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**OPERABLE UNIT 4 TREATABILITY STUDY
WORK PLAN FOR THE VITRIFICATION OF
RESIDUES FORM SILOS 1, 2, AND 3. DRAFT
NOVEMBER 1991**

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OPERABLE UNIT 4

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**TREATABILITY STUDY WORK PLAN
FOR THE VITRIFICATION OF RESIDUES FROM
SILOS 1, 2, AND 3**

**Fernald Environmental Management Project
Fernald, Ohio**



November 1991

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**Fernald Office
U.S. DEPARTMENT OF ENERGY**

DRAFT

Fernald Environmental Management Project

OPERABLE UNIT 4

**TREATABILITY STUDY WORK PLAN
FOR THE VITRIFICATION OF RESIDUES FROM SILOS 1, 2, AND 3**

November 1991

Fernald Site Office
Department of Energy

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LIST OF ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
ASI/IT	Advanced Sciences, Inc./International Technology Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	Department of Energy
DQO	Data Quality Objectives
EPA	Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FFCA	Federal Facilities Compliance Agreement
FS	Feasibility Study
HSL	Hazardous Substance List
mL	milliliters
mrem	millirem
mTCLP	Modified Toxicity Characteristic Leaching Procedure
Pb	Lead
pCi/m ² -s	picoCuries/meter ² per second
pCi/L	picoCuries/liter
PCi/hr	picoCuries/hour
pCi/g	picoCuries/gram
PNL	Pacific Northwest Laboratory
Po	Polonium
ppm	parts per million
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Program Plan
Ra	Radium
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
TBC	To Be Considered
TCLP	Toxicity Characteristic Leaching Procedure
Th	Thorium
U	Uranium
WEMCO	Westinghouse Environmental Management Company of Ohio

LIST OF APPENDICES

- Appendix A PNL Project QA Plan
- Appendix B Waste Technology Center Safety Plan

1.0 PROJECT DESCRIPTION

1.1 SITE DESCRIPTION

The Fernald Environmental Management Project (FEMP) is a contractor-managed federal facility once used for the production of purified uranium metal for the U.S. Department of Energy (DOE). The FEMP is located on 1050 acres in a rural area approximately 20 miles northwest of downtown Cincinnati, Ohio. On July 18, 1986, a Federal Facilities Compliance Agreement (FFCA) was jointly signed by the U.S. Environmental Protection Agency (EPA) and DOE to ensure that environmental impacts associated with past and present activities at the FEMP are thoroughly investigated so that appropriate remedial actions can be assessed and implemented.

A Remedial Investigation/Feasibility Study (RI/FS) has been initiated to develop these remedial actions. The FEMP has been segregated into five operable units. Operable Unit 4 consists of Silos 1 and 2 (K-65 Silos), Silo 3 (metal oxide silo), the unused Silo 4, and their ancillary structures and the surrounding berms. Operable Unit 4 is located at the western periphery of the site, south of the waste pit area. The Feasibility Study (FS) for Operable Unit 4 is considering remedial actions for wastes stored in the silos and for contaminants in the surrounding berms.

Silos 1 and 2 were used for the storage of radium-bearing residues formed as by-products of uranium ore processing. Silos 1 and 2 received approximately 7,200 cubic yards of residues from 1952 to 1958. Raffinates (residues resulting from uranium solvent extraction) were pumped into the silos as a slurry where the solids would settle. The free liquid was decanted through a series of valves and piping placed at various levels along the height of the silo wall. This procedure, pumping of slurry, followed by the settling and decanting, continued until the waste material was approximately four feet below the top of the vertical wall. Historic analyses of the K-65 silo residues indicate that approximately 11,200 kilograms of uranium (0.71 percent U-235) is present in Silos 1 and 2. Analytical results of residue samples, taken in July 1988, indicated uranium concentrations was 1400 parts per million (ppm) in Silo 1 and 1800 ppm in Silo 2. In addition, the estimated concentration of radium was between 0.13 to 0.21 ppm in the K-65 residues.

In 1989, Westinghouse Environmental Management Company of Ohio (WEMCO) collected residue samples from Silos 1 and 2. The analyses of the samples indicate that the concentration of radium-226 (Ra-226) in Silo 1 ranges from 89,280 picoCuries/gram (pCi/g) to 192,600 pCi/g; in Silo 2 from 657 to 145,300 pCi/g. Thorium-230 (Th-230) concentrations in Silo 1 range from 10,569 to 43,771 pCi/g and from 8,365 to 40,124 pCi/g in Silo 2. The concentration of lead-210 (Pb-210) in Silo 1 ranges from 48,490 to 181,000 pCi/g and from 77,940 to 399,200 in Silo 2. Total uranium concentrations in Silo 1 range from 1,189 to 2,753 ppm and from 137 to 3,717 ppm in Silo 2.

1 Radon and the elements resulting from its decay (referred to as daughter products, or
2 progeny) are the nuclides of concern from a health and environmental perspective. Radon is
3 known to be emanating from the silos via cracks and at joints. Radon and its daughter
4 products are relatively mobile and capable of migrating through air and water. Due to the
5 probable diffusion of radon into the berms, it is believed that the berms and subsoils contain
6 elevated levels of lead-210 (Pb-210) and polonium-210 (Po-210). Also, there may have been
7 leakage from the existing leachate collection system beneath the silos into the surrounding
8 soils. If this has occurred, the potential for uptake of long-lived radionuclides would be a
9 major hazard. Sampling of the berms and soil beneath the silos is underway to confirm the
10 nature and extent of any soil contamination.

11
12 Silos 3 and 4 were constructed in 1952 in a manner similar to Silos 1 and 2; however, the
13 silos were designed to receive dry materials only. Raffinate slurries from refinery operations
14 were dewatered in an evaporator and spray-calcined to produce a dry waste for removal to
15 Silo 3. The material was blown in under pressure to fill Silo 3. Silo 4 was never used and,
16 except for rainwater infiltration, remains empty today.

17
18 Silo 3 contains approximately 5,100 cubic yards of calcined residues consisting of silica,
19 uranium (39,600 pounds), a very small amount of radium, thorium, and other metal oxides.
20 Silo 3 is not a significant radon source because of the physical and chemical characteristics of
21 its contents. Also, Silo 3 is not believed to be a source of contamination to the surrounding
22 areas and underlying soils. Nevertheless, Silo 3 must be considered a potential hazard
23 because its contents are radioactive and in its dry powdery state susceptible to airborne
24 dispersal if exposed to wind.

25 26 27 1.2 REMEDIAL ACTION OBJECTIVES

28
29 Remedial action objectives (RAOs) are medium-specific cleanup goals for protecting human
30 health and the environment. The RAOs address the contaminants of concern as well as
31 exposure routes and receptors identified in the baseline risk assessment. The primary
32 purposes of RAOs are to ensure site-wide compliance with:

- 33
- 34 ● Chemical-specific Applicable or Relevant and Appropriate Requirements
35 (ARARs) and To Be Considered (TBC) guidelines
- 36 ● U.S. EPA guidance for risk to public health from hazardous chemicals
- 37 ● Regulatory standards for control of radiation and radioactivity in the
38 environment
- 39

40 The remediation objectives for Operable Unit 4 must cover all constituents (radiological and
41 chemical) that contribute to a reasonable maximum exposure (RME) scenario. RAOs for
42 Operable Unit 4 are given in Figure 1-1. Alternatives for remediation must meet airborne
43 and direct radiation RAOs at a point immediately adjacent to the silos, as well as drinking

1 water RAOs in any perched water that might be encountered directly below the silos. The
2 treatability study goals are given in Section 1.4.

3
4 Ten remediation alternatives for Operable Unit 4 are listed in the DOE report "Initial
5 Screening of Alternatives for Operable Unit 4, Task 12 Report, October 1990." Nine of
6 these alternatives are still under consideration. Laboratory data are required to evaluate the
7 alternatives, eliminate alternatives that are not technically feasible, and aid in the selection of
8 the preferred alternatives(s). Further details of the alternatives are given in Section 2.0.

11 1.3 TREATABILITY STUDY

13 1.3.1 Justification

14
15 The justification to conduct these tests is provided by EPA in "Guide for Conducting
16 Treatability Studies Under CERCLA." Treatability studies can provide the critical
17 performance and cost information needed to evaluate and select treatment alternatives. The
18 document recommended treatability tests for those substances that do not have standard
19 treatment methods or supporting data in the literature that prove the material of interest can
20 be effectively treated to render it nonhazardous. More explicitly in the case of Operable
21 Unit 4, the purpose of treatment is to render the residues from Silos 1, 2, and 3 nonleachable
22 so that it is not classified as characteristic waste under the Resource Conservation and
23 Recovery Act (RCRA). Among the studies being conducted is the vitrification of the K-65
24 and metal oxide materials. These studies will provide information in determining the impacts
25 of the effectiveness of vitrification.

26
27 The laboratory testing previously accomplished by Battelle Pacific Northwest Laboratory
28 (PNL) in Richland, Washington provides a basis that the K-65 material has the capabilities to
29 be vitrified. However, in order to be able to compare the effectiveness of vitrification to
30 stabilization and metal extraction as treatment options for the remedial alternatives for Silo 3
31 and the K-65 Silos in the feasibility studies and in the subsequent engineering designs,
32 vitrification tests must be performed on the metal oxide residues (Silo 3 material) and
33 additional data must be obtained for the K-65 residues. It is planned to utilize PNL to
34 accomplish the treatability studies outlined in this document. PNL has extensive experience
35 in conducting vitrification tests and has developed the laboratory bench-scale apparatus and
36 the necessary experimental procedures for meeting quality assurance (QA) requirements.

37
38 The objectives of the previous laboratory tests were to determine the quantity and
39 composition of the off-gas (including radon concentration) generated during vitrification of
40 K-65 residue, the radon emanation rate from the vitrified K-65 waste, and the leachability of
41 the vitrified K-65 waste. The test results from the previous laboratory tests have been
42 documented in "Characteristics of Fernald's Silos 1 and 2 Residue Before, During and After
43 Vitrification." Due to unforeseen laboratory conditions, inadvertently, the total volume of

1
2

MEDIA	REMEDIAL ACTION OBJECTIVES
1. SILO CONTENTS	<p><u>For Human Health:</u> 1-1 Prevent exposures to non-carcinogens which would result in a Hazard index less than or equal to unity (1), and/or combined risks from exposure to carcinogens less than or equal to 1.0E-04, using 1.0E-06 as the point of departure.</p> <p>1-2 Prevent migration of contaminants which would result in groundwater concentrations greater than the MCLs or that would result in a Hazard Index less than or equal to unity (1), and/or combined risks from exposure to carcinogens less than or equal to 1.0E-04, using 1.0E-06 as the point of departure.</p> <p>1-3 Prevent current and future direct radiation doses from exceeding 100 mrem/yr.</p> <p><u>For Environmental Protection:</u> 1-4 Prevent migration of contaminants that would result in surface water levels greater than ambient water quality criteria.</p> <p>1-5 Prevent current and future direct radiation doses from causing detectable chronic effects.</p>
2. AIR	<p><u>For Human Health:</u> 2-1 Prevent inhalation of contaminants which would result in a Hazard index less than or equal to unity (1), and/or combined risks from exposure to carcinogens less than or equal to 1.0E-04, using 1.0E-06 as the point of departure.</p> <p>2-2 Prevent doses from radionuclide emissions at the FEMP from exceeding 10 mrem/yr, and radon flux from exceeding 20 pCi/square meter-second.</p> <p><u>For Environmental Protection:</u> 2-3 Prevent current and future radiation emissions from causing detectable chronic effects.</p>

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FIGURE 1-1. REMEDIAL ACTION OBJECTIVES

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MEDIA	REMEDIAL ACTION OBJECTIVES
3. SOILS	<p><u>For Human Health:</u> 3-1 Prevent inhalation of/ingestion of/direct contact with soils surrounding the silos which would result in a Hazard Index less than or equal to unity (1), and/or combined risks from exposure to carcinogens less than or equal to 1.0E-04, using 1.0E-06 as the point of departure.</p> <p>3-2 Prevent migration of contaminants which would result in groundwater concentrations greater than the MCLs or that would result in a Hazard Index less than or equal to unity (1), and/or combined risks from exposure to carcinogens less than or equal to 1.0E-04, using 1.0E-06 as the point of departure.</p> <p>3-3 Prevent contact with radium and thorium to 5 pCi/g in the first 15 cm of soil, and 15 pCi/g at lower depths. Prevent contact with other nuclides at concentrations resulting in doses greater than 100 mrem/yr.</p> <p><u>For Environmental Protection:</u> 3-4 Prevent migration of contaminants that would result in surface water contamination levels greater than ambient water quality criteria.</p>
4. SEDIMENTS	<p><u>For Human Health:</u> 4-1 Prevent ingestion of/direct contact with sediment contaminants which would result in a Hazard Index less than or equal to unity (1), and/or combined risks from exposure to carcinogens less than or equal to 1.0E-04, using 1.0E-06 as the point of departure.</p> <p><u>For Environmental Protection:</u> 4-2 Prevent releases of contaminants from sediments that would result in surface water contamination levels greater than ambient water quality criteria.</p>

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FIGURE 1-1.
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MEDIA	REMEDIAL ACTION OBJECTIVES	
5. SURFACE WATER	5-1	<u>For Human Health:</u> Prevent exposures to non-carcinogens which would result in a Hazard Index less than or equal to unity (1), and/or combined risks from exposure to carcinogens less than or equal to 1.0E-04, using 1.0E-06 as the point of departure.
6. GROUNDWATER	5-2	<u>For Environmental Protection:</u> Restore surface water to below ambient water quality criteria.
	6-1	<u>For Human Health:</u> Prevent ingestion of water having contaminant levels greater than the MCLS or TBSs, or which would result in a Hazard Index less than or equal to unity (1), and/or combined risks from exposure to carcinogens less than or equal to 1.0E-04, using 1.0E-06 as the point of departure.
	6-2	<u>For Environmental Protection:</u> Restore groundwater aquifer to contaminant concentration below the MCLS.

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FIGURE 1-1.
(CONTINUED)

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1 the generated off-gas during vitrification and, therefore, the total emanation of radon during
2 vitrification, was not accurately measured. During the bench-scale treatability tests outlined
3 in this document, special effort will be made to obtain accurate measurements of the total
4 volume of the off-gas during vitrification and the emanation of radon during vitrification.
5 The composition of the off-gas generated from the previous laboratory tests and the
6 composition of the condensate from the previous laboratory tests are presented in Table 1-1.

7
8 The radon emanation rate from the vitrified K-65 waste indicated that the radon
9 concentration, which began at 0 pCi/L, averaged about 4 pCi/L. For the once through open
10 loop system used, this represents an emanation rate of 48 pCi/hr or 1.56 pCi/m²-s. This is
11 order of magnitude lower than the EPA limit of 20 pCi/m²-s.

12
13 Also, the Toxicity Characteristic Leaching Procedure (TCLP) leachate results from the
14 previous laboratory test for the vitrified K-65 waste are presented in Table 1-2. The results
15 are well below the established TCLP limits.

16 17 1.3.2 EPA Treatability Guidance

18
19 EPA's "Guide for Conducting Treatability Studies Under CERCLA" outlined a three-tiered
20 approach to conducting treatability studies for a SUPERFUND site. The approach is
21 exhibited in Figure 1-2. The evaluation of remedial alternatives phase of the RI/FS may
22 require as many as three tiers of treatability testing:

- 23
- 24 ●Laboratory Screening
- 25 ●Bench Scale Testing
- 26 ●Pilot-scale Testing
- 27

28 Laboratory screening and bench-scale testing are usually performed during evaluation of
29 remedial alternatives. Pilot-scale testing is generally accomplished during remedy
30 implementation. Laboratory screening has been performed on the K-65 material (Silos 1 and
31 2 material) during the previous laboratory testing accomplished by PNL. Additional
32 laboratory screening of the K-65 material will be completed, as described in this work plan,
33 prior to the bench-scale vitrification testing of the K-65 material. Laboratory screening of
34 the metal oxide material (Silo 3 material) will be outlined in this document and will be
35 performed prior to the bench-scale vitrification testing of the metal oxide material. The
36 completion of the RI/FS detail analysis of remedial alternatives will determine if pilot-scale
37 testing of the vitrification treatment option is required. Figure 1-3 illustrates the relationship
38 of the completed, planned, and to be determined Operable Unit 4 vitrification treatability
39 studies to the RI/FS process.

40
41 The detailed analysis of alternatives phase of the RI/FS follows the development and
42 screening of alternatives and precedes the actual selection of a remedy in the Record of
43 Decision (ROD). During the detailed analysis of alternatives, all remedial alternatives are
44 evaluated based on nine RI/FS evaluation criteria.

TABLE 1-1

Composition of the Vitrification Off-Gas

COMPONENT	VOLUME %
Nitrogen	77.2%
Oxygen	17.1%
Other Ions	3.4%
Water	1.4%
Argon	0.9%
Carbon Dioxide	0.06%
Organic Compounds	None Detected

Condensate Composition

COMPONENT	(mg/L)
Aluminum	<0.1
Antimony	0.04
Arsenic	<0.01
Barium	0.07
Cadmium	<0.01
Calcium	14.1
Chromium	<0.01
Cobalt	0.01
Iron	0.06
Lead	0.09
Magnesium	3.7
Mercury	0.0029
Nickel	0.1
Phosphorus	0.2
Potassium	0.7
Selenium	0.19
Sodium	3.2
Total Uranium	0.011

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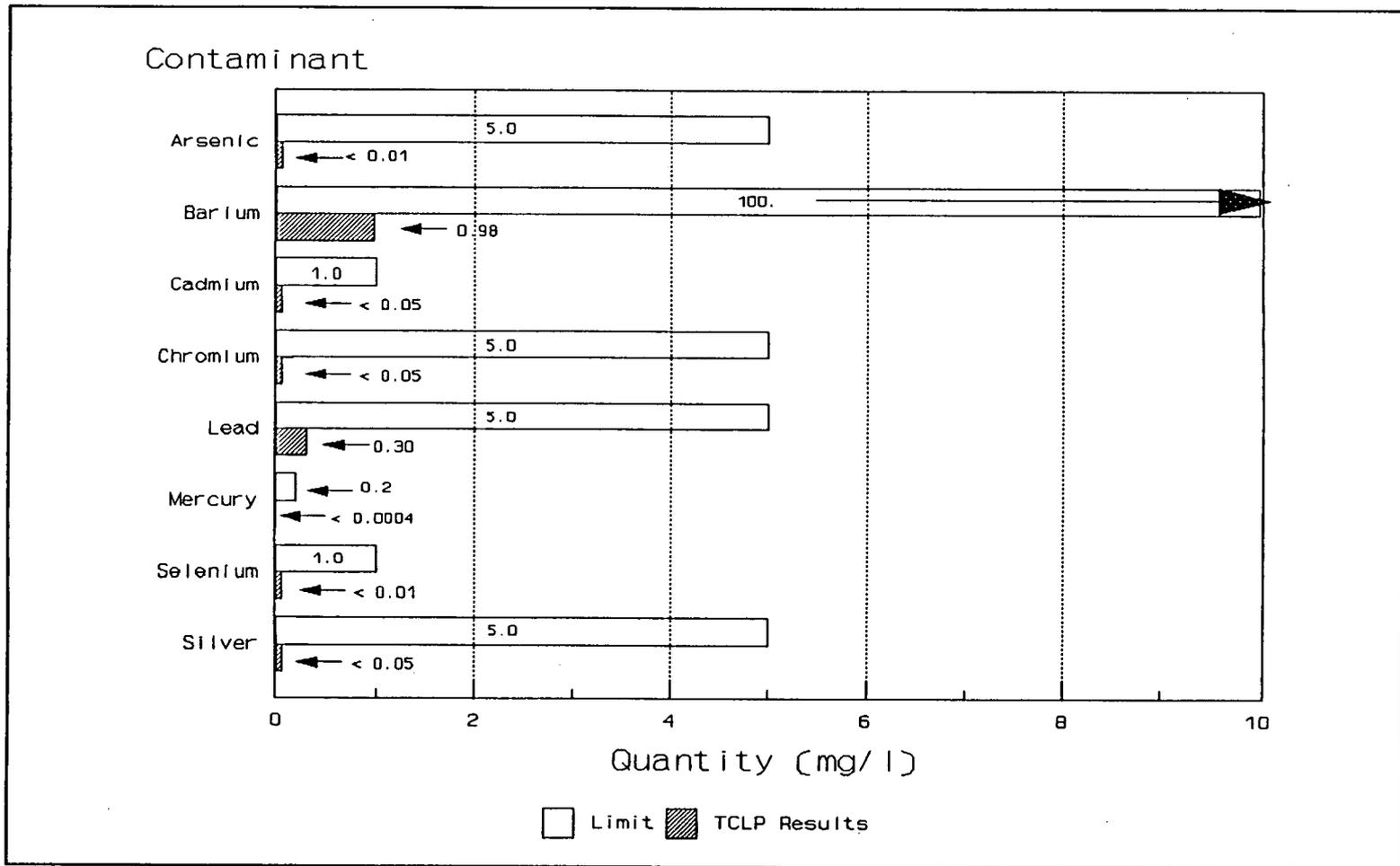


TABLE 1-2

Previous Laboratory Vitrification Tests
 TCLP Leachate Results for Vitrified K-65 Material:
 Concentration of Metals in Leachate

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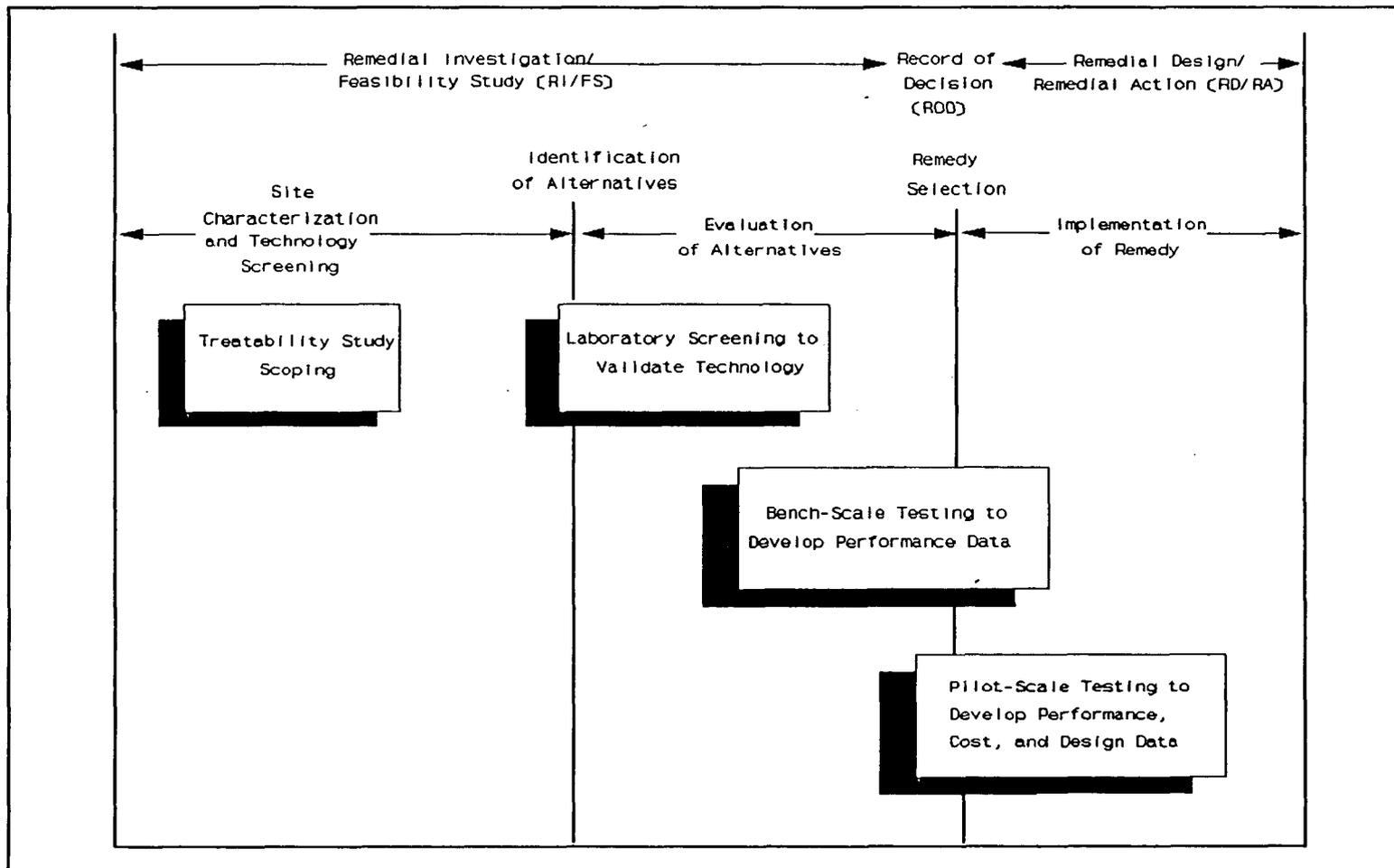


Figure 1-2
The Role of Treatability Studies in the RI/FS and RD/RA Process

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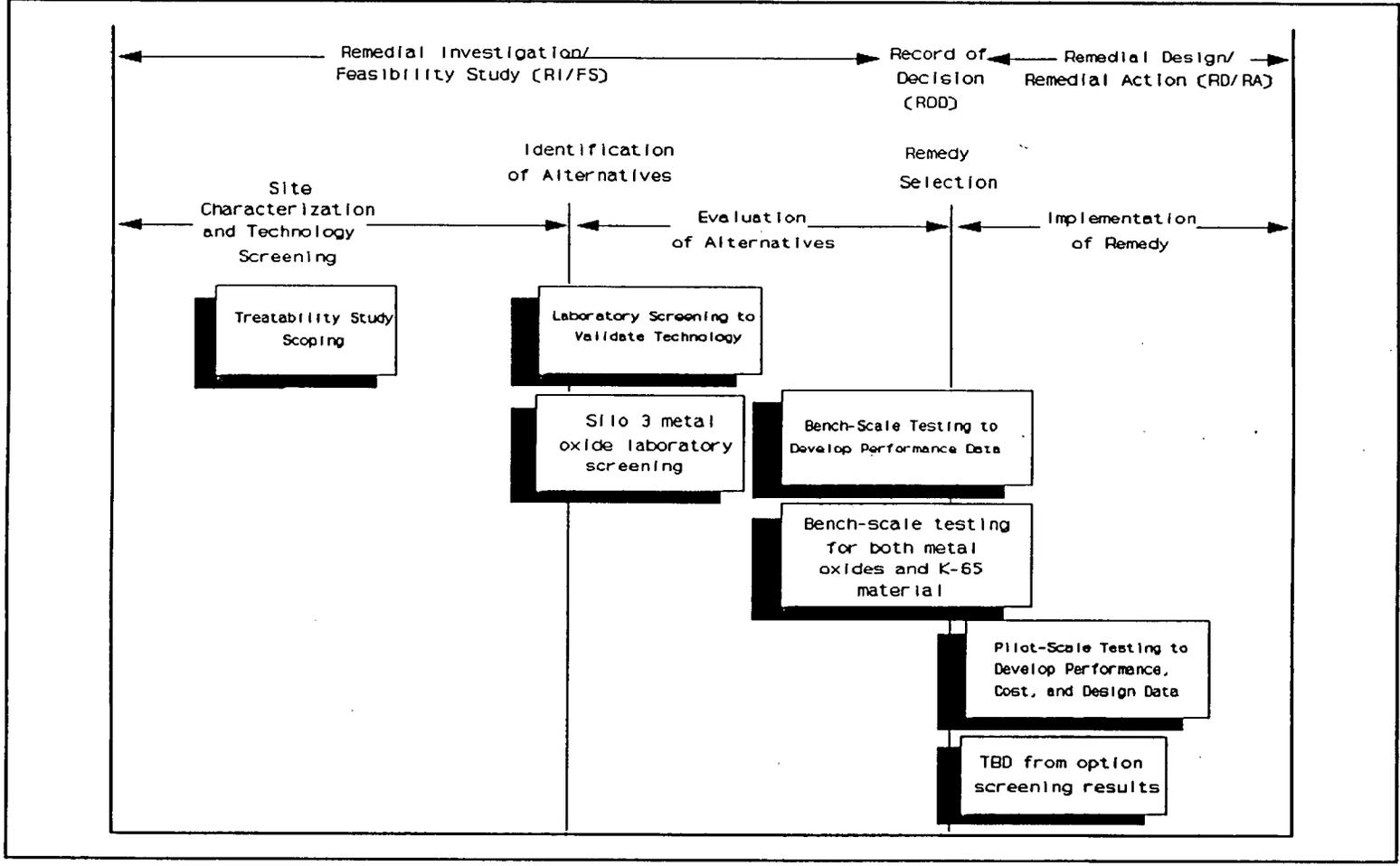


Figure 1-3
Relationship of the Operable Unit 4 Vitrification Treatability Studies to the RI/FS

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1 Results of the treatability studies should address seven of these criteria:
2

- 3 1) Overall protection of human health and the environment
- 4 2) Compliance with ARARs
- 5 3) Implementability
- 6 4) Reduction of toxicity, mobility, or volume
- 7 5) Short-term effectiveness
- 8 6) Cost
- 9 7) Long-term effectiveness

10 11 1.3.3 Approach

12
13 Treatability studies on the K-65 materials and the metal oxides will be performed as part of
14 the evaluation of remedial alternatives phase of the RI/FS. The vitrification treatability
15 studies described in this work plan and the stabilization and metal extraction treatability
16 studies outlined in the "Treatability Study Work Plan for Operable Unit 4" prepared by
17 Advanced Sciences, Inc./International Technology Corporation (ASI/IT), dated July 1991,
18 will aid in the selection of a remedial alternative that is feasible, implementable, and cost
19 effective.

20
21 The vitrification treatability studies described in this work plan will involve the vitrification
22 of K-65 material from Silos 1 and 2 and the metal oxide material from Silo 3. Vitrification
23 studies will be performed on the K-65 material by itself, the K-65 material with added Bento-
24 grout, the metal oxide material by itself, and a predetermined mixture of K-65 material and
25 metal oxide material.

26
27 A forthcoming Operable Unit 4 removal action is the addition of a layer of Bento-grout to
28 Silos 1 and 2. The Bento-grout layer retards the diffusion of radon being produced during
29 the uranium decay sequence. Consequently, the Bento-grout layer with its trapped hazardous
30 and radiological constituents will require the same treatment option as that of the K-65
31 material. To determine the impacts of this Bento-grout layer, one testing sequence will
32 include Bento-grout added to the K-65 material prior to the vitrification.

33
34 The method used to collect residue samples from Silos 1 and 2 was to use the Vibra-Corer
35 Unit. These samples were collected according to the methods and procedures detailed in the
36 "Revised K-65 Silo Sampling and Analysis Plan" issued by ASI/IT on July 15, 1991. PNL
37 will receive samples of the K-65 material from sections "A", "B", and "C" for each Silo 1
38 and 2 and one composite sample from each of the K-65 Silos. Metal oxide material from
39 Silo 3 is available from cores archived during previous sampling operations. PNL will
40 receive composite material from Silo 3 for use in the bench-scale tests for the metal oxide
41 material.

42
43 Prior to performing vitrification testing on the metal oxide material, laboratory screening of
44 the metal oxide material will be accomplished to determine the optimum glass forming

1 material(s) to be added to the metal oxide material during vitrification. Also using existing
2 K-65 material, tests will be conducted on the off-gas collection system and the radon
3 adsorption system to optimize the bench-scale design of these systems.
4

5 1.3.4 Verification of Results 6

7 After a successful test run of each vitrification sequence; K-65 material, K-65
8 material/Bento-grout mixture, metal oxide material, metal oxide material/K-65 material
9 mixture, analyses will be conducted on the vitrified residues to determine the leachability of
10 hazardous constituents and the radon emanation rate of the vitrified residues. These tests
11 will include the standard EPA TCLP protocols and determining the radon emanation rate
12 with appropriate instrumentation. After a successful test run, PNL will send samples of the
13 vitrified residues from each vitrification sequence to an independent laboratory for the TCLP
14 analysis as established in the Quality Assurance Project Plan (QAPP) approved as part of the
15 RI/FS Work Plan. Utilizing the laboratory equipment and instrumentation available, PNL
16 will monitor the vitrified residues to determine the radon emanation rate.
17

18 Also, for each vitrification sequence, the liquid collected from separating the moisture from
19 the off-gas will be sent to an independent laboratory as established in the QAPP approved as
20 part of the RI/FS Work Plan. The liquid will then be analyzed for constituents as identified
21 in the QAPP and will include: general water quality parameters, Hazardous Substance List
22 (HSL) parameters, gross alpha, gross beta, gamma spectral analysis, and the following
23 radionuclides:
24

- 25 ● Radium-226
- 26 ● Radium-228
- 27 ● Radon-222
- 28 ● Strontium-90
- 29 ● Technetium-99
- 30 ● Neptunium-237
- 31 ● Cesium-137
- 32 ● Actinium-227
- 33 ● Protactinium-231
- 34 ● Polonium-210
- 35 ● Lead-210
- 36 ● Isotopic Thorium
- 37 ● Isotopic Uranium
- 38 ● Total Uranium
39

40 The analysis of the liquid effluent will aid in determining the required treatment or
41 evaporation of the liquid. This data will aid in implementation of the design for the
42 vitrification treatment option for the preferred alternative.
43

44 Information obtained for the identified vitrification treatability studies will aid in estimating
45 the cost of implementation of the vitrification treatment option of remedial Alternatives 6 and
46 7 for the Silos 1 and 2, the vitrification treatment option of remedial Alternatives 3 and 4 for

1 Silo 3, and the vitrification treatment of the leaching/stabilization of the contaminant
2 separation stage of Alternatives 8 and 9 for the Silos 1 and 2.
3

4 1.4 GOALS OF THE TREATABILITY STUDY 5

6 The primary goal of the treatability study is to support remedy selection during the feasibility
7 study (FS). It supports the FS by providing data about the waste treatment under
8 consideration by the FS. This information is used to select the most promising treatment
9 technologies for further consideration, in conjunction with other aspects of the proposed
10 alternative designs.
11

12 This treatability study is designed to provide data for technologies that lower the leachability
13 of contaminants vitrifying them into an altered material. These data will be compared to
14 preliminary remediation goals, toxic constituent regulatory limits (TCLP limits), and site
15 background concentrations to determine if attainment of any or all of these goals is feasible
16 using the vitrification technology. These quantitative goals are developed in Section 3.0,
17 which outlines the treatability study's specific performance objectives.

2.0 REMEDIAL TECHNOLOGY DESCRIPTION

Several remediation technologies are being considered for Operable Unit 4. These alternatives have been described in detail in the DOE report "Initial Screening of Alternatives for Operable Unit 4, Task 12 Report, October 1990." In the Task 12 Report, Silos 1 and 2 are treated by the same alternatives because the materials in the structures are similar. Silo 3 is treated in separate alternatives.

The vitrification technology considered in the following alternatives consists of heating the residues to sufficient temperatures to induce the formation of glass-like mass. The resulting vitreous solid will have a reduced volume, be less likely to leach hazardous or radioactive components, and have a greatly reduced radon emanation rate. The vitrified material would be well suited for long-term disposal.

2.1 SUMMARY OF ALTERNATIVES - SILOS 1 AND 2

Alternative 0A - No Action

This alternative calls for no action and provides a baseline against which the other alternatives can be compared. It provides for the silos and its contents to remain unchanged without the implementation of any removal, treatment, containment, or mitigative measures. However, it does include the installation of long-term monitoring equipment and the implementation of a monitoring program.

Alternative 1A - Nonremoval and Silo Isolation

This nonremoval alternative for Silos 1 and 2 consists of enhancing the containment integrity of the silos and utilizing them as permanent disposal facilities. An impermeable clay cap and slurry walls are among the technologies considered for this alternative.

Alternative 2A - Nonremoval, In Situ Stabilization, and Capping

This nonremoval alternative for Silos 1 and 2 consists of in situ stabilization and capping. Conventional physical stabilization and vitrification were considered as options. However, vitrification was screened out as a process option due to concerns about the difficulty of implementability. The capping and isolation technologies, with the exception of the slurry wall, are identical to those described for Alternative 1A.

Alternative 6 - Removal, Treatment, and On-Property Disposal

This alternative for Silos 1 and 2 calls for the removal and conventional stabilization or vitrification of the silo contents before on-property disposal in an engineered disposal facility.

1 This alternative includes silo demolition and disposal of the debris. Figure 2-1 is a flow
2 diagram of Alternative 6.

3
4 Alternative 7 - Removal, Treatment, and Off-Site Disposal

5
6 This alternative is identical to Alternative 6 except that the material would be packaged for
7 shipment to an approved off-site disposal facility. A flow diagram for Alternative 7 is
8 provided in Figure 2-2.

9
10 Alternative 8 - Removal, Contaminant Separation, and On-Property Disposal

11
12 This alternative is similar to Alternative 6 but adds an additional step of contaminant
13 separation to remove various radionuclides and metals before stabilization and on-property
14 disposal. A potential volume reduction of material to be disposed of as radioactive waste.
15 The waste materials will be subjected to acid and EDTA leaching processes to dissolve the
16 radioactive and hazardous metals, including lead, uranium, thorium, and radium. This
17 leaching process is based on data from Seeley (1977), Mound Laboratories (1951), and
18 Battelle (1981). Lead, barium, copper, and other metals will also be dissolved in the
19 extraction fluid. Following this leaching stage, the remaining solids will enter a solid/liquid
20 separation stage, and the leachate containing the radioactive and hazardous materials will be
21 sent to a precipitation stage. This precipitation stage will add selected anions to yield a
22 radioactive/hazardous precipitate to be solidified or stabilized for disposal. With the
23 successful leaching process, the raffinate residues remaining after the acid or EDTA leaching
24 processed will be disposed of as a nonhazardous waste. A flow diagram of this alternative is
25 presented in Figure 2-3.

26
27 Alternative 9 - Removal, Contaminant Separation, and Off-Site Disposal

28
29 This alternative is identical to Alternative 8, except that the solidified/vitrified material would
30 be packaged and shipped to an approved off-site disposal facility while the nonhazardous
31 portion is sent to a landfill or is used as backfill on the property. See Figure 2-4 for the
32 Flow diagram.

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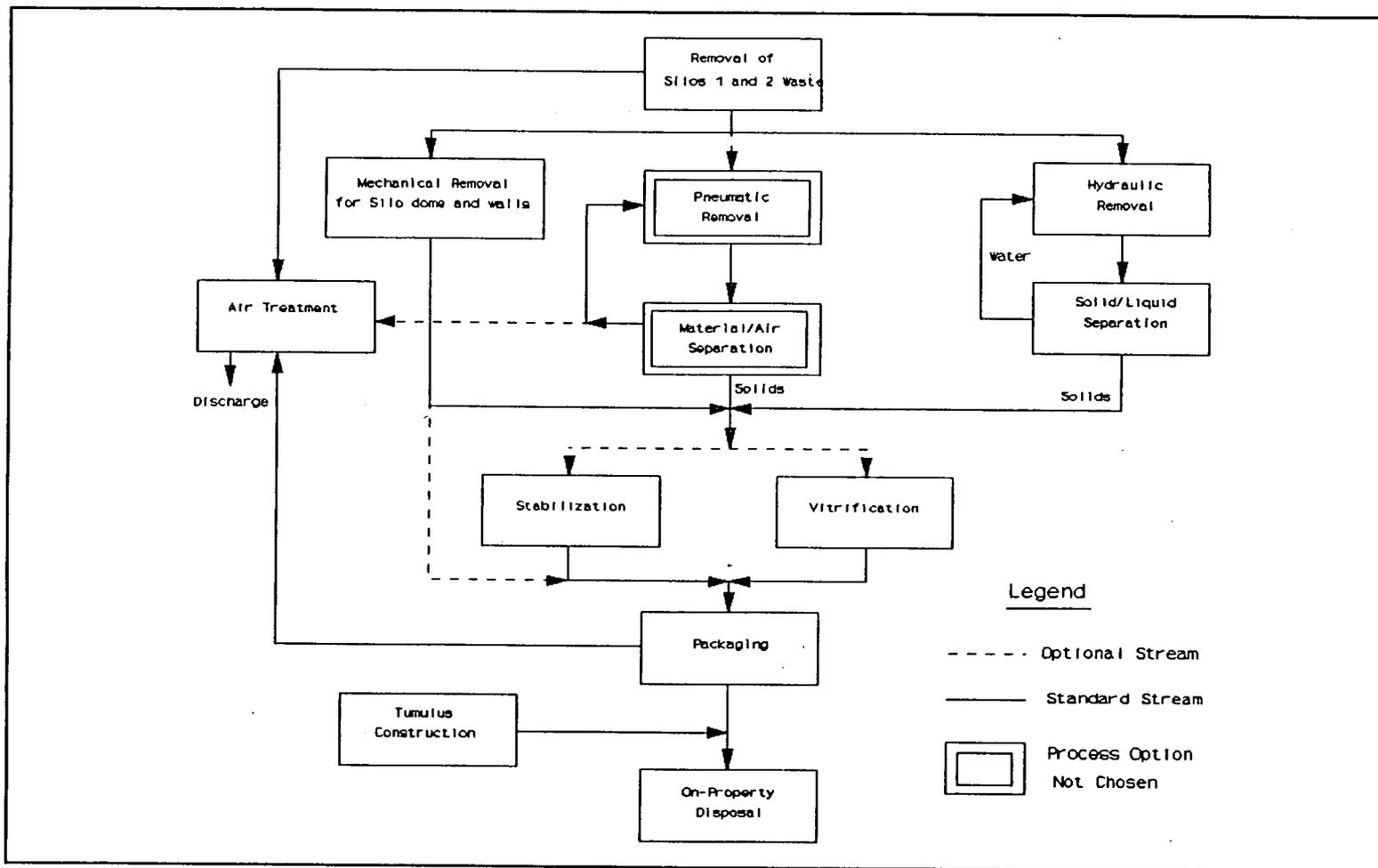


FIGURE 2-1
ALTERNATIVE 6: REMOVAL, TREATMENT, ON-PROPERTY DISPOSAL

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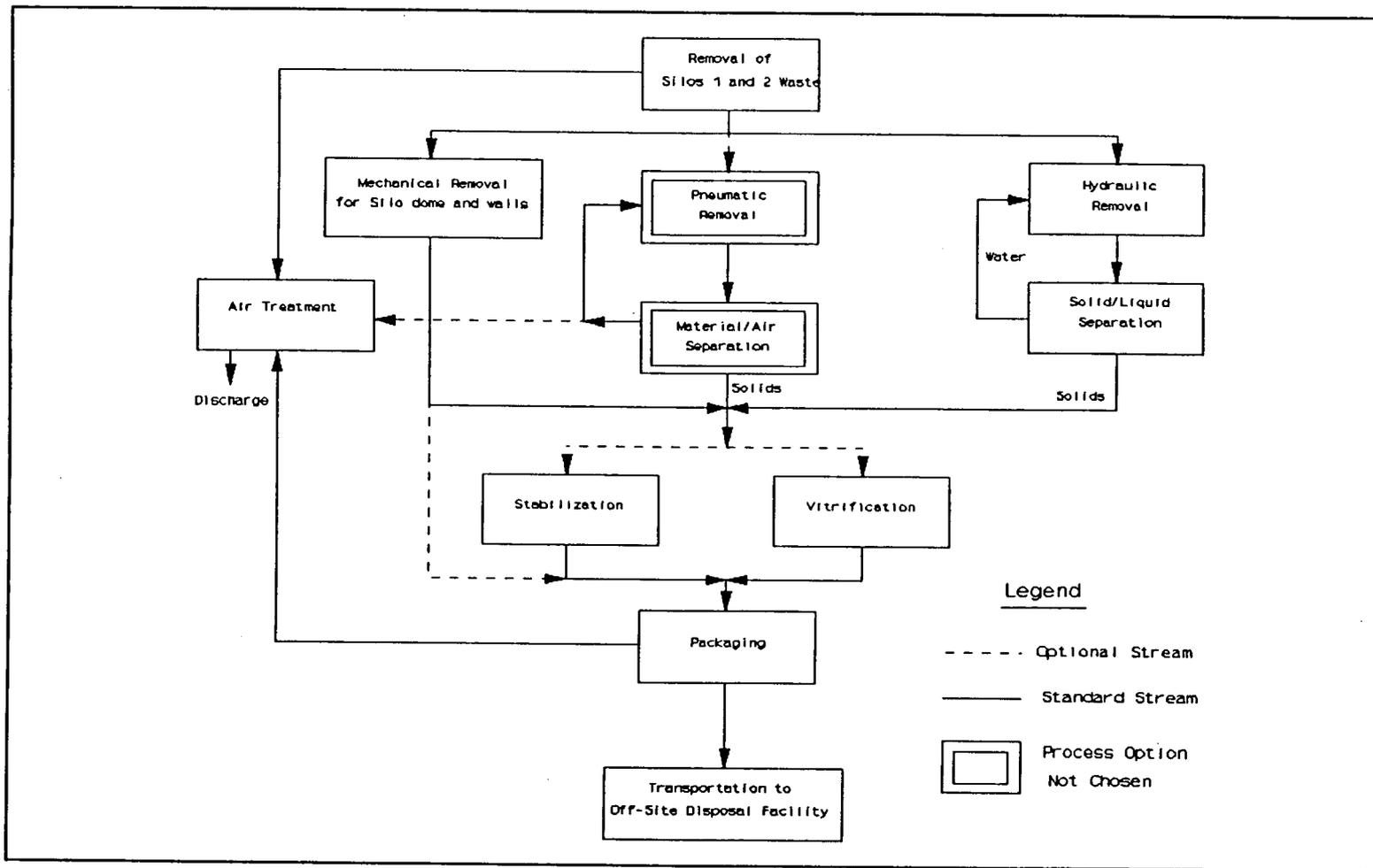


FIGURE 2-2
ALTERNATIVE 7: REMOVAL, TREATMENT, OFF-SITE DISPOSAL

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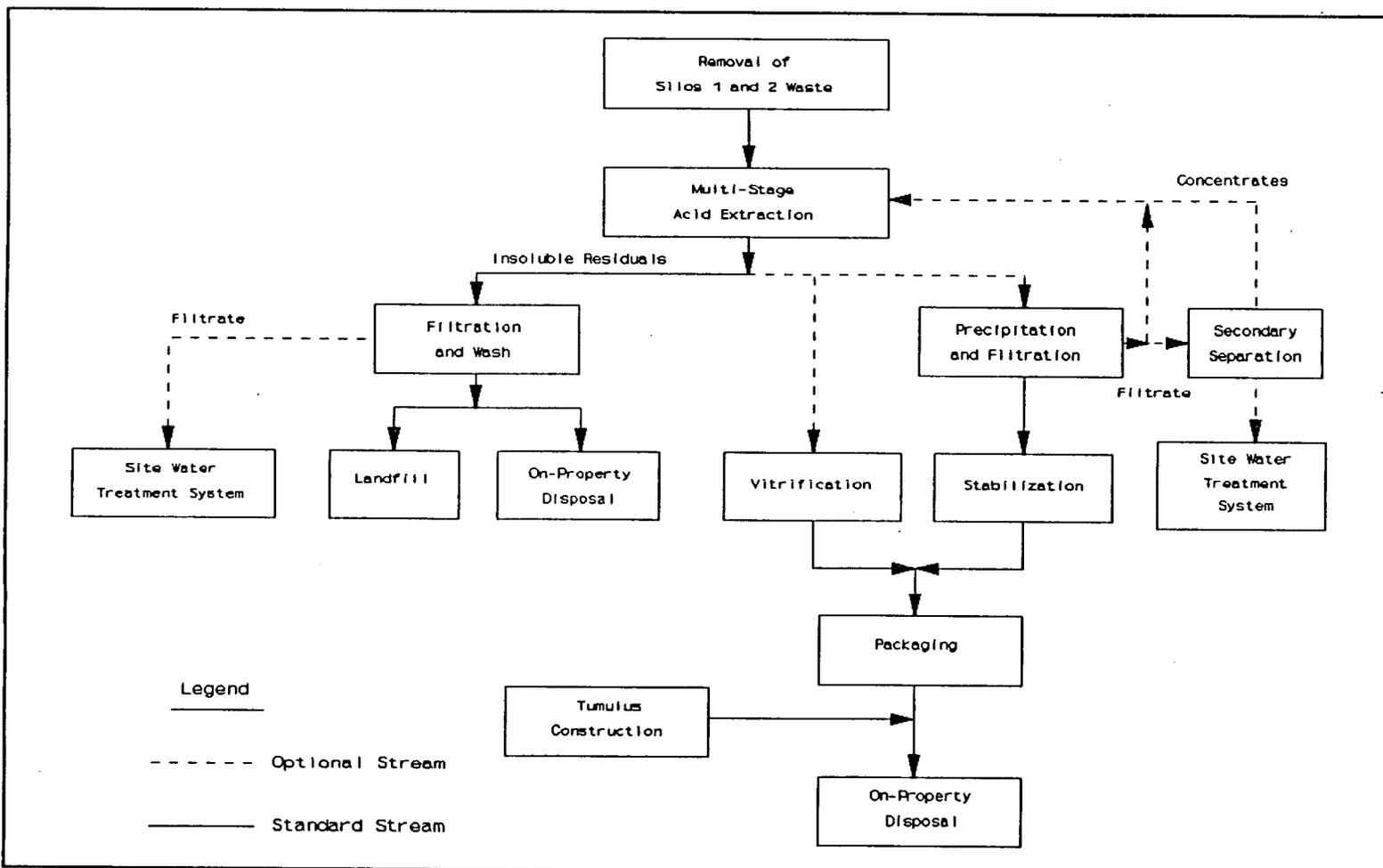


FIGURE 2-3
ALTERNATIVE 8: REMOVAL, CONTAMINANT SEPARATION, ON-PROPERTY DISPOSAL

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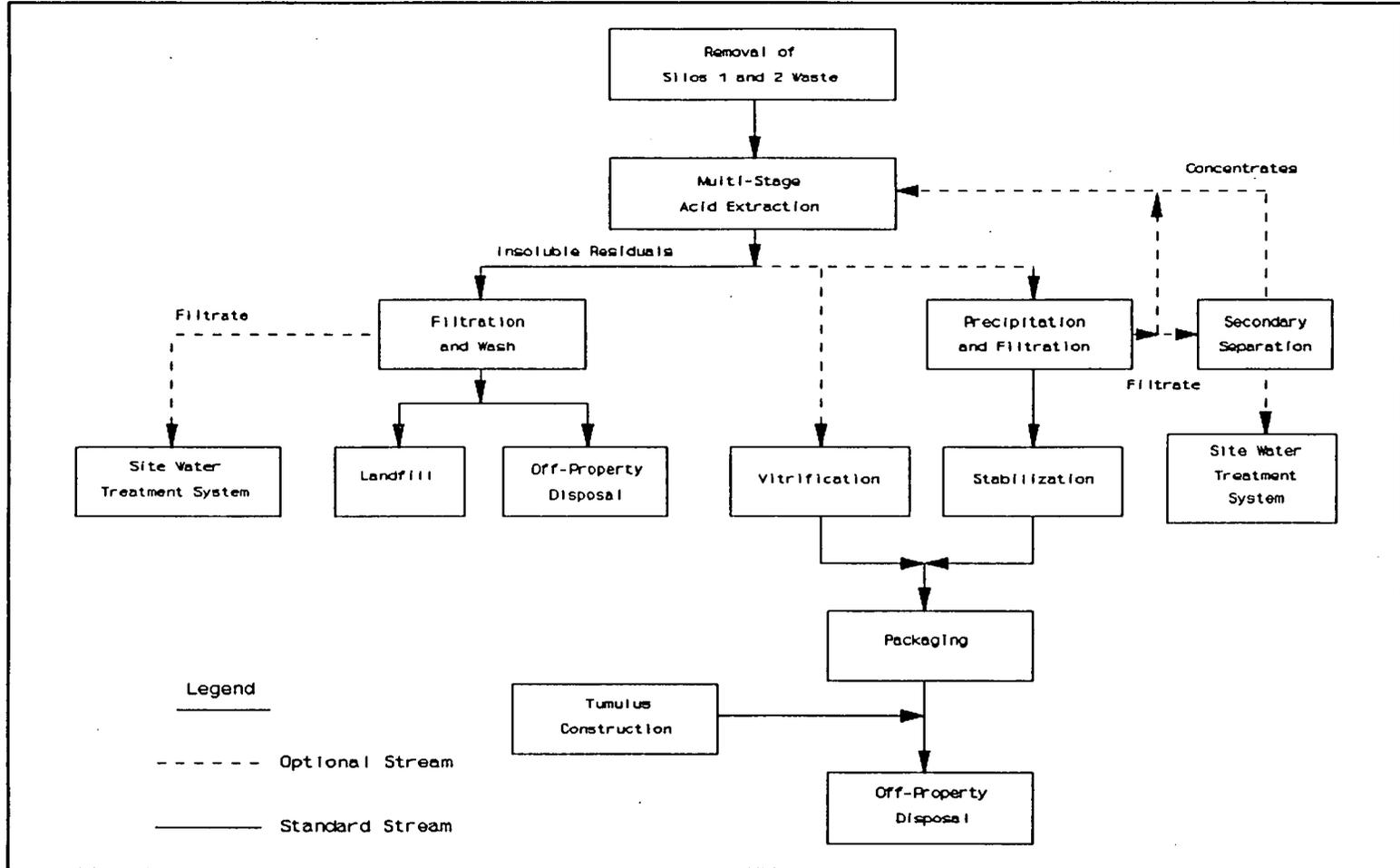


FIGURE 2-4
ALTERNATIVE 9: REMOVAL, CONTAMINANT SEPARATION, OFF-SITE DISPOSAL

27

1 2.2 SUMMARY OF ALTERNATIVES - SILO 3

2
3 Alternative 0B - No Action

4
5 The no-action alternative for Silo 3, as was the case for Silos 1 and 2, provides a baseline, but
6 no remedial action. Only installation of long-term monitoring equipment and the implementation
7 of the monitoring program are included.

8
9 Alternative 1B - Nonremoval and Silo Isolation

10
11 This nonremoval alternative for Silo 3 consists of enhancing the containment integrity of the silo
12 and utilizing it as a permanent disposal facility. An impermeable clay cap and slurry walls are
13 among the technologies considered for this alternative.

14
15 Alternative 2B - Nonremoval, In Situ Stabilization, and Capping

16
17 This nonremoval alternative for Silo 3 consists of in situ stabilization and capping. The capping
18 and isolation technologies, with the exception of the slurry wall, are identical to those described
19 in Alternative 1B.

20
21 Alternative 3 - Removal and On-Property Disposal

22
23 This alternative for Silo 3 calls for removal and conventional stabilization or vitrification before
24 disposal in an engineered on-property disposal facility. This alternative includes silo demolition
25 and disposal of the debris. The flow diagram for Alternative 3 for Silo 3 is identical to
26 Alternative 6 for the K-65 silos except that the feed for the process is from Silo 3.

27
28 Alternative 4 - Removal of Metal Oxides and Off-Site Disposal

29
30 This alternative for Silo 3 is identical to Alternative 3, except that the material would be
31 packaged for shipment to an approved off-site disposal facility. The flow diagram for
32 Alternative 4 is analogous to that for Alternative 7.

33
34 Alternative 5 - Removal and Replacement in Rehabilitated Silos

35
36 This alternative for Silo 3 provides for the removal of the metal oxides and their return to a
37 rehabilitated Silo or Silo 4 reconstructed as a permanent disposal facility. This alternative was
38 not carried through to detailed analysis because of its inadequate effectiveness and
39 implementability.

40
41 Four alternatives for the three silos are considered non-viable. These alternatives are the "No
42 Action" alternatives, OA (K-65 Silos) and OB (Silo 3); Alternative 2B "Nonremoval, In Situ
43 Stabilization, and Cap," (Silo 3); and Alternative 5 "Removal and Replacement in Rehabilitated
44 Silo 3" Alternative 5.

1 The treatability tests described in this work plan will provide data for evaluating the performance
2 of the remedial alternatives for both the K-65 residues (Silos 1 and 2) and the metal oxide waste
3 stored in Silo 3. The treatability testing will be conducted to determine the effectiveness and
4 long-term stability of; the vitrification treatment option of remedial Alternatives 6 and 7 for the
5 Silos 1 and 2, the vitrification treatment option of remedial Alternatives 3 and 4 for Silo 3, and
6 the vitrification treatment of the leaching/stabilization of the contaminant separation stage of
7 Alternatives 8 and 9 for the Silos 1 and 2.

3.0 TEST AND DATA QUALITY OBJECTIVES

The purpose of the proposed vitrification tests is to obtain quantitative data for assessing the performance of the process in support of the RI/FS. The operational and performance information resulting from the proposed bench-scale test will permit more accurate full-scale cost and schedule estimates than those that can be made from laboratory screening information. The bench-scale tests will also provide information to configure and size unit operation for pilot scale testing.

3.1 PERFORMANCE OBJECTIVES AND DESIRED DATA

Specific test objectives have been identified so that the performance of this process can be readily compared to other remediation technologies under investigation. Leachability and volume reduction are two aspects on which this technology will be evaluated. The objectives of the test, both laboratory screening and bench-scale testing, are listed below:

Laboratory Screening

- To determine the chemical inorganic composition of samples from both K-65 material and the metal oxides
- To determine the anions present in both primary waste streams
- To determine the concentration of radioactive isotopes in both primary waste streams
- To measure the bulk density
- To determine the percent moisture
- To measure the specific gravity

Bench-Scale Testing

- To determine the volume of off-gas produced by the vitrification process
- To determine the composition of the off-gas
- To determine the radon concentration in the off-gas
- To measure the radon emanation from the vitrified product

- 1 ● To ensure the final waste product meets the leaching criteria established in 40
- 2 CFR 261.24 by performing the TCLP on final waste products
- 3
- 4 ● To evaluate the volume reduction potential of the vitrification process for the two
- 5 primary waste streams
- 6
- 7 ● To determine the chemical composition of the aqueous waste stream
- 8
- 9 ● To measure the specific gravity
- 10
- 11

12 3.2 DATA QUALITY OBJECTIVES

13

14 The establishment of data quality objectives (DQOs) is part of the process that defines the data
15 quality needs of the project. The implementation of an appropriate quality assurance /quality
16 control (QA/QC) program is required to ensure that data of known and documented quality are
17 generated. Establishment of the DQOs will determine the level of QA/QC required for the
18 treatability testing and analysis. DQO analytical levels are defined in EPA's guidance document
19 "Guide for Conducting Treatability Studies Under CERCLA" (EPA/540/2-89-058). Table 3-1
20 summarizes the DQO levels. A list of tests and associated DQOs is delineated in Table 3-2.
21

1	Level I		2506
2	Type of analysis	Field Screening or analysis with portable instruments	
3	Limitations	Usually not compound-specific, but results are available in real time. Not quantifiable.	
4	Data Quality	Can provide an indication of contamination presence. Few QA/QC requirements.	
5	Level II		
6	Type of analysis	Field analysis with more sophisticated portable instruments or mobile laboratory. Organics by GC; inorganics by AA, ICP, or XRF.	
7	Limitations	Detection limits vary from low parts per million to low parts per billion. Tentative identification of compounds. Techniques/instruments limited mostly to volatile organics and metals.	
8	Data Quality	Depends on QA/AC steps employed. Data typically reported in concentration ranges.	
9	Level III		
10	Type of analysis	Organics/inorganics performed in an off-site analytical laboratory. May or may not use CLP procedures. Laboratory may or may not be a CLP laboratory.	
11	Limitations	Tentative compound identification in some cases.	
12	Data Quality	Detection limits similar to CLP. Rigorous QA/QC.	
13	Level IV		
14	Type of analysis	Hazardous Substances List (HSL) organics/inorganics by GC/MS, AA, ICP. Low parts-per-billion detection limits.	
15	Limitations	Tentative identification of non-HSL parameters. Validation of laboratory results may take several weeks.	
16	Data Quality	Goal is data of known quality. Rigorous QA/QC.	
17	Level V		
18	Type of analysis	Analysis by nonstandard methods.	
19	Limitations	May require method development or modification. Method-specific detection limits. Will probably require special lead time.	
20	Data Quality	Method-specific	

TABLE 3-1
SUMMARY OF ANALYTICAL LEVELS

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LABORATORY SCREENING		
TEST	DQO/COMMENT	DQO LEVEL
Chemical Inorganic composition by Inductively Coupled Plasma (ICP)	Prior to vitrification tests, samples of both K-65 material and metal oxides will be analyzed to determine their inorganic components. This information will be used to predict the type and quantity of glass forming agents required.	II
Anion composition by Inductively Coupled Plasma Mass Spectrometer (ICPMS)	Anion composition analysis will give a basis from which to predict some general off-gas characteristics.	II
Radioactive isotope composition by Gamma scan	Determining the quantity of some pertinent isotopes will aid in predicting radon concentration in the off-gas.	II
BENCH-SCALE TESTING		
Volumetric measurement of the off-gas	To predict the total volume of this waste stream and help determine the scale of the off-gas treatment system required for full-scale.	V
Elemental composition of the off-gas	Characterization of the off-gas is important in determining the best treatment system for handling that waste stream.	II
Radon concentration in the off-gas	Determining the amount of radon contained in the off-gas is critical in designing the off-gas treatment system for full-scale implementation.	II
Measurement of the radon emanation from the vitrified product	This quantity will be used to evaluate the effectiveness of vitrification in reducing radon emanation.	II
Modified Toxicity Characteristic Leaching Procedure (MTCLP)	The MTCLP will be used as a preliminary test to determine if the vitrified product should be accepted as a satisfactory test. A sample from the product that passes this test will be sent to an independent lab for the full TCLP.	V
Full TCLP	To determine if the vitrified product meets the TCLP criteria. This test will provide data for the FS risk assessment calculations.	III
Volume reduction	To quantify vitrification's ability to reduce the volume of waste requiring disposal.	V

TABLE 3-2
ANALYTICAL TESTS AND ASSOCIATED DQO LEVELS

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4.0 EXPERIMENTAL DESIGN AND PROCEDURES

4.1 LABORATORY SCREENING

Laboratory screening will be performed on the metal oxide material from Silo 3 and the K-65 material from Silos 1 and 2. The laboratory screening will be used to establish the validity of vitrifying the metal oxide material. This screening study will yield data that will be used as indicators of the vitrification technology to meet performance goals and will identify parameters for investigation during the bench-scale testing outlined in Sections 4.2.2 through 4.2.5.

Laboratory screening of the metal oxide material will involve analytical tests to determine the chemical inorganic and anion composition of the metal oxide material. Table 4-1 lists the elements that will be included in the inorganic analysis of the metal oxide material. The results of the analysis will be expressed in weight percent (wt%) as oxides. Table 4-2 specifies the chemicals to be included in the analyses for anions in the metal oxide material. Also during the laboratory screening of the metal oxide material, a gamma scan will be conducted on the metal oxide material that will be used in the bench-scale vitrification testing to determine the radionuclide isotopic content of the material. Table 4-3 specifies the isotopes that will be identified by each gamma scan during laboratory screening.

During the previous laboratory tests on the K-65 residue material that was supplied to PNL, analytical tests were performed to determine the chemical inorganic composition of the K-65 residue. The sample material provided to PNL for these previous laboratory tests was understood not to be representative of the material in Silos 1 and 2. Therefore, the laboratory screening tests to be executed per this work plan will include analyses to determine the chemical inorganic composition of the K-65 material to be supplied to PNL, which includes samples from sections "A", "B", and "C" for each Silo 1 and 2 (six separate samples). PNL will be required to extract material from each of the samples provided to form a composite sample for each silo. Each of these composite samples will be analyzed for chemical inorganic composition of the material. Table 4-1 specifies the elements that will be included in the inorganic analysis of the K-65 material.

During the previous laboratory test on the K-65 material, the analytical tests did not include determining the anion composition of the K-65 material. The laboratory screening tests to be executed per this work plan will also include analytical tests to determine the anion composition of the K-65 material to be supplied to PNL. Each sample from sections "A", "B", and "C" for each Silo 1 and 2 and the composite sample formed from the samples provided will be analyzed for anion composition. Table 4-2 specifies the chemicals to be included in the analyses for anions in the K-65 material.

Also, during the previous laboratory tests on the K-65 residue material, a gamma scan was conducted to determine the isotopic content of the material. Table 4-3 represents the isotopic content of the K-65 material that was vitrified during the previous laboratory tests.

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TABLE 4-1
Laboratory Screening

Inorganic Chemical Analyses of Metal Oxide Material
and K-65 Material:
(weight % as oxides)

Silica	Copper
Lead	Cerium
Iron	Vanadium
Barium	Lanthanum
Aluminum	Uranium
Calcium	Manganese
Magnesium	Zirconium
Sodium	Neodymium
Phosphorus	Strontium
Titanium	Beryllium
Potassium	Thorium
Nickel	Tin
Cobalt	Selenium
Molybdenum	Zinc
Chromium	Chlorine
Sulfur	Fluorine

TABLE 4-2
Laboratory Screening

Characterization of Anions in Metal Oxide Material
and K-65 Material

Sulfate
Sulfide
Sulfite
Chloride
Nitrate
Carbonate

TABLE 4-3

Isotopic Content of K-65 Material
from Previous Laboratory Testing

ISOTOPE	ACTIVITY (nCi/g)
Th-230	264.7
Ra-226	479.4
Pb-214	297.8
Bi-214	280.0
PB-210	338.2
Pa-231	29.8
Th-227	21.1
Ra-223	22.4
Rn-219	20.8
Pb-211	65.7

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1 A gamma scan will also be conducted on the K-65 material samples from sections "A", "B", and
2 "C" for Silo 1 and 2 and the composite sample for each of the K-65 Silos that will be vitrified
3 as outlined in this work plan. Table 4-3 also specifies the isotopes that will be identified by each
4 gamma scan during laboratory screening.
5
6

7 4.2 BENCH-SCALE TESTING

8
9 The bench-scale tests are designed to verify whether the alternatives which include vitrification
10 as a treatment option described in Section 2 can meet the performance goals established by the
11 ARARs. These tests will provide a quantitative evaluation of the performance of the vitrification
12 treatment option as well as minimal cost and design information. The general objectives of the
13 following tests are to: determine the quantity and composition of the off-gas generated during
14 vitrification, the radon emanation rate from the vitrified material, and the leachability of the
15 vitrified material. Determining the quantity and composition of the off-gas generated during
16 vitrification of the K-65 material will focus on quantifying the amount of radon generated from
17 a given amount of K-65 material.
18

19 Prior to performing the testing identified in the following sections, the K-65 material and metal
20 oxide material will be separated into batches. The bench-scale vitrification tests will be
21 conducted by batch operations. The material will not be dried or sieved to remove rocks and
22 other extraneous items as done in the previous vitrification testing. A batch of material from
23 each testing sequence will be processed through the entire bench-scale system. Open system
24 tests using specific components of the bench-scale system will be required to determine ideal
25 melting temperatures for the various blends of material in Test Sequence B (K-65
26 material/Bento-grout) and Test Sequence D (K-65 material/Silo 3 material). Open system tests
27 may also be required to determine ideal melting temperatures for Test Sequence A and Test
28 Sequence C. Any required open system tests will utilize approximately 100 grams of material
29 per test. Also, partial system tests will be performed for Test Sequence C (Silo 3 material) to
30 determine process parameters prior to performing a complete bench-scale system test. Table 4-4
31 outlines the vitrification tests and identifies the type of material for each testing sequence. The
32 amount of material listed on Table 4-4 for each test sequence is the estimated quantity of
33 material required to complete each test sequence. This estimate will determine the amount of
34 K-65 material and Silo 3 material to be shipped to PNL in support of the vitrification testing.
35 The batch material will be melted in a 4-inch diameter by 12-inch tall (about 2.5 liters) inconel
36 crucible, or relative equal, in a bench-scale furnace. The following data will be recorded for
37 each batch of material tested (the specific data to be recorded for each test is included in Section
38 8.0):
39

- 40 ● The off-gas will be collected and the volume of off-gas measured;
- 41
- 42 ● The chemical composition, including the radon concentration, of the collected off-
43 gas measured; and

TABLE 4-4
Operable Unit 4 Vitrification
Tests for K-65 Material and Metal Oxide Material

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SEQUENCE	TEST	TYPE OF MATERIAL	APPROX. AMOUNT OF MATERIAL	DESCRIPTION
0		K-65	0 kg	Off-gas collection/radon adsorption system testing using 900 grams of material at PNL. Remaining tests will use modified system.
A	1	K-65	2.0 kg	K-65 material and glass forming reagents based on previous tests and chem. composition analyses.
A	2	K-65	2.0 kg	Duplicate of Test 1.
B	3	K-65	1.0 kg	Test to determine the influence of Bento-grout on the vitrification of K-65 material. 50/50 ratio is max. on removal of material from Silos 1 and 2.
		Bento-grout	1.0 kg	
B	4	K-65	1.0 kg	Duplicate of Test 3.
		Bento-grout	1.0 kg	
C	5	Silo 3	1.5 kg	Initial trial run of metal oxide to glass forming reagents. Ratio determined during the laboratory screening.
C	6	Silo 3	1.5 kg	If Test 5 results are within specified bounds, this test will be a duplicate of Test 5. Or if initial ratio is revised per Test 5 results, Test 7 will be required.
C	7	Silo 3	1.5 kg	Duplicate of Test 6, if required.
D	8	K-65	2.0 kg	Initial trial run of 70/30 ratio to determine characteristics on vitrified product of mixing waste streams.
		Silo 3	1.0 kg	
D	9	K-65	2.0 kg (max)	If Test 8 results are within specified bounds, this test will be a duplicate of Test 8. Or if initial ratio is revised per Test 8 results, Test 10 will be required.
		Silo 3	2.0 kg (max)	
D	10	K-65	2.0 kg (max)	Duplicate of Test 9, if required.
		Silo 3	2.03 kg (max)	
				Total estimated amount of K-65 sample required: 12.0 kg Total estimated amount of Silo 3 metal oxides required: 9.5 kg

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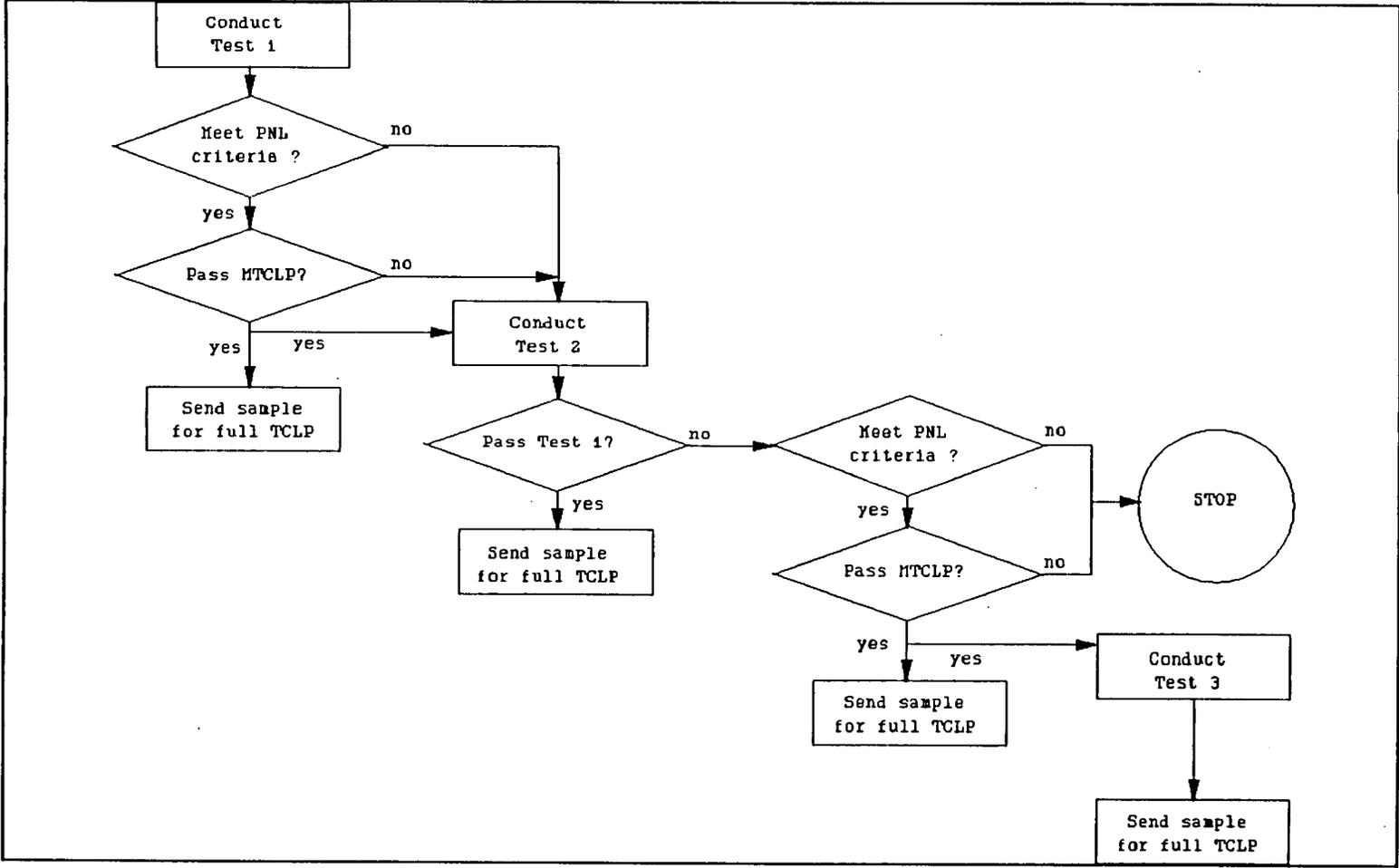


FIGURE 4-1
Decision Analysis Tree for Vitrification Treatability Studies
for Silos 1, 2 and 3 Material

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3 ● The resulting vitrified material from each batch will be monitored for radon emanation.
4

5 After a successful test run from each vitrification sequence, PNL will send samples of the vitrified residues
6 from both the successful test run and the duplicate test run to an independent laboratory for the TCLP analysis
7 as established in the QAPP approved as part of the RI/FS Work Plan.
8

9 4.2.1 PRELIMINARY OFF-GAS COLLECTION SYSTEM TESTING

10
11 Based on results of the previous vitrification testing performed previously used off-gas collection system and
12 radon adsorption system, PNL is currently reviewing the results of the previous vitrification testing and the
13 laboratory equipment set-up to determine the modifications required to accurately measure the quantity of off-
14 gas and the amount of radon generated from a given amount of K-65 material. This preliminary testing of the
15 off-gas collection system may require several trial test runs. The material to be used during this testing will
16 be the 900 grams (approximate) of untreated K-65 material previously shipped to PNL that was not used during
17 the previous vitrification tests on the K-65 material. All subsequent tests will use the modified off-gas
18 collection and radon absorption system.
19

20 4.2.2 SEQUENCE A - VITRIFICATION OF K-65 MATERIAL

21
22 The batch of material for the first vitrification test (Test 1) will consist of approximately 2000 grams (2 kg)
23 of K-65 material and the identified glass forming reagents based on the previous vitrification testing. Particular
24 attention will be given to the volumetric measurement of the off-gas collected and the measurement of the radon
25 concentration of the collected off-gas. Samples of the vitrified waste will be analyzed for TCLP concentration
26 of metals in the leachate.
27

28 Test 2 will duplicate Test 1 to verify the results. Duplicating or triplicating each successful test for performing
29 bench-scale tests is recommended by the EPA "Guide for Conducting Treatability Studies Under CERCLA."
30

31 4.2.3 SEQUENCE B - VITRIFICATION OF K-65 MATERIAL MIXED WITH BENTO-GROUT

32
33 A forthcoming Operable Unit 4 removal action is the addition of a layer of Bento-grout to Silos 1 and 2. The
34 Bento-grout layer retards the diffusion of radon produced during the decay of radium-226. Consequently, the
35 Bento-grout layer with its trapped hazardous and radiological constituents will require the same treatment option
36 as that of the K-65 material. To determine the impacts of this Bento-grout layer, testing Sequence B will
37 include Bento-grout added to the K-65 material prior to the vitrification process. Testing the K-65
38 material/Bento-grout mix will determine the influence of Bento-grout on the vitrified product. Preliminary open
39 system tests will be performed to determine ideal melting temperatures, the suitable glass forming reagents and
40 the blend of K-65 material to Bento-grout.
41

42 The initial test run (Test 3) will involve a mix ratio by mass of K-65 material to Bento-grout. The initial mix
43 ratio by mass will be based on the maximum amount of Bento-grout that possibly could be in the waste stream
44 upon removal of the top layer of material from Silos 1 and 2 and the results of the preliminary open system
45 tests.
46

47 Test 4 will duplicate Test 3 to verify the results.

1 4.2.4 SEQUENCE C - VITRIFICATION OF METAL OXIDE MATERIAL

2
3 Sequence C tests will determine if it is possible to obtain an acceptable vitrified metal oxide product. The
4 specific glass forming reagents that are required will be calculated based on the results of the laboratory
5 screening of the metal oxide material. Preliminary tests will be performed using the Silo 3 material to
6 determine the initial process parameters prior to performing a complete system test to vitrify the Silo 3
7 materials. If the identified test for Sequence C is in compliance with the PNL specific criteria for vitrification,
8 the vitrified product will be analyzed for leachability by PNL or their subcontractor by conducting a modified
9 TCLP¹ (mTCLP) on the vitrified material.

10
11 If the initial test run, Test 5, is compliant with the PNL specific criteria for vitrification and results of the
12 mTCLP comply with 40 CFR 261.24g, Test 5 will be considered a successful test run and a sample of the
13 vitrified product will be sent to the independent laboratory as established in the QAPP. Test 6 will be
14 performed as a duplicate test of Test 5 and a sample of the vitrified product also sent to the independent
15 laboratory as established in the QAPP.

16
17 If the initial test run, Test 5, is compliant with the PNL specific criteria for vitrification or the vitrified product
18 from the Test 5 does not meet the TCLP leach rates limits, the appropriate modifications based on the results
19 of Test 5 will be made for conducting Test 6. The modifications could involve revising the glass forming
20 reagents or altering the vitrification process parameters, or modifying the bench-scale equipment set-up.
21 Modification of the process parameters will be a major factor in determining whether the same process facility
22 could be utilized for the vitrification of the K-65 material and the metal oxide material.

23
24 If required, the appropriate modifications will be made and Test 6 will be performed. If Test 6 is compliant
25 with the PNL specific criteria for vitrification and the mTCLP results meets TCLP leach rates limits, Test 6
26 will be considered a successful test run and a sample of the vitrified product will be sent to the independent
27 laboratory as established in the QAPP. Test 7 will be performed as a duplicate test of Test 6 and a sample of
28 the vitrified product also sent to the independent laboratory as established in the QAPP.

29
30 There is a possibility that based on the results of Test 5, 6 and 7, PNL will determine that vitrification of the
31 metal oxide material is not a technically feasible treatment option for the remediation of the Silo 3 material.

32
33 4.2.5 SEQUENCE D - VITRIFICATION OF METAL OXIDE MATERIAL MIXED WITH K-65
34 MATERIAL

35
36 Sequence D tests will determine if it is possible to obtain an acceptable vitrified product by mixing the K-65
37 material and the metal oxide material. The initial test run of Sequence D (Test 9) will involve a 70/30 mix
38 ratio² by mass of K-65 material to metal oxide material. The 70/30 mix ratio by mass is based on the

39 ¹The modified TCLP, as it applies to the identified vitrification tests, is defined as analysis of the vitrified
40 product for leachability of the following constituents; Arsenic, Barium, Cadmium, Chromium, Lead,
41 Mercury, Selenium, and Silver.

42 ²Unless determined otherwise after reviewing the laboratory screening analytical results.

1 estimated total mass of the two primary Operable Unit 4 waste streams: the K-65 material and the metal oxide
2 material. To conduct Sequence D tests, the specific glass forming reagents and the PNL specific criteria for
3 vitrification will be calculated using the results of the laboratory screening of the metal oxide material and
4 results from Sequence A and C tests. If the identified test for Sequence D is compliant with the PNL specific
5 criteria for vitrification, the vitrified product will be analyzed for leachability by PNL or their subcontractor
6 by conducting a modified TCLP on the vitrified material.

7

8 If the initial test run, Test 8, is compliant with the PNL specific criteria for vitrification and the mTCLP results
9 meets the TCLP leach rate limits, Test 8 will be considered a successful test run and a sample of the vitrified
10 product will be sent to the independent laboratory as established in the QAPP. Test 9 will be performed as
11 a duplicate test of Test 8 and a sample of the vitrified product also sent to the independent laboratory as
12 established in the QAPP.

13

14 If the initial test run, Test 8, is not satisfactory, the appropriate modifications based on the results of Test 8
15 will be made for conducting Test 9. The modifications could involve revising the glass forming reagents or
16 altering the vitrification process parameters or modifying the bench-scale equipment set-up. Results of these
17 tests will be a major factor in determining whether the same process facility could be utilized for the
18 vitrification of the K-65 material and the metal oxide material.

19

20 If required, the appropriate modifications will be made and Test 9 will be performed. If Test 9 is satisfactory,
21 this test will be considered a successful test run and a sample of the vitrified product will be sent to the
22 independent laboratory as established in the QAPP. Test 10 will be performed as a duplicate test of Test 9 and
23 a sample of the vitrified product will also be sent to the independent laboratory as established in the QAPP.

24

25 There is a possibility that based on the technical results of Test 8, 9, and 10, a determination by PNL will be
26 made that vitrification of Operable Unit 4 mixed waste streams, the K-65 material and the metal oxide material,
27 is not a technically feasible treatment option for the remedial alternatives for Operable Unit 4.

28

5.0 EQUIPMENT AND MATERIALS1
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Table 5-1 provides a preliminary list of equipment and materials required to complete the bench-scale tests. All the items listed, in addition to those identified by PNL, will be provided by PNL.

**TABLE 5-1
EQUIPMENT AND MATERIALS**

Furnace
Furnace Temperature Controller
Crucible with sealing flanges and unique label
Collection Vessel
Collection Vessel and Crucible Seals
Non-evacuated Gas Sample Bombs (75 or 40 mL)
Condensate Sample Bottles (100 mL)
Fresh Activated Charcoal Canister
Glass Former Chemicals
Dilution Canister and Seal
Radon Gas Monitor (and computer/printer if required)
Desiccant Cartridge
Flow Meters
Gas Pumps

6.0 SAMPLING AND ANALYSIS

1
2

3 The sampling and analysis plan for the acquisition of residue samples for Silos 1 and 2 is contained in the
4 "Implementation Plan for the K-65 and Metal Oxide Sampling Project at the Feed Materials Production Center,
5 Fernald, Ohio," Addendum-SAP, October 10, 1990.

7.0 DATA MANAGEMENT

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The collection and preparation of silo residues for shipment to PNL shall be according to procedures developed by ASI/IT and WEMCO as contained in the "Implementation Plan for the K-65 and Metal Oxide Sampling Project at the Feed Materials Production Center, Fernald, Ohio," Addendum-SAP, October 10, 1990. The vitrification data will be acquired in accordance with the PNL Vitrification QA Plan WTC-060 as presented in Appendix A. PNL shall provide a records-turnover-package which contains all raw data generated during the vitrification project, all calculations performed, plus all QA documentation specified in the above mentioned QA Project Plan.

Laboratory notebooks will be used for this project. All laboratory notebooks are uniquely numbered and permanently bound with sequentially numbered pages. The notebook will be a project-specific notebook which will be assigned to the individuals working on the project. All daily laboratory activities associated with the project will be recorded in the project-specific notebooks.

The all records management and reporting for the TCLP analyses performed on the vitrified material will follow standard QA/QC protocol in the QAPP and Volume 4 on the RI/FS Work Plan.

8.0 DATA ANALYSIS AND INTERPRETATION

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8.1 EFFECTIVENESS OF WASTE FORM

The results of the TCLP in determining the leach rates of the vitrified material will be used to evaluate the long-term effectiveness of each sequence of testing. The concentrations of radioactive and hazardous constituents in the leachate will be used as input into the geochemical models described in the RI/FS Work Plan Addendum on risk assessment methodology. These models will be used with groundwater fate and transport models, which will then be used to calculate concentrations of contaminants in the aquifer at the reasonable maximum exposure, and the resulting risks to human health and the environment.

8.2 LABORATORY SCREENING

8.2.1 Metal Oxide Material From Silo 3

The following data will be presented in tabular form for the metal oxide material provided to PNL:

- General description of the waste
- Chemical inorganic composition as listed in Table 4-1
- Anion composition as listed in Table 4-2
- Radionuclide isotopic content as listed in Table 4-3
- Physical characteristics: percent moisture, bulk density

8.2.2 K-65 Material From Silos 1 and 2

The following data will be present in tabular form for each of the six samples provided to PNL from section "A", "B", and "C" of each Silo 1 and 2 and the composite samples for each K-65 Silo PNL made from the samples provided (8 sets of data will be provided):

- General description of the waste
- Chemical inorganic composition as listed in Table 4-1
- Anion composition as listed in Table 4-2
- Radionuclide isotopic content as listed in Table 4-3
- Physical characteristics: percent moisture, bulk density

8.3 BENCH-SCALE TESTS

The following data will be presented for the bench-scale vitrification Sequence A tests:

- Formula of glass forming reagents and weights
- Percent moisture versus percent solids content of the glass forming reagents
- Amount of water added to form a 45% moisture content slurry

- 1 ● Weight of K-65 waste material
- 2 ● Size of furnace/crucible
- 3 ● Temperature of furnace
- 4 ● Heating time of sample (elapsed time vs temperature)
- 5 ● Electrical conductivity of molten material
- 6 ● Viscosity as a function of temperature for molten material
- 7 ● Volume of off-gas from vitrification
- 8 ● Composition of off-gas from vitrification
- 9 ● Radon released during vitrification
- 10 ● Composition of condensate
- 11 ● Radon released from vitrified waste
- 12 ● Specific gravity of vitrified waste
- 13 ● TCLP leachate results for metals from vitrified waste

14
15 The following data will be presented for the bench-scale vitrification Sequence B tests:

- 16
- 17 ● Formula of glass forming reagents and weights
- 18 ● Percent moisture vs percent solids content of glass forming reagents
- 19 ● Amount of water added to form a 45% moisture content slurry
- 20 ● Weight of K-65 waste material
- 21 ● Dry weight of Bento-grout
- 22 ● Bento-grout slurry composition
- 23 ● Physical characteristics of K-65 material/Bentogrout mix: percent moisture, bulk density
- 24 ● Size of furnace/crucible
- 25 ● Temperature of furnace
- 26 ● Heating time of sample (elapsed time vs temperature)
- 27 ● Electrical conductivity of molten material
- 28 ● Viscosity as a function of temperature for molten material
- 29 ● Volume of off-gas from vitrification
- 30 ● Composition of off-gas from vitrification
- 31 ● Radon released during vitrification
- 32 ● Composition of condensate
- 33 ● Radon released from vitrified waste
- 34 ● Specific gravity of vitrified waste
- 35 ● TCLP leachate results for metals from vitrified waste
- 36 ● Modified TCLP results from vitrified waste

37
38 The following data will be presented for the bench-scale vitrification Sequence C tests:

- 39
- 40 ● Formula of glass forming reagents and weights
- 41 ● Amount of water added to form a 45% moisture content slurry
- 42 ● Percent moisture vs percent solids content of glass forming reagents
- 43 ● Weight of metal oxide material
- 44 ● Size of furnace/crucible

- 1 ● Temperature of furnace
- 2 ● Heating time of sample (elapsed time vs temperature)
- 3 ● Electrical conductivity of molten material
- 4 ● Viscosity as a function of temperature for molten material
- 5 ● Volume of off-gas from vitrification
- 6 ● Composition of off-gas from vitrification
- 7 ● Radon released during vitrification
- 8 ● Composition of condensate
- 9 ● Radon released from vitrified waste
- 10 ● Specific gravity of vitrified waste
- 11 ● TCLP leachate results for metals from vitrified waste
- 12 ● Modified TCLP results from vitrified waste

13

14 The following data will be presented for the bench-scale vitrification Sequence D tests:

15

- 16 ● Formula of glass forming reagents and weights
- 17 ● Percent moisture vs percent solids content of glass
- 18 ● Amount of water added to form a 45% moisture content slurry forming reagents
- 19 ● Weight of K-65 waste material
- 20 ● Weight of metal oxide material
- 21 ● Temperature of furnace
- 22 ● Size of furnace/crucible
- 23 ● Heating time of sample (elapsed time vs temperature)
- 24 ● Electrical conductivity of molten material
- 25 ● Viscosity as a function of temperature for molten material
- 26 ● Volume of off-gas from vitrification
- 27 ● Composition of off-gas from vitrification
- 28 ● Radon released during vitrification
- 29 ● Composition of condensate
- 30 ● Radon released from vitrified waste
- 31 ● Specific gravity of vitrified waste
- 32 ● TCLP leachate results for metals from vitrified waste
- 33 ● Modified TCLP results from vitrified waste

34

9.0 HEALTH AND SAFETY

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2
3 PNL will conduct the vitrification studies outlined in this work plan in accordance with the applicable OSHA
4 requirements thereby ensuring worker protection in the workplace. The Waste Technology Center component
5 of Battelle Northwest is responsible for vitrification studies at PNL. The Safety Plan for the Waste Technology
6 Center is found in Appendix B.
7

10.0 RESIDUALS MANAGEMENT

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The vitrified residues and any untreated K-65 material and Silo 3 material will be returned to the FEMP for disposal. All other operationally derived waste material generated as part of the vitrification treatability testing will also be disposed of by the FEMP.

Operationally derived wastes are wastes generated in the performance of various activities. These wastes include, but are not limited to:

- Disposable personal protective equipment such as Tyvek coveralls, gloves, and booties
- Disposable decontamination supplies

Protective clothing will be placed in plastic bags, in a B-25 box, or metal drum for disposal as compactible, potentially contaminated waste by Westinghouse Environmental Management Company of Ohio (WEMCO).

Operationally derived wastes are the property of the client and are to be shipped back to Fernald unless otherwise specified in the written contract.

The client will be responsible for proper transport, shipment, or disposal unless otherwise specified in the written contract.

11.0 REPORTS

1
2
3 An interim draft report will be prepared by PNL personnel and transmitted to WEMCO within 45 calendar
4 days, or no later than October 19, 1992, of completing the laboratory screening and the bench-scale tests. This
5 report will present the data identified in Section 8 and detail the vitrification process employed, along with any
6 problems. The report will be generated utilizing Section 3.12 of the "Guide for Conducting Treatability Studies
7 Under CERCLA". The results of the leachate from the TCLP analyses performed per the QAPP will be
8 incorporated into the interim report. The interim draft report will be reviewed by WEMCO, and PNL
9 personnel will incorporate the WEMCO comments and submit a final report to WEMCO on or before
10 December 9, 1992. This final report will be reviewed internally by WEMCO, ASI, and DOE prior to final
11 submittal to the U.S. EPA.

12
13

12.0 COMMUNITY RELATIONS

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3 The vitrification treatability study for Silos 1, 2, and 3 material and community information and involvement
4 activities are required in the CERCLA process. Community Relations activities shall be conducted; to support
5 treatability studies for Operable Unit 4 to explain the role of treatability studies in the RI/FS, and to raise the
6 public's confidence in cleanup alternatives and technologies identified in the alternatives screening/analysis
7 process and in the preferred alternative for this operable unit. The Treatability Study Community Relations
8 activities for Operable Unit 4 will comply with the Community Relations Plan (CRP) -- Remedial
9 Investigation/Feasibility Study and Removal Actions at the U.S. Department of Energy Feed Materials
10 Production Center (now called Fernald Environmental Management Project), Fernald, Ohio, August 1990.
11 At a minimum, the following Community Relations activities will be conducted to explain treatability studies
12 for Operable Unit 4.

- 13
14 ● Community Meeting - Held a minimum of three times per year to provide status on cleanup
15 issues, and to ensure that interested area residents have a routine public forum for receiving new
16 information, expressing their views, and getting answers to their questions. The meetings shall
17 focus on operable unit updates, removal actions, major RI/FS documents, and other appropriate
18 topics. During the July 1991 community meeting, an initial discussion of treatability was held
19 to make the community aware of treatability studies underway.
- 20
21 ● Publication - RI/FS materials such as progress reports, facts sheets and a community newsletter,
22 Fernald Cleanup Report, provide updates of CERCLA-related activities at the FEMP and will
23 include information on treatability study activities for this operable unit.
- 24
25 ● Presentations to Community Groups - Information about treatability studies for this operable unit
26 shall be included in briefings to community groups in Ross, Crosby, and Morgan townships, and
27 to Fernald Residents for Environmental Safety and Health, as appropriate. Also, this
28 information shall be included in presentations to other organizations, as requested.

29
30 Key milestones in treatability studies have been identified through negotiations for the Amended CERCLA
31 Consent Agreement and are included in the schedule in Figure 14-1. These milestones include:

- 32
33 ● Submittal of this Work Plan to the DOE and U.S. EPA
- 34 ● U.S. EPA approval of this Work Plan
- 35 ● Treatability Testing
- 36 ● Submittal of Treatability Testing Report

37
38 The progress of these key milestones will be reported to the community through the above mentioned
39 presentations and publications.

13.0 MANAGEMENT AND STAFFING

1
2

3 Personnel involved in the management of the overall RI/FS process include: J. R. Craig, DOE Project
4 Director; R. B. Allen, DOE Operable Unit 4 Manager; John Wood, ASI/IT Project Director; John Wood,
5 ASI/IT Deputy Project Director; D. J. Carr, WEMCO RI/FS Contract Technical Monitor; Susan Rhyne,
6 Acting ASI/IT Operable Unit 4 Manager; and D. A. Nixon, WEMCO Operable Unit 4 Manager.

7

8 The principal parties included in the management of the Operable Unit 4 Vitrification Treatability Study are
9 DOE Fernald, WEMCO, ASI/IT, PNL, and Parsons. Personnel involved in the specific management of the
10 Operable Unit 4 Vitrification Treatability Study include: R. B. Allen, DOE Operable Unit 4 Manager; D. A.
11 Nixon, WEMCO Operable Unit 4 Manager; L. A. Heckendorn, WEMCO Operable Unit 4 Program Engineer;
12 C. C. Chapman, PNL, Manager of Operable Unit 4 Vitrification testing; and D. A. Janke, PNL, responsible
13 for WEMCO Operable Unit 4 Vitrification testing and reporting.

1 14.0 OPERABLE UNIT 4 VITRIFICATION TREATABILITY STUDY SCHEDULE
2

3 Figure 14-1 includes the schedule of activities required to complete the Operable Unit 4 treatability studies for
4 vitrification treatability studies for Silos 1, 2, and 3 material. The schedule of activities in Figure 13-1 are part
5 of the RI/FS schedules that were agreed to between the U.S. DOE and the U.S. EPA during negotiations of
6 the Amended CERCLA Consent Agreement.

REM DUR	EARLY START	EARLY FINISH	1991												1992											
			JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC					
0	17JUN91A	30JUL91A	PREPARE TS WORK PLAN - VIT (4205W31305)																							
0	31JUL91A	31JUL91A	SUBMIT TS WORK PLAN TO WEMCO - VIT (4205W31320)																							
0	1AUG91A	29AUG91A	WEMCO REVIEW OF TS WORK PLAN - VIT (4205W31325)																							
0	30AUG91A	2OCT91A	INCORPORATE WEMCO COMMENTS - VIT (4205W31330)																							
0	14SEP91A	10OCT91A	SHIP RESIDUE TO SUBCONTRACTOR (4205W31402)																							
0	3OCT91A	3OCT91A	SBMT REV TS WP TO DOE/WEMCO/ASI-VIT (4205W31340)																							
0	4OCT91A	21OCT91A	DOE/WEMCO/ASI RVW REVISED WP - VIT (4205W31345)																							
2	22OCT91A	11NOV91	INCORP COMMENTS TO REVISED WP - VIT (4205W31350)																							
1	12NOV91	12NOV91	SBMT REVISED TS WP TO DOE/WEMCO-VIT (4205W31355)																							
1	13NOV91	13NOV91	SUBMIT TS WORK PLAN TO EPA - VIT (4205W31360)																							
21	14NOV91	12DEC91	EPA REVIEW OF TS WORK PLAN - VIT (4205W31370)																							
15	13DEC91	2JAN92	INCORPORATE EPA COMMENTS - VIT (4205W31380)																							
5	3JAN92	9JAN92	DOE/WEMCO RVW OF FINAL TS WP-VIT (4205W31385)																							
1	10JAN92	10JAN92	SUBMIT FINAL WORK PLAN TO EPA - VIT (4205W31390)																							
21	13JAN92	10FEB92	EPA REVIEW OF FINAL TS WORK PLAN (4205W31395)																							
1	11FEB92	11FEB92	EPA APPROVAL OF TS WORK PLAN - VIT (4205W31400)																							
147	12FEB92	3SEP92	CONDUCT TREATABILITY STUDY - VIT (4205W31405)																							
10	4SEP92	17SEP92	COMPILE TEST RESULTS FROM TS - VIT (4205W31410)																							
21	18SEP92	16OCT92	PREPARE TS REPORT - VIT (4205W31415)																							
1	19OCT92	19OCT92	TRANSMIT TS REPORT TO WMCO - VIT (4205W31417)																							
21	20OCT92	17NOV92	WMCO REVIEW OF TS - VIT (4205W31420)																							
15	18NOV92	8DEC92	INCORP WEMCO COMMENTS TO TS RPT-VIT (4205W31425)																							
1	9DEC92	9DEC92	SUBMIT REVISED TS RPT TO WEMCO-VIT (4205W31430)																							
10	10DEC92	23DEC92	WEMCO FINAL RVW/APPRV OF TS RPT-VIT (4205W31432)																							

ET
ET

Activity Bar/Early Dates
Critical Activity
Program Bar
Primavera Systems, Inc. 1988-1991

WESTINGHOUSE ENVIRONMENTAL MGMT CO
OPERABLE UNIT 4 - SILOS 1,2,3, AND 4
TREATABILITY STUDY - VITRIFICATION
Project Start: 30JUN86
Project Finish: 23MAR99
Sheet 1 of 1
Data Date: 8NOV91
Plot Date: 8NOV91

Prepared by Control Planning and Integration			
Date	Revision	Checked	Approved

2506

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39
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APPENDIX A

PNL PROJECT QA PLAN

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PNL-MA-70 QA PLAN

QA Plan No. WTC-060 Rev. 0
Issue Date
Page 1 of 4

PROJECT IMPACT LEVEL II

TITLE: Vitrification Tests on K-65 Residue Material

SCOPE:

- a: Characterize and determine the amount of the off gases evolved during vitrification of the K-65 sample (WBS-02).
- b: Define the rate of release of radon and other radioactive products from the solid glass product (WBS-02).

CLIENT: Westinghouse Materials Company of Ohio (WMCO)

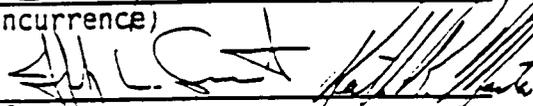
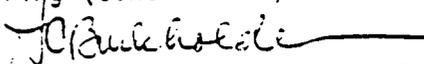
AUTHORIZING DOCUMENT: WMCO Purchase Order No. 412387-00; Project No. 16611

QA REQUIREMENT SPECIFICATION(S):

- ANSI/ASME NQA-1 as delineated in PNL-MA-70
- Other

Impact Level II WBS element activities shall comply with the applicable requirements, as appropriate for the work being performed, in Parts 1 and 3 of PNL-MA-70. Impact Level III activities shall comply with the GPS Standards located in Part 2 of PNL-MA-70. This QA Plan also identifies client QA requirements, if applicable, and any client imposed exclusions or limitations to PNL procedure requirements. If other quality-related activities are later performed, the appropriate PNL-MA-70 requirements and procedures shall be applied, unless specifically excluded.

CONCURRENCES AND APPROVAL:

CC Chadman		8-2-90
Cognizant Manager (Concurrence)		Date
JW Smith/KR Martin		Aug 3, 1990
Quality Engineering (Concurrence)		Date
HC Burkholder		8-2-90
Line Manager (Approval)		Date

PNL-MA-70 QA PLAN

QA Plan No. WTC-060 Rev. 0
 Issue date
 Page 2 of 4

QA PROGRAM/ORGANIZATION:

The PNL Quality Assurance Program conforms to the requirements of NQA-1 as interpreted by parts 1 and 3 of PNL-MA-70, Quality Assurance Manual. This QA Plan applies only the project Impact Level II WBS Elements, as noted in Exhibit A. WBS elements identified as Impact Level III shall comply with the requirements of PNL-MA-70, part 2. The project organization with key personnel is shown below.

Department Manager: JL McElroy
 Project Manager: CC Chapman
 Task Leader: DS Janke
 Test Plan/Procedure Author: LD Anderson, DS Janke
 Test Results Evaluator: CC Chapman, DS Janke, LD Anderson
 M&TE Custodian: DS Janke
 Records Custodian: DS Janke
 Quality Engineer: KR Martin

IMPACT LEVEL:

This QA Plan has been assigned an overall Impact Level of II.

SPECIAL CLIENT REQUIREMENTS:

- A. Covered by Part(s) 1 and/or 3 of PNL-MA-70

<u>Client Requirements</u>	<u>Where Covered</u>
- Test Plans shall be planned and executed per PAP-70-1101. Data Sheets incorporated in test plans shall be used to record pertinent test data, and will be traceable to the project LRB.	
- Evaluation of test results shall be reviewed and approved through independent technical reviews per PAP-70-604.	
- Measuring and test equipment shall be calibrated in accordance with PAP-70-1201.	
- All sample material will be treated (tested) and returned to WMCO (per WMCO instructions in a vitrified form (except small portions used to determine material composition or to determine the appropriate glass forming additives). Materials will be controlled per PAP-70-801.	

PNL-MA-70 QA PLAN

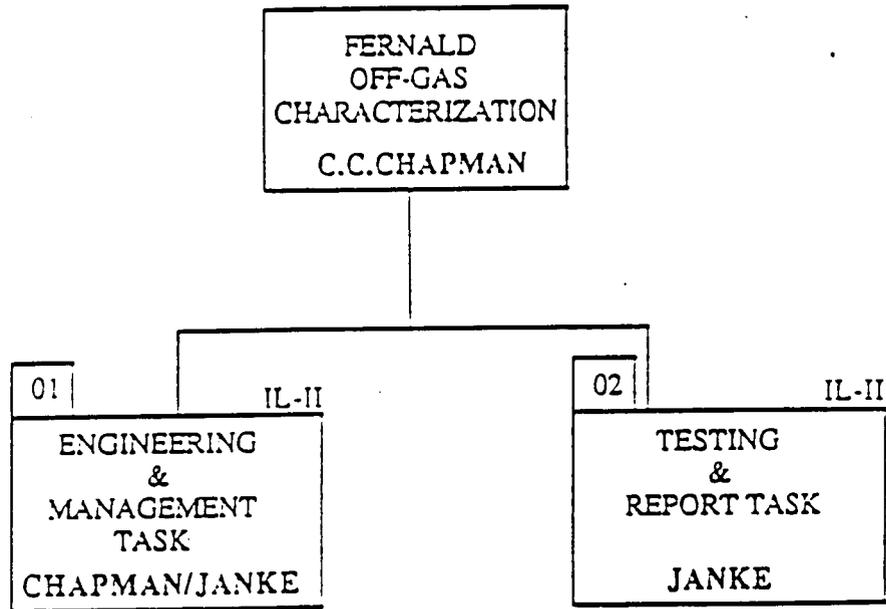
QA Plan No. WTC-060 Rev. 0
Issue Date
Page 3 of 4

- B. Not covered by Part(s) 1 and/or 3 of PNL-MA-70
- Review and Approval of Test Plan by WMCO personnel
- C. Client required exclusions or limitations of procedure applicability
- None

OTHER REQUIREMENTS, DIRECTION OR PLANNING:

- a) Procurement of an appropriate radon monitor per PAP-70-401.
- b) There are no known activities which require qualified and certified inspection personnel per PAP-70-203.
- c) There are no known controlled processes or special processes to be performed within the scope of this QA plan per PAP-70-901 or PAP-70-902.
- d) Records will be indexed and maintained per PAP-70-1701. Records will be designated for single storage and nonpermanent. Records will be maintained by assigned records custodian(s) until turnover to Building 712. Records turnover, including generic records, will be within 90 days of the termination of the project. The cognizant QE will be required to review and concur with the completed project RIDS form. Each record generated will have a activity identifier task number, subtask number, and file classification in the upper right hand corner.
- e) Procedures, plans, or instructions will be in accordance with PAP-70-1101 as applicable.

Exhibit A



Analytical Request Form

To: _____ Date: _____ WP/WO Number: _____

Requested by: _____
(name) (signature) (phone) (mail stop)

Analysis Requested:

Identification Numbers:

Material Description:

Special Storage or Handling Requirements: _____ None, _____ Other:

Disposal of Samples: _____ Discard, _____ Return, _____ Other:

Requested Reports/Additional Instructions:

QA Requirements: _____ Impact Level: I II (indicate level)
_____ SOW number
_____ Other:

Results must be signed and dated by the analyst and reviewer, identifying the measuring and test equipment and the procedure used (including revision).

QP Representative sign/date QP Representative approval required only for the first ARF in a series for internal work. Approval not required for external work.

To the best of my knowledge, this work was accomplished in accordance with the requirements of this Analytical Request Form:

By: _____ Date: _____
Responsible Analyst or Group Manager

(Return this form or a copy to the requestor).

The report/data furnished has been reviewed and to the best of my knowledge complies with the above request.

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By: _____ Date: _____
Requestor

This is a recommended format. Other forms may be used if they provide information which is equivalent to that required by this exhibit.

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Statement of Work

SOW number and revision: (may use the work order or work package number)

Title: type of service, performed by, for what project or organization

Review by: _____ (QP Representative) Date: _____

Concurred by: _____ (Coognizant Scientist/Engineer) Date: _____

Approved by: _____ (Recipient/Person Performing Work) Date: _____

Note: The following is intended as an example only. Each SOW will be written to fit the scope of the work involved.

A. Scope of Work

Include the following:

1. A complete description of the technical work authorized by the SOW including schedule and cost requirements as appropriate. Where necessary, technical requirements shall be specified by reference to drawings, specifications, codes, standards, procedures or instructions.

B. QA Requirements

Include the following:

1. The Impact Level
2. For internal organizations any specific guidance related to the PNL-MA-70 Administrative Procedures.
3. When applicable for other Hanford Contractors, a subsection detailing the applicable QA requirements.
4. A statement that work is to be conducted in accordance with the Service Organizations's activity QA Plan if appropriate. Note, the SOW may act as the QA Plan.
5. A statement allowing Impact Level III scoping studies or preparation activities prior to performing the Impact Level I or II service if necessary to develop methods, procedures, etc.
6. A statement (when applicable) that individual units of work will be (e.g., an Analytical Request Form) transmitted to the recipient. If applicable, identify documentation that will accompany each unit of work.
7. Identification, by name and/or title of personnel who may authorize subsequent changes to the SOW, or related documents. 63
8. A statement that no subcontracting of the work shall be allowed without prior approval of the cognizant engineer and a QP Representative.

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9. A statement requiring QP Representative surveillance prior to or during the performance of the service if appropriate. Identify hold points if appropriate.

C. Reports

1. Define what is to be reported and/or provided and by what date.
2. State that reported results are to be in writing and provided to the individual requesting the work.
3. State that the reported results are to reference the SOW number and are to include the dated signature of the person responsible for the work.

D. Records

1. For work performed by PNL organizations, identify what supporting records are to be submitted to the person requesting the work. Alternately, the organization performing the work may maintain the supporting records in accordance with PAP-70-1701. In either case, specify what records will be maintained and by whom. Examples of supporting records may include:
 - indoctrination and training records
 - calibration records
 - technical procedures
 - raw data including instrument printout
 - other documents required by the applicable PNL-MA-70 Administrative Procedures (unless included as part of the reported results)
 - nonconformance or deficiency reports.
2. For SOWs for other Hanford contractors, identify the records and the retention requirements that apply to the person or organization providing the service. As an alternate, specify the records to be transferred to the requestor at the completion of the work.

APPENDIX B
WASTE TECHNOLOGY CENTER SAFETY PLAN

WASTE TECHNOLOGY CENTER
SAFETY PLAN

March 1991

Approved:



J. L. McElroy, Manager
Waste Technology Center

PACIFIC NORTHWEST LABORATORY
RICHLAND, WASHINGTON 99352

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WASTE TECHNOLOGY CENTER
SAFETY PLAN

BACKGROUND

Implementation of the safety aspects of the WTC Environment, Safety, and Health Plan is described in this plan. Many existing safety requirements are incorporated into the plan by reference. Primary emphasis is placed on motivation and attitude, as safety performance can best be improved by frequent and visible management attention to safety.

OBJECTIVES

The objectives of this Safety Plan are to:

- assist in providing and maintaining a safe working environment for Center Staff
- clearly define Center safety policy and the responsibilities of WTC staff concerning safety matters
- motivate all staff members to a high level of safety consciousness
- assist in ensuring good communication between staff members and management on safety matters
- provide an annotated list of sources of safety guidance

CENTER SAFETY POLICY

The Waste Technology Center's safety policy can be summarized in two words: SAFETY FIRST. It is the duty of every staff member to follow established procedures and to continually evaluate potential risks associated with any activity. The individual is not to rely solely on others to define how to perform a job, but must evaluate the directions received and proceed in accordance with safe practices. Staff members will not knowingly engage in unsafe practices--regardless of who instructed them to do so. It is the duty and right of each staff member to know the health aspects (hazards) of the working environment and not to undertake any work that is perceived to be unsafe. Work will be halted until the individual's concern is addressed. The individual is not to restart that work until the situation is evaluated and action is taken.

No individual or manager will take lightly or dismiss the safety concerns of another. No staff member will be ordered to do a task he/she feels might be unsafe. Such intimidation tactics or dismissals of concerns will be reported to the cognizant line manager and project manager or task leader. Resolution will be achieved by working simultaneously through both lines of responsibility, with escalation to higher management levels, if needed, to achieve prompt resolution.

Policies and responsibilities assigned in applicable PNL and WTC specific safety guidance (see Appendix A) will be fulfilled. Because of the wide range of activities within the Center and new activities that are continually being initiated, flexibility is required within the Center and within individual organizational components. Safety is not "ensured" by adopting unnecessary rules and procedures. The only uniform inviolable policy is--SAFETY FIRST.

Management recognition will be given for demonstrating on the job safety. The safety record, attitude, and awareness of each individual will be evaluated in the yearly Staff Development Review process. Appropriate SDR safety goals will be included in each SDR. Line managers will periodically review the safety performance of their staff during routine and special activities to verify that safe practices are being employed.

The Department Manager will periodically review the safety of each project. If a project has a number of mishaps, it may be caused by excessive emphasis placed on schedules and budgets at the expense of safety. Such a situation shall be corrected immediately.

It is anticipated that this plan will be fully integrated into the WTC Environment, Safety and Health (ES&H) Plan for 1992.

Center Safety Goals

The following six general safety goals are identified for the WTC for CY-1991:

1. Zero Loss Time Accidents
2. Skin contaminations will show a reduction over CY-1990.
3. No reportable occurrences classified as an Emergency or Unusual Occurrence
4. No vehicular accidents
5. First Aid cases will show a reduction over CY-1990.
6. No occurrences or audit deficiencies resulting from the lack of safety training or an appropriate training plan

The following eight specific safety related goals are identified for CY-1991:

1. ES&H training requirements for each WTC staff will be documented by May 14, 1991.
2. ES&H qualifications for each staff position will be documented by April 15, 1991.

3. Scheduled safety meetings will be completed on a timely basis (by December 15, 1991).
4. A management inspection schedule to evaluate and monitor ES&H performance for the facilities operated by the WTC will be completed by April 1, 1991.
5. WTC facility ES&H oversight inspections will be conducted and documented by December 15, 1991.
6. ES&H goals will be included for each Staff in the CY-1991 performance appraisals (by March 31, 1991).
7. By December 31, 1991, complete an evaluation of the performance of all staff in the area of ES&H.
8. Implement an evaluation, control, and decontamination program. (By June 1, 1991)

GENERAL IMPLEMENTATION REQUIREMENTS

Training

Staff assigned to work in laboratory areas will receive training for the specific facility, equipment, and hazards associated with the work they are to perform. Line (Department) Managers are responsible for ensuring that staff receive the necessary safety training. Documentation and status of safety training for staff members is maintained by the PNL Training Coordinator. Duplicate records to provide easy day-to-day reference will be maintained by the Department Manager. Attendance at safety training meetings and should also be documented.

Job Specific Safety Training--

Job-specific safety training requirements apply to both on site and off site research facilities under the control of the WTC. The Department Training Plan will address the job-specific training requirements of assigned staff. Typical areas that the plan might address are: radiation work considerations, facility/equipment SOPs, hazardous chemical handling, crane operation, pollution prevention, and waste minimization.

Training on PNL/WTC Safety Policies/Requirements/Procedures--

Under the direction of the Department Manager, the designated Organizational Safety Representative or other qualified individuals will review general safety policies and procedures with each new staff member. The review will include the information listed under the employee orientation in PNL-MA-43, Section 1, as well as the information contained in the WTC Environment,

Safety and Health Plan and this Plan. This orientation should be accomplished and documented within 1 week of the arrival of new staff. The Hazard Materials Custodian will, on request, provide an orientation on the Chemical and Waste Management Plan, Waste Minimization and Pollution Prevention Plan, and PNL-MA-50, Facility Operational Controls, and Industrial Hygiene Plan.

Emergency Preparedness Training--

Every year and upon initial hire/building reassignment, each staff member should obtain the latest copy of his/her assigned building "Procedures for Emergencies." Annual retraining on the building emergency procedures will, at a minimum, address emergency alarms, procedures, staging areas, and location of fire alarm pull boxes and fire extinguishers. For WTC components occupying space in facilities managed by another contractor or DOE, WTC staff will comply with the requirements of the respective building safety plan/emergency procedures regarding training relating to emergency response.

Vehicle and Office Safety Training--

Vehicle operations, office safety and housekeeping will be periodically reviewed with all staff members.

Safety Meetings--

Documented safety meetings for all WTC staff will be held periodically to carry out appropriate safety training. The minimum frequency of safety meetings for each WTC organizational component is defined in Appendix C. Safety meetings may be part of a periodic organizational staff meeting.

Occurrence Reporting and Investigating

Prompt and accurate reporting of incidents is the basis for early resolution and recovery. After first attempting to stabilize and control any off-normal event, the WTC staff should then contact the immediate line manager. (Call the single point of contact [SPC] on 375-2400 if the line manager is not available.) The line manager will take appropriate additional action. Investigation and reporting shall be in accordance with the requirements of PNL-MA-7, Off-Normal Event Reporting System. Temporary and permanent corrective action for off-normal events will be developed by WTC line management in consultation with appropriate support organizations.

Inspections

Department Managers should inspect all offices and assigned work areas on a periodic basis. Appendix C provides a general schedule of safety related inspections.

SPECIFIC IMPLEMENTATION RESPONSIBILITIES

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Building upon the above general guidelines, the roles of WTC management and staff in implementing the WTC Safety Plan are defined below. Appendix C provides a matrix outlining Center management responsibility for safety inspection and safety meetings.

Center Manager:

The WTC Manager has overall responsibility for implementation of all safety programs within the Center, for proper execution of all safety assignments delegated to others within the Center, and for coordinating multi-center facility and ONE reporting activities in the 324 Building. This responsibility is primarily fulfilled by specific delegation, together with personal involvement in evaluating the effectiveness of the Center safety program. Assuring that all staff members achieve a high level of safety awareness and performance is a major area of concern to the Center Manager. Specific responsibilities include:

- Selectively participates in WTC-wide safety inspections including a quarterly audit of compliance to the 324 Building Operational Safety Requirements (OSRs).
- Maintains an open door policy for safety concern and ensures prompt corrective action in response to these concerns, inspections or occurrence reports.
- Ensures that resources are available to Department Managers to implement necessary safety measures.
- Serves on the Center Safety Committee. Ensures that concerns expressed by the committee are promptly addressed.
- Serves as the Lead Facility Manager for the 324 Building and implements provisions of ACT Now Directive 90-7 pertaining to reporting of Off-Normal Events.

Operations Manager:

The Operations Manager has oversight responsibility to the Center Manager for implementation of the ES&H program. Specific responsibilities include:

- Assists in conducting safety inspections of Center facilities and coordinates Center Manager involvement in planned inspections.
- Chairs the WTC Safety Committee. Ensures that safety suggestions/concerns are brought up for discussion in committee meetings.
- Assists, on request, departments with their training plans and safety meetings agendas.
- Provides support to WTC staff thorough the Environmental Compliance Manager, Industrial Hygiene Specialist, NEPA Representative, and Hazardous Material Custodian for chemical and waste management, waste minimization, industrial hygiene, and OSHA compliance activities.
- Reviews all Center staff radiation exposures
- Acts by assignment as a 324 Building Facility Manager.
- Maintains an open door policy concerning safety issues.

Department Manager:

Department Managers are responsible for duties assigned 1) through this Plan, 2) through guidance documents listed in Appendix A (especially PNL-MA-42 and PNL-MA-43), and 3) by the Center Manager. As with the Center Manager, many of these responsibilities are fulfilled through delegation supplemented by significant personal involvement. Specific responsibilities include:

- Reviews and approves a Preliminary Safety Review and Risk Assessment for each project.
- Reviews and approves the Project Management Plan (PMP) or equivalent document for each project and assures that any unusual safety issues are appropriately addressed.
- Ensures that appropriate safety documentation, (e.g., Safety Analysis Report (SAR), Operational Readiness Plan (ORP), Safety Evaluation Document (SED), etc., is in place before beginning work and ensures that all work is carried out in compliance with these requirements.
- Ensures that Laboratory Safety has been made aware of any proposed project that involves a significant safety issue.
- Acts by assignment as a Facility Manager for the 324 Building.
- Interfaces with Building Manager concerning significant changes in programmatic requirements that may impact the building emergency procedures or have significant safety implications to the facility, occupants, equipment, or environment.
- Approves safety related procedures and other operational documents as required.
- Maintains an open-door policy for safety issues and resolves safety issues promptly.
- Reports safety related inspection findings to the WTC Compliance Tracking System. Sets specific schedules for resolving findings and ensures prompt follow up action.
- Ensures that ONE action is timely and thorough and communicates the results of safety audits/inspections and ONEs to the staff.
- Ensures that a Laboratory Manager and Monitor are assigned to each work area.
- Ensures that planned organizational safety meetings are held.
- Visits all department-responsible facilities on site at least bimonthly to verify that safe practices are being employed and to identify and evaluate hazards in the work place. Assures that staff are informed about all hazards associated with their activities.
- Conducts, with the Building Manager, quarterly, documented safety inspections of facilities occupied by the department.
- Appoints a Departmental Organizational Safety Representative from D7W10, D7W20, D7W30.
- Ensures that staff exposure to ionizing radiation and nonradiological hazards is maintained as low as reasonably achievable (ALARA) and that appropriate dosimetry is being used. Assures that the ALARA concept is covered at safety meetings at least annually (D7W20 and D7W30).
- Maintains a current Training Plan addressing the safety training requirements and training status for all assigned staff and assures that all staff receive the appropriate training to perform the assigned work.

- Ensures that new center staff and staff assigned from other organizations receive timely and appropriate safety orientation.

The Department Manager has shutdown authority for operations and activities that pose immediate threat to safe operations.

Group Leader

Group Leader safety responsibilities are focussed on day-to-day operations. Specific responsibilities include:

- Conducts frequent walk-through inspections of work areas.
- Ensures that work is carried out in compliance with all procedures Operational Safety Requirements or other limits and controls necessary to assure safe operations.
- Maintains an open-door policy for safety issues.
- Identifies and evaluates hazards in the work place. Ensure that staff are informed about hazards associated with these tasks.
- Confirms that assigned operating space/space facilities are appropriately posted with emergency information.
- Confirms that staff assigned to work on the project have the required training for the job.
- Confirms that all safety related procedures are approved and posted, where appropriate, before initiation of the work.

The Group Leader has shutdown authority for operations and activities that pose immediate threat to safe operations.

Project Manager or Task Leader

A successful project requires that the Project Manager be concerned about the safety of those working on the project. This requires care in up front planning; and during the project, day-to-day attention to safety in the work place. The Project Manager should know what the safety related issues are with respect to the project and what has and is being done to address them. Specific responsibilities include the following:

- Conducts frequent walk-through inspections of work areas.
- Prepares the preliminary safety review and risk assessment documents for a project and informs Laboratory Safety if the project will generate solid, gaseous, or liquid effluent.
- Prepares and obtains the necessary approvals for safe operating procedures to support the project.
- Ensures that the PMP describes all significant safety issues in the project.
- Identifies job-specific training required for the work and assure that it is complete and properly documented before initiating work.
- Confirms that all physical controls are in place prior to initiation of work.
- Initiates Operational Readiness Reviews (ORR's) if required.
- Resolves promptly safety concerns expressed by project staff.

- Preplans for project safety, including such items as: waste disposal during and after the project; adequacy of facilities to safely house the project (ventilation, fire protection, sewers, etc.); and personnel exposure where hazardous materials are involved.
- Regularly monitors project activities to ensure that all safety issues are addressed and procedures and requirements are complied with.
- Maintains an open door policy for safety issues.

The Project Manager or Task Leader has shutdown authority for operations and activities that pose immediate threat to continued safe operations.

Laboratory Manager

A laboratory manager is designated for each lab. This individual is typically a line manager and is responsible for ensuring that the laboratory/facility has a safe working environment and that those working in the facility have addressed all safety issues related to the work to be performed. The Laboratory Manager delegates day-to-day operating responsibility and authority to the Laboratory Monitor. See Appendix B for a list of assigned Laboratory Managers and Monitors. Specific Laboratory Manager responsibilities are as follows:

- Coordinates external audits and surveillances of the laboratory.
- Ensures that any deficiencies noted during safety audits are addressed promptly and correctly.
- Ensures that the laboratory has a qualified Laboratory Monitor.
- Exercises shutdown authority for the laboratory if unsafe conditions are noted.
- Ensures issues have been satisfactorily resolved before authorizing start up of a laboratory that has been shutdown for safety reasons.

The Laboratory Manager has shutdown authority for operations and activities within the laboratory that pose immediate threat to the laboratory's continued safe operation and to its occupants.

Laboratory Monitor

The Laboratory Monitor is assigned by the Department Manager and will be familiar with the laboratory equipment, ongoing processes, and utilities that are available in the laboratory. The assigned Laboratory Monitor, acting under the direction of the Laboratory Manager, has the responsibility and authority to ensure safety within a specific laboratory or work area. Duties and responsibilities of the Laboratory Monitor are as follows:

- Takes the lead, consistent with Hazardous Material Custodian (HMC) guidance, to maintain a current inventory of the chemicals and other materials under their cognizance.
- Posts and maintains current emergency notification listings by the main entry door of the laboratory consistent with PNL-wide guidelines.
- Acts as the principal contact for proposed or ongoing laboratory work and coordinates facility and maintenance activities. Ensures that new

- work to be introduced into the laboratory or work area is consistent with the intended use of the work area.
- Resolves with responsible staff any deficiencies noted by safety and housekeeping inspections and ensures issues have been satisfactorily resolved before authorizing start up of a laboratory that has been shut down for safety reasons.
 - Is familiar with any job specific training required for work in the laboratory and ensures that all staff working with equipment, chemicals, materials, and generated waste in the laboratory have received the necessary job-specific training.
 - Ensures that all staff assigned to work in the laboratory maintain their work area in a safe and orderly manner.
 - Monitors work and ensures that it is performed consistent with procedures and requirements of the laboratory.
 - Coordinates audits of assigned space.

The Laboratory Monitor has shutdown authority for operations and activities within the laboratory that pose immediate threat to the laboratory's continued safe operation and to its occupants and also the authority to obtain assistance in housekeeping.

Individual Contributor

The attitude and commitment of the individual to safety is the crucial element to assure that activities are performed safely. The individual contributor is expected to take the initiative in ensuring that he/she is prepared to undertake work that involves a hazard and that a continued attention to safe practices and procedures is maintained throughout the project. Specific responsibilities include the following:

- Participates in the preparation of safety documentation, procedures, etc.
- Completes job specific safety training before initiating work.
- Refers any safety inquiries from the public or news media to Press Relations and WTC line management.
- Maintains own exposure to radiological and nonradiological hazards to levels consistent with ALARA.
- Is familiar with the PMP and performs assigned work safely and responsibly according to applicable limits, PNL Manuals, SOPs, JHBs (or JSAs), RWPs, CSSs, etc.
- Observes the local safety program when visiting or working off site.
- Informs the immediate line manager and project manager or task leader about any safety concerns.
- Provides safety guidance for, and reviews safety performance of less experienced personnel working near you.
- Ensures good housekeeping in the work area and that equipment is maintained and properly identified.
- Reports any off-normal events to his/her immediate line manager. For emergencies or where the line manager is not immediately available, contacts 375-2400.

Organizational Safety Representative:

Organizational Safety Representatives are assigned from and represent the following WTC organizational components:

- D7W10, 11, 12, & 13. (Represented by one individual)
- D7W20, D7W30.

The specific duties and responsibilities of the Organizational Safety Representative are as follows:

- Represents WTC organizational components on the WTC Safety Committee.
- Keeps informed of current safety morale, awareness and implementation/concerns within organization(s) represented.
- Provides feedback to the Department Manager and staff regarding safety issues.
- Assists management on inspections and corrective actions.
- Under the direction of the Department Manager, provides a safety orientation to all new center staff.

Center Safety Committee:

The Center Safety Committee provides a forum to address specific safety issues. It meets approximately every 2 months to discuss grassroots-level safety morale, safety awareness, and specific safety concerns within the Center. The Committee is chartered to facilitate two-way communications about safety throughout the Center.

The roles of the Environmental Compliance Manager, Hazardous Materials Custodian, and Industrial Hygiene Representative are described in the Waste Technology Center Chemical and Waste Management Plan.

PRINCIPAL SAFETY INTERFACES

The Facilities Management, Technical Services, and Laboratory Safety Departments all provide resources necessary to support line management in carrying out their safety responsibilities. These resources provide information on safety criteria, training methods, and inspection techniques. They are also charged with performing safety appraisals and audits and for follow-up to ensure that corrective actions are completed.

The Laboratory Safety Department (see Appendix D) is responsible for 1) assisting line management by serving as a technical safety resource and 2) conducting independent safety reviews and audits. These responsibilities include:

- Accident prevention (formal audits and appraisals, walk-through inspections, exercising "Stop Work" authority).
- General safety education and counseling (orientation for new staff members; conveying information on standards, requirements and

- regulations; and conveying information on general safety and "lessons learned" from off-normal events either within or outside PNL).
- Occurrence reporting and investigation (determining classification of accidents, managing the Unusual Occurrence Reporting system, serving as technical experts during investigations).

The Building Manager is an immediate resource in maintaining safe operations. A key responsibility of the Building Managers (Facilities Management Department) is to identify potential safety problems through daily monitoring of activities and to communicate areas of concern to line management. Routine housekeeping functions, status change in experiments under way in the assigned facilities, and the start up of new operations are all monitored by the Building Managers.

Building Managers function as extensions of line management to ensure management awareness of any potential impacts on the safety of the facility. Their principal safety responsibility is to report directly to line management any unusual circumstances that might relate to the safety of that facility. Act Now Directive 90-2 defines the interaction of line and facility management in operation of building facilities and equipment.

The Laboratory Preparedness function within the Technical Services Department provides emergency planning, operational readiness review (ORR) management, and event management support; coordinates the Safety Review Council activity; and coordinates major accident investigations.

SOURCES OF SAFETY GUIDANCE

- PNL Environment, Safety and Health Plan Issued by W. R. Wiley
Provides overall guidance for safety within PNL, stressing line management responsibility.
- Management Guide 11.2 Safety, Summarizes PNL policies and responsibilities in assuring a safe working environment.
- PNL-MA-6 Radiation Protection. Establishes basic radiation protection standards applicable to all PNL work with radioactive materials or radiation-generating devices. Designed to minimize radiation exposures of personnel and releases of radioactive material to the environment.
- PNL-MA-7 Off-Normal Event Reporting System. Provides guidelines for reporting of all off-normal events, including unusual occurrences. Describes overall system, notifications, investigation, reporting, and recovery.
- PNL-MA-8 Waste Management and Environmental Compliance. Presents procedures and requirements related to the handling and storage of radioactive and/or nonradioactive hazardous waste materials.
- PNL-MA-25 Criticality Safety. Describes requirements for preventing accidental criticality in the handling, storage, and use of fissionable materials.
- PNL-MA-42 Manager's Guide to Safety. Provides a concise summary of the information managers need to know or be aware of in establishing and maintaining safety programs. In addition, the "Guide" contains a list of the primary contacts in Laboratory Safety who can answer safety-related questions.
- PNL-MA-43 Health and Safety Management. Gives guidance for industrial safety within PNL. Includes 28 chapters and Appendices on a variety of Safety related topics.
- PNL-MA-50 Facility Operational Controls. Provides guidelines for integrating PNL facility operations and the individual operating occupant groups to ensure that; 1) the individual operations are each conducted in an effective, safe, secure and environmentally acceptable manner; 2) several individual operations are mutually compatible; 3) the facility systems (e.g., exhaust ventilation systems) are designed and operated to provide the necessary capacity and capability to support the needs of the individual operations and ensure the safe, secure, and environmentally acceptable operation of the combined operations. Defines

APPENDIX B

WTC STAFF ASSIGNMENTS FOR CHEMICAL AND WASTE MANAGEMENT

324 Building/Facility Common Space - WTC Center Manager -- J. L. McElroy
 Environmental Compliance Manager -- C. M. Andersen
 324 Building/Facility - HAZARDOUS MATERIAL CUSTODIAN -- C. M. Andersen

<u>SPACE</u>	<u>LABORATORY MONITOR</u>	<u>LABORATORY MANAGER</u>
EDL-101	Tom Brouns	Harry Burkholder
EDL-102	Chris Chapman	Harry Burkholder
Module 1.	Dan Janke	Harry Burkholder
2, 3	Dan Janke	Harry Burkholder
4.	Tom Brouns	Harry Burkholder
5.	Bill Heath	Harry Burkholder
6.	Matt Cooper	Harry Burkholder
7, 8	Joe Perez	Harry Burkholder
11	Dan Janke	Harry Burkholder
12, 14	Greg Whyatt	Chuck Allen
13	Dan Janke	Harry Burkholder
15, 16, 17, 18	Joe Perez	Harry Burkholder
Tank Pit	Joe Perez	Harry Burkholder
Lab 115	Tom Brouns	Harry Burkholder
Lab 207/Lab 208	Tom Powell	Harry Burkholder
Lab 210	Mike Elliott	Harry Burkholder
Lab 212	Greg Whyatt	Chuck Allen
Room 145, 147	Jim Jarrett	Chuck Allen
Room 146	Dan Janke	Harry Burkholder
Room 18	Jim Jarrett	Chuck Allen
Room 309A	Cheryl Thornhill	Chuck Allen
Chem Makeup Room	Jeff Surma	Chuck Allen
Head Tank Room	Jeff Surma	Chuck Allen
3718E&G Warehouses	Cameron Andersen	Don Knowlton
324 Building Yard	Mike Pueschner	Lynn Eberhardt
High-Bay	Gary Ketner	Chuck Allen
Cask Handling	Jim Jarrett	Chuck Allen
Truck Lock	Jim Jarrett	Chuck Allen
324 Bldg. North LLW Storage	Jim Jarrett	Chuck Allen
ISV Site	Jim Jeffs/Tom Powell	Harry Burkholder
D Cell	Cheryl Thornhill	Chuck Allen
A, B Cells	Jim Jarrett	Chuck Allen
C Cell	Jeff Surma	Chuck Allen
Sky Park	Cameron Andersen	Don Knowlton

Updated 3/22/91:Lab-Mntr.Asn

MATRIX OF SPECIFIC WTC INSPECTION AND SAFETY MEETING
RESPONSIBILITIES

<u>Org. Code</u>	<u>Documented Facility Inspections Freq per yr.</u>		<u>Safety Meetings Freq per yr.</u>	<u>Responsible Manager</u>
	Lab.*	Office		
7W00	2	1	1	JL McElroy
7W10		1	1	GW McNair
7W20	4	1	4	CR Allen
7W22	4	1	4	HC Burkholder

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- These inspections are conducted with the Building Manager. Not included here are bimonthly walk through inspections of all experimental work areas by the Department Manager.

Primary Contacts in Laboratory Safety

Glenn Hoenes, Manager, 376-1187

2506

**Occupational &
Radiological Safety**
Pat Wright, 376-1634

Fire Protection
Andy Minister, 376-4938

Occupational Safety
Bob Gough, 376-1886

Industrial Hygiene
Monty Rosbaca, 376-3037

Radiological Engineering

Safety & Risk Assessment
Donna Lucas, 376-1331

**Hazardous Waste Site
Health & Safety**
Jim Mohart, 376-8358

**Injury or Illness
Investigation**
Patti Myers, 376-0918

ALARA
Cheryl Oxley, 376-0223

Criticality Safety
Les Davenport, 376-8388

**Design Review, Mod Permits,
& Nuclear Purchases**
Russ Richman, 376-1887

Fire Extinguishers
Doug Clark, 376-2858

**Explosives & Flammable
Liquids**
Scott Allen, 376-1042

Motor Vehicle Safety
Doug Wright, 376-4792

MSDSs & Chemical Hygiene
Rich Johanson, 376-1536

Rad. Air Emissions
Monte Sula, 376-0605

Respiratory Protection
Bob McDowell, 376-3351

**Waste Management &
Environmental
Compliance**
Bill Bjorklund, 376-4781

NEPA Reviews
David Guzzetta, 376-3752

**Hazardous Material
Shipping/Transportation**
John Taylor, 376-1786

Regulatory Analysis
Harold Tilden, 376-0499

Oils, PCBs, & USTs
Brian Day, 376-3835

Compliance Inspections
Mike McCoy, 376-1483

Environmental Permits
Harold Tilden, 376-0499

Treatability Permits
Mike McCoy, 376-1483

Spill Reporting
Deanna Klages, 376-4088

Waste Minimization
Eric Hauth, 376-5631

Mixed Waste
Kevin Selby, 376-7233

TRU Waste Disposal
Kyle Webster, 376-1587

**Low-Level Radioactive Waste
and Radioactive Liquid Waste
Disposal**
Bruce Killand, 376-3158

Liquid or Airborne Releases
Deanna Klages, 376-4088

**RCRA & Hazardous Waste
Disposal**
Glenn Thornton, 376-7688

Waste Designation
Gregg Bartel-Bailey, 376-41

Radiation Protection
Dave Higby, 376-3057

Field Dosimetry Services
Mary Ann Hensyel, 376-3538

Medical Scheduling
Stacy Berg, 376-3645

Radiation Instrumentation
Andy Mileham, 376-0942

RPT Supervision:

300 Area
Ron Schrotke, 376-4703

308, 324, 325 Bldgs.
Jerry Allen, 376-8502

331 Bldg., 3000, & Outer Areas
Jon Hudspeth, 376-3155

Safety Education
Jeene Hobbs, 376-1631

Female Rad Worker Concerns
Jean Buck, 376-8771

Variations
Jeri Weston, 376-1929

Emergency Assistance
375-2400

Alarm Review
373-2345

**Employee Concerns
Hotline**
375-3999