'S	UPR-200-W-113	D,S,SS				? P					X		SAME AS ABOVE
weir box	11	2904-S-171	76	2904-S-171 weir box	? S,SS				? P	Y	X					SINCE THE WEIR BOX EXTENDS ABOVE GROUND, WITH SLUICE GATE, THERE IS A POTENTIAL FOR RELEASE TO AIR. IT IS ASSUMED THAT THIS UNIT IS NOT ENGINEERED FOR PERMANENT WASTE STORAGE. THUS, IT IS RECOMMENDED FOR REMEDIATION. LIQUID WASTE IS ALSO SUSPECTED TO BE PRESENT IN THE UNIT.
weir box	11	2904-S-170	76	2904-S-170 weir box	? S,SS				? P	Y	X					SAME AS ABOVE
weir box	11	216-S-172	76	216-S-172 weir box	? S,SS				? P	Y	X					SAME AS ABOVE, EXCEPT ONLY SOLID WASTE.

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TABLE 3-24 200 N RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

200 North Release Potential and Need For Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radioactive Structures	NEED FOR ACTION: Remediation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
Trench	4ER	216-N-3	212-N-2 trench, 212-N-3 (9)	1952	D-SS	?	NS	NS	NS					X		Piping removed. Trench backfilled. Chemical contamination not addressed but site was last used 35 years ago.
Pond	4ER	216-N-1	212-N Swamp, 216-N-1 Swamp, 216-N-1 covered Pond (9)	1952	D-SS	?	NS	NS	NS					X		Removed from radiation zone status. Chemical contamination not addressed but site was last used 35 years ago
Trench	4ER	216-N-2	216-N-1 Trench, 216-N-2 trench (9)	1947	D-SS	?	NS	NS	NS					X		Piping removed. Trench backfilled. Chemical contamination not addressed but site was last used 40 years ago.
Pond	1ER	216-N-4	212-P Swamp, 216-N-2, 216-N-4 swamp (9)	1952	D-SS	?	NS	NS	NS		X					Pond is covered. Contamination detected in subsurface soil (4 ft. deep). Chemical contamination not addressed but site last used 35 years ago.
Trench	4ER	216-N-5	212-P trench, 216-N-5 trench (9)	1952	D-SS	?	NS	NS	NS					X		Piping removed. Trench backfilled. Chemical contamination not addressed but site was last used 35 years ago.
Pond	1ER	216-N-6	212-R Swamp, 216-N-6 Swamp (9)	1952	D-SS	?	NS	NS	NS		X					Pond is covered. Contamination detected in subsurface soil (4 ft. deep). Chemical contamination not addressed but site last used 35 years ago.
Trench	4ER	216-N-7	212-R trench, 212-N-7 trench (9)	1952	D-SS	?	NS	NS	NS					X		Trench backfilled. Chemical contamination not addressed but site last used 35 years ago.

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TABLE 3-25 300 AREA RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

300 AREA Release Potential and Need For Action Matrix

Unit Type	Site Code	Official Number	Date Last Used	Site Name/ Description	Release Potential: Soil	Release Potential: Ground Water	Release Potential: Surface Water	Release Potential: Subsurface Gas	Release Potential: Air	Residual Radio-active Structures	Remedi-ation	Need for Action: Verify No Release	Need for Action: Verify No Hazardous Constituents	Need for Action: Verify No Residual Contamination	No Further Action Required	Comments
acid spill	[illegible]		1935?	Uranium/Acid Waste (Bldg. 313)	?-S,SS	?	ND		ND		X					PROCESS SEWER LINE LEAKING FOR UNKNOWN TIME. PROCESS LEAKAGE DIRECTED TO THIS LINE.
crib	[illegible]	316-4	1956	300 North Crib	SS	?	?	?	ND		X					USED TANKS.
drain field	[illegible]		1974	331 Life Sciences Laboratory	SS	?	?	?	ND	Y			X			
drain field	[illegible]		1978	Retired 315 Sanitary Drain	SS	?	?	?	ND				X			
drain field	[illegible]		1978	Retired 335/336 Sanitary	SS	?	?	?	ND				X			
gravel pit	[illegible]		1987	300 Area Interim Filter	S,SS	?	?								X	NONHAZARDOUS FILTER BACKWASH.
pipe trench system	[illegible]	UPR-300-31/40	1974?	Pipe Trench System, 311	S,SS	?	?	NS	NS	Y	X					SEVERE EROSION OF BOTTOM OF TRENCH, MULTIPLE DRAIN CONNECTIONS BROKEN. PREVIOUS SPILLS BELIEVED TO HAVE OCCURED. MADE TRENCH AND PIPING REPAIRS. TRENCH FLOOR REMAINS CONTAMINATED. URANIUM FOUND IN SOIL.
pond	[illegible]		1987	Retired Filter Backwash Pond	SS	?	?			Y					X	NONHAZARDOUS WASTE.
sewer pipe	2HM		1975	Retired Liq. Waste Sewer	?-SS	ND	ND	ND	ND			X				PIPES DRAINED AND LEFT IN PLACE. PIPING IS STAINLESS STEEL AND CONTAINS RESIDUAL RADIATION CONTAMINATION. SYSTEM REPLACED.
tank	[illegible]		1986	334 Tank Farm Waste Acid Tank	?-S,SS	ND	ND			Y		X				LINER FAILURE CAUSED TANK LEAKAGE. DISCHARGED TO PROCESS SEWER TO WHICH NaOH ADDED TO NEUTRALIZE. PREVIOUS CHEMICAL USAGE NOT KNOWN.
tanks	[illegible]		1968	323 Tanks (4)	ND	ND	ND	ND	ND	?		X				TANKS ENCASED IN CONCRETE VAULT. 3 OF 4 TANKS EMPTY OR FILLED WITH SAND.
testing unit	[illegible]		1986	In Situ Vitrification Test	S	ND	NS	NS	? P						X	DECONTAMINATION TO BACKGROUND RADIATION LEVELS. NO CHEMICALS APPEAR USED.
transfer line	[illegible]	UPR-300-1	1970	Transfer Line Leak	S,SS	?	ND	NS	?,P,C					X		TOP 2 FT OF SOIL REMOVED. FURTHER REMOVAL POSSIBLE THREAT TO ADJACENT STRUCTURES.
trench	[illegible]		1974	331 Life Sci Lab (1964-1974)	SS	?	ND	?	ND				X			
trench	[illegible]		1969	331 Life Sci Lab (1966-1969)	SS	?	ND	?	ND				X			
underground tanks	1EQ		1971	Methanol Storage (315 bldg)	?-S	ND	ND	ND	ND		X					REMOVE WASTES
underground tanks	1EQ		1971	Methanol Stor. (311 Tank Farm)	?-S	ND	ND	ND	ND		X					REMOVE WASTES
underground tanks	[illegible]		1973	309 TW Tanks (3)	ND	ND	ND	ND	ND	Y		X				UNIT NOW EMPTY. CARBON STEEL PIPE RETAINS RADIATION CONTAMINATION. TANKS IN CONCRETE UNDERGROUND VAULT.

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TABLE 3-26 400 AREA RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

400 AREA Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	Remedi-ation	NEED FOR ACTION: Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
french drains	[illegible]		French Drain South of 4722 C	1965	D-SS	NS	NS	NS	NS						X	Sample from french drain was non-hazardous. Latex paints are nonhazardous
french drains	[illegible]		400 Retired French Drains	ND	D-SS	ND	ND	ND	ND				X			Type of washing operations not identified.
ponds	[illegible]		400 Area Retired Sanitary Pond	1979	D-S/SS	?	NS	ND	ND				X			Source of wastes feeding to treatment plant not identified. Basis for non-hazardous sludge designation not identified.
tank	[illegible]		Retired Septic Tanks (3)	1963	ND	NS	NS	ND	ND				X			Received wastes from offices. Any laboratories?
trench	[illegible]		400 Area Retired Sand Trench	ND	D-SS	ND	NS	NS	NS				X			Constituents of cooling tower blowdown not identified. Could contain metals or inorganics.

KEY:
* = official number not assigned
but identified by unit number
D= documented
?= suspected
ND= no data
NS= not suspected
SS= subsurface soil
S= surface soil
P= past air release
C= current air release
F= future air release
X= yes
Blank = no

TABLE 3-27 600 AREA RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

600 Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Date Last Used	Site Name/ Description	Release Potential: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radioactive Structures	Remediation	Need for Action: Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
burial ground	CR	618-11	1967	300 Wye Burial Ground	D-S	?	NS	ND	P,C?	NS		X				PIPE/CAISSON STORAGE UNITS LIKELY RUSTED AND RELEASING CONTAMINANTS. SURFACE SOIL CONTAMINATION. INCLUDES UPR 600 9 10. ONE CONTAMINATED AREA WASHED DOWN WITH 6000 GALLONS WATER.
burial ground	5CM		1955	J.A. Jones No. 2 (9)	?-S	NS	NS	NS	NS	NS					X	CONSTRUCTION MATERIAL BURIED UNDER CLEAN SOIL AND SOME METALLIC WASTE. SITE EXHUMED AND CONTENTS MOVED TO 200 AREA; SITE BACKFILLED IN 1971.
burial ground	4CQ	618-10	1963	300 North SW Burial Ground	D-S	NS	NS	ND	P,C?	NS		X				PIPE STORAGE UNITS MAY HAVE RUSTED THROUGH SURFACE SOIL CONTAMINATION FOLLOWING UPR 600 1 AND 2. INCLUDES UPR 600 1,2,3. IMPROPER BURIAL CONTAINER USED; CONTAMINATED AREA WASHED DOWN WITH WATER.
burial ground	5CQ		ND	Army Munitions Burial Site	NS	NS	NS	NS	NS						X	ALL MATERIALS EXHUMED/REMOVED TO YAKIMA FIRING RANGE (1965) OR DESTROYED. MATERIAL BURIED IN CRATES ORIGINALLY.
burial ground	3CQ	USBM 2, 4 D	1967	USBM 2, 4 D burial ground	SS	NS	NS	?	? P			X				
burning pit	4LM	618-5	1962	Burial Ground No. 5	?-SS	NS	NS	NS	P,C?					X		URANIUM TRASH BURNING PIT. SOURCE OF CONTAMINATION/RELEASE STILL PRESENT?
crib	4CM	P-11	1951	116 F 6 Crib	SS	NS	NS	NS	NS					X		SITE AND STRUCTURE EXHUMED IN 1974
crib	4CM	216-J and K	1950	Gable Mountain Cribs	D-SS	NS	NS	NS	NS	NS				X		UNDERGROUND CRIBS, RECEIVED VERY LITTLE AQUEOUS SOLUTION. PIPE FOUND TO BE FREE OF RADIOACTIVITY ABOVE BACKGROUND (ACCOUNT LEVELS). REMOVED FROM RADIATION ZONE STATUS.
crib	4CQ		1945	Pickling Acid Crib (9)	?-SS	?	NS	NS	P	NS				X		
landfill	5CQ		1945	Hanford Trailer Camp (9)	?-S	NS	NS	NS	NS	NS					X	PRESUMED TO BE SMALL QUANTITIES OF GENERALLY NONCHEMICAL NATURE.
landfill	3CQ		1970	Horn Rapids Disposal	?-S	NS	NS	ND	NS	NS		X				SITE CONTAINS MAINLY OFFICE WASTE AND OILS & SOLVENTS. BECAUSE OF UNKNOWN QUANTITIES OF ORGANICS, MUST EVALUATE ANY RELEASE.
landfill	4CQ		1945	Sodium Dichromate Barrel	?-S	NS	NS	NS	P	NS				X		EMPTY CRUSHED BARRELS HAD CONTAINED SODIUM DICHROMATE. MUST VERIFY THAT HAZARDOUS CHEMICALS OR OTHER CONTAMINANTS ARE NOT CURRENTLY PRESENT. NO DATA REGARDING DECONTAMINATION OF DRUMS PRIOR TO DISPOSAL. BACKFILLED OVER DRUMS BUT SOME DEBRIS STILL VISIBLE.
landfill	4CQ		1943	White Bluffs City Landfill	D-S ?-SS	?	NS	?	P	NS				X		INDUSTRY/COMMERCIAL, DOMESTIC WASTE. QUANTITIES UNKNOWN. RELEASE MAY STILL BE OCCURING. BULLDOZED AND COVERED WITH CLEAN SOIL.
landfill	4CQ		1979	J.A. Jones No. 1 (9)	ND	NS	NS	NS	NS	NS			X			NONRADIOACTIVE SOLID WASTE, CONSTRUCTION MATERIALS BURIED/COVERED BY CLEAN SOIL.
landfill	4CQ		1943	City of Hanford Landfill	D-S ?-SS	?	NS	?	P	NS				X		INDUSTRIAL & DOMESTIC WASTES. QUANTITIES UNKNOWN. RELEASE MAY STILL BE OCCURING. BACKFILLED AND COVERED WITH CLEAN SOIL.
landfill	4CQ		1960	Midway Landfill No. 1 (9)	D-S ?-SS	NS	NS	?	P	NS				X		DESIGNATED DISPOSAL SITE FOR "ORDINARY" HOUSEHOLD WASTE. MUST VERIFY THAT NO HAZARDOUS RELEASES OCCURING OR RESIDUAL CONTAMINATION. COMMERCIAL/DOMESTIC WASTE SINCE 1950.
landfill	4CQ		1943	East White Bluffs City Landfill	D-S ?-SS	?	NS	?	P *	NS				X		
landfill	3CQ		1970	Midway Landfill No. 2 (9)	?-S,SS	NS	NS	?	P			X				CONTAINS "SMALL QUANTITIES" OF SPENT SOLVENTS, HERBICIDE CONTAINERS, CAPACITOR CELLS. QUANTITIES UNKNOWN. MUST VERIFY AMOUNTS & CHECK FOR RELEASES. COVERED WITH CLEAN FILL AND VEGETATED.
pits	2CM	618-4	1961	Burial Ground No. 4	?-SS	ND	NS	ND	NS			X				URANIUM WASTE; NO CONTAINMENT. RELEASES CONTINUING? COVERED WITH CLEAN SOIL.
pond	2CQ	618-12	1964	North Process Pond Scraping	D-SS	NS	NS	ND	?			X				URANIUM CONTAMINATED SOIL COVERED/BACKFILLED

KEY:
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?- suspected
ND- no data
NS- not suspected
SS- subsurface soil
S- surface soil
P- past air release
C- current air release
F- future air release
X- yes
Blank - no

TABLE 3-27 600 AREA RELEASE POTENTIAL AND NEED FOR ACTION MATRIX (continued)

600 Release Potential and Need for Action Matrix

Unit Type	Site Code	Official Number	Date Last Used	Site Name/ Description	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	Remedi-ation	NEED FOR ACTION: Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	COMMENTS
				Disposal Area												WITH RUN. SITE CLOSURE INADEQUATE, EXPOSURE LIKELY.
tank	3LU	6652-G*	1960	6652-G NLE Field Storage	?-SS	ND	NS	ND	ND				X			INACTIVE SEPTIC TANK. VERIFY NO HAZARDOUS CONSTITUENTS DISPOSED.
tank	3LU		1950s	Army Bunkers Septic Tank (3)	?-SS	ND	NS	ND	ND				X			INACTIVE SEPTIC TANK. VERIFY NO HAZARDOUS CONSTITUENTS DISPOSED.
tank	3LU	6652-C*	1960	6652-C Space Science Labs	?	?	NS	ND	NS				X			INACTIVE SEPTIC TANK. VERIFY NO HAZARDOUS CONSTITUENTS DISPOSED.
trench	3GS	618-6*	1946	Burial Ground No. 6	NS	NS	NS	NS	NS						X	SITE NO LONGER EXISTS. AT 325 BUILDING 1944-46, 303 BUILDING 1952-57, 324 BUILDING 1957-62. LAST RELOCATED TO 618-10 IN '62. BUILDINGS CONSTRUCTED AT PREVIOUS LOCATIONS.
trench	2CM	618-5*	1955	Burial Ground No. 5	?-SS	NS	NS	NS	NS			X				URANIUM WASTE/CONTAMINATED BUILDING MATERIAL. IS WASTE IN MOBILE FORM? RELEASES OCCURING?
trench	1CM	618-1*	1956	300 West Burial Ground	?-SS	?	NS	?	ND		X					DRUMS OF URANIUM CONTAMINATED ORGANIC SOLVENT BURIED. LEAKING LIKELY. BACKFILLED AND STABILIZED (HOW?)
trench	2CM	618-4	1944	Early Waste Burial Ground	?-SS	NS	NS	ND	NS			X				WASTE PRESENTLY COVERED BY PARKING LOT. RELEASES OCCURING?
trench	2CM	618-7	1973	Burial Ground No. 7	?-SS	NS	NS	ND	ND			X				URANIUM, THORIUM WASTES; [illegible] CONTAMINATION. EVALUATE EXTENT OF CONTAMINATION. RELEASES OCCURING? BACKFILLED AND COVERED WITH CLEAN SOIL.
trench	2CM		1956	Original Central Landfill (9)	ND	ND	NS	NS	P	NS		X				IN PAST, WASTES BLEW OFF GENERAL AREA. BACKFILLED TO GRADE.
trench	2CR	618-2	1954	SW Burial Ground No. 2	?-SS	?	NS	NS	? P			X				URANIUM WASTES AND PLUTONIUM FISSION PRODUCTS. NO CONTAINMENT. INCLUDES OXIDES.
trench and pits	2CM	618-1	1956	SW Burial Ground No. 1	?-SS	?	NS	ND	ND			X				URANIUM, PLUTONIUM FISSION PRODUCTS, LAB WASTES. NO CONTAINMENT.
waste pile	2RR	618-13	1950	303 Area Contaminated Soil Burial Ground	Y-SS	NS	ND	NS	? C			X				MOUND OF CONTAMINATED SOIL. UNKNOWN TOTAL RADIOACTIVITY. EXPOSURE POTENTIAL SUBSTANTIAL. POSTED AS RADIATION ZONE.

KEY: * official number not assigned (or identified by unit number) D= documented ?= suspected ND= no data NS= not suspected SS= subsurface soil S= surface soil P= past air release C= current air release F= future air release X= yes Blank= [illegible]

TABLE 3-28 700 AREA RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

700 AREA Release Potential and Need For Action Matrix

Unit Type	Site Code	Official Number	Site Name/ Description	Date Last Used	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	NEED FOR ACTION: Remedi-ation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
tank	410		Underground Waste Solvent Tank CD	ND	ND	ND	ND	ND	ND					X		Tank has been emptied and triple rinsed. Tank is scheduled for removal. Waste was disposed off-site as hazardous waste. Need additional data to confirm no soil contamination.

KEY: * = official number not assigned but identified by unit number; D= documented; ?= suspected; ND= no data; NS= not suspected; SS= subsurface soil; S= surface soil; P= past air release; C= current air release; F= future air release; X= yes; Blank= no

TABLE 3-29 1100 AREA RELEASE POTENTIAL AND NEED FOR ACTION MATRIX

1100 AREA Release Potential and Need For Action Matrix

Unit Type	Site Code	Official Number	Date Last Used	Site Name/ Description	RELEASE POTENTIAL: Soil	Ground Water	Surface Water	Subsurface Gas	Air	Residual Radio-active Structures	NEED FOR ACTION: Remedi-ation	Verify No Release	Verify No Hazardous Constituents	Verify No Residual Contamination	No Further Action Required	Comments
ground disposal	1E8	UPR-1100-2	1988	disposal on railroad tracks	D-S	NS	?	?	P		X					est. total disposal of 3000 gal over 30 yrs.
pit	1E8	UPR-1100-1	1977	sand pit	?	NS	NS	NS	NS		X					saturated sand removed periodically and replaced with new sand.
pit	1F8	UPR-1100-3	1988	sand pit	?	?	NS	?	P		X					materials appear to be in place. Wash water also disposed.
tank	4G8	UPR-1100-4	pre-1978	underground disposal tank	?	NS	NS	?	NS					X		antifreeze not hazardous constituent under RCRA. Can be toxic waste under WAC. Residual waste should be removed.

KEY: # = official number not assigned but identified by unit number; D= documented; ?= suspected; ND= no data; NS= not suspected; SS= subsurface soil; S= surface soil; P= past air release; C= current air release; F= future air release; X= yes; Blank= no

construction of the unit or the nature of the wastes or both. Verification of no hazardous constituents is selected where a solid waste generally posing little threat (such as sanitary wastewater) may have served as a source of release of hazardous constituents based on the nature of the operations served. Verification of no residual contamination is selected where action has been taken to remediate a release to the environment but documentation of findings is incomplete or chemical contamination from a mixed waste spill does not appear to have been adequately assessed/addressed by the actions identified. The time period over which the site was used, the volume of waste disposed, and the time since last use of the site were all considered in making these assessments.

The final activity in evaluating the need for action was to code each site based on the waste type and action area identified. The three digit code appears under the column "Site Code." This three digit code allows identification of each site's need for action and was used for additional site sorting and for prioritizing sites. Scheduling site priorities for the master characterization and remediation schedule.

The first digit of the code refers to the need for action; this code is a numeric code assigned as follows:

1 = Site requires remediation (and characterization prior to remediation)
2 = Site requires verification of no release
3 = Site requires verification of no hazardous constituents
4 = Site requires verification of no residual contamination
5 = No further action required.

The code was assigned to reflect the most to least "pressing" status of a unit.

The second digit of the code refers to the unit type. Each site in an area received an alphabetic code designating the unit type. The inactive sites present at Hanford cover a wide variety of designs, but many of them function in the same general manner for waste disposal or dispersion and can thus be grouped into distinctive "types." These unit type codes have been developed to uniquely identify sites based on construction, operation, and environmental releases as a result of operations in order to select one "in-place" remediation technique for that situation. The codes developed for each type of unit are as follows:

SOLID WASTE SITES
- o A - aboveground covered landfill
- o B - aboveground uncovered landfill
- o C - belowground covered landfill
- o D - belowground uncovered landfill

LIQUID WASTE SITES
- o E - surface impoundments (includes large bottom percolation systems, ponds, etc.)
- o F - ditches (includes bottom/side dispersion systems-ditches, small trenches)
- o G - underground dispersion systems (french drains, tile fields, cribs)
- o H - aboveground tank
- o I - underground tank
- o J - spills

MISCELLANEOUS
- o K - underground vault
- o L - burning pit
- o M - incinerator
- o N - process sewer
- o O - other.

In this designation system, "covered" landfill is defined as a landfill or waste pile where some material has been placed on top of the wastes (soil, gravel, ash, etc.) rather than an engineered structure. "Uncovered" landfill is defined as a landfill or waste pile in which the wastes are exposed.

The third digit of the site code refers to the nature of the waste managed in the unit. The code is an alphabetic code assigned as follows:

Q = solid/hazardous wastes = nonradioactive wastes
R = radioactive waste = does not include chemical wastes
M = mixed wastes = wastes with both chemical and radioactive components.

Appendix D-2 presents a listing of the potential RCRA 3004(u) sites by Hanford Area. The sites in each area are sorted by the need for action code.

3.2.3 Characterization Costing Strategy

As described above, potential RCRA 3004(u) sites have been matched to one of the following four categories:

- o Verify no residual contamination
- o Verify no hazardous constituents
- o Verify no release
- o Characterize for remediation.

In order to develop costs for the potential 3004(u) sites, the following strategy was applied:

1. Segregate sites on the basis of the Hanford Area by hydrogeologic setting (nearby or shallow groundwater versus distant or deep groundwater). The distance to groundwater will impact the depths of groundwater monitoring wells or soil borings and thus, their costs, schedule time, and manpower requirements.

2. Estimate the dimensions of a generalized Hanford unit for each of the 15 types of units identified (A-O). Sampling and remediation strategies can then be applied to these generalized units for costing purposes.

3. Develop a sampling strategy for each of the four characterization categories.

4. Estimate sampling and characterization costs.

The following sections address each of these steps in further detail.

3.2.3.1 Classification by Hydrogeologic Setting

The potential 3004(u) sites requiring action were sorted into two groundwater regions. Table 3-30 presents the sites located near shallow groundwater (average depth to groundwater, 40 feet) or deep groundwater (average depth to groundwater, 245 feet). Tables 3-31 and 3-32 summarize the number of each type of potential 3004(u) summarize the number of each type of potential 3004(u) site in each characterization category within each of the two hydrogeologic settings.

At sites located in the region of shallow groundwater, it is assumed that liquid contaminants released on land infiltrated the sandy soil and were transported through the vadose zone to the aquifer. Once reaching the aquifer, groundwater flows towards the Columbia River transporting contaminants to the River. The shallow groundwater region is located nearest to the Columbia River and includes the 100 areas, 300 area, sections of the 600 area, the 700 area, and the 1100 area.

At sites located in the region of deeper groundwater, it is assumed that, in general, contaminants precipitate or absorb to the soil particles in the upper ten to forty feet of the soil column. Additionally, in the deep groundwater region, a caliche layer and clay lenses exist which could promote lateral spread of contaminants. Vadose zone and groundwater plumes of contamination are expected. Sampling data for some sites have shown contaminants at 130 feet below surface as well as groundwater contamination. The depth required for soil and groundwater sampling are far greater for this area than the shallower areas, will require deeper sampling, and will have a greater cost. The deep groundwater region includes the 200 areas, the 400 areas, and some of the 600 area sites.

The 600 area sites were divided into deep or shallow groundwater sites based on location. Appendix D-3 provides a listing of the 600 area sites by hydrogeologic setting.

TABLE 3-30 DISTRIBUTION OF WASTE UNIT TYPES IN AREAS WITH SHALLOW VERSUS DEEP GROUNDWATER

UNIT TYPE	(CODE)	SHALLOW GROUNDWATER AREA	DEEP GROUNDWATER AREA	TOTAL
Aboveground covered landfill	(A)	1	0	1
Abovegound uncovered landfill	(B)	0	1	1
Belowground covered landfill	(C)	41	31	72
Belowground uncovered landfill	(D)	0	2	2
Surface impoundments (includes large bottom percolation systems, ponds, trenches, etc)	(E)	10	77	87
Ditches (includes bottom/side dispersion systems)	(F)	2	8	10
Underground dispersion systems (french drains, tile fields, cribs)	(G)	54	76	130
Aboveground tank	(H)	9	9	18
Belowground tank	(I)	20	98	118
Spills	(J)	5	8	13
Underground vault	(K)	1	8	9
Burning Pit	(L)	8	2	10
Incinerator	(M)	0	1	1
Process Sewer	(N)	1	1	2
Other	(O)	4	2	6
TOTAL		156	327	480

TABLE 3-31 DEEP GROUNDWATER SITES*

Unit Type	Verify No Residual Contamination	Verify No Hazardous Constituents	Verify No Release	Characterize for Remediation	Total
A					0
B			1		1
C	13	3	9	6	31
D		1		1	2
E	60		1	16	77
F	2			6	8
G	42	7	1	26	76
H			4	5	9
I	3	3	44	51	101
J	4		1	3	8
K	3		4	1	8
L	2				2
M			1		1
N				1	1
O	1		1		2
TOTAL	130	14	67	116	327

*Includes the following Hanford Areas: 200 East, 200 West, 200 North, 400 and 600 (some)

TABLE 3-32 SHALLOW GROUNDWATER SITES*

Unit Type	Verify No Residual Contamination	Verify No Hazardous Constituents	Verify No Release	Characterize for Remediation	Total
A			1		1
B					0
C	10	3	27	1	41
D					0
E	1	1	1	7	10
F				2	2
G	25	21		8	54
H	5		4		9
I	2	4	6	8	20
J	1			4	5
K				1	1
L	6		1	1	8
M					
N			1		1
O	1		3		4
TOTAL	51	29	44	32	156

*Includes the following Hanford Areas: 100 B/C, 100 D/DR, 100 F, 100 H, 100 KE/KW, 100 N, 300, 700, 1100, and 600 (some)

3.2.3.2 Generalized Hanford Units

The next step in the characterization process was to develop a method to group all of the potential RCRA 3004(u) sites into a generic classification system based on the fifteen types of sites identified in Section 3.2.1. Providing a characterization and remediation cost for individual units was beyond the scope of this work. Therefore, generalized Hanford waste units were developed to represent the identified 3004(u) waste sites.

For each of the 15 sites, a generalized unit was developed from the data provided for actual Hanford sites. Two methods of data analysis were used: (1) if the number of sites within a given type of site is less than 20, then all sites were considered in the analysis; (2) if the type of site contains more than 20 sites, approximately only ten percent of the sites, chosen randomly among all areas of the Hanford Reservation, were considered in the analysis.

The characteristics of the generalized Hanford unit, such as the dimensions of the structure, method of waste emplacement, average service life, etc., were developed on the basis of the selected units within that type of site. For example, the dimensions of the generalized surface impoundment are calculated as an average of the dimensions of the impoundments selected under a type "E" site. Descriptions of the generalized Hanford units developed for each type of site are provided in Appendix C.

3.2.3.3 Characterization Techniques and Unit Costs

The methodologies used to characterize sites include reviewing historical data and documentation for the sites, waste unit sampling, soil sampling, and groundwater monitoring. These techniques have been selected as appropriate because these represent the basic characterization techniques used in the RCRA 3004(u) program and in RCRA closure and groundwater corrective action programs.

Table 3-33 summarizes the type of characterization technique(s) selected for each different characterization activity. In most cases, the

TABLE 3-33 CHARACTERIZATION TECHNIQUES

Characterization Categories	Characterization Techniques			
	File Search	Sample Waste Unit	Soil Sampling	Groundwater Sampling
Verify no residual contamination	X		X	
Verify no hazardous constituents	X	X		
Verify no release	X		X	
Characterize for remediation	X		X	X

same series of techniques may apply to more than activity because the characterization issues are similar. In order to estimate costs for characterization, the techniques noted in Table 3-33 were applied to the four categories of characterization for each generalized Hanford unit (as appropriate). These form the basis of the characterization cost estimates.

For all sites, the file review is recommended because it is an inexpensive method of obtaining data that can facilitate hazardous constituent release and residual contamination determinations. It may also assist in determining whether hazardous constituents are present without requiring sampling. This information also contributes to development of sampling and analysis plans and health and safety plans for field activities.

Sampling the actual waste unit is recommended only to make determinations that no hazardous constituents are present.

Soil sampling with a minimum number of four samples per site, is recommended for sites requiring characterization to verify no residual contamination, to verify no release, or to remediate.

Groundwater monitoring using minimum well configurations of at least one upgradient and three downgradient wells is recommended only for sites that will be undergoing remediation. Soil sampling is adequate to make further decisions on sites designated as requiring verification.

Table 3-34 presents an overview of the verification process based on the type verification sampling conducted. A site match into one of the categories (I, II, or III) identified in Table 3-34 as described above. The outcome of verification is to further refine the separation of sites into those that are not subject to RCRA 3004(u) that require no further action, or that require remediation. Sites identified as potentially requiring remediation will undergo an RI/FS process similar to that for CERCLA sites.

The details of the characterization techniques and the basis for estimating the number of samples, borings, or wells for each generalized Hanford unit are described below.

TABLE 3-34 NEED FOR ACTION (VERIFICATION PROCESS)

I. Verify no hazardous constituents are present

   A. If present, evaluate release potential and determine additional need for action
   B. If not present, site not subject to RCRA 3004(u)

II. Verify no release of hazardous constituents occurred

   A. Sampling program should include the following
      1. sampling to verify release of hazardous constituents
      2. sampling to determine levels of residual contamination
      3. evaluations of potential future release that may require additional investigation as part of this effort.
   B. If no contamination is found and there is no potential for future release, then no further action is required
   C. If no contamination is found and there is potential for future release, then remediation must be performed to prevent future release
   D. If contamination is found, then remediation must be performed to address residual contamination

III. Verify no residual contamination remains from past/present releases or insufficiently documented cleanups

   A. Sampling program should include the following
      1. sampling to verify no residual contamination remains
      2. sampling to determine residual levels of contamination
      3. evaluations of potential future releases that may require additional investigation as part of this effort
   B. If no contamination found and there is no potential for future release, then no further action is required
   C. If no contamination is found and there is potential for future release, then remediation must be performed to prevent future release
   D. If contamination is found, then remediation must be performed to address residual contamination.

Evaluation of Existing Data

Characterization of all sites first requires a review of the information available in incident reports, historical documentation, and other file materials to provide current sampling data, sampling and analytical records on decontamination or cleanup, engineering diagrams of waste flows, and waste constituents. Investigators compile the data to determine the adequacy of the data and documentation to support the development of remedial actions or to demonstrate the absence of a problem. This review may determine the need for additional environmental monitoring and would facilitate development of a sampling and analysis plan and a health and safety plan.

Sampling plans need to be developed for the inactive waste sites designated for verification of no release, verification of no hazardous constituents, and verification of no residual contamination. These plans should be developed on a site-specific basis (or within a grouping) so that the media affected and the techniques employed are most appropriate to the site situation and configuration. The sampling plans should identify the purpose of the study, the media to be sampled, the sampling locations, sampling and decontamination techniques, data management and sample chain of custody requirements, analytical parameters selected and health and safety requirements. The sampling programs should be geared towards documenting that there is no problem. If contamination problems are encountered, then the site will need to be re-evaluated for further action.

Similar sampling and analysis plans would be developed for sites being characterized for remediation. However, the focus of these plans would be in determining the nature and extent of contamination and to obtain data needed for a feasibility study.

For the purpose of developing characterization costs, this technique is assumed to cost ten percent of the total characterization cost to a maximum of $100,000. The costs associated with developing remediation activities are not included in this cost.

Waste Unit Sampling

Sampling the actual waste unit is recommended only to make determinations that no hazardous constituents are present. The cost of sampling the waste unit is assumed to result from analysis of three samples for constituents from the full RCRA 40 CFR 261 Appendix VIII or IX scan. For most units, this technique requires sampling and analysis of residual waste; however, for incinerators, since sludge is not present, the sample is a wipe from the incinerator facility and the sample frequency is increased to ten samples.

The cost of sampling the waste unit is estimated a $7,000 per sample. However, for underground units where drilling and soil removal is necessary to sample the site, the cost is increased to $8,700 per sample to cover the cost of drilling down to the the wastes. The increased cost results from the cost of drilling to a depth of 20 feet from the surface at an average cost of $85 per foot of drilling to extract a sample. The only units for which the $8,700 per sample cost applies are underground landfills.

Groundwater Monitoring

Groundwater monitoring wells are used to characterize groundwater quality, determine the absence of contamination, and, where necessary, the extent of contamination.

For this characterization strategy, wells are considered to be placed in a configuration that includes one upgradient well and three downgradient wells per site. This is based on the RCRA Groundwater Monitoring Technical Enforcement Guidance Document and the requirements of 40 CFR 264.90, as well as Washington State regulations WAC173-304-490 and 173-160. Well spacing is estimated at 150 feet between wells based on the EPA guidance for RCRA groundwater monitoring. The actual configuration of wells onsite may vary from this general configuration because sites which are adjacent to one another may need to be considered as one larger site for site characterization. Site size (small, large) will also affect the actual spacing.

Groundwater monitoring using minimum well configurations of at least one upgradient and three downgradient wells is recommended only for sites requiring characterization for remediation.

In order to develop costs for characterization, each type of site was be assumed to have a one upgradient and three downgradient wells spaced at 150 feet. Based on this, it is assumed that the numbers of wells should be increased if the longest dimension of the unit is greater than 400 feet. The following formula was used to determine the numbers of downgradient wells for generalized Hanford units with a length or width dimension greater than 400 feet:

$$\frac{\text{length of largest side}}{150\text{ ft}} + 1$$

The number of upgradient wells are calculated as 1/3 the number of downgradient wells. It is also assumed that the direction of groundwater flow is through the shortest dimension of the site (i.e., the longest side is oriented perpendicular to groundwater flow).

In order to determine the costs associated with groundwater monitoring, it was assumed that one groundwater sample was collected from each well at a cost of approximately $7,100 per sample. The monitoring wells were assumed to be installed ten feet into the aquifer resulting in well installation depths of 50 feet (shallow groundwater areas) and 255 feet (deep groundwater areas). The costs for monitoring well installation are presented in Section 2. When adding this cost to the cost of sampling, a total cost (rounded) of $12,200 for shallow areas and $33,200 for deep groundwater areas was obtained and used for calculating the costs of groundwater monitoring.

Exceptions to the above strategy for site characterization occur for several generalized Hanford units. For incinerators and aboveground tanks (site type M and H) which required characterization for remediation, groundwater monitoring was not applied because contamination is expected to remain in the enclosed building housing the tank or in soil and not reach the groundwater. The same strategy was applied to the process sewers (N) and the units categorized as "other" (O, primarily wastewater pumping stations), because these units are expected to consist of pipes in buried units or trenches which do not have as high potential for liquid waste releases to groundwater as to soil. Additionally, groundwater wells spaced at 150-foot intervals around such a large site would be excessively expensive while providing proportionately little additional data. Soil borings were used to replace soil samples from the monitoring wells for process sewers (N), aboveground tanks (4), and other units (0). For the exceptions listed above, the characterization costs were adjusted accordingly.

Soil Sampling

Soil sampling, where soil borings are collected at least on each of the four sides of the site, is recommended for sites requiring characterization to verify no residual contamination, to verify for no release, or characterize for remediation.

For sites identified for remediation, soil core monitoring or soil sampling during monitoring well installation will be used to determine whether contamination is present in the uppermost soil column onsite, or to determine if contaminants remained onsite or have been released. The constituents to be monitored include the full scan of RCRA 40 CFR 261 Appendix VIII or IX constituents.

Soil samples collected during groundwater monitoring well installation, in the deep groundwater areas, are collected at five-foot intervals to a depth of 255 feet, which is ten feet below the groundwater table. Samples in the shallow groundwater areas are collected at two-foot intervals during monitoring well installation. Soil samples collected from monitoring wells include 28 samples from shallow wells and 56 samples from deep wells. The unit costs of soil sample analysis during groundwater monitoring well construction are $7,000 per sample. These costs are based on the sampling cost data provided in Section 2.

Soil borings in areas where groundwater monitoring wells are not included in site characterization are placed according to the length of the perimeter of the unit, as follows:

- o Up to 500 feet, every 50 feet on each side
- o Greater than 500 feet, every 100 feet on each side.

In the shallow groundwater areas, soil boring samples are collected every two feet to a depth of 30 feet. In the deep groundwater areas where liquid wastes are disposed, samples are collected every two feet to a depth of 100 feet and for dry waste sites every two feet to a depth of 50 feet. The sites which are considered "liquid" sites are those where a substantial amount of liquid was placed over the life of the unit and include: surface impoundments, ditches, and underground dispersion systems. Spills were not included as liquid sites.

In addition to the samples specified above, an increase in the sample numbers by ten percent was applied for all soil samples in order to account for duplicates and spikes for the analysis. Therefore, for soil borings in the shallow area, 17 samples are collected per boring. From soil borings in the deep groundwater area at units which contained liquid waste, 55 samples are collected per boring; in non-liquid units, 28 samples were collected per boring.

The cost of obtaining and analyzing samples from soil borings is approximately $7,100 per sample (refer to Section 2 for development of these costs).

The following exceptions to the above-described monitoring strategy were identified applied:

- o For ditches (F units), the number of borings to be completed to verify for no release and verify for no residual contamination for the generic site was decreased because of the large size of the generalized Hanford (over 2,000 feet). This would require 82 borings under the strategy presented above. The unit is not very wide, so it was determined that half as many borings would provide adequate data. A strategy of alternating sampling locations over

100-foot intervals on either side of the site was chosen for an overall interval of 200-foot spacing between borings. One boring on each end of the ditch was also included.

- For verifying no release in aboveground tanks (H), the soil samples are to be taken at two-foot intervals to a depth of 6 feet in each boring.

- For the "other" category (O), soil sampling was determined to be needed only to a depth of 30 feet in the shallow and deep groundwater areas because the potential for liquid release is low.

- Soil monitoring at the incinerators (M) to verify no release will be replaced by collecting ten wipe samples of the incinerator.

- For characterizing process sewers (N) for remediation, soil sampling was applied to a depth of 30 feet at two-foot intervals instead of using monitoring wells.

- For spills (J), a soil sampling depth of 20 feet was determined to be adequate to characterize for no release and no residual contamination.

For each of the above-listed bullets the characterization cost estimate has been adjusted accordingly.

Other Methods

Other methods of site characterization are applicable to the waste management units on a case-by-case basis, but it is beyond the scope of this project to apply these methods to the generic sites in calculating the costs for characterization in this section. Other potentially applicable site characterization methods include test pit excavation for direct observations of subsurface conditions; piezometer installation and monitoring; soil gas sampling and analysis; grab sampling of air, wastes, surface soils, surface water and/or sediments; remote sensing; aquifer tests; modeling; aerial photography; long-term groundwater monitoring; and infrared imagery for identifying areas of vegetative stress or contamination.

3.2.4. Summary of Characterization Costs

The process for estimating the characterization and remediation cost for the 3004(u) sites consists of the following steps:

(1) For each waste site type, develop a generic waste unit description and dimensions (entitled "generalized Hanford unit).

(2) Identify the number of units associated with each generalized Hanford unit.

(3) Apply the generic characterization strategy methodology to each generalized Hanford unit.

(4) Apply the unit costs to all sites each generalized Hanford unit with each characterization category, and obtain an estimated total cost for all sites.

For each Hanford area, the number of waste units within each type of waste site are counted and the results were listed earlier in Table 3-30. A detailed description of the generalized Hanford units and the numbers of samples required under the characterization strategy are presented in Appendix C.

Tables 3-35 and 3-36 present the estimated costs for characterization of the RCRA 3004(u) sites. Table 3-35 presents the costs for sites located in shallow groundwater areas while Table 3-36 presents the costs for sites located in the deep groundwater areas. The costs are developed based on the type of characterization anticipated (verify no residual contamination, verify no hazardous constituents, verify no release, or remediation). The characterization cost for the shallow groundwater area sites $166 million. The characterization cost for the deep groundwater area sites is $1.07 billion. The total characterization cost for the RCRA 3004(u) sites is $1.24 billion on an individual site basis. Reductions in these costs through site groupings are addressed in Section 4.

TABLE 3-36 CHARACTERIZATION COSTS FOR DEEP GROUNDWATER AREAS

DEEP AREA CHARACTERIZATION COSTS

	VERIFY FOR NO HAZARDOUS CONSTITUENTS						VERIFY FOR NO RELEASE						VERIFY FOR NO RESIDUAL CONTAMINATION						CHARACTERIZE FOR REMEDIATION					
		Strategy						Strategy						Strategy						Strategy				
UNIT TYPE	No. of Sites	Plan-ning	GW Mon. Well	Unit Sampling	Cost Per Site ($)	Total Cost ($)	No. of Sites	Plan-ning	GW Mon. Well	Soil Sampling	Cost Per Site ($)	Total Cost ($)	No. of Sites	Plan-ning	GW Mon. Well	Soil Sampling	Cost Per Site ($)	Total Cost ($)	No. of Sites	Plan-ning	GW Mon. Well	Soil Sampling	Cost Per Site ($)	Total Cost ($)
A. ABOVEGROUND COVERED LANDFILL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B. ABOVEGROUND UNCOVERED LANDFILL	0	0	0	0	0	0	1	100,000	0	560	4,076,000	4,076,000	0	0	0	0	0	0	0	0	0	0	0	0
C. BELOWGROUND COVERED LANDFILL	3	2,800	0	3	28,900	86,700	9	100,000	0	560	4,076,000	36,684,000	13	100,000	0	560	4,076,000	52,988,000	6	100,000	4	224	1,800,800	10,804,800
D. BELOWGROUND UNCOVERED LANDFILL	1	2,800	0	3	28,900	28,900	0	0	0	0	0	0	0	0	0	0	0	0	1	100,000	14	844	6,472,800	6,472,800
E. SURFACE IMPOUNDMENT	0	0	0	0	0	0	1	100,000	0	770	5,567,000	5,567,000	60	100,000	0	770	5,567,000	334,020,000	16	100,000	6	336	2,651,200	42,419,200
F. DITCH	0	0	0	0	0	0	0	0	0	0	0	0	2	100,000	0	1,265	9,081,500	18,163,000	6	100,000	20	1,120	8,604,000	51,624,000
G. UNDERGROUND DISPERSION SYSTEM	7	2,800	0	3	28,900	202,300	1	100,000	0	220	1,662,000	1,662,000	42	100,000	0	220	1,662,000	69,804,000	26	100,000	4	224	1,800,800	46,820,800
H. ABOVEGROUND TANK	0	0	0	0	0	0	4	11,400	0	16	125,000	500,000	0	0	0	0	0	0	5	11,400	0	16	125,000	625,000
I-1. UNDERGROUND TANK	3	2,100	0	3	23,100	69,300	42	80,000	0	112	875,200	36,758,400	3	80,000	0	112	875,200	2,625,600	133	100,000	4	224	1,800,800	239,506,400
I-2. UNDERGROUND TANK	0	0	0	0	0	0	2	80,000	0	112	875,200	1,750,400	0	0	0	0	0	0	48	100,000	4	224	1,800,800	86,438,400
J. SPILLS	0	0	0	0	0	0	1	31,200	0	44	343,600	343,600	4	31,200	0	44	343,600	1,374,400	3	100,000	4	224	1,800,800	5,402,400
K. UNDERGROUND VAULT	0	0	0	0	0	0	4	80,000	0	112	875,200	3,500,800	3	80,000	0	112	875,200	2,625,600	1	100,000	4	224	1,800,800	1,800,800
L. BURNING PIT	0	0	0	0	0	0	0	0	0	0	0	0	2	80,000	0	112	875,200	1,750,400	0	0	0	0	0	0
M. INCINERATOR	0	0	0	0	0	0	0	0	0	0	0	0	1	7,100	0	10	78,100	78,100	0	0	0	0	0	0
N. PROCESS SEWER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100,000	0	714	5,098,000	5,098,000
O. OTHER	0	0	0	0	0	0	1	48,300	0	68	531,100	531,100	1	48,300	0	68	531,100	531,100	0	0	0	0	0	0
TOTAL						387,200						91,373,300						483,960,200						497,012,600
GRAND TOTAL																								1,072,733,300

TABLE 3-35 CHARACTERIZATION COSTS FOR SHALLOW GROUNDWATER AREAS

SHALLOW AREA CHARACTERIZATION COSTS

UNIT TYPE	VERIFY FOR NO HAZARDOUS CONSTITUENTS: No. of Sites	Strategy: Plan-ning	Strategy: GW Mon. Well	Strategy: Waste Unit Sampling	Cost Per Site ($)	Total Cost ($)	VERIFY FOR NO RELEASE: No. of Sites	Strategy: Plan-ning	Strategy: GW Mon. Well	Strategy: Soil Sampling	Cost Per Site ($)	Total Cost ($)
A. ABOVEGROUND COVERED LANDFILL	0	0	0	0	0	0	1	47,396	0	68	521,356	521,356
B. ABOVEGROUND UNCOVERED LANDFILL	0	0	0	0	0	0	0	0	0	0	0	0
C. BELOWGROUND COVERED LANDFILL	3	2,800	0	3	28,900	86,700	27	100,000	0	340	2,469,800	66,684,600
D. BELOWGROUND UNCOVERED LANDFILL	0	0	0	0	0	0	0	0	0	0	0	0
E. SURFACE IMPOUNDMENT	1	2,800	0	3	28,900	28,900	1	100,000	0	238	1,758,860	1,758,860
F. DITCH	0	0	0	0	0	0	0	0	0	0	0	0
G. UNDERGROUND DISPERSION SYSTEM	21	2,800	0	3	28,900	606,900	0	0	0	0	0	0
H. ABOVEGROUND TANK	0	0	0	0	0	0	4	11,150	0	16	122,670	490,680
I-1. UNDERGROUND TANK	4	2,100	0	3	23,100	92,400	6	47,396	0	68	521,356	3,128,136
J. SPILLS	0	0	0	0	0	0	0	0	0	0	0	0
K. UNDERGROUND VAULT	0	0	0	0	0	0	0	0	0	0	0	0
L. BURNING PIT	0	0	0	0	0	0	1	47,396	0	68	521,356	521,356
M. INCINERATOR	0	0	0	0	0	0	0	0	0	0	0	0
N. PROCESS SEWER	0	0	0	0	0	0	1	100,000	0	714	5,076,500	5,076,500
O. OTHER	0	0	0	0	0	0	3	47,396	0	68	521,356	1,564,068
TOTAL						814,900						84,485,236

UNIT TYPE	VERIFY FOR NO RESIDUAL CONTAMINATION: No. of Sites	Strategy: Plan-ning	Strategy: GW Mon. Well	Strategy: Soil Sampling	Cost Per Site ($)	Total Cost ($)	CHARACTERIZE FOR REMEDIATION: No. of Sites	Strategy: Plan-ning	Strategy: GW Mon. Well	Strategy: Soil Sampling	Cost Per Site ($)	Total Cost ($)
A. ABOVEGROUND COVERED LANDFILL	0	0	0	0	0	0	0	0	0	0	0	0
B. ABOVEGROUND UNCOVERED LANDFILL	0	0	0	0	0	0	0	0	0	0	0	0
C. BELOWGROUND COVERED LANDFILL	10	100,000	0	340	2,469,800	24,698,000	1	79,720	4	112	888,120	888,120
D. BELOWGROUND UNCOVERED LANDFILL	0	0	0	0	0	0	0	0	0	0	0	0
E. SURFACE IMPOUNDMENT	1	100,000	0	238	1,758,860	1,758,860	7	100,000	4	112	908,400	6,358,800
F. DITCH	0	0	0	0	0	0	2	100,000	20	560	4,142,000	8,284,000
G. UNDERGROUND DISPERSION SYSTEM	25	47,396	0	68	521,356	13,033,900	8	100,000	4	112	908,400	7,267,200
H. ABOVEGROUND TANK	5	11,150	0	16	122,670	613,350	0	0	0	0	0	0
I-1. UNDERGROUND TANK	2	47,396	0	68	521,356	1,042,712	8	100,000	4	112	908,400	7,267,200
J. SPILLS	1	47,396	0	68	521,356	521,356	4	100,000	4	112	908,400	3,633,600
K. UNDERGROUND VAULT	0	0	0	0	0	0	1	79,720	4	112	888,120	888,120
L. BURNING PIT	6	47,396	0	68	521,356	3,128,136	1	79,720	4	112	888,120	888,120
M. INCINERATOR	0	0	0	0	0	0	0	0	0	0	0	0
N. PROCESS SEWER	0	0	0	0	0	0	0	0	0	0	0	0
O. OTHER	1	47,396	0	68	521,356	521,356	0	0	0	0	0	0
TOTAL						45,317,670						35,475,160
GRAND TOTAL												166,092,966

3.3 REMEDIATION STRATEGY

The process and criteria used to select a remedial alternative for a 3004(u) site is essentially the same as that for a CERCLA site. Under current EPA policy and guidance, a SWMU requiring corrective action will undergo an RI/FS process. The basic difference in the selection process involves the cleanup criteria and cost.

Under SARA, CERCLA site cleanups must comply with ARARs. The RCRA program does not have this requirement. Therefore, RCRA actions at this time must be consistent with the RCRA cleanup standards under the closure standard, groundwater corrective action, and land disposal prohibitions. The closure standard requires that a site be cleaned up to background concentrations or closed in compliance with the closure and post-closure requirements for a RCRA landfill. Groundwater corrective action requires cleanup to background concentrations or generic drinking water standards (such as MCLs) applicable to all facilities. Health-based standards specific to the situation (alternate concentration limits or ACLs) may be proposed for site closure or groundwater corrective action. The land disposal prohibitions require that wastes to be disposed into "land" units (such as a new landfill constructed as part of a remedial action) must meet certain concentration limits or disposal is not allowed.

As the RCRA program currently stands, cleanup to background concentrations is the established requirement with which corrective actions must be consistent. Allowances are made to pursue other standards (MCLs and ACLs, as identified above) as an alternative, but this would be made on a case-by-case basis through submission of data and negotiation with the State of Washington and EPA Region X.

It should be noted that one approach under consideration in promulgating the RCRA corrective action regulations is for EPA to establish health-based cleanup target levels in each medium. The draft regulations are currently being prepared and EPA's commitment to this alternative is not yet established.

Another area of difference between RCRA 3004(u) and CERCLA cleanups is that cost is not a factor in selecting remediation at 3004(u) sites. All other factors identified in Section 2 regarding the cost-effectiveness evaluation would still apply.

Section 3.3.1 provides an overview of the remediation strategy. Section 3.3.2 discusses the in-place remediation techniques identified for the inactive sites. The technologies selected and the basis for the selection are also identified. Section 3.3.3 discusses the exhumation alternative and the assumptions made regarding the applicability and implementation of the technique to the Hanford sites. Section 3.3.4 presents the unit costs associated with each remediation technique and activity. Section 3.3.5 presents a summary of the potential remediation costs for the RCRA 3004(u) sites.

3.3.1 Overview of the Remediation Strategy

The remediation strategy has been developed based on identification of remediation techniques suitable to the types of sites identified in the characterization effort as potentially requiring remediation. The Statement of Work for this project required that exhumation be considered in all cases and that one applicable in-place remediation technique be selected for each type of unit. Together, these two techniques, on a site-by-site basis, are assumed to provide the range of effort and cost required to address site problems.

Approximately 70 remediation techniques are available to remediate RCRA 3004(u) sites. These are listed in Appendix A. Of these, fifteen were selected as potentially applicable techniques at Hanford for the purposes of developing budgetary estimates. To identify the potential remediation techniques to be applied to the generalized Hanford units, a broad engineering analysis was performed which included review of available remediation techniques by SAIC engineers and geologists. The criteria for selecting potentially applicable remediation techniques included cost, manpower requirements, equipment requirements, and release/dispersal effects in the local hydrogeologic settings. The remedial technique or combination of techniques that will actually be implemented will depend on the results of an engineering feasibility study ultimately conducted for each site.

3.3.2 Selection of In-Place Remediation Techniques

In-place remediation techniques are defined in this report to include remedial actions that generally do not require the removal of the waste and contaminated soil from the unit. Instead, application of these techniques will remove contaminants or immobilize the contaminants within the local area surrounding the unit.

Of the 15 generalized Hanford units, only 11 have been identified as potentially requiring remediation: belowground landfill (covered, uncovered), surface impoundments, ditches, underground dispersion systems, aboveground tanks, belowground tanks, spills, underground vaults, burning pit, and process sewer. A review of the available information concerning remedial techniques for such waste sites indicates that eight techniques are generally applicable to these units:

- Soil flushing
- Soil treatment
- Grout-in-place
- In-situ vitrification
- Cap/cover
- Subsurface barriers
- Groundwater pumping and treatment
- In-place decontamination.

Each of these techniques is explained briefly in Appendix B. It should be noted that on a site-specific basis these techniques may or may not be the preferred remediation technique. In general, the final remediation technique is selected through a feasibility study and often involves multiple technologies. The technologies identified above are anticipated to be appropriate for the type and number of units considered in this analysis.

For the RCRA 3004(u) sites, one in-place remedial technique for each type of generalized Hanford unit identified in Section 3.2 was selected according to the following steps. The first step for each type of waste unit is to review all of the potential in-place remedial actions described above, and generate a preliminary set of techniques that appear to be applicable for the remediation of that unit. The second step is to select the most appropriate remedial action for the unit from the preliminary set of remediation techniques. The results of this exercise are presented in Table 3-37 and the basis for selecting each remediation technique is described below. The selection process focused on techniques that could permanently resolve contamination problems to be consistent with current RCRA program strategy.

In general, for waste disposal unit types E (surface impoundments), F (ditches), and G (underground dispersion systems) that received liquid waste, groundwater pumping and treatment is selected as the in-place remediation technique for this analysis. This selection is based on the following assumptions: (1) most, if not all, of the wastes disposed of have reached the groundwater, and (2) wastes still in the vadose zone have sufficient liquid present to permit pumping. Other in-place treatment techniques such as soil treatment, capping/covering, etc., may effectively control the migration of any remaining contaminants in at least part of the soil column beneath the unit. However, the contamination to the groundwater still remains untreated. Only soil flushing appears to one of the techniques that may be applicable to contaminants in the soil column. A disadvantage of soil flushing is that effective containment and collection of the elutriate is difficult. In soil flushing, the potential for mobilizing some contaminants and allowing others to remain in place exists.

Based on the above considerations, groundwater pumping and treating is <u>generally</u> considered to be the most appropriate method for removing the contamination from the groundwater for the purposes of this analysis. It is further assumed that any contaminants that remain in the unsaturated region and cannot be pumped out will remain absorbed the soil, and will not migrate to groundwater.

In practice, groundwater recovery and treatment is not generally conducted alone. It is often more appropriate to consider additional in-place techniques such as capping/covering sealing and partial excavation to complete the remedial action for these sites. Also, it should be noted that selection of one remediation technique for a general type of problem

TABLE 3-37 POTENTIAL IN-SITU REMEDIAL ACTIONS FOR WASTE UNITS

Type of Waste Units	POTENTIAL IN-SITU REMEDIAL ACTIONS								Comments
	Soil Flushing	Soil Treatm.	Grout-in-Place	In-situ Vitrif.	Cap/ Cover	Subsurface Barrier	Grd Wtr Recovery & Treatment	In-place Decont.	
C (Belowground Covered Landfill) D (Belowground Un-Covered Landfill)			X	X	X	X			Grout-in-place or encapsulation with grout is chosen to contain and immobilize the waste within the unit.
E (Surface Impoundments) F (Ditches) G (Underground Depression Systems)	X		X	X	X	X	X		Ground Water Recovery and Treatment is chosen as the technique for removing contaminants that have migrated to the groundwater or any materials that can be flushed from the vadose zone (Comment 1).
H (Aboveground Tanks)			X					X	In-place decontamination by draining the tank and rinsing with appropriate solvent. Sludge will be removed using hi-pressure water injection system. In some cases, this technique may not work, thus, grout-in-place should be used.
I-1 (Underground Tanks)	?[1]	X	X				?[1]		Grout-in-place by injecting grout into the tank and the surrounding soil to contain and immobilize contaminants.
I-2 (Underground Diversion Boxes)	?[1]		X			?[1]	?[1]		Grout-in-place or encapsulation of unit using grout to contain waste within unit.

[1]Technical implementation and chemical compatibility concerns must be addressed before these actions can be taken. They are the techniques which were considered to be potentially applicable.

TABLE 3-37 POTENTIAL IN-SITU REMEDIAL ACTIONS FOR WASTE UNITS (continued)

Type of Waste Units	POTENTIAL IN-SITU REMEDIAL ACTIONS								Comments
	Soil Flushing	Soil Treatm.	Grout-in-Place	In-situ Vitrif.	Cap/ Cover	Subsurface Barrier	Grd Wtr Recovery & Treatment	In-place Decont.	
J (Spills)		X	?[1]		?[1]		X		Grout-in-place is recommended to immobilize the contamination in subsurface soil. Ground water recovery and treatment is also suggested if the contamination reaches groundwater table.
K (Underground Vault)			X	X			?[1]	X	Grout-in-place such as encapsulation of unit in grout is recommended for this type of waste unit.
L (Burning Pit)			X	X	X		X		Grout-in-place is selected to immobilize the waste within the unit.
N (Process Sewer)		X	X	X	X		X	X	Grout-in-place is recommended to stabilize the unit.

[1]Technical implementation and chemical compatibility concerns must be addressed before these actions can be taken. They are the techniques which were considered to be potentially applicable.

overlooks site-specific selection of a remediation technique. For example, not all liquid waste disposal units have contaminated groundwater. Some units that are located in a shallow groundwater region and near the bank of the Columbia River may have contaminated the local groundwater at one time in the past; however, the groundwater may have been flushed many times so that only traces of contamination remain. In this case, other in-situ remedial actions or no action may be chosen to deal with potential remobilization of the contaminants that remain bound to the soil beneath the units.

For the generalized Hanford units including burial grounds (C/D), process sewers (N), burning pits (L), and ditches (F), grout-in-place and encapsulation are considered to be the most appropriate alternatives for this analysis. Other applicable treatment techniques include in-situ vitrification, capping/covering, and subsurface barriers. In-situ vitrification is still a developmental technique with many economic and applicability limitations. Capping/covering would limit the potential for exposing the waste; however, it would not prevent migration of contaminants from the unit due to any interactions with active liquid waste disposal units located nearby. Finally, subsurface barriers may not be applicable to control contaminated groundwater for units that are located in deep groundwater areas such as the 200 areas where the water table is more than 200 feet below ground surface or where subsurface migration is found unlikely.

For generalized Hanford units C and D (belowground covered and uncovered landfills), it is recommended that in-situ encapsulation be used as the remediation technique rather than grout-in-place, since the amount of solidifier and cost required for the latter technique can become exorbitant while the benefit is nominally the same as the in-situ encapsulation method. Encapsulation refers to injecting a "liner" or "barrier" of grout below and around the unit, thus creating a containment structure.

It is assumed that most diversion boxes (type I-2), weir boxes (type K). and underground vaults (type K) are empty. If there was any leakage from the units, it would be confined to the surrounding soil. Since the contamination is primarily contained within the unit, it is most appropriate to consider grout-in-place or encapsulation of the unit for this analysis. The grouted unit can remain buried in the ground with little possibility of releasing contaminants to the soil.

For spills (type J), it is assumed that the released contamination did not spread vertically and laterally to a great extent from the original site. Grouting-in-place was selected to remediate this type of waste site. Groundwater recovery and treatment is applicable, if the contamination reaches the groundwater table. In-situ vitrification is also applicable, however, the technology is still new and the cost could be too high for such a site. Cap/covers and subsurface barriers would have limited impact on the site due to climatic and geological site characteristics.

For underground tanks (type I-1), the most practical choice of the in-place remediation techniques is grout-in-place. For aboveground tanks (type H), in-place decontamination can be used as the in-place remediation technique. It should be noted that in cases where removal of the remaining waste is not possible, grout-in-place should be used as an alternative.

Waste unit types A (aboveground covered landfill), B (aboveground uncovered landfill), M (incinerators), and O (other) are not recommended for remediation, based on their match to the four characterization categories (verify no release, verify no residual contamination, verify no hazardous constituents or characertize for remediation) in Section 3.2. Therefore, no remedial alternative is suggested for these units.

3.3.3 Exhumation

One commonly used option for cleaning up a waste site is to exhume the waste material, treat it, and dispose of it at a permitted RCRA or Dangerous Waste disposal site. Depending on the extent of the contamination at the site and the exhumation effort, application of this technique can lead to virtually complete removal of the contamination from the site. The statement of work for this project required that exhumation be considered along with in-place remediation.

The exhumation technique consists of excavating, removing, treating, and disposing of the waste and the contaminated soil. Prior to excavating the site, site planning needs to be performed. During this phase, all engineering and survey work is conducted to establish the basis for the actual excavation. During the planning phase, a staff which includes engineers, surveyors, draftpersons, geologists, health and safety officers, and secretaries, will be needed.

Excavation of contaminated soil and structures requires heavy construction or mining equipment. The excavated soil then must be drummed prior to disposal. Containment of the wastes, decontamination of containers prior to disposal, and transport of the waste containers by truck will also be required to control radionuclides. Removal and transportation of the contaminated material from the site will rely on flat-bed trucks. Disposal of the waste is assumed to be onsite, at a permitted and controlled land disposal site. Excavated waste material that does not meet the constituent concentration limitations under the EPA and State regulations ("land disposal ban") cannot be disposed of without pretreatment prior to disposal. A more detailed description of the exhumation technique is presented in Appendix A of this report.

Exhumation can be applied to remediate most of the waste units identified at the Hanford site. However, exhumation alone may not completely remove all of the contamination. Special equipment may be required for deep excavations, but some contamination may be so deep or so hazardous that excavation is neither practical nor feasible. In selecting the actual remedial alternative for a specific site, a combination of excavation and in-place remediation is most likely. Such decisions reflect a case-by-case analysis beyond the scope of this study.

3.3.3.1 Excavation Estimate

The amount of soil to be excavated is dependent on the extent of the contamination in the sub-surface soil. For liquid waste sites, the lateral migration mainly appears to be caused by the occurrence of clay lenses at depths of 30 to 50 feet under many sites. A review of the Waste Management Operations Report, Volume 2 (Rockwell International Energy Systems Group, 1979) indicates that for CERCLA Site 216-S-1&2, the lateral contamination extends on the average to about 115 feet on each side of the site. The lateral migration of the contaminants from a liquid waste unit can be calculated using the following equation:

$$V = (L + 230ft + D) \times (W + 230ft + D) \times D \qquad \text{(Eq. 1)}$$

where: V = Volume of excavated soil (ft^3)
L = Length of the unit (ft)
W = Width of the unit (ft)
D = Depth of excavation (ft)

The maximum depth of excavation is limited to 60 feet below surface since the excavation costs assume no shoring nor utilization of special deep excavation equipment.

For dry waste sites, it is assumed that the contaminants do not migrate far from the site because there is not enough precipitation to mobilize the contaminants from the waste unit. It is necessary to modify the above formula before it can be applied to these sites. The modification is to use a factor of 1.5 times the dimensions of the site (length and width only) instead of a multiplier of three because the factor of three produced an excavation area for the landfills may be several hundred feet for a one hundred-foot wide unit. This appeared unreasonable given the sandy soil conditions where contaminants are generally transported downward to a greater extent than laterally. Also, it was also determined that reasonable excavation depth would be conservatively limited to 20 feet beneath the bottom of the waste site, even though the contaminants may not have reached that depth. The following equation may be used:

$$V = [(1.5 \times L) + D] \times [(1.5 \times W) + D] \times D \qquad \text{(Eq. 2)}$$

Equation 2 is assumed to be applicable for most units with small to average size, where the length does not exceed two times the width. For units that have an elongated shape such as ditches of more than 1000 feet long but only five to ten feet wide, it is not practical to assume significantly greater migration along the longest dimension. Contamination is anticipated to occur in a more elliptical fashion around such a unit. Thus, to accommodate such a unit structure, equation 2 is modified as follows. With regard to the width of the unit, the lateral extent of the migration still remains at 1.5 times the width. However, for the length of the unit, this lateral migration is assumed to be also 1.5 times the width as shown in Equation 3:

$$V = [(1.5 \times W) + L + D] \times [(1.5 \times W) + D] \times D \qquad \text{(Eq. 3)}$$

The above formulas were used to develop cost estimates to excavate all sites that were determined to potentially require remediation. However, it should be noted that these equations were developed based on limited data and information on the sites. Cost estimates for actual remediation will draw on a more extensive assessment of the extent of the site contamination.

3.3.3.2 Limitations and Applications

Engineering and health and safety limitations exist that should be considered prior to selecting excavation as a remedial technique. First, it is necessary to establish a working excavation depth for the remediation sites. In some areas of the Hanford site, the water table is located at more than 200 feet from the surface (200 Areas). If all liquid waste disposed of reached groundwater, then the soil column beneath the waste unit is contaminated and requires remediation. In the cases where the sites are located in an area with a deep water table, the depth of the excavation can exceed 200 feet below ground surface. Although it is possible to excavate to this depth, the cost can become exorbitant due to special modification to equipment, additional requirements for support such as shoring, and potential production rate reduction (USEPA, 1985). Thus, to use conventional heavy construction equipment such as backhoes, dozers, and loaders, a maximum optimal excavation depth of 60 feet was chosen as the basis for the exhumation technique (USEPA, 1985).

A review of the location of the potential RCRA 3004(u) sites indicated that the majority of these units are buried or "operated" within 30 feet below ground level. In addition, an examination of the contamination profiles in the soil column beneath sites such as cribs, it appears that the contamination is more or less concentrated within the next 20 feet of the soil column beneath the unit. If this assumption stands for all waste units, then excavation to 60 feet below ground surface would at least exhume the soil region where the contamination is most concentrated. Although site interaction in the subsurface is known to occur, in order to estimate excavation volumes it was necessary to assume that there is no interaction from other units located in the proximity of the excavated site and therefore any contaminants remaining in the soil below the 60-foot depth from the ground surface may be considered immobilized. In actual selection of remediation strategies it is recommended that additional remediation techniques such as groundwater recovery and treatment be considered in conjunction with exhumation to remove any contaminants that have reached the groundwater or may remain in mobile form in the unsaturated zone.

Second, a one to one slope is assumed to be used for the excavation. For excavation to a depth of 60 feet, such a slope will generally not require shoring.

Third, exhumation of large buried structures such as cement or asphalt-lined, contaminated retention basins requires additional work to break the structures into manageable size for packaging and hauling and to create areas suitable for excavation. In such cases, the cost for excavation is increased by at least 20 percent.

Fourth, it is questionable whether or not exhumation is an appropriate technique for remediation of large underground tanks that still contain highly radioactive residues. Direct exposure to the residues could pose a potentially high threat to the health and safety of the workers. This technique has therefore not been presented as a remediation technique for the tank farms.

Fifth, disposal of excavated soil or the residues from treatment or the soil could become a major issue requiring resolution. Normally, the excavated or treated contaminated soil can be packaged and disposed of offsite in a permitted land disposal site. However, if exhumation is required for the majority of the identified sites at Hanford, offsite disposal may not be feasible due to the amount of contaminated soil to be disposed. Neither offsite nor onsite capacity is sufficient to accommodate the volumes of mixed waste anticipated to be generated from exhumation of the waste sites. As a result, an engineered and approved land disposal site may need to be constructed onsite to accommodate the disposal of all excavated material.

3.3.4 Estimated Remediation Costs

This section discusses the methodology for estimating the costs associated with the exhumation or in-place remediation of each of the generalized Hanford units defined in Section 3.2.

3.3.4.1 Methodology for Cost Evaluation

The process for estimating the remediation costs for the potential 3004(u) sites consists of the following steps:

(1) For each waste site type, develop a generic waste unit description and dimensions (entitled "generalized Hanford unit").

(2) Identify the number of units associated with each generalized Hanford unit designated for remediation.

(3) Apply the generic remediation strategy methodology to each generalized Hanford unit.

(4) Apply the unit remediation costs for each generalized Hanford unit and obtain an estimated total cost for all sites.

Steps 1 through 2 have already been developed and were described in Section 3.2. In Step 3 of the above process, all engineering estimates of the volume of waste to be treated or excavated are calculated for each generalized Hanford unit. The calculations and bases for these estimates are incorporated in the unit descriptions provided in Appendix C of this report. The development of generic remediation cost requires unit costs associated with each of the suggested remedial actions. These unit costs are presented in detail in Appendix A of this report.

3.3.4.2 Remediation Cost Estimates

The process for estimating the remediation costs for the RCRA 3004(u) sites consists of estimating the cost associated with each generalized

Hanford unit as described earlier, and applying that cost to the number of units requiring remediation for that generalized unit.

For each unit that requires remediation, the following three elements are considered in the estimate for the total cost:

- o Feasibility study, engineering, and construction management costs
- o Remedial action (or cleanup) cost
- o Post remedial action cost, or monitoring cost.

Although site characterization is a required activity prior to the actual remedial action, it is not being considered as part of the total cost for the site remediation. Instead, it is being analyzed under the general topic of site characterization. In general, all units that were identified as potential sources of hazardous constituent release to the environment required some sort of site characterization, even for those that were recommended for remediation, to determine the extent of the contamination. The strategies and costs associated with the site characterization were described in Section 3.2.

Feasibility Study, Engineering, and Construction Management Cost

The cost associated with this study phase of the remedial action is comprised of two cost elements: (a) feasibility study cost, and (b) engineering and construction management cost.

For a feasibility study (FS), there is a minimum amount of work that needs to be performed, such as analyzing remedial investigation (RI) data, formulating and selecting remedial action (RA) alternatives, estimating public and environmental risk associated with each RA alternative, etc. Based on SAIC's experience in performing these studies, the estimated cost for an FS ranges from $100,000 to $300,000 for one unit/site, depending on the amound of work that needs to be done and the complexity of the site. Thus, for a small waste unit such as an underground vault, the FS cost is estimated at about $100,000. On the other hand, for complex waste unit such as a crib or a pond where liquid waste was disposed of and more technologies may require evaluation, it is estimated that the FS cost is approximately $300,000 due to greater extent of subsurface contamination, possible groundwater contamination, potential interaction with other waste units located nearby, etc. For large solid waste units, it is assumed that subsurface contamination is more or less localized. The potential for groundwater contamination would be negligible and fewer RA alternatives would need to be considered. However, because the unit is rather large, the evaluation and analysis of RI data will take more time than a smaller unit. As a result, for these units, it is assumed that the FS cost is approximately $200,000. This cost is also assumed to be the cost incurred for a medium-sized liquid waste unit.

The cost of the engineering, and construction management (Engr, CM) is generally defined as a percentage of the actual remedial action (RA) cost, and typically ranges between ten to 20 percent of the total cost. For example, on the DOE CENTRA project, which involves low-level radioactive and heavy metal wastes, this cost averages about 15% of the total remediation cost. For this study, the Engr, and CM cost element is an average of 15% of the actual remediation cost. Also, this cost element can inversely vary with the unit size and this factor is being considered by site size as follows:

Site Size (Lateral Surface Area)	FS, Engr, CM Cost (% of RA Cost)
Small (<1,000 sq. ft.)	20
Medium (1,000-10,000 sq. ft.)	15
Large (>10,000 sq. ft.)	10

Using the above criteria, the size of each type of unit can be determined. Table 3-38 presents the estimate of the size of each type of waste site based on the generic descriptions presented in Appendix C. Only certain types of sites have been designated for remediation as discussed previously. Site types not requiring remediation [A (aboveground covered landfill), B (aboveground uncovered landfill), M (incinerator), and O (other)] have therefore been omitted from this remediation analysis.

The combination of the FS and Engineering studies is also limited to a maximum cost of $2,000,000 per waste unit.

TABLE 3-38. SIZE CATEGORIZATION BY TYPE OF WASTE SITE

Type of Waste Site		Lateral Surface Area (ft^2)	Relative Size
A	Aboveground Covered Landfill	NA	NA
B	Aboveground Uncovered Landfill	NA	NA
C	Belowground Covered Landfill	56,000	Large
D	Belowground Uncovered Landfill	750,000	Large
E	Surface Impoundment	90,000	Large
F	Ditches	12,200	Large
G	Underground Dispersion Systems	276	Small
H	Aboveground Tank	NA	NA
I	Underground Tank	NA	NA
J	Spills	5,000	Medium
K	Underground Vault	128	Small
L	Burning Pit	11,000	Large
M	Incinerator	NA	NA
N	Process Sewer	24,000	Large
O	Other	NA	NA

NOTE: Waste Site Types A, B, M, and O were not identified as requiring remediation.

Remedial Action Cost

The cost for remedial action is estimated using the unit costs documented in Appendix A and are listed below:

o Excavation and disposal	$365/Cubic Yard (CY)
o Excavation, treatment, and disposal	$689/CY
o Grout-in-place	$ 60/CY
o In-situ decontamination	$1.10/gal or $210/CY
o Groundwater recovery and treatment	$35/1000 gal

In the development of the remediation strategy for the 3004(u) sites the selection of remediation techniques includes exhumation and one potentially applicable in-place treatment method for each generalized Hanford unit. Since the remediation alternatives have already been established, only the costs associated with these techniques will be estimated and presented in this section.

Post-Remedial Action (RA) Monitoring Cost

This cost element is geared towards monitoring groundwater, soil, and vegetation at each site for radioactivity, heavy metals, and other organic and inorganic contaminants after remediation has been completed. As part of the post-RA monitoring strategy, each site is assumed to be monitored semi-annually. As described in Section 2, at least four groundwater samples will be analyzed per site remediated during each monitoring event at the cost of about $7,100 per sample. Therefore, for each waste unit undergoing remediation, the cost associated with the post-RA monitoring activities will be about $60,000/year, given a labor cost of $3,200/year. These costs include monthly inspection of the wells, semi-annual sampling, semi-annual data analysis, and semi-annual maintenance. According the RCRA regulations, post-closure monitoring activities should be conducted for 30 years after closure of the site. As a result, the total post-RA monitoring for each site is estimated at $1,800,000.

The above monitoring cost is based on a semi-annual monitoring strategy. This is applicable for most of the selected in-place treatment processes, except for the in-place decontamination. For the latter technique, it is assumed that once the unit is cleaned, there is no residual contamination left in the unit, and therefore, post-RA monitoring is not required.

3.3.5 Estimated Remediation Cost Summary

For each Hanford area, the total remediation cost for each generalized Hanford unit identified as requiring remediation was estimated for two scenarios: exhumation for almost all cases, and one applicable in-place remedial action. For each remedial action, costs associated with feasibility study, engineering, actual remedial action, and post-remedial action monitoring are estimated wherever applicable. For each generalized Hanford unit, the various costs are calculated based on the total cost per unit and the number of units requiring remediation within that type.

Table 3-39 presents the exhumation costs. Two costs are identified: Method A and Method B. Method A represents the cost of waste or contaminated material removal and redisposal. Method B represents the cost of waste or contaminated material removal, treatment, and residue disposal. The single shell tank farms and catch tanks were not included in this analysis as the hazard to human health and the environment from attempting to exhume these sites was too extensive to consider this option.

Table 3-40 presents the in-place remediation costs. Tables 3-39 and 3-40 identify the volume of material estimated for the basis of the cost evaluation. Estimation details are presented in Appendix A.

Based on the information presented in Tables 3-39 and 3-40, the cost range for exhumation is $14.8 billion to $27.6 billion for sites designated for potential remediation on a site-by-site basis. The cost of in-place remediation is estimated at $874 million on a site-by-site basis.

It should be noted that these costs are generated based on remediation of individual sites. However, sites can be grouped together and treated as an entity. As a result, it is expected that the remediation cost could be reduced drastically. Examples of these cost reductions are provided in Appendix I.

TABLE 3-39 RCRA 3004(u) Sites Excavation Costs

Type of Waste Site	Number of Unit	Excavation Volume (CY)	EXHUMATION: FS Cost ($/unit)	Method A: ENG Cost ($/unit)	Method A: RA Cost ($/unit)	Method B: ENG Cost ($/unit)	Method B: RA Cost ($/unit)	Post-RA Monitoring Cost ($/unit)	Method A: Tot. Unit Cost ($/unit)	Method A: Total Cost ($)	Method B: Tot. Unit Cost ($/unit)	Method B: Total Cost ($)
C	7	222,800	200,000	1,800,000	81,322,000	1,800,000	153,509,200	1,800,000	85,122,000	595,854,000	157,309,200	1,101,164,400
D	1	2,680,000	200,000	1,800,000	978,200,000	1,800,000	1,846,520,000	1,800,000	982,000,000	982,000,000	1,850,320,000	1,850,320,000
E	23	668,500	300,000	1,700,000	244,002,500	1,700,000	460,596,500	1,800,000	247,802,500	5,699,457,500	464,396,500	10,681,119,500
F	8	1,530,000	300,000	1,700,000	558,450,000	1,700,000	1,054,170,000	1,800,000	562,250,000	4,498,000,000	1,057,970,000	8,463,760,000
G	34	210,000	300,000	1,700,000	76,650,000	1,700,000	144,690,000	1,800,000	80,450,000	2,735,300,000	148,490,000	5,048,660,000
H	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
I-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
I-2	50	3,600	100,000	262,800	1,314,000	496,080	2,480,400	1,800,000	3,476,800	173,840,000	4,876,480	243,824,000
J	7	28,400	100,000	1,554,900	10,366,000	1,900,000	19,567,600	1,800,000	13,820,900	96,746,300	23,367,600	163,573,200
K	2	550	100,000	40,150	200,750	75,790	378,950	1,800,000	2,140,900	4,281,800	2,354,740	4,709,480
L	1	80,000	200,000	1,800,000	29,200,000	1,800,000	55,120,000	1,800,000	33,000,000	33,000,000	58,920,000	58,920,000
N	1	4,200	100,000	306,600	1,533,000	578,760	2,893,800	1,800,000	3,739,600	3,739,600	5,372,560	5,372,560
SUM										14,822,219,200		27,621,423,140

NOTES: Method A consists of excavation and disposal w/o incineration (@ $365/CY).
Method B consists of excavation and disposal with incineration (@ $689/CY).
NA Not Applicable. Require other remedial techniques.
C Belowground Covered Landfill
D Belowground Uncovered Landfill
E Surface impoundments
F Ditches
G Underground Dispersion Systems
H Aboveground Tank
I-1 Underground Tank
I-2 Diversion Boxes
J Spills
K Underground Vault
L Burning Pit
N Process Sewer

Table 3-40 RCRA 3004(u) Sites In-Place Remediation Costs

			IN-SITU REMEDIAL ACTIONS													
			Grout-in-Place				In-Place Decontamination				Groundwater Recovery Treatment					
Type of Waste Site	Number of Unit	FS Cost ($/unit)	Volume of Soil (CY)	ENG Cost ($/unit)	RA Cost ($/unit)	Mon. ($/unit)	Vol. of Waste Water (gal)	ENG Cost ($/unit)	RA Cost ($/unit)	Mon. ($/unit)	Volume of Water (Mgal)	ENG Cost ($/unit)	RA Cost ($/unit)	Mon. ($/unit)	Tot. Unit Cost ($/unit)	Total Cost ($)
C	7	200,000	40,000	240,000	2,400,000	1,800,000	NA	NA	NA	NA	NA	NA	NA	NA	4,640,000	32,480,000
D	1	200,000	347,000	1,800,000	20,820,000	1,800,000	NA	NA	NA	NA	NA	NA	NA	NA	24,620,000	24,620,000
E	23	300,000	NA	NA	NA	NA	NA	NA	NA	NA	71	248,500	2,485,000	1,800,000	4,833,500	111,170,500
F	8	300,000	NA	NA	NA	NA	NA	NA	NA	NA	165	577,500	5,775,000	1,800,000	8,452,500	67,620,000
G	34	300,000	NA	NA	NA	NA	NA	NA	NA	NA	19	133,000	665,000	1,800,000	2,898,000	98,532,000
H	5	100,000	NA	NA	NA	NA	21,000	4,620	23,100	0	NA	NA	NA	NA	127,720	638,600
I-1	140	100,000	3,000 (a)	93,600	936,000	1,800,000	NA	NA	NA	NA	NA	NA	NA	NA	2,929,600	410,144,000
I-2	50	100,000	9 (a)	281	2,808	1,800,000	NA	NA	NA	NA	NA	NA	NA	NA	1,903,089	95,154,440
J	7	100,000	17,000	102,000	1,020,000	1,800,000	NA	NA	NA	NA	NA	NA	NA	NA	3,022,000	21,154,000
K	2	100,000	75 (a)	2,340	23,400	1,800,000	NA	NA	NA	NA	NA	NA	NA	NA	1,925,740	3,851,480
L	1	200,000	46,000	276,000	2,760,000	1,800,000	NA	NA	NA	NA	NA	NA	NA	NA	5,036,000	5,036,000
N	1	100,000	4,200 (a)	131,040	1,310,400	1,800,000	NA	NA	NA	NA	NA	NA	NA	NA	3,341,440	3,341,440
SUM																873,742,460

NOTES: NA Not Applicable.

(a) Since this technique requires direct injection of grout into the unit, the volume is expressed in terms of volume of grout. Unit cost for this technique is estimated at ($312/CY).

C Belowground Covered Landfill
D Belowground Uncovered Landfill
E Surface impoundment
F Ditches
G Underground Dispersion Systems
H Aboveground Tank
I-1 Underground Tank
I-2 Diversion Boxes
J Spills
K Underground Vault
L Burning Pit
N Process Sewer

3.4 ESTIMATED MANPOWER AND SCHEDULING

A description of the characterization and remediation tasks necessary at each of the generalized Hanford units, as well as a list of the numbers of sites included under each characterization or remediation effort were provided in Sections 3.2 and 3.3. This section provides a description of the manpower needed to complete site characterization and remedial action on the basis of the RCRA 3004(u) site types. Then, unit schedules for completion of characterization and remediation are provided. This effort was necessary to ultimately produce a master schedule for addressing both RCRA and CERCLA sites as described in Section 4. The methods used to develop estimates of manpower and scheduling recommended for characterization and remediation are also provided in this section.

3.4.1 Characterization Unit Schedules and Manpower Requirements

Characterization activities for the generalized Hanford units vary according to the category of characterization as described in Section 3.2. In order to develop unit schedules, the characterization activities were segregated into three tasks as follows:

- Task C1 - review file data, prepare health and safety plans, prepare safety and analysis plans

- Task C2 - conduct field activities (soil and groundwater monitoring and sampling waste management units)

- Task C3 - sample analysis, evaluation of results, and report preparation.

Each of the above described activities has an associated time requirements that were developed on the basis of engineering field experience and assumptions regarding the average time necessary to perform the various activities.

To develop the time estimates to complete various activities, a factor of $60 per hour was selected as the average cost per hour, fully loaded (overhead, administrative costs, etc.), for a person with the appropriate skills. The cost represents a person with the level of engineering or scientific skills needed to perform the engineering, planning, and implementation activities to characterize a site.

The total amount of money allotted for planning site characterization and evaluating results (Tasks C1 and C3) is ten percent of the total characterization costs for sampling and analysis. A maximum of $100,000 was selected as the ceiling for these efforts (combined). This value was divided by $60 per hour to determine the maximum number of man-hours available.

Next, the total planning cost for site characterization was allocated between the C1 and C3 tasks. In order to segregate the costs, the costs were sorted into six cost brackets. By using the $60 per hour rate, the total hours to complete the tasks could be calculated. It was assumed that significantly more planning was required for sampling and analysis, health and safety, etc., in the higher cost brackets than the lower cost brackets, so a longer schedule was required to complete the work for the higher cost bracket sites. For each cost bracket and corresponding number of hours to complete the task, the percent of personnel time needed for Tasks C1 and C3 is shown on Table 3-41. The schedule time is also shown on Table 3-41. The schedule time for Task C1 was established based on best judgment and previous experience; different schedule times have been assigned based on the anticipated complexity of the sampling needed. Task C3 schedule times were similarly developed and include six weeks for sample analysis.

For the lower cost brackets (less than $35,000), the budget and time needed to perform Task C1 was significantly greater than the budget and time for Task C3. Since the planning costs were derived on the basis of the total cost for characterization, the lower cost brackets represent the characterizations with the least data to be collected. That is, for the lower cost brackets a much greater proportion of the money will be spent on developing health and safety plans and sampling and analysis plans (C1) than will be spent on evaluating the monitoring data and preparing a report (C3) on a small data base (data may include as little as three samples analyses). On the other hand, for a site to be characterized for remediation, a much

TABLE 3-41. SCHEDULE TO COMPLETE CHARACTERIZATION

	TASK C1			TASK C3		
Cost Bracket ($)	% of Total Planning Cost	Man-Weeks	Schedule Weeks	% of Total Planning Cost	Man-Weeks	Schedule Weeks
0-6,000	75	0.8	1	25	0.4	7
6,000-15,000	50	2.3	4	50	2.4	10
15,000-35,000	30	3.9	4	70	9.0	10
35,000-50,000	30	5.9	4	70	13.7	12
50,000-85,000	30	10.0	6	70	23.4	14
85,000-100,000	30	12.5	8	70	29.2	16

greater proportion of money will be spent on evaluating the data (C3), which may include tracking contaminant plumes, using computer data analysis for hundreds of samples, etc., than will be spent in preparing for sampling (C1).

Task C2, the field activities necessary to characterize a site, include groundwater monitoring, soil monitoring and waste unit sampling. In order to develop manpower estimates and scheduling, the following was assumed:

- Drilling crews include: one supervisor, one driller, one person to conduct sampling and to address health and safety concerns/monitoring

- Crews work eight-hour shifts, one shift per day. If additional work is necessary, additional drill rigs and crews are added to the site. Alternatively, the numbers of shifts that the crew works can be increased. The target for drilling and well installation time was kept to a maximum of four to eight weeks per site

- Drilling one groundwater monitoring well, collection of soil borings at two-foot intervals to a depth of 50 feet (shallow groundwater areas), purging one well, collecting one groundwater sample, and decontamination of equipment will take three people four days to complete (12 mandays over 0.8 weeks scheduling time)

- Drilling one groundwater monitoring well, collection of soil borings at five-foot intervals to a depth of 255 feet (deep groundwater areas), purging one well, collecting one groundwater sample, and decontamination of equipment will take three people seven days to complete (21 mandays over one [1] week of scheduling time)

- Completing one soil boring and collecting soil samples every two feet to a depth of 30 feet (shallow groundwater areas) and decontamination will take three people three days to complete (nine mandays over 0.6 weeks scheduling time)

- o Completing one soil boring and collecting soil samples every two feet to a depth of 50 feet (deep groundwater areas with non-liquid wastes placed in the unit during the active life) and decontamination will take three people three days to complete (nine mandays over 0.6 weeks scheduling time)

- o Completing one soil boring and collecting soil samples every two feet to a depth of 100 feet (deep groundwater areas with liquid waste placed in the unit during the active life) and decontamination will take three people four days to complete (12 mandays over 0.8 weeks scheduling time)

- o Completing four soil borings and collecting soil samples every two feet to a depth of six feet (aboveground tanks regardless of area located) and decontamination will take three people three days to complete (9 mandays over 0.6 weeks scheduling time).

The total manweeks were calculated by multiplying the number of people by the number of days they were needed and dividing the number of days the crew works by the number of days per workweek (five days per week). The scheduling time was calculated by dividing the number of days to complete a well or boring by the number of days per workweek (five days).

To calculate the schedule to complete each type characterization for each generalized Hanford Unit, worksheets were prepared. The worksheets provided in Appendix E show the schedule for each site type in each characterization category (characterization for verify for no hazardous constituents, verify for no release/no residual contamination in shallow groundwater areas, verify for no release/no residual contamination in deep groundwater areas, characterize for remediation in the shallow groundwater areas, and characterize for remediation in the deep groundwater areas).

On the worksheets, Tasks C1, C2 and C3 correspond to the three tasks described in this Section. The scheduling times for the three tasks were linked end to end for each type of site in each characterization category to obtain unit schedules.

At the end of the characterization tasks, six months are allowed for review of materials prior to beginning remediation.

The numbers of samples necessary for characterizing the various Hanford units in the shallow and deep areas, as well as the rationale for the numbers of groundwater monitoring wells and soil borings, and the numbers of samples collected in both the deep and shallow groundwater areas are described in Section 3.2.3. Appendix C describes the generalized Hanford units.

3.4.2 Remediation Unit Schedules and Manpower Requirements

The scheduling and manpower required to perform remediation and post-remediation monitoring at a given unit are presented in this section. Remedial activities include the following tasks:

- R1 - Conduct feasibility study (RIA) and conduct engineering design (RIB)
- R2 - Perform remedial action
- R3 - Conduct post-remediation monitoring.

Each of the above three tasks has associated time requirements that were calculated on the basis of engineering field experience and assumptions regarding the average time needed to perform the activities. Each task is described below:

- o RIA - For units that have been designated for remediation, a feasibility study (FS) will need to be performed to identify and evaluate remedial alternatives. For the purposes of this study, a period of six months was scheduled for completion of the FS, and three more months were added for the review of the FS by EPA. Thus, a total of nine months was scheduled to complete this task. Based on the costs required to perform this activity (as identified in Section 3.3), the total number of manweeks was determined as follows, using an average labor rate of $60/hr:

  Estimated FS cost ($) x $60/hr $\div$ 40 hrs/week = Total Manweeks

- RIB - After the FS has been completed, reviewed, and approved by EPA, engineering analysis of the recommended remedial alternatives can be started. It is assumed that a period of one year (52 weeks) is require to conduct the engineering analysis which includes initial engineering design and review, cost estimates, and construction management. Based on the costs required to perform this activity (as identified in Section 3.3), the total manpower requirement can be calculated as follows, using an average labor cost of $60/hr:

  Estimated Eng. Cost ($) x $60/hr ÷ 40 hrs/wk = Total Manweeks

- R2 - A remedial action will be implemented at each site requiring remediation. The scheduling and manpower requirements for each unit are based on the estimated volume of waste/soil/water identified as requiring remediation or treatment at each unit. Labor efficiency rates and production rates have been determined for each proposed remedial action. Unit schedules were determined by applying the production rates to the identified volume needing remediation; manpower requirements (manweeks were determined by applying the labor productivity rates to the identified volume needing remediation

  Worksheets showing calculations for manhours and scheduling are provided in Appendix F

- R3 - After a unit has been remediated, it will be necessary to perform post-remedial action groundwater monitoring. A 30-year groundwater monitoring program is recommended so that the site cleanup program will be consistent with the RCRA post-closure monitoring program. Under the RCRA program, land disposal facilities that have undergone closure are required to perform groundwater sampling at the facility on a semi-annual basis for a period of 30 years. The objective of this program is to verify that the closure actions (remediation) have resulted in either the elimination of hazardous constituents from the environment or the reduction of constituent concentrations to levels below the applicable regulatory standards. Under this program, semi-annual groundwater sampling for hazardous constituents will be performed at one upgradient and three downgradient wells at each remediated site.

It is assumed that the four wells (one upgradient, three downgradient) to be monitored were installed during the characterization phase and therefore the majority of costs associated with the program will be associated with sample collection and analysis.

The monitoring program consists of three phases as follows: well purging and sampling, offsite laboratory analyses of collected samples, and onsite data analyses, as follows:

- Each of the unit's four wells will be purged and sampled. It is assumed that each well will be pumped the equivalent of three well volumes (purging) prior to sampling. The process is estimated to require four hours to complete each well and only a single well at a unit can be purged at a given time. Sampling of the purged well is expected to require four hours to complete. This time includes the sample labeling, packaging, and paperwork associated with shipping the collected samples offsite for analysis as well as decontamination. Thus, one well would be completed in one day. This phase will require an expenditure of 96 hours (three people, four days, eight hours/day) twice a year per unit (a total of 192 hours a year for 30 years)

- Offsite laboratory analyses of the groundwater samples are expected to require six weeks. Shorter turnaround times are not anticipated for this type of activity. No manpower expenditures are required

- The sample results received from the laboratory will be evaluated and any necessary reports based on the analytical data will be generated. It is expected that one person will require four hours to complete this task per unit for a total of eight hours per year per unit

- o It is anticipated that clerical support and well maintenance support will be necessary. Four hours of clerical support will be necessary per year and twelve hours of well and pump maintenance and inspection is expected to be necessary per year for each unit. Appendix F presents worksheets for development of the manpower necessary to conduct post-remediation activities.

3.5 SUPPORT ACTIVITIES

Support activities have been identified for site characterization and site remediation. These activities represent studies, plans, and procedures that need to be developed in order to proceed with site characterization and site remediation. The following activities represent support needs for the inactive RCRA 3004(u) sites:

- o Assessment of waste management needs to accommodate the wastes generated from site remediation and development of waste management plans

- o Characterization and modeling studies of site areas to account for contributing sources (both active and inactive)

- o Treatability studies to support remediation technique selection on a site-specific basis

- o Evaluation of the need for requesting that Alternate Concentration Limits (ACLs) be used as the cleanup criteria for the inactive waste sites given site-specific conditions

- o Evaluation of the need to modify existing permits

- o NEPA documentation to support new facilities development and possible remediation activities.

Each of these support activities are described in more detail below.

Existing waste management capacity both onsite and offsite is insufficient to handle the volumes of mixed waste anticipated to be generated from site remediation. This will require an evaluation of available offsite capacity and an assessment of onsite new facility needs to determine whether new management units are needed as well as the form required (landfill, wastewater treatment system, etc.). Engineering designs and appropriate permits will be required for new facilities to handle the wastes from remediation. Also, characteristics of the waste and contaminated materials expected to be generated from the remediation activities may need to be evaluated to determine if the materials may be delisted as dangerous wastes thereby allowing disposal as only radioactive waste.

Modeling studies will be needed to fully evaluate site conditions and subsurface transport of radioactive and chemical contaminants on a larger grouping on regional (area based) scale rather than on a site-specific basis. The inactive waste sites at Hanford involve a complex environment through the interaction of waste management units that operated twenty or thirty years ago and waste management units that recently ceased operations or are still operating. In addition, sites may be located directly next to each other that are being addressed under different remediation programs [CERCLA and RCRA 3004(u)] that can create an artificial barrier between the sites and may not take into account the complexity of the site interactions. Finally, subsurface processes in effect at Hanford create complex contaminant distributions. For example, thermal gradients and lenses of high/low permeability in the subsurface contribute to lateral spread of contaminant plumes in situations where a downward or elliptical plume may be expected. These conditions coupled with the hydraulic interaction with the Columbia River; operations variations in the past that affected groundwater movement and possibly contaminant flow; and continued interactions with active discharges create an environment that may be best understood and evaluated through detailed regional site modeling of both the chemical and radioactive materials movement and behavior. Such modeling would support detailed regional site characterization, long-term monitoring strategies, and selection/design of remediation techniques.

The state-of-the-art for site remediation is continuing to evolve. EPA has generally found that site-specific treatability studies are required prior to final remediation technology selection and design in order to ensure that the selected technique will successfully apply to site conditions and the combinations of waste constituents found. Often, these studies can determine design modifications, alternative equipment or materials of construction selection, or treatment parameters/procedures required. Sometimes these studies can identify the inapplicability of a given technique otherwise thought to be suitable. The need for treatability studies will depend on a site-by-site basis, but is generally recommended for any type of in-situ treatment or waste treatment process.

Current RCRA closure and cleanup requirements establish the cleanup criteria as background concentrations of a given constituent or a health-based standard such as a maximum concentration limit (MCL). In many cases, particularly where no health-based standard exists (such as soil) or where site conditions do not support cleanup to background concentration, alternate concentration limits (ACLs) may be pursued as alternate cleanup standards. The ACL development process requires detailed studies of site conditions, contaminant characteristics and movement in the environment, and contaminant toxicity and other health effects. This involves a fairly detailed assessment process supported by detailed modeling. EPA review and approval will be necessary. The need for and the feasibility of proposing alternate concentration levels for cleanup criteria at Hanford remediation projects should be evaluated once more detailed site characterization information is available.

Hanford has existing waste management units with RCRA (Washington Dangerous Waste) interim status which are seeking operating permits. These facilities may be likely candidates to receive some of the wastes generated from remediation actions. The permit conditions and waste acceptance criteria will require evaluation, prior to facility use for remediation wastes, to determine whether these wastes may be accepted or whether permit modifications are required prior to waste acceptance.

NEPA documentation such as environmental assessments and environmental impact statements may be needed to support remediation decisionmaking and actual remediation activities. The Savannah River Plant is currently completing a final Environmental Impact Statement for Waste Management Activities, which addresses proposed remediation strategies, proposed waste management changes, and proposed strategies for development and construction of new waste management facilities to handle future wastes and wastes generated from site remediation. The Nevada Test Site is currently in the process of preparing environmental assessment documents to support the expansion of the existing radioactive waste landfill to provide new landfill cells for disposal of mixed wastes. Finally, Rocky Flats has encountered difficulties in completing the trial burn for a RCRA incinerator because the incinerator was not addressed in previous environmental documents. Although there are already a number of environmental documents addressing waste management issues at Hanford, it is anticipated that new documentation may be needed as remediation plans progress.

3.6 STUDY LIMITATIONS

The data and information used to develop a characterization strategy and remediation strategy for the RCRA 3004(u) sites was provided by Westinghouse and included approximately 5000 pages of data on inactive waste disposal sites and areas of environmental contamination at the Hanford Reservation. Approximately 2000 pages of this information related to potential RCRA 3004(u) sites. These data included lists of the waste sites at the Hanford Reservation, codes for the lists which related to the geographic location of the sites at Hanford, and brief narratives (usually one to two pages) for each site. This section describes some of the limitations of the site data and information provided which formed the basis of the site assessments, remediation selection, and cost estimating for the ten tasks and resulting in this project report.

The statement of work for this project limited the data analysis to the information supplied. The analyses presented in this report are based on this information and reflect the programmatic status (RCRA vs. CERCLA) of each site as of June 1987. Site identification and evaluation efforts have continued at Hanford since that time and negotiations have proceeded with the State of Washington and EPA Region X regarding a Memorandum of Agreement to address inactive waste sites and NPL listing of sites at Hanford. As a result of those efforts, additional CERCLA sites have been designated. These sites may appear in this report as RCRA sites.

The focus of this effort was to conduct a preliminary assessment of potential RCRA sites in order to estimate potential budgetary requirements and time requirements to characterize and remediate these sites. As such, this analysis and the supporting selections of remediation technologies are not intended to be definitive. For example, one in-place remediation technique was required to be selected for each type of site and thus one technique, considered to be the most applicable on a broad basis, was selected for each unit type. The final selection of the remediation alternative to be implemented will ultimately be conducted through a site-specific feasibility study analysis of all technologies that may be appropriate.

The data used in the site characterization and selection of the remediation technologies usually varied in quality from site to site and required that some assumptions be made regarding site conditions, waste constituents, migration pathways, and potential receptors in order to develop a site score. The chemical constituents disposed were generally unknown. In some instances, the radionuclide species disposed were not known. Assumptions were made in all cases and the characterization or remediation need for action was based upon these assumptions regarding potential constituents based on the processes generating the wastes disposed.

In determining the need for action at a particular site, the information available regarding past site remediation activities was considered. Little supporting documentation was present to verify that remediations performed (such as exhumation) removed all the contamination. Several terms were encountered that could have more than one meaning as applied to remediation. For example, the term "stabilized" can refer to physical stabilization (to prevent erosion) or to chemical fixation (to prevent chemical constituent leaching or migration). Chemical fixation would represent an acceptable corrective action whereas erosion control without other measures may not have addressed the problem. This information affected the need for action assessments regarding choices between remediation and verification for no residual contamination.

Overall, the RCRA 3004(u) analysis was conducted on a site-by-site basis. The analysis is a subjective one and may be subject to change through consideration of additional information regarding wastes disposed and past actions taken, as well as monitoring results that can serve as indicators of hazardous constituent release to the environment. Additional consideration of site groupings is appropriate both to obtain regional characterizations and remediation strategies that will be more practical for implementation (considering the complex waste management unit interactions present) and more cost-effective.

4.0 COST AND SCHEDULE BENEFITS FROM GROUPING OF SITES

The previous analyses of characterization costs apply on a site-by-site basis. In reality, many of the sites are in such close proximity that they are indistinguishable as units in terms of characterization or remediation because any releases in the subsurface may have been transported to adjacent units. In addition, since some of the RCRA sites are located amidst multiple CERCLA units, therefore the designation as a RCRA site or a CERCLA site may be an artificial distinction.

Characterization and remediation can be more realistically costed and scheduled by considering site groupings which result in time and cost reductions. The following sections identify the RCRA site groupings by area (Section 4.1) and then RCRA/CERCLA group (Section 4.2). Section 4.1 groupings do not effect the characterization or remediation costs however, the groupings in Section 4.2 were considered in developing the costs, manpower and scheduling requirements in Section 4.3.

4.1 RCRA SITE GROUPINGS AND INTERACTION

4.1.1 Site Locations and Groupings

Within a given area, site locations were compared with other RCRA 3004(u) site locations and CERCLA site locations to determine if and how sites may be grouped together for characterization and remediation purposes. Evaluation factors considered included: geographic proximity of sites, need for action category, and potential for contamination from other nearby sites (subsurface and surface interactions). Geographic proximity was the major factor in site groupings. Sites within 100 feet of each other were generally grouped together.

The need for action category was frequently readjusted to account for nearby contamination sources. For example, three or four cribs were adjacent to each other. One crib, based on the data evaluated, was to be remediated while the others were used sufficiently long ago that verification of no residual contamination was an appropriate action. Under such circumstances, the need for action was "upgraded" to remediation because of the influence of the nearby site.

It is common for more than one waste management unit type to be grouped together. Timing of characterization efforts was an additional factor in establishing the site groupings. A more extensive site characterization/remediation effort in one area could readily accommodate a limited sampling effort in the same vicinity. The following sections describe the site groupings determined in each area.

4.1.1.1 100B/C Area

In the 100B/C Area, 28 RCRA sites have been identified. Of these 28 sites, 12 may be organized into groups. The remaining 16 sites would be addressed individually.

The 12 sites have been organized into five groups of waste sites to facilitate scheduling and planning of anticipated additional site investigation. In each grouping, waste sites are as follows:

A.	116-B-6(1)	111B Crib
	116-B-6-2	111B Crib
	118-B-7	Burial Ground
	118-B-5	Burial Ground
B.	116-B-10	Dry well, Quench Tank
	118-B-6	Burial Ground
C.	116-B-5	Crib
	116-B-9	French Drain
D.	118-B-3	Burial Ground (Construction)
	118-B-2	Burial Ground (Construction)
E.	107-B	Retention basin
	107-C	Retention basin (tanks)

In the first four groups have been identified as requiring verification that no hazardous constituents or residual contamination remains. Release of contaminants to subsurface soil is projected to have occured at all sites. The individual groupings are based on geographic proximity.

Group E consists of three large retention basins exhibiting residual radioactivity and surrounded by contaminated soil, and a CERCLA site (trench) which received effluent from the retention basins. Although these sites are encompassed by a relatively large area (1000 feet on each side), it is useful to consider these sites as a unit for the purpose of corrective action as they are part of the same processing facility and the zones of contamination for each one may be indistinguishable. Site remediation has been recommended for both RCRA sites 107-B and 107-C.

4.1.1.2 100 D/DR Area

In the 100 D/DR Area, 24 RCRA sites have been identified. Of these 24 sites, ten may be organized into groups. The remaining sites would be addressed individually.

The ten sites have been organized into four groups of waste sites. Sites within each group are sufficiently close in proximity and like in character to be treated as a unit for the purpose of site remediation/corrective action. The groups are as follows:

A.	116-DR-4	Crib
	116-DR-3	Crib
	118-D-5	Burial Ground
	116-DR-8	Crib
B.	116-D-3	French Drain
	116-D-4	French Drain
C.	116-D-6	French Drain
	116-D-2	Crib
D.	107-D	Retention Basin
	107-DR	Retention Basin

In Group A, subsurface soil contamination is likely to be an issue at each site and the sites are located near one another. It has been recommended that these sites be examined for residual contamination. In Groups B and C, French Drains and Cribs are located in close proximity. Again, subsurface soil contamination is anticipated to have occured and each site should be evaluated for residual contamination. Group D consists of two Retention Basins both of which are currently radioactive. Soil contamination has been documented and surface water and ground water contamination is likely to have occured. Remediation has been recommended for both sites in this group.

4.1.1.3 100 F Area

In the 100 F Area, 22 RCRA sites have been identified. Of these 22 sites, eight sites may be organized into groups. The remaining sites would be addressed individually.

The eight sites have been organized into four groups of waste sites to facilitate planning and scheduling of site remediation/corrective action. Waste sites in each of these groups are sufficiently close in proximity or like in character to be considered as a unit. The four groups are as follows:

Group A

118-F-1	Burial Ground
118-F-6	Solid Waste Burial Ground

Group B

116-F-13	Experimental garden
116-F-12	French drain

Group C

116-F-11	French drain
1608-F	Pumping station

Group D

118-F-4 Pit
118-F-3 Burial ground

The release of contaminants to soil is the primary issue at all of these sites. Recommendations have been made to verify that no release has occured, or to verify that no hazardous constituents or residual contamination remains. The geographic proximity of the sites was a major factor in each grouping.

In developing plans for remediation in the 100 F Area, CERCLA site 116-F-3 is quite close to RCRA site 116-F-4 (crib) and these two sites could be addressed together.

4.1.1.4 100 H Area

In the 100 H Area, 15 RCRA sites have been identified. These sites are not sufficiently close enough in proximity, or like in character, to develop RCRA "groupings" for the purposes of site remediation/corrective action.

4.1.1.5 100 KE/KW Area

In the 100 KE/KW Area, 23 RCRA sites have been identified. Of these 23 sites, ten sites may be organized into groups. The remaining sites would be addressed individually.

The ten sites have been organized into three groups of waste sites to facilitate scheduling/planning of site remediation and corrective action. These sites are sufficiently close in proximity and like in character to warrant consideration as a unit or group. The first group (A) is composed of four RCRA sites, but is in the immediate vicinity of two related CERCLA sites, as follows:

Group A

183-KE Sodium dichromate tank
183-KE1 Sulfuric acid tank
183-KE2 Sulfuric acid tank
100KE*3 Filter water facility trench
(100KE*2: CERCLA site)
(100KE*1: CERCLA site)

In Group B, release of contaminants to soil is the primary issue of concern. Recommendations have been made to verify that no residual contamination remains, or that no release has occured.

Group B

116-KE-3	French drain
116-KE-1	Crib
105-KE	Diesel fuel tank.

Group C is composed of three RCRA sites but is in the vicinity of two related CERCLA sites. The RCRA-designated sites, release of contaminants to soil is anticipated to have occured, and recommendations have been made to verify that no residual contamination remains.

Group C

183-KW	Sodium dichromate tank
183-KW1	Sulfuric acid tank
183-KW2	Sulfuric acid tank
(100KW*2	CERCLA site)
(100KW*1	CERCLA site)

4.1.1.6 100 N Area

In the 100 N Area, 11 RCRA sites have been identified. Of these 11 sites, eight sites may be organized into groups. The remaining sites would be addressed individually.

The eight sites have been organized into three groups of waste sites to facilitate scheduling/planning of site remediation and corrective action. Waste sites within each of these groups are sufficiently close in proximity and like in character to be treated as a unit. Group A consists of two French drains which have received sulfuric acid:

Group A

108-N	French drain
120-N-7	Acid unloading facility French drain

Soil contamination is the primary issue of concern at both sites.

Group B consists of four septic tanks. Subsurface soil contamination is anticipated at all of these locations and recommendations have been made to verify that no residual contamination remains.

Group B

124-N-5	Septic tank
124-N-6	Septic tank
124-N-7	Septic tank
124-N-8	Septic tank

Group C consists of two sites at which diesel oil supply line leaks had occured.

UN-116-N-22
UN-116-N-23.

4.1.1.7 200 East Area

In the 200 East Area, 155 sites have been identified. Of these 155 sites, 118 RCRA sites may be organized into groups. The remaining sites would be addressed individually.

The 118 sites have been organized into twenty-six (26) groups of waste units. These units are grouped based on: (1) their proximity, (2) their commonalities such as type of unit, type of wastes, or type of releases to the environment, and (3) a combination of these two factors.

The grouping of the waste units in the 200 East Area is as follows:

Group A

216-B-47	Crib
(216-B-48	CERCLA)
(216-B-49	CERCLA)
(216-B-50	CERCLA)
(216-B-43	CERCLA
(216-B-44	CERCLA)
(216-B-45	CERCLA)
(216-B-46	CERCLA)

Group B

241-BX	Tank Farm
241-BXR-153	Diversion Box
241-BX-155	Diversion Box
241-BX-153	Diversion Box
241-BXR-152	Diversion Box
241-BX-154	Diversion Box
241-BX-302-A	Catch Tank
241-BX-302-B	Catch Tank
241-BX-302-C	Catch Tank

(Sites are within confines of tank farm boundary.)

Group C

241-BY	Tank Farm
241-BYR-151	Diversion Box
241-BYR-152	Diversion Box
241-BYR-153	Diversion Box
241-BYR-154	Diversion Box

(Sites are within confines of tank farm boundary.)

Group D

241-B	Tank Farm
241-B-151	Diversion Box
241-B-152	Diversion Box
241-B-153	Diversion Box
241-B-154	Diversion Box
241-B-252	Diversion Box
241-BR-152	Diversion Box
242-B	Evaporator
241-B-301-B	Catch Tank
241-B-301-C	Catch Tank
241-B-302-B	Catch Tank

(Sites are within confines of tank farm boundary.)

Group E

216-B-35	Trench
216-B-36	Trench
216-B-37	Trench
216-B-38	Trench
216-B-39	Trench
216-B-40	Trench
216-B-41	Trench
216-B-42	Trench

Group F

218-E-2	Burial Ground
218-E-5	Burial Ground
218-E-9	Burial Vault
218-E-2A	Burial Ground
218-E-4	Burial Ground
218-E-5A	Burial Ground

Group G

216-B-4	Reverse Well
216-B-13	French Drain
218-E-6	Burial Ground
218-E-7	Burial Vaults
UPR-200-E-80	Waste Line

Group H

216-B-10B	Crib
(216-B-10A	CERCLA)

Group I

216-B-2-1	Ditch
(216-B-2-2	CERCLA)

Group J

216-B-3-1	Ditch
216-B-3-2	Ditch

Group K

241-C	Tank Farm
241-C-252	Diversion Box
241-C-151	Diversion Box
241-C-152	Diversion Box
241-C-153	Diversion Box
241-C-154	Diversion Box
241-CR-151	Diversion Box
241-CR-152	Diversion Box
241-CR-153	Diversion Box

(Sites are within confines of tank farm boundary.)

Group L

216-A-18	Trench
216-A-19	Trench
216-A-20	Trench
216-A-34	Ditch

Group M

241-AZ-151	Diverter Station
241-AZ-151	Catch Tank
216-A-39	Crib

Group N

216-A-41	Crib
(216-A-40	CERCLA)

Group O

241-CX-70	Tank
241-CX-72	Tank
241-C-6	Crib
241-C-5	Crib
(216-C-1	CERCLA)

Group P

216-C-4	Crib
216-C-3	Leaching Pit

Group Q

216-A-3	Crib
216-A-22	Crib
(216-A-28	CERCLA)

Group R

216-A-13	French Drain
216-A-35	French Drain

Group S

216-A-12	French Drain
216-A-14	French Drain

Group T

216-A-15	French Drain
(216-A-5	CERCLA)

Group U

216-A-33	French Drain
216-A-2	Crib
216-A-26A	French Drain
(216-A-4	CERCLA)

Group V

241-A	Tank Farm
216-A-16	French Drain
216-A-17	French Drain
216-A-23A	French Drain
216-A-23B	French Drain
241-A-152	Diversion Box
241-A-153	Diversion Box
241-A-302-B	Catch Tank

Group W

241-AY-152	Diversion Box
241-AY-152	Diverter Station

Group X

216-A-1	Crib
(216-A-7	CERCLA)

Group Y

216-B-14	Crib
216-B-15	Crib
(216-B-16	CERCLA)
216-B-17	Crib
216-B-18	Crib
216-B-19	Crib

Group Z

216-B-20	Trench
216-B-21	Trench
216-B-22	Trench
216-B-23	Trench
216-B-24	Trench
216-B-25	Trench
216-B-26	Trench
216-B-27	Trench
216-B-28	Trench
216-B-29	Trench
216-B-30	Trench
216-B-31	Trench
216-B-32	Trench
216-B-33	Trench
216-B-34	Trench
216-B-52	Trench
216-B-53A	Trench
216-B-53B	Trench
216-B-54	Trench
216-B-58	Trench

4.1.1.8 200 West Area

In the 200 West Area, 147 sites have been identified. Of these 147 sites, 79 RCRA sites may be organized into groups. The remaining sites would be addressed individually.

The 79 sites have been organized into eighteen (18) groups of waste units. These units are grouped based on: (1) their proximity, (2) their commonalities such as type of units, type of wastes, or type of releases to the environment, and (3) a combination of these two factors.

The grouping of the waste units in the 200 West area is as follows:

Group A

216-T-14	Trench
216-T-15	Trench
216-T-16	Trench
216-T-17	Trench

Group B

216-T-26	Crib
216-T-27	Crib
(216-T-28	CERCLA)

Group C

216-Z-6	Crib
216-Z-17	Ditch
216-Z-4	Trench
216-Z-5	Crib
(216-Z-10	CERCLA)

Group D

216-T-9	Trench
216-T-10	Trench
216-T-11	Trench

Group E

216-T-21	Trench
216-T-22	Trench
216-T-23	Trench
216-T-24	Trench
216-T-25	Trench

Group F

216-Z-1A	Tile Field
(216-Z-1&2	CERCLA)

Group G

216-S-15	Pond
(216-S-3	CERCLA)

Group H

216-T-4-1	Ditch
216-T-4-2	Ditch
216-T-4	Pond

Group I

216-U-6	Trench
216-U-5	Trench
216-U-7	French Drain

Group J

218-W-4A	Burial Ground
218-W-11	Burial Ground
218-W-1	Burial Ground
218-W-2	Burial Ground
218-W-3	Burial Ground

Group K

216-Z-1	Ditch
216-Z-19	Ditch
216-Z-11	Ditch
216-Z-9	Ditch
216-U-10	Pond

Group L

218-W-7	Vault
218-W-8	Vault

Group M

241-UR-154	Diversion Box
241-UR-153	Diversion Box
241-U-252	Diversion Box
241-U-153	Diversion Box
241-UR-152	Diversion Box
241-U-301	Catch Tank
241-U	Tank Farm
244-UR	Vault

(Sites are within confines of tank unit boundary.)

Group N

240-S-151	Diversion Box
240-S-152	Diversion Box
241-S-152	Diversion Box

240-S-302	Catch Tank
241-S	Tank Farm

(Sites are within confines of tank farm boundary.)

Group O

241-SX-151	Diversion Box
241-SX-152	Diversion Box
241-SX-302	Catch Tank
241-SX	Tank Farm

(Sites are within confines of tank farm boundary.)

Group P

241-TX-153	Diversion Box
241-TXR-152	Diversion Box
241-TXR-153	Diversion Box
241-TXR-244	Diversion Box
241-TXR-151	Diversion Box
241-TXR-155	Diversion Box
241-TX-302-A	Catch Tank
241-TX-302-B	Catch Tank
241-TX	Tank Farm
242	Evaporator

(Sites are within confines of tank farm boundary.)

Group Q

216-T-13	Trench
216-T-36	Crib
216-T-32	Crib
216-T-5	Trench
241-TR-152	Diversion Box
241-T-152	Diversion Box
241-TR-153	Diversion Box
241-T-151	Diversion Box

241-301-B	Catch Tank
241-T	Tank Farm

(Sites are within confines of tank farm boundary.)

Group R

241-TY-153	Diversion Box
241-TY-302-A	Catch Tank
241-TY-302-B	Catch Tank
241-TY	Tank Farm

(Sites are within confines of tank farm boundary.)

4.1.1.9 200 North Area

In the 200 North Area, seven RCRA sites have been identified. Of these seven sites, two sites may be organized into groups. The remaining sites would be addressed individually. The two sites have been organized into a single grouping for characterization, as follows:

Group A

216-N-2	Trench
216-N-3	Trench

Both trenches have been identified for characterization to determine whether residual contamination is present. The primary consideration is their close proximity.

4.1.1.10 300 Area

In the 300 Area, 18 RCRA sites have been identified. Of these 18 sites, six sites may be organized into groups. The remaining sites would be addressed individually.

The six sites have been organized into three groups of waste sites to facilitate scheduling and planning of site remediation/corrective action. Waste sites in these groups are sufficiently close in proximity to be considered as a unit. These three groups are as follows:

Group A

(no number)	Uranium Acid Spill (313 Bldg)
(no number)	Methanol Storage Tank

Group B

UPR-300-31/40	Unplanned releases
(no number)	311 Tank farm

Group C

(no number)	323 Tanks
316-4	Cribs

In addition to the three groups noted above, a group of four 600 Area waste sites which are located at the northern end of the 300 area, have been identified to facilitate the timing of corrective action. The four burial grounds are sites 618-1, 618-2, 618-3, and 618-8. Sites 618-2 and 618-3 form one large continuous unit.

4.1.1.11 400 Area

In the 400 Area, five sites have been identified. Of these five sites, two sites may be organized into one group. The remaining sites would be addressed individually.

The one site grouping consists of "400 Area retired French drains" and the "400 Area retired Sand bottom Trench". Both of these sites require verification that there are no hazardous constituents associated with the sites.

4.1.1.12 600 Area

With the exception of the four burial grounds near the 300 Area (618-1, 618-2, 618-3, and 618-8), none of the 31 waste sites in the 600 Area are in close enough proximity to constitute a group for the purposes of site remediation/corrective action. The 600 Area sites should therefore be addressed individually. However, in developing a schedule for further site investigation and remediation, the following sites may be considered together:

- 618-9 West Burial Ground
  618-13 Contaminated Soil Burial Ground
  Horn Rapids Disposal

- 618-7 Burial Ground No. 7
  618-4 Burial Ground No. 4
  618-6 Burial Ground No. 6

The grouping of the burial grounds was described in 4.1.1.10.

4.1.1.13 700 Area

Only one site is identified in the 700 Area. This site, an underground tank, is the only "group" for this area.

4.1.1.14 1100 Area

In the 1100 Area, four sites have been identified. None of these sites are in close enough proximity to constitute a group and should therefore be addressed individually within the 1100 Area.

4.2 RCRA/CERCLA GROUPING

Site groupings at the Hanford Reservation were identified for characterization and remediation purposes. Evaluation factors considered included: geographic proximity of sites, need for action category, and potential for contamination from other nearby sites (subsurface and surface interactions). The resulting groups were assessed for each area at Hanford. Many of the groups initially developed did not include CERCLA sites. However, CERCLA sites in the immediate vicinity of a RCRA grouping were identified. This section outlines the methodology used to determine which RCRA groups can be expanded to "zones" which include both RCRA and CERCLA sites.

The assumptions used to evaluate the interaction of RCRA sites with CERCLA sites include the following:

- o Geographic proximity is defined for RCRA groupings as sites within 100 feet of each other and for zones the distance is increased to 300 feet. This is the major factor in both groups and zones.

- o Need for action category for RCRA group as the collective assessment of the containment provided by the site in the past and timing of characterization efforts. The inclusion of a CERCLA site in a zone was not determined by the need for action category.

- o Potential for contamination is defined as the potential exposure hazards, potential media, impacted, and pathway of migration for RCRA groups. The inclusion of a CERCLA site in a zone was not determined by the potential for contamination.

As identified in Section 4.1, there are RCRA units near CERLA units. As a result of such proximity to a site requiring action, the need for action previously suggested for some RCRA units is reconsidered based on the grouping to reflect the integrated process of recommending resolutions to waste units. For example, group E (200 West) consists of five trenches that are located next to each other. A preliminary review indicated that only trench 216-T-21 required remediation, while the remaining trenches (216-T-22, 23, 24, and 25) would only require verification that there is no residual contamination. However, because of the grouping, all trenches in the group are recommended for remediation since the trench requiring remediation is expected to have impacted the nearby trenches and it is difficult to remediate one without disturbing the other units.

The Hanford Reservation's 100, 200, 300, 400, and 600 Areas sites were analyzed based upon the existing groupings. Twenty-eight zones were developed from RCRA groups and individual CERCLA sites. CERCLA sites were identified and initially associated with RCRA groups based upon proximity. Next, the compatability of unit disposal types was considered. However, having common unit types was not the sole basis for inclusion in the zone, since it was not uncommon for more than one waste management unit type to be grouped together. The type of waste and/or type of release to the environment were assessed before a candidate CERCLA site was rejected or included in a zone.

The twenty-eight zones can be identified by Hanford (i.e., 200 West, Group Q, or Zone 1). The zones are ranked according to the average HRS score of the CERCLA sites within a zone. Each zone is numbered by this ranking system which establishes a hierarchy for group and site remediation schedules. The twenty-eight zones and the sites which comprise them are as follows:

Zones	Description	Ranking
1.	Group Q (200 West)	2
2.	Group A (200 East)	8
3.	Group Y (200 East)	9
4.	Group T (200 East)	11
5.	Group G (200 West)	13
6.	Group H (200 East)	15
7.	Group U (200 East)	15
8.	Group L (200 West)	15
9.	Group A (100 F)	17
10.	Group F (100 B&C)	18
11.	Group X (200 East)	20
12.	Group C (100 F)	21
13.	Group D (100 D&DR)	22
14.	Group F (100 F)	22
15.	Group A (100 H)	22
16.	Group A (100 K)	22
17.	Group E (100 B&C)	23
18.	Group G (100 B&C)	23
19.	Group B (100 D&DR)	23
20.	Group B (200 West)	25
21.	Group C (100 K)	25
22.	Group O (200 East)	26
23.	Group F (200 West)	27
24.	Group N (200 East)	32
25.	Group Q (200 East)	32

26.	Group C (200 West)	32
27.	Group I (200 East)	34
28.	Group A (100 D&DR)	35

The following sections describe the zones determined in each area.

4.2.1 100 B/C Area

In the 100 B/C Area, four CERCLA sites have been identified. All four sites may be included in RCRA groups to form zones.

The four sites have been included in three RCRA groups to form three zones to facilitate scheduling and planning. In each zone the waste sites are as follows:

Zone 17 (Group E)

107-B	(RCRA)
107-C	(RCRA)
116-B-1	
116-C-1	

Zone 10 (Group F)

116-B-3	(RCRA)
116-B-4	

Zone 18 (Group G)

118-C-1	(RCRA)
118-C-2-2	(RCRA)
116-C-2	

4.2.2 100 D/DR Area

In the 100 D/DR Area, five CERCLA sites have been identified. Three of the sites may be included in RCRA groups to form zones. One of the sites is grouped with an individual RCRA site (116-D-1A) forming a fourth zone. The remaining site would be addressed individually. In each zone the waste sites are as follows:

Zone 13 (Group D)

107-D	(RCRA)
107-DR	(RCRA)
116-DR-1	
116-DR-2	

Zone 19 (Group B)

116-D-1A	(Individual RCRA site)
116-D-1B	

Zone 28 (Group A)

116-DR-4	(RCRA)
116-DR-3	(RCRA)
118-D-5	(RCRA)
116-DR-8	(RCRA)
116-DR-7	

4.2.3 100 F Area

In the 100 F Area, six CERCLA sites have been identified. All sites may be grouped with individual RCRA sites forming three zones. In each zone the waste sites are as follows:

Zone 17 (Group E)

118-F-2	(Individual RCRA site)
116-F-1	

Zone 23 (Group F)

107-F (Individual RCRA site)
116-F-9
116-F-2

Zone 18 (Group G)

116-F-4 (RCRA)
116-F-3
116-F-6
116-F-10

4.2.4 100 H Area

In the 100 H Area, three CERCLA sites have been identified. Two sites may be grouped with an individual (118-H-5) RCRA site forming a zone. RCRA site 118-H-5 is near the 116-H-2 and 116-H-3 CERCLA sites and may be influencing each other (i.e., subsurface interactions). The remaining site would be addressed individually. The waste site in the zone are as follows:

Zone 15 (Group A)

118-H-5
116-H-2
116-H-3

4.2.5 100 KE/KW Area

In the 100 K, Area four CERCLA sites have been identified. All four sites may be included in RCRA group to form zones.

The four sites have been included in two RCRA groups to form two zones. In each zone the waste sites are as follows:

Zone 16 (Group A)

183-KE
183-KE1
183-KE2
100 KE*2
100 KE*2
100 KE*1

Zone 21 (Group C)

183-KW
183-KW1
183 KW2
100 KW*2
100 KW*1

4.2.6 200 Area CERCLA Sites

In the 200 Area, 52 sites have been identified. Of these 52 sites, 38 sites may be organized into groups or zones.

In the 200 West area 14 CERCLA sites have been organized into four groups of CERCLA-only waste units. These units are grouped based on: (1) their proximity, (2) their commonalities such as type of unit, type of waste, or type of releases to the environment, and (3) a combination of these factors, with proximity being the major factor.

The grouping of the CERCLA waste units in the 200 West Area is as follows:

Group I

216-S-15	Crib
216-S-6	Crib
216-S-17	Pond
216-S-16P	Pond
216-S-16D	Ditch

Group II

216-S-1&2	Crib (2)
216-S-7	Crib
216-S-3	French Drain
216-S-9	Crib

Group IV

216-S-4	French Drain
216-S-21	Crib

Group IV

216-U-4	Reverse Well
216-U-4A	French Drain
216-U-4B	French Drain

4.2.7 200 East Area

In the 200 East Area, 26 sites have been identified. Of these 26 sites, 18 of the sites may be included in RCRA groups to form zones. Fourteen CERCLA sites may be included in RCRA groups to form zones. Four of the sites are grouped with individual RCRA sites to form zones. The remaining eight sites would be addressed individually.

The 15 CERCLA sites have been included in six RCRA groups to form six zones. Four CERCLA sites have been grouped with individual RCRA groups forming four zones. In each zone the waste sites are as follows:

Zone 2 (Group A)

216-B-47	(RCRA)
216-B-48	
216-B-49	
216-B-50	
216-B-43	

216-B-44
216-B-45
216-B-46

Zone 6 (Group H)

216-B-10B (RCRA)
216-B-10A
216-B-6

Zone 27 (Group I)

216-B-2-1 (Individual RCRA Site)
216-B-2-2

Zone 24 (Group N)

216-A-41 (Individual RCRA site)
216-A-40

Zone 22 (Group O)

241-CX-70 (RCRA)
241-CS-72 (RCRA)
216-C-6 (RCRA)
216-C-5 (RCRA)
216-C-1
216-C-10

Zone 25 (Group Q)

216-A-3 (RCRA)
216-A-22 (RCRA)
216-A-28

Zone 4 (Group T)

216-A-15 (Individual RCRA Site)
216-A-5

Zone 7 (Group U)

216-A-33 (RCRA)
216-A-2 (RCRA)
216-A-26A (RCRA)
216-A-4

Zone 11 (Group X)

216-A-1 (Individual RCRA site)
216-A-7

Zone 3 (Group Y)

216-B-14 (RCRA)
216-B-15 (RCRA)
216-B-16
216-B-17 (RCRA)
216-B-18 (RCRA)
216-B-19 (RCRA)

4.2.8 200 West Area

In the 200 West Area, 20 CERCLA sites have been identified. Of the 20 sites, 12 may be included in the RCRA groups to form zones. Two of the sites are grouped with individual RCRA sites to form zones. The remaining six sites would be addressed individually.

The 12 CERCLA sites have been included in four RCRA groups to form four zones. Two CERCLA sites have been grouped with individual RCRA sites to form tow zones. In each zone the waste sites are as follows:

Zone 20 (Group B)

216-T-26	(RCRA)
216-T-27	(RCRA)
216-T-28	

Zone 26 (Group C)

216-Z-6	(RCRA)
216-Z-17	(RCRA)
216-Z-4	(RCRA)
216-Z-5	(RCRA)
216-Z-10	

Zone 23 (Group F)

216-Z-1A	(Individual RCRA site)
216-Z-1&2	

Zone 5 (Group G)

216-S-15	(Individual RCRA site)
216-S-3	

Zone 8 (Group L)

218-W-7	(RCRA)
218-W-8	(RCRA)
216-T-8	

Zone 1 (Group Q)

241-TR-152	(RCRA)
241-T-152	(RCRA)
241-TR-153	(RCRA)
241-T-151	(RCRA)
241-301-B	(RCRA)
241-T	(RCRA)

216-T-7	
216-T-13	(RCRA)
216-T-36	(RCRA)
216-T-32	(RCRA)
216-T-5	(RCRA)

4.3 COST REDUCTIONS FOR RCRA/CERCLA GROUPINGS

As has been suggested previously, addressing waste management units on an individual versus group basis has resulted in high characterization and remediation cost estimates. These costs can be lowered substantially if similar type units in close proximity to one another can be addressed as one larger unit. Cost savings result for a number of reasons related to economies of scale including decreased planning costs, reduction in the number of required groundwater and/or soil samples, elimination of double counting related to excavation areas and sampling, etc. The reductions in characterization and remediation costs that can be realized by grouping units, where possible and/or practical, are illustrated in the examples that follow and are summarized in Table 4-1. Table 4-1 presents the number of individual RCRA units that comprise a given RCRA group, the estimated cost for characterizing each individual unit independent of the group, the estimated characterization cost for characterizing the group itself, and the estimated (RCRA) cost savings, if any, related to addressing the units as a group. Cost savings for RCRA/CERCLA groupings are also noted. Appendix I presents example calculations of cost reductions.

For the 56 site groups considered in Table 4-1, characterizing 342 RCRA units individually would cost $966,254,200. By grouping the sites together, characterization costs are an estimated $183,745,500 for a reduction of $782,508,700 or 81 percent for the sites. Thus, the characterization costs for RCRA sites, as estimated in Section 3.2 to be a total of $1,240,000,000 can be reduced significantly through groupings of RCRA sites or units and groupings of RCRA sites with CERCLA sites.

Additional reductions may be achieved in remediating sites in groups or regions.

TABLE 4-1. COST REDUCTIONS THROUGH GROUPING RCRA SITES AND RCRA/CERCLA SITES FOR CHARACTERIZATION

Area	# of Units in Group	Characterization Costs as Individual Units	Characterization Costs as a Group	Estimate of Cost Savings
100 North Area				
Group B	4	115,600	115,600	None expected
100 K Area				
Group B	3	2,363,300	1,415,600	947,700
Group A (R/C)	4	4,639,000	438,000	4,201,000
Group C (R/C)	3	375,000	250,000	125,000
100 F Area				
Group A	2	5,028,000	2,393,300	2,634,700
Group B	2	560,000	560,000	None Expected
Group C	2	1,062,200	929,400	132,800
Group D	2	5,028,000	1,307,000	3,721,000
Group A (R/C)	1	No change	No change	No change
Group B (R/C)	1	916,100	0[1]	916,100
Group C (R/C)	1	531,100	0[1]	531,100
100 BC Area				
Group A	4	6,090,200	1,427,700	4,662,500
Group B	2	3,045,100	1,427,700	1,617,400
Group C	2	1,062,200	1,062,200	None Expected
Group D	2	57,800	57,800	None Expected
Group A (R/C)	2	1,832,200	1,689,000	143,200
Group B (R/C)	1	531,100	0[1]	531,100
Group C (R/C)	2	3,045,100	2,514,000	531,100

R/C = RCRA/CERCLA Grouping.
[1]Costs are included in CERCLA Characterization.

TABLE 4-1. COST REDUCTIONS THROUGH GROUPING RCRA SITES AND RCRA/CERCLA SITES FOR CHARACTERIZATION (continued)

Area	# of Units in Group	Characterization Costs as Individual Units	Characterization Costs as a Group	Estimate of Cost Savings
100 D and 100 DR Area				
Group B	2	1,062,200	1,062,200	None Expected
Group C	2	1,062,200	1,062,200	None Expected
Group A (R/C)	2	1,832,200	0[1]	1,832,200
Group B (R/C)	1	No change	No change	No change
Group C (R/C)	4	5,366,000	1,790,000	3,576,000
200 East				
Groups B, C, D,	58	56,318,600	6,053,000	50,265,600
Group E	8	44,536,000	9,081,500	35,454,500
Group F	6	28,710,200	7,256,800	21,453,400
Group G	5	9,150,400	4,076,000	5,074,400
Group K	20	36,016,000	3,076,400	32,939,600
Group R	2	3,324,000	2,443,000	881,000
Group S	2	3,324,000	2,443,000	881,000
Group V	13	22,855,200	3,501,600	19,353,600
Group Z	20	$111,340,000	$19,625,000	$91,715,000
Group A (R/C)	1	1,800,800	0[(1)]	1,800,800
Group I (R/C)	1	2,651,200	2,512,000	139,200
Group Q (R/C)	2	3,324,000	1,662,000	1,662,000
Group Y (R/C)	5	9,004,000	4,352,000	4,652,000
Group X (R/C)	1	1,800,800	0[(1)]	1,800,800

R/C = RCRA/CERCLA Grouping.
[(1)]Costs are included in CERCLA Characterization.

TABLE 4-1. COST REDUCTIONS THROUGH GROUPING RCRA SITES AND RCRA/CERCLA SITES FOR CHARACTERIZATION (continued)

Area	# of Units in Group	Characterization Costs as Individual Units	Characterization Costs as a Group	Estimate of Cost Savings
<u>200 West</u>				
Group A	4	10,604,800	1,800,800	8,804,000
Group D	3	16,701,000	2,443,000	14,258,000
Group E	5	13,256,000	2,844,000	10,412,000
Group H	3	23,730,000	17,494,400	6,235,600
Group I	2	11,134,000	11,134,000	None Expected
Group K	5	45,671,200	28,588,400	17,082,800
Group M	17	40,492,800	4,352,000	36,140,800
Group N	16	288,130,000	4,352,000	283,778,000
Group O	18	32,414,400	4,352,000	28,062,400
Group P	27	46,945,800	5,202,400	41,743,400
Group Q	26	56,318,600	6,478,000	49,840,600
Group R	9	16,207,200	3,927,000	12,280,200
Group B (R/C)	2	3,601,600	935,000	2,666,600
Group C (R/C)	4	14,856,800	2,651,000	12,205,800
Group F (R/C)	2	3,462,800	1,800,800	1,662,000
<u>200 North Area</u>				
Group A	2	11,134,000	4,076,000	7,058,000
<u>300 Area</u>				
Group D	2	8,152,000	2,208,700	5,943,300

R/C = RCRA/CERCLA Grouping.
(1)Costs are included in CERCLA Characterization.

4.4 MASTER SCHEDULE FOR RCRA/CERCLA GROUPINGS

Figure 4-1 presents a master schedule covering ten years of site characterization and remediation. The schedule has been constructed in a time line fashion to denote, with a dashed line, those time periods relating to site characterization and to denote, with asterisks, those time periods relating to site remediation activities. The dark solid line visually separates the two time periods. A six month gap has been allowed between site characterization and the beginning of site remediation to accommodate review periods by regulatory agencies anticipated for the remedial investigation reports.

Three lines of cost data are provided at the top of Figure 4-1. The top line presents the yearly expenditures for site characterization. The middle line presents quarterly totals for site characterization. The third line presents the yearly expenditure for site remediation.

The master schedule was constructed using the following assumptions and considerations:

- o Unit schedules identified in Sections 2 and 3 were the basis for constructing a master schedule on a site-by-site basis.

- o A yearly budget of $50 million for site characterization and $100 million for site remediation was assumed. The first few years of the program were assumed to be a phase-in period for which the yearly budgets were less than full funding. The funding amounts selected were based on budgets that could reasonably be anticipated as compared to budgets anticipated at other DOE facilities.

- o CERCLA site characterization costs and schedules involved greater than one year to complete, however, the majority of the funds were anticipated to be expended in the first year for each CERCLA site or grouping. Each RCRA site was considered to have expended the budget for that site within three-fourths to one year.

- o Remediation schedules were geared towards completion within a ten to 15 year time frame. This time frame is based on current EPA policy regarding site cleanups: cleanups generally must be completed within 15 years after start.

In constructing the example master schedule shown in Figure 4-1, sites were selected for scheduling on a priority basis. CERCLA sites were considered first. Sites with the hazard ranking of ten or less (HRS score greater than 51) were scheduled first based on the hazard ranking regardless of site location. Then, CERCLA sites in the 200 West Area were scheduled because of the concerns regarding existing multiple contamination plumes. RCRA sites grouped with CERCLA sites were kept in the listing in conjunction with the appropriate CERCLA sites. Sites of major concern that were in the "RCRA" section of this study were also pulled up into the listing to follow those CERCLA sites being characterized nearby. One example is the tank farms in the 200 West area that are pulled up into the listing.

Although the example schedule proceeds through only ten years, the site scheduling effort found that characterization of the CERCLA sites will involve more than ten years of time to complete. Characterization of the RCRA sites is estimated to continue to year 25. Remediation of the sites cannot begin until characterization is complete; and the scheduling analysis indicated that by year 25, remediation may have begun on up to two-thirds of the CERCLA sites given the yearly budget identified above. Less problematic sites, such as RCRA sites requiring only sampling documentation of no contamination problems, may need to be moved up in the schedule so that site characterization for sites known to need remediation is not performed so far in advance of the remediation activities that a site will need to be recharacterized before beginning remediation.

Several limiting factors were used in this analysis. First, the number of drilling rigs available will have a significant impact in some years on the level of activities. The master schedule shown in Figure 4-1 is based on having no more than 25 drilling rigs in operation at any given time. This number was selected as being the number of the type of rigs that could reasonably be expected to be available at one time to support the efforts at the Hanford Reservation. It is very likely that there will be some years in which the full $50 million characterization budget cannot be exercised

FIGURE 4-1. EXAMPLE MASTER SCHEDULE FOR CHARACTERIZATION AND REMEDIATIONS FOR A TEN-YEAR PERIOD.

	Year 1				Year 2				Year 3				Year 4				Year 5			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Annual Characterization Cost				$11,024,464				$12,461,134				$14,649,752				$34,383,744				$150,236,996
Quarterly Characterization Cost	$2,819,021	$2,819,021	$2,819,021	$2,567,401	$3,204,654	$6,362,654	$1,481,913	$1,411,913	$3,328,748	$4,328,748	$4,179,128	$2,813,128	$5,946,196	$9,188,196	$11,838,676	$7,410,676	$33,565,424	$40,157,324	$40,598,124	$35,916,124
Annual Remediation Cost												$800,000				$10,075,000				$101,092,100

Area	Zone	Group	Source	CERCLA	RCRA	Haz Rank
300	-	-	316 - 1	X		1
			316 - 2	X		1
			316 - 3	X		1
200 WEST	1	Q	216-T -7	X		2
			241-TR -152		X	
			241-T -152		X	
			241-TR -153		X	
			241-T -151		X	
			241-301-B		X	
			241-T		X	
			216-T -13		X	
			216-T -36		X	
			216-T -32		X	
			216-T -5		X	
200 EAST	-	-	216-B -7A&B	X		2
	-	-	216-B -5	X		3
200 WEST	-	-	216-T -3	X		4
200 EAST	-	-	216-A -27	X		6
	-	-	216-A -21	X		7
	-	B	241-BX		X	
			241-BXR-153		X	
			241-BX -155		X	
			241-BX -153		X	
			241-BXR-152		X	
			241-BX -154		X	
			241-BX -302-A		X	
			241-BX -302-B		X	
			241-BX -302-C		X	
	-	C	241-BY		X	
			241-BYR-151		X	
			241-BYR-152		X	
			241-BYR-153		X	
			241-BYR-154		X	
	-	D	241-B		X	
			241-B -151		X	
			241-B -152		X	
			241-B -153		X	
			241-B -154		X	
			241-B -252		X	
			241-BR -152		X	
			242-B		X	
			241-B -301-B		X	
			241-B -301-C		X	
			241-B -302-B		X	
	2	A	216-B -48	X		8
			216-B -49	X		
			216-B -50	X		
			216-B -43	X		
			216-B -44	X		
			216-B -45	X		
			216-B -46	X		
			216-B -47		X	
	3	Y	216-B -16	X		9
			216-B -14		X	
			216-B -15		X	
			216-B -17		X	
			216-B -18		X	
			216-B -19		X	
100	-	-	116-K -2	X		10
	-	-	116-K -1	X		
	-	-	107KE		X	
	-	-	107KW		X	
200 WEST	-	-	216-U -1&2	X		13
	7	L	216-T -2	X		15
			216-T -8	X		
			218-W -7		X	
			218-W -8		X	
	-	-	216-T -19	X		16
	-	-	216-S -20	X		19

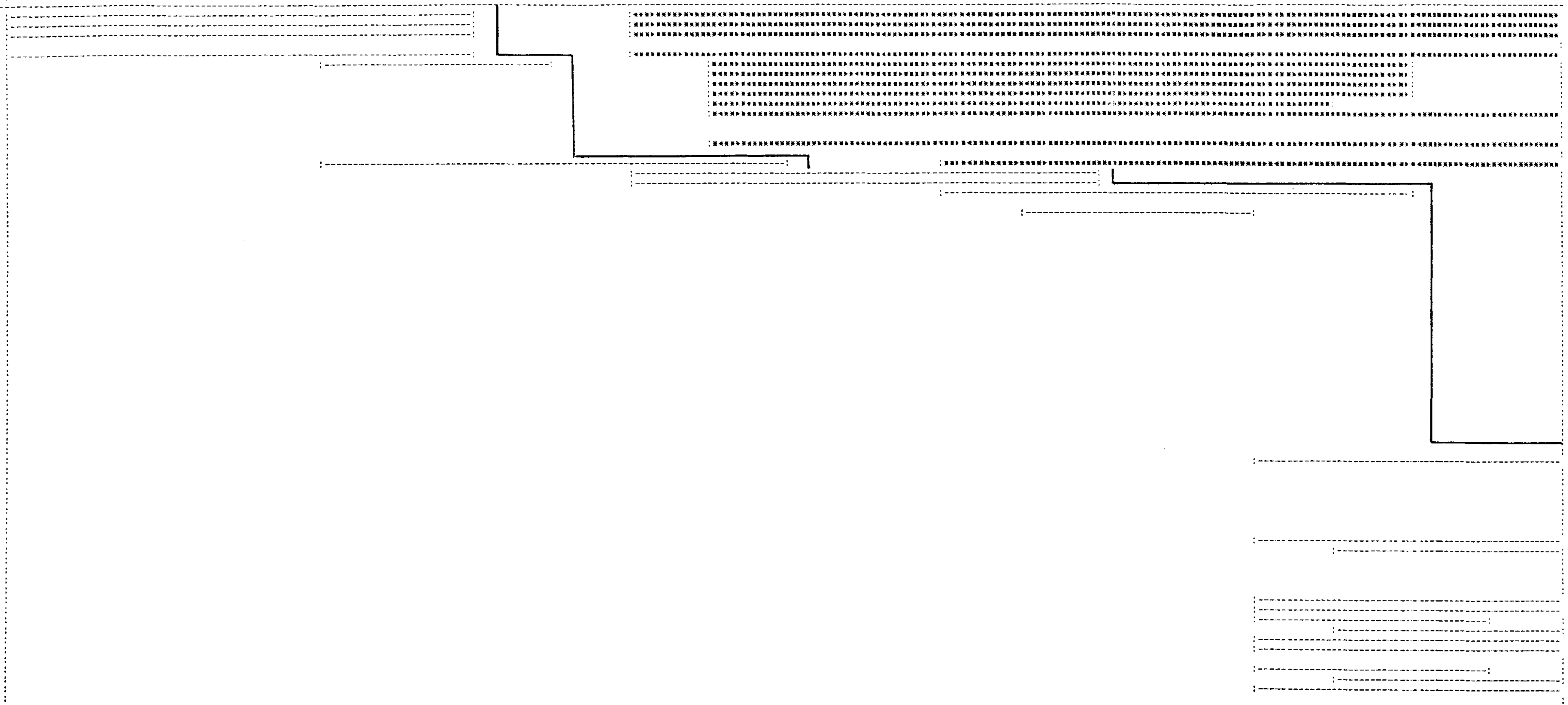
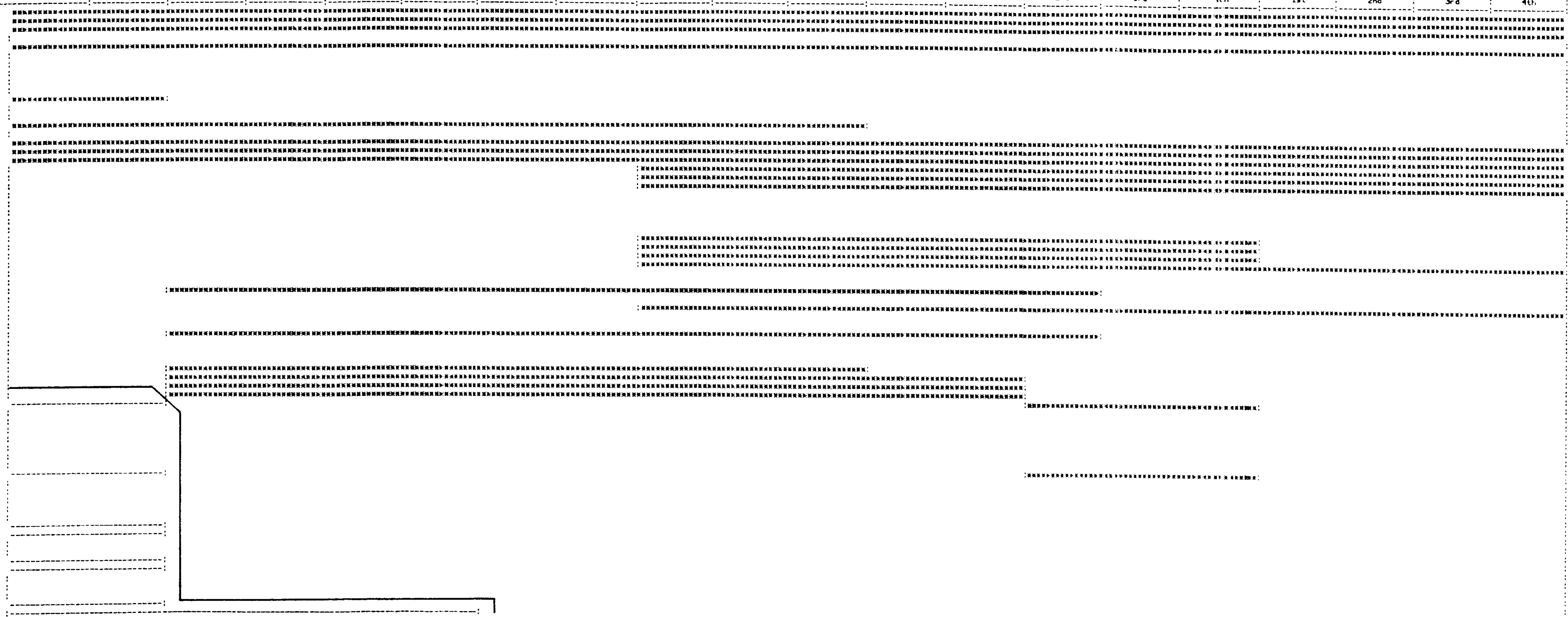


FIGURE 4-1. EXAMPLE MASTER SCHEDULE FOR CHARACTERIZATION AND REMEDIATIONS FOR A TEN-YEAR PERIOD (Continued).

	Year 6				Year 7				Year 8				Year 9				Year 10			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Annual Characterization Cost				$ 49,750,274				$ 50,335,932				$ 49,181,033				$ 49,412,597				$ 50,103,113
Quarterly Characterization Cost	$ 12,336,404	$ 15,955,404	$ 12,642,233	$ 8,816,233	$ 10,081,511	$ 12,784,511	$ 11,188,455	$ 16,281,455	$ 12,267,830	$ 12,849,275	$ 12,031,964	$ 12,031,964	$ 10,636,746	$ 14,588,801	$ 11,157,660	$ 13,029,390	$ 12,520,398	$ 15,775,208	$ 9,231,298	$ 12,576,209
Annual Remediation Cost				$ 100,224,200				$ 100,345,200				$ 94,312,800				$ 89,653,000				$ 101,199,000

Area	Group	Source	CERCLA	RCRA
300	-	316 - 1	X	
		316 - 2	X	
		316 - 3	X	
200 WEST	Q	216-T -7	X	
		241-TR -152		X
		241-T -152		X
		241-TR -153		X
		241-T -151		X
		241-301-B		X
		241-T		X
		216-T -13		X
		216-T -36		X
		216-T -32		X
		216-T -5		X
200 EAST	-	216-B -7A&B	X	
	-	216-B -5	X	
200 WEST	-	216-T -3	X	
200 EAST	-	216-A -27	X	
	-	216-A -21	X	
	B	241-BX		X
		241-BXR-153		X
		241-BX -155		X
		241-BX -153		X
		241-BXR-152		X
		241-BX -154		X
		241-BX -302-A		X
		241-BX -302-B		X
		241-BX -302-C		X
	C	241-BY		X
		241-BYR-151		X
		241-BYR-152		X
		241-BYR-153		X
		241-BYR-154		X
	D	241-B		X
		241-B -151		X
		241-B -152		X
		241-B -153		X
		241-B -154		X
		241-B -252		X
		241-BR -152		X
		242-B		X
		241-B -301-B		X
		241-B -301-C		X
		241-B -302-B		X
	A	216-B -48	X	
		216-B -49	X	
		216-B -50	X	
		216-B -43	X	
		216-B -44	X	
		216-B -45	X	
		216-B -46	X	
		216-B -47		X
	Y	216-B -16	X	
		216-B -14		X
		216-B -15		X
		216-B -17		X
		216-B -18		X
		216-B -19		X
100	-	116-K -2	X	
	-	116-K -1	X	
	-	107KE		X
	-	107KW		X
200 WEST	-	216-U -1&2	X	
	L	216-T -2	X	
		216-T -8	X	
		218-W -7		X
		218-W -8		X
	-	216-T -19	X	
	-	216-S -20	X	



because the number of available drilling rigs is insufficient. It should be noted that the cost of a particular remedial action could impact the ability to startup new remediations. One or two relatively expensive actions enacted at one time could significantly tie up available funds for several years, thus delaying the startup of new efforts. As described above, the planning process needs to consider such delays in setting up the characterization schedules. Additional limiting factors to ultimately be considered in scheduling remedial actions are the limitations in available manpower and equipment necessary to complete the action.

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