DOE/RL--90-25

DE91 002444

STATE ENVIRONMENTAL POLICY ACT (SEPA) CHECKLIST

FOR THE

105-DR LARGE SODIUM FIRE FACILITY

REVISION 0

SEPTEMBER 1990

WASHINGTON ADMINISTRATIVE CODE
ENVIRONMENTAL CHECKLIST FORMS
[WAC 197-11-960]

SEPA ENVIRONMENTAL CHECKLIST

A. BACKGROUND

1. Name of proposed project:

Closure of the 105-DR Large Sodium Fire Facility (LSFF). Information contained in this State Environmental Policy Act (SEPA) Checklist pertains only to the portion of the Hanford Site 100-D Area which contains the 105-DR LSFF. In the context of the document, "site" refers to only the area covered by the physical structure of the 105-DR LSFF and associated facilities discussed in the answer to Checklist Question A.11, whereas "Site" refers to the Hanford Site.

2. Name of applicants:

U.S. Department of Energy-Richland Operations (DOE-RL); and Westinghouse Hanford Company (WHC)

3. Address and phone number of applicant and contact person:

U.S. Department of Energy Richland Operations Office P.O. Box 550 Richland, Washington 99352	Westinghouse Hanford Company P.O. Box 1970 Richland, Washington 99352

Contact Persons:

R. D. Izatt, Director Environmental Restoration Division (509) 376-5441	R. E. Lerch, Manager Environmental Division (509) 376-5556

4. Date checklist prepared:

September 28, 1990

5. Agency requesting the checklist:

State of Washington
Department of Ecology
Mail Stop PV-11
Olympia, WA 98504

6. Proposed timing or schedule (including phasing, if applicable):

Final closure activities will be completed and certified in accordance with the closure plan. Soil and sediment sampling will be conducted during closure activities. If the sampling results indicate that clean closure is not possible, closure (decontamination) will be coordinated with decontamination of the 105-DR Reactor, which is located in the Resource Conservation and Recovery Act (RCRA) Past Practice Operable Unit 100-DR-2. Decommissioning activities will be conducted in accordance with the records of decision for the 100-DR-2 Operable Unit and for the environmental impact statement (EIS), *Decommissioning of Eight Surplus Production Reactors at the Hanford Site*.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

   The LSFF is located within Operable Units 100-DR-2 (source) and 100-HR-3 (groundwater), as designated in the Hanford Federal Facility Agreement and Consent Order (HFFACO). Clean closure is proposed, and once any dangerous waste associated with the LSFF is removed, the entire reactor will remain for future decontamination and decommissioning as discussed in the draft surplus production reactor decommissioning EIS (DOE 1989; pp 1.7 - 1.13). Any remedial action with respect to either contaminants not associated with the LSFF, or associated with the LSFF not yet cleaned to action levels under this closure plan, will be deferred to the reactor decommissioning EIS record of decision or the RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) process.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

   This SEPA Checklist is being submitted to the Washington State Department of Ecology (Ecology) and the Environmental Protection Agency (EPA) concurrently with the RCRA Closure Plan for the 105-DR LSFF. The RCRA Part A and Part B permit applications were submitted to Ecology in November 1985. A revised Part A permit application was submitted to Ecology in November 1987.

   Draft Environmental Impact Statement - *Decommissioning of Eight Surplus Production Reactors at the Hanford Site*, Richland, Washington DOE/EIS-0119D, U.S. Department of Energy, 1989, Washington, D.C.

9. Do you know whether applications are pending for government approvals of other proposals directly affecting property covered by your proposal? If yes, explain.

   No applications are known to be pending.

10. List any government approvals or permits that will be needed for your proposal, if known.

    Ecology is the lead agency authorized to approve the closure plan for the 105-DR LSFF pursuant to the requirements of the Washington Administrative Code, (WAC) 173-303-610. The closure plan must also receive approval from the EPA. No other permits are known to be required at this time.

11. Give a brief, complete description of your proposal, including the proposed uses and the size of the project and site.

    The proposed project is the final closure of the 105-DR Large Sodium Fire Facility. Clean closure is proposed as the condition for final closure of the facility. Clean closure is contingent on verification that all wastes and contaminants are removed to accepted action levels and that all equipment, structures, liners, soils and/or other materials containing dangerous wastes or waste residues associated with the LSFF are removed from the site.

The facility consists of three fire rooms, a Sodium Handling Room, the Supply Fan Room, the 105-DR Stack, and office space directly connected to the 105-DR Reactor. Other items included in the LSFF closure plan are the 117-DR Filter Building, the 116-DR-8 Crib, the 1720-DR Building, and all interconnecting underground concrete ductwork.

All equipment and fixtures will be decontaminated, removed, and appropriately disposed of. The buildings and floors will be decontaminated to appropriate action levels with one or more of the following methods:

- Damp wipe downs
- Vacuum assisted mechanical removal
- Sandblasting
- High-pressure steam/water and suction

The buildings, floors, ductwork, and underlying shallow soils will be sampled to determine the levels of remaining contamination and the requirements for additional decontamination. Clean closure will be achieved when sampling shows that the remaining contamination is below acceptable action levels as defined in the closure plan. Eventually, the concrete will be disposed of with the rest of the 105-DR Reactor under the decommissioning program.

12. Give the location of the proposal. Give sufficient information for a person to understand the precise location of the proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available.

    The 105-DR LSFF is located in the northwest portion of the Hanford Site 100-D Area approximately 35 miles northwest of the city of Richland. The 105-DR LSFF is connected to the 105-DR Reactor. It is in the W 1/2, NW 1/4, Section 23, T14N, R26E. A location map and site plans are included in the closure plan.

B. ENVIRONMENTAL ELEMENTS

1. <u>Earth</u>

    a. General description of the site:

        Flat.

    b. What is the steepest slope on the site (approximate percent slope)?

        The approximate slope of the land at the site of the 105-DR LSFF is less than two percent.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

The soil at the site consists of compacted sand and gravel fill material underlain by sandy gravel with excellent drainage characteristics. No farming is permitted on the Hanford Site.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

No.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate the source of the fill.

No fill material or grading will be required.

f. Could erosion occur as a result of clearing, construction, or use? If so, describe.

Erosion is not expected.

g. Approximately what percentage of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Approximately 80% of the surface is covered at the existing site. No change will be made.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if there are any?

None at this time.

2. <u>Air</u>

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

Minor amounts of exhaust will be generated by vehicles used to gain access to the site. Small quantities of dust could be generated by decontamination and sampling activities.

b. Are there any off-site sources of emissions or odors that may affect your proposal? If so, generally describe.

No.

c. Proposed measures to reduce or control emissions or other impacts to the air, if any?

None at this time.

3. <u>Water</u>

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

No. The closest body of water is the Columbia River approximately 3/4 mile from the 105-DR LSFF.

2) Will the project require any work over, in, or adjacent to (within 200 feet of) the described waters? If yes, please describe and attach available plans.

No.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

None.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No.

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities, if known.

No.

2) Describe waste materials that will be discharged into the ground from septic waste tanks or other sources, if any (for example: domestic sewage; industrial, containing the following chemicals...; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

Does not apply.

c. Water Run-off (including storm water):

1) Describe the source of run-off (including storm water) and methods of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

The Hanford Site receives 6 inches to 8 inches of annual precipitation. Any precipitation that occurs at the site will run away from the buildings and seep into the soil on and near the site. No runoff will enter surface waters.

2) Could waste materials enter ground or surface waters? If so, generally describe.

Rain water from the exterior of the buildings will runoff onto the surrounding soils.

d. Proposed measures to reduce or control surface, ground, and run-off water impacts, if any:

All water used for cleaning and sampling activities will be collected, and sent to the appropriate disposal site on the Hanford Site.

4. <u>Plants</u>

a. Check the types of vegetation found on the site:

___ deciduous tree: alder, maple, aspen, other
___ evergreen tree: fir, ceder, pine, other
_x_ shrubs
_x_ grass
___ pasture
___ crop or grain
___ wet soil plants: cattail, buttercup, bulrush, skunk cabbage, other
___ water plants: water lily, eelgrass, milfoil, other
_x_ other types of vegetation

Small amounts of forbes and grasses may be seasonally present. Sagebrush is also present.

b. What kind and amount of vegetation will be removed or altered?

None.

c. List threatened or endangered species known to be on or near the site.

None. Additional information on the Hanford Site environment can be found in the EIS referred to in the answer to Checklist Question A.8.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

None at this time.

5. Animals

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, songbirds, other
mammals: deer, bear, elk, beaver, other
fish: bass, salmon, trout, herring, shellfish, other

A variety of insects, birds, and small mammals common to the Hanford Site, including pigeons, passerine birds, rodents, and lagomorphs, have been observed at the proposed site. Larger mammals commonly seen in the vicinity include deer and coyote. Additional information on birds and animals on the Hanford Site can be found in the EIS referred to in the answer to Checklist Question A.8.

b. List any threatened or endangered species known to be on or near the site.

The Bald Eagle and the White Pelican are sometimes seen on the Hanford Site and may occasionally visit the 100-D Area.

The site of the 105-DR LSFF is not known to be used by any threatened or endangered species. However, additional information concerning endangered and threatened species on the Hanford Site can be found in the environmental document referred to in the answer to Checklist Question A.8.

c. Is the site part of a migration route? If so, explain.

No; however, the adjacent Columbia River is part of the broad Pacific Flyway for waterfowl migration and other birds also migrate along the river.

d. Proposed measures to preserve or enhance wildlife, if any:

None at this time.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity for lighting.
Fuel and oil for vehicles and equipment.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

None.

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

The 105-DR LSFF will be cleaned by removing or decontaminating all dangerous waste and waste residues to appropriate action levels. All proper procedures will be followed during these operations to minimize exposure to hazardous waste. The potential exists for worker exposure to hazardous waste during sampling of the buildings and ductwork. Procedures to prevent and manage hazards are presented in the closure plan.

1) Describe special emergency services that might be required.

Hanford Site security, fire response, and ambulance services are on call at all times in the event of an onsite emergency.

2) Proposed measures to reduce or control environmental health hazards, if any:

Environmental health hazards are expected to be minimal. Procedures to prevent and manage potential hazards are presented in the closure plan.

b. Noise

1) What type of noise exists in the area which may affect your project (for example: traffic, equipment, operation, other)?

None.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for

example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Minor amounts of noise from traffic and equipment are expected on a short term basis during day shift hours.

3) Proposed measures to reduce or control noise impacts, if any:

Vehicles and equipment will meet manufacturer's requirements for noise suppression.

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties?

The 105-DR LSFF site is a part of the Hanford Site. The Hanford Site is owned by the U. S. Government and is used for the production of special nuclear materials and the management of wastes associated with the production of those materials.

The 105-DR LSFF is not currently being used. It was last used in 1986 for dangerous waste treatment as needed during the operation of the testing program.

b. Has the site been used for agriculture? If so, describe.

No portion of the Hanford Site, including the site of the 105-DR LSFF, has been used for agricultural purposes since 1943.

c. Describe any structures on the site.

The LSFF consists of a concrete building which houses 3 Fire Rooms, a Supply Fan Room, a Sodium Handling Room, a stack, and office space directly connected to the 105-DR Reactor. Other buildings included in the closure plan are the 1720-DR Storage Building and the 117-DR Filter Building. Other structures included in the closure plan include the 116-DR-8 Crib and all interconnecting aboveground and belowground ductwork and piping.

d. Will any structures be demolished? If so, what?

None will be demolished as a part of closure. At a later date, demolition work will be conducted as a part of decommissioning of the 105-DR Reactor.

e. What is the current zoning classification of the site?

The Hanford Site is zoned by Benton County as an Unclassified Use (U) district.

f. What is the current comprehensive plan designation of the site?

The 1985 Benton County Comprehensive Land Use Plan designates the Hanford Site as the "Hanford Reservation." Under this designation, land on the Site may be used for "activities nuclear in nature." Non-nuclear activities are authorized "if and when DOE approval for such activities is obtained."

g. If applicable, what is the current shoreline master program designation of the site?

Does not apply.

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

No.

i. Approximately how many people would reside or work in the completed project?

No people will reside in the facility, approximately 6 individuals will be assigned to work at the facility during closure activities.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Does not apply.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

Does not apply. (See answer to Checklist question B.8.f.)

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high-, middle-, or low-income housing.

None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high-, middle-, or low-income housing.

None.

c. Proposed measures to reduce or control housing impacts, if any:

Does not apply.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The existing concrete stack connected to the 105-DR LSFF is approximately 200 feet high.

b. What views in the immediate vicinity would be altered or obstructed?

None.

c. Proposed measures to reduce or control aesthetic impacts, if any:

None.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

None.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No.

c. What existing off-site sources of light or glare may affect your proposal?

None.

d. Proposed measures to reduce or control light and glare impacts, if any:

Does not apply.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

None.

b. Would the proposed project displace any existing recreational uses? If so, describe.

Does not apply.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any?

Does not apply.

13. Historic and Cultural Preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

No places or objects listed on, or proposed for, national, state, or local preservation registers are known to be on or next to the site. Additional information on the Hanford Site environment can be found in the EIS referred to in the answer to Checklist question A.8.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

There are no known archaeological, historical, or native American religious sites at or next to the facility. Additional information on the Hanford Site environment can be found in the EIS referred to in the answer to Checklist question A.8.

c. Proposed measures to reduce or control impacts, if any:

Where appropriate, a cultural resource review will provide the vehicle for necessary approvals required under the National Historic Preservation Act.

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

Does not apply.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

The site is not publicly accessible, and, therefore, is not served by public transportation.

c. How many parking spaces would the completed project have? How many would the project eliminate?

None.

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

No.

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No.

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

None.

g. Proposed measures to reduce or control transportation impacts, if any:

Does not apply.

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection police protection, health care, schools, other)? If so, generally describe.

No.

b. Proposed measures to reduce or control direct impacts on public services, if any:

Does not apply.

16. Utilities

a. List utilities currently available at the site (electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other):

Electricity, water, and telephone.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

No new utilities are required.

SIGNATURES

The above answers are true and complete to the best of my knowledge. We understand that the lead agency is relying on them to make its decision.

EA Bracken for RDI — 9-27-90

R. D. Izatt, Director
Environmental Restoration Division
U.S. Department of Energy
Richland Operations Office

Date

S A Wagner for — 9/27/90

R. E. Lerch, Manager
Environmental Division
Westinghouse Hanford Company

Date

DOE/RL-90-25
Revision 0

105-DR Large Sodium Fire Facility Closure Plan

Date Published
September 1990

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

Approved for Public Release

LIST OF TERMS

DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy-Richland Operations Office
DW	dangerous waste
Ecology	Washington State Department of Ecology
EHW	extremely hazardous waste
EII	Environmental Investigations Instructions
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FY	fiscal year
HASP	Health and Safety Plan
HEPA	high-efficiency particulate air (filter)
LMFBR	liquid metal fast breeder reactor
LSFF	Large Sodium Fire Facility
MSDS	Material Safety Data Sheet
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RCRA/CERCLA	Resource Conservation and Recovery Act/Comprehensive Environmental Response Compensation and Liability Act
RFI/CMS	RCRA facility investigation/corrective measures study
ROD	record-of-decision
TAL	target analyte list
Tri-Party Agreement	Hanford Federal Facility Agreement and Consent Order
TSD	treatment, storage, or disposal
WAC	Washington Administrative Code
Westinghouse Hanford	Westinghouse Hanford Company

CONTENTS

CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

The Hanford Site, located northwest of the city of Richland, Washington, houses reactors, chemical-separation systems, and related facilities used for the production of special nuclear materials, as well as for activities associated with nuclear energy development. The 105-DR Large Sodium Fire Facility (LSFF), which was in operation from about 1972 to 1986, was a research laboratory that occupied the former ventilation supply room on the southwest side of the 105-DR Reactor facility. The LSFF was established to provide a means of investigating fire and safety aspects associated with large sodium or other metal alkali fires in the liquid metal fast breeder reactor (LMFBR) facilities. The 105-DR Reactor facility was designed and built in the 1950's and is located in the 100-D Area of the Hanford Site. The building housed the DR defense reactor, which was shut down in 1964.

The LSFF initially was used only for engineering-scale alkali metal reaction studies. In addition, the Fusion Safety Support Studies program sponsored intermediate-size safety reaction tests in the LSFF with lithium and lithium lead compounds. Later on, the facility was used to store and treat alkali metal wastes. The LSFF is subject to the regulatory requirements for the storage and treatment of dangerous wastes. Clean closure is the proposed method of closure for the LSFF. Closure will be conducted pursuant to the requirements of the Washington Administrative Code (WAC) 173-303-610 (Ecology 1989).

This closure plan presents a description of the facility, the history of wastes managed, and the procedures that will be followed to close the LSFF as an Alkali Metal Treatment Facility. No future use of the LSFF is expected. The LSFF is located within the 100-DR-2 (source) and 100-HR-3 (groundwater) operable units as designated in the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989) referred to as the Tri-Party Agreement. These operable units will be addressed through the *Resource Conservation and Recovery Act of 1976* (RCRA) facility investigation/corrective measures study (RFI/CMS) process. The 100-DR-2 operable unit is expected to begin characterization work in fiscal year (FY) 1992; characterization work at 100-HR-3 is expected to begin in FY 1991.

Consistent with the Tri-Party Agreement (Ecology et al. 1989, p. 6-4), once any dangerous wastes associated with the LSFF are removed, the entire reactor will remain for future decontamination and decommissioning as discussed in the *Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington*, Environmental Impact Statement (EIS) (DOE 1989, pp 1.7 through 1.13).

Any remedial action with respect to contaminants either not associated with the LSFF or associated with the LSFF but not cleaned to action levels under this closure plan will be deferred to the reactor decommissioning EIS record of decision or the RFI/CMS process.

1.1 PERMITTING HISTORY

As a result of storing and treating dangerous wastes, RCRA Part A and Part B (Alkali Metal Treatment and Storage Facilities) permit applications were submitted to the Washington State Department of Ecology (Ecology) in November 1985. Revision 2 of the Part A permit application was submitted in November 1987. The permit application was submitted under the single Dangerous Waste Permit Identification Number, WA7890008967, issued to the Hanford Site by the Environmental Protection Agency (EPA) and Ecology. The permit application designates the LSFF as a thermal treatment facility, subject to RCRA regulations for treatment, storage, and/or disposal (TSD) units. This initial closure plan is being submitted to provide site characterization information and a closure strategy for the LSFF.

1.2 PART A PERMIT APPLICATION

General information describing the 105-DR LSFF was presented in the 1987 RCRA Part A permit application. A copy of the submitted Part A permit application is located in Appendix A.

2.0 FACILITY DESCRIPTION

2.1 GENERAL HANFORD SITE DESCRIPTION

In early 1943, the U.S. Army Corps of Engineers selected the Hanford Site as the location for reactor and chemical-separation facilities for the production and purification of plutonium. The Hanford Site (Figure 2-1) is a 560-mi² tract of semiarid land that is owned by the U.S. Government and operated by the U.S. Department of Energy (DOE), in conjunction with Westinghouse Hanford Company (Westinghouse Hanford) as the primary contractor for the U.S. Department of Energy-Richland Operations Office (DOE-RL).

2.2 FACILITY DESCRIPTION AND OPERATIONS

The 105-DR Reactor facility was designed and built in the 1950's and is located in the 100-D Area of the Hanford Site as shown in Figures 2-1 and 2-2. A schematic of the 105-DR Reactor building (including the LSFF) is shown in Figure 2-3. Figure 2-4 shows the areas of the LSFF covered by the closure plan. Approximately 15,000 ft² were used by the LSFF. The 105-DR Reactor building is a nonairtight industrial structure of reinforced concrete in the lower portions and concrete block in the upper portions. The roof is constructed of reinforced concrete or precast concrete roof tile, depending on the specific roof area.

Tests were conducted in three different concrete fire rooms: the large fire room, the small fire room, and the exhaust fan room. Each room is 20 ft 6 in. wide, 27 ft long, and 21 ft high. The steel doors are 4 ft by 8 ft. The large fire room houses the Large Test Cell, which is a steel cubicle 3,743 ft³ in volume. There are two 10-in.-square, 1/4-in.-thick Pyrex* glass observation windows located in the large fire room doors. The windows are made of tempered glass protected by safety glass.

The small fire room contains one steel cylindrical pressure vessel with a dished top. This vessel has a volume of approximately 498 ft³ and is pressure rated at 138 kPa (a similar additional vessel was removed from the room and sent to T-Plant as a test vessel). Both the Large Test Cell and the pressure vessels in the small fire room could be purged with nitrogen or argon to maintain a controlled atmosphere.

The third fire room tested is the exhaust fan room, in which reactions of alkali metals were conducted at atmospheric pressure. It was here that waste alkali metals from various sources (e.g., residuals from tests, failed equipment, drum heals) were reacted. The burn pans and equipment were sprayed occasionally with water and cleaned. The liquid effluent from the burn pans was neutralized to a pH level of less than 12.5, drained to the sump, which

*Pyrex is a trademark of Corning Glass Works.

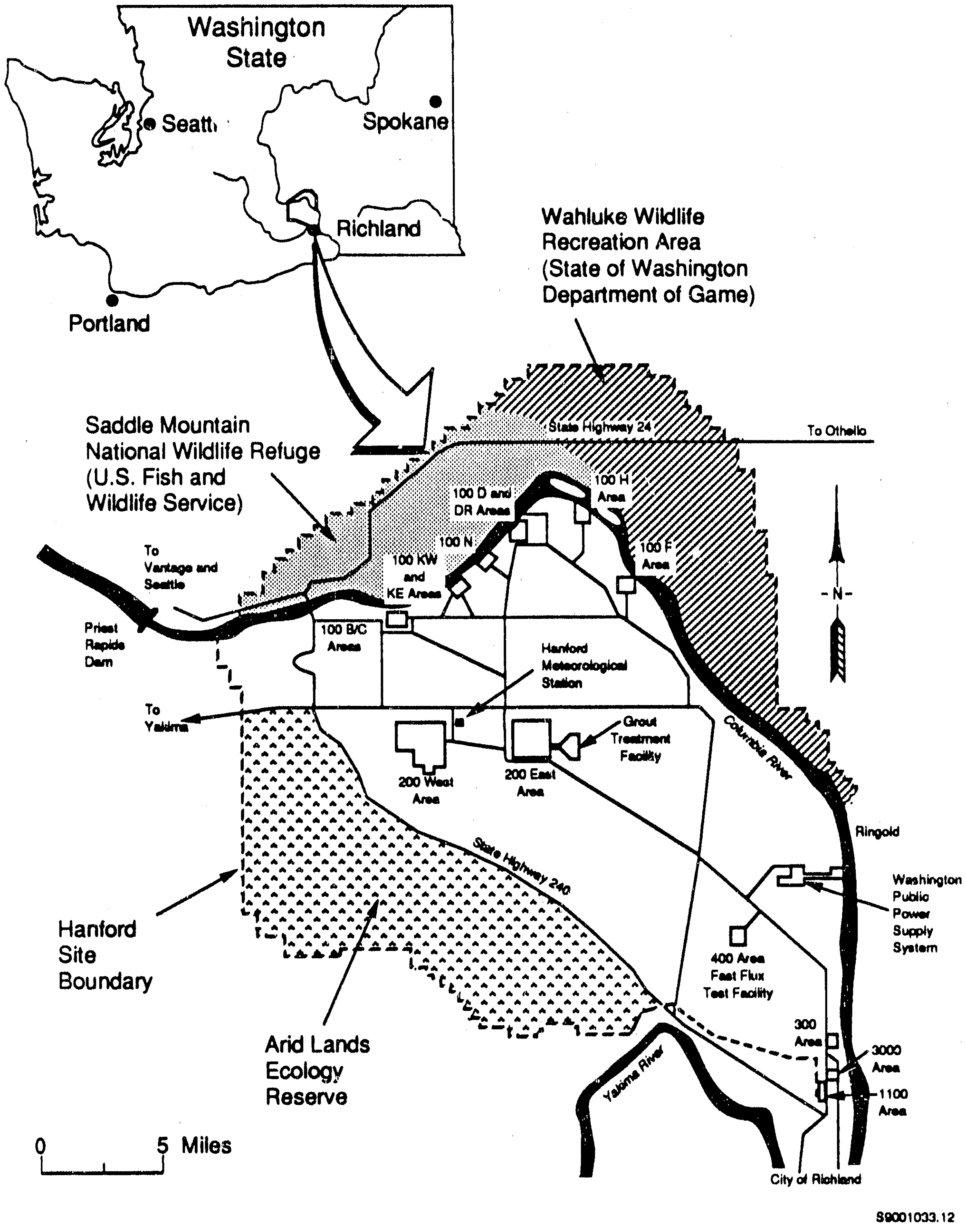
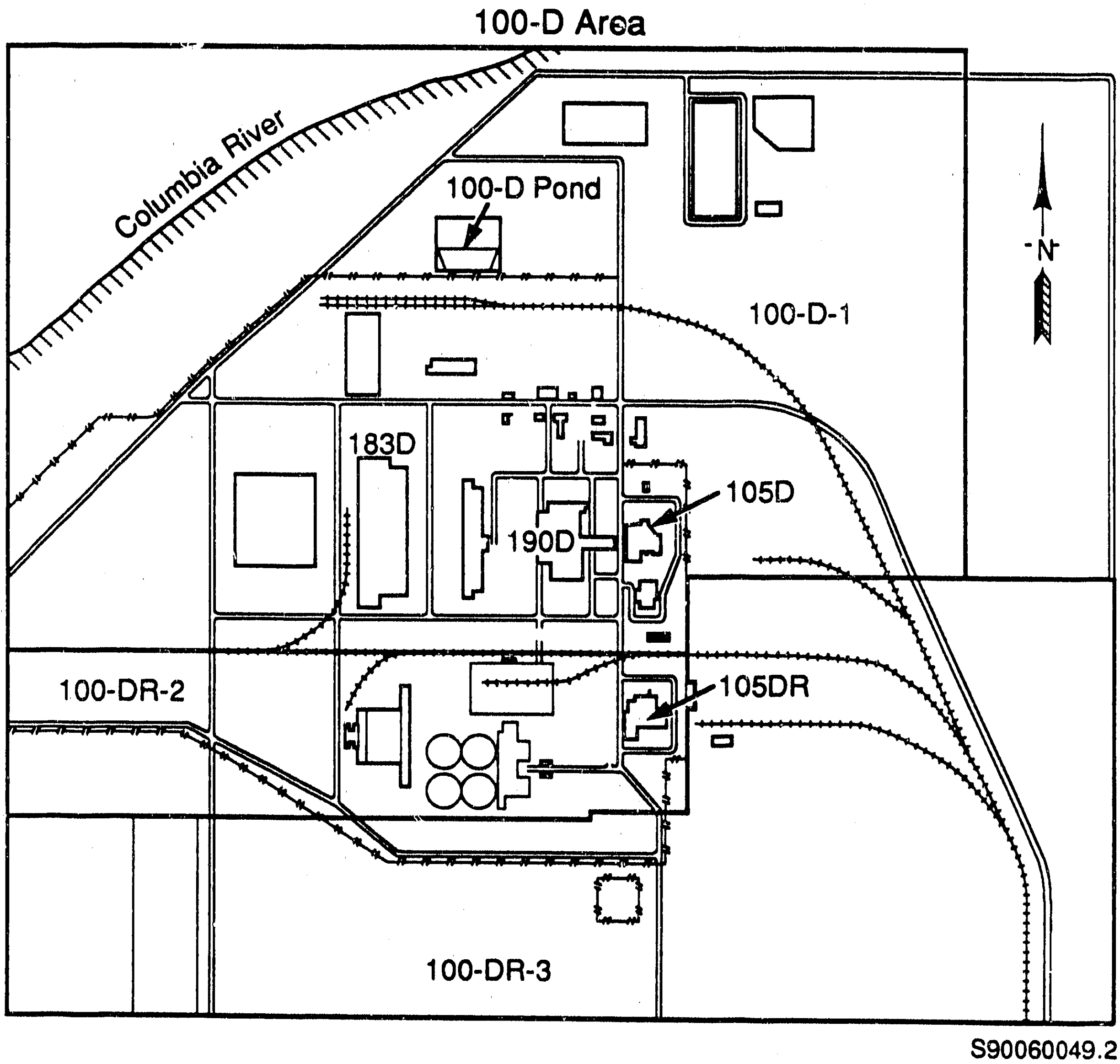


Figure 2-1. The Hanford Site Reactor Facilities.



1 Figure 2-2. The 100-D Area of the Hanford Site.

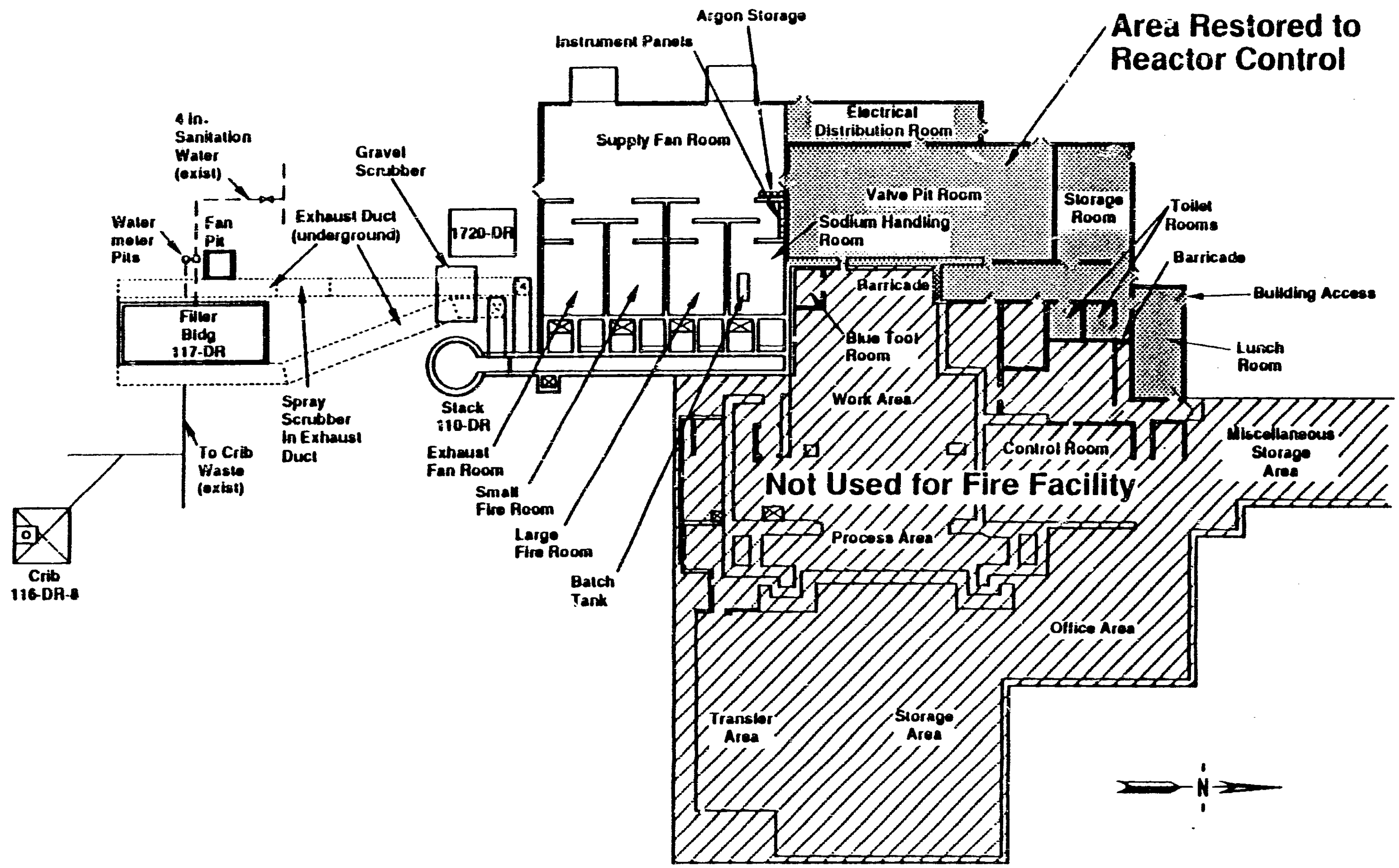


Figure 2-3. A Schematic of 105-DR Reactor Building Including the Large Sodium Fire Facility.

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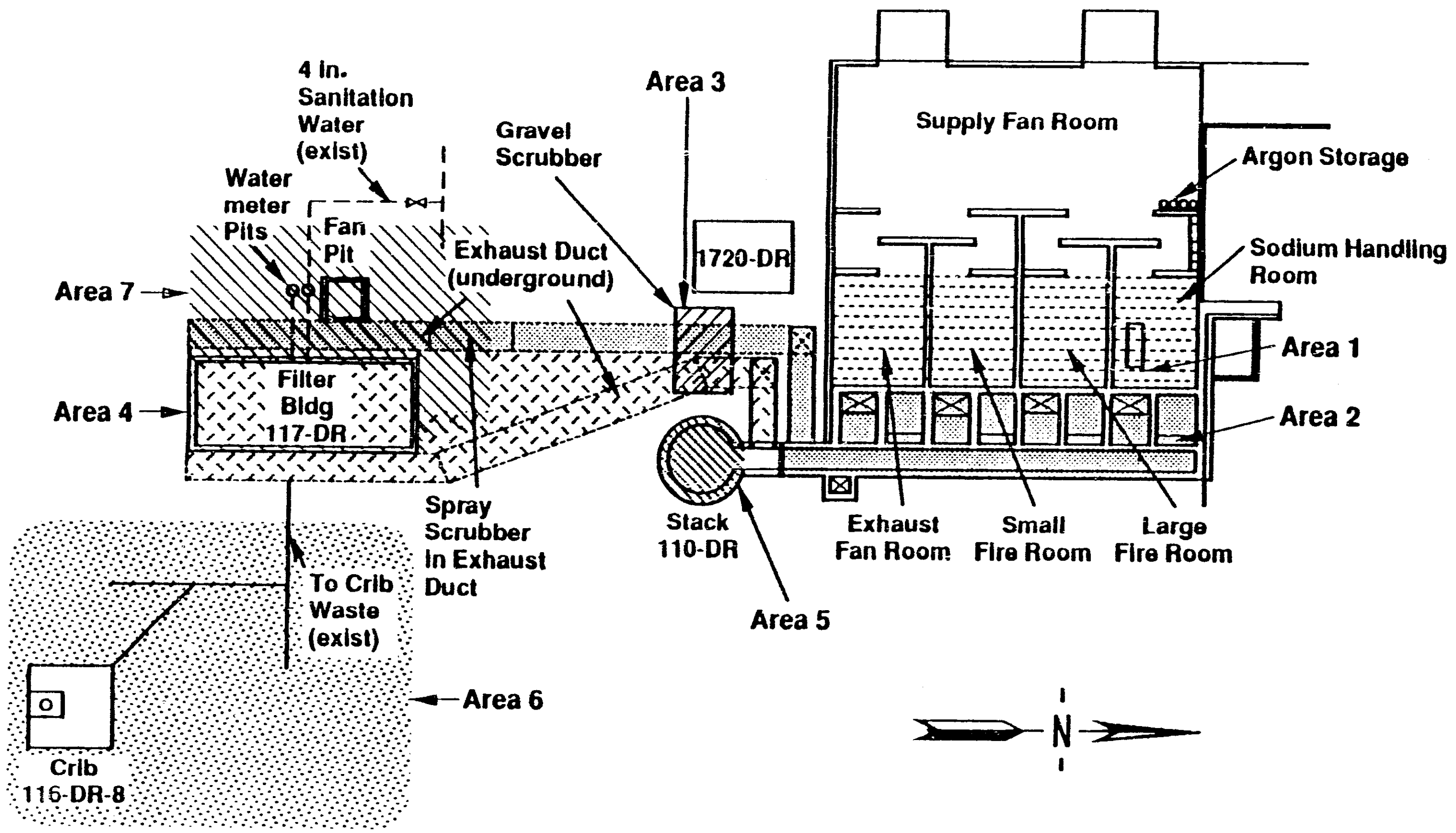

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1 Figure 2-4. A Schematic of the Large Sodium Fire Facility Covered by the Closure Plan.

was pumped to the seal pit in the filter building, and discharged to the 116-DR-8 Crib (Figures 2-3 and 2-4). A liquid drain is located in the bottom of the sump in the exhaust fan room.

Adjacent to the large fire room is the sodium handling room which serviced the large fire room with a 900-gal Type-304 stainless-steel sodium batch tank and drum melters. The sodium drums were brought in and heated up to liquify the sodium, which was then discharged into the batch tank with inert gas. Other rooms provided space for storage (nondangerous material) and office work.

The LSFF was equipped with an offgas treatment system that serves the test vessels and the exhaust fan room. The overall exhaust system is shown in Figure 2-5. The exhaust route is from the lower tunnel through the upper tunnel to underground concrete tunnels via a 10-in. duct with a 10,000-ft^3/min blower and test filters. Steel barricades at the north end of the tunnels block air flow from and to the reactor. The system consists of a 100,000-ft^3/min capacity filter building, a gravel bed exhaust scrubber (120-gal/min), high-efficiency particulate air (HEPA) filters, and a 200-ft stack (9-ft 6-in. internal diameter) located next to the 105-DR Building (Figures 2-3 through 2-6). Test room ventilation rates were 0 to 10,000-ft^3/min. Only the submerged gravel bed exhaust scrubber and the ducts leading to and away from the scrubber were constructed for the LSFF.

The 117-DR Filter Building (Figure 2-6) houses the exhaust air filters, while the exhaust air tunnel just upstream from the filter building contains the smoke scrubber. The building is about 59 ft long, 39 ft wide, and 35 ft high. The scrubber circulating pump and the waste discharge pump are located in the filter building. The 117-DR Filter Building is an existing below-grade reinforced concrete structure located about 100 ft from the 105-DR exhaust duct system and the 116-DR exhaust stack and connected by underground concrete ductwork. The filter building contains the HEPA filters, which are installed in four filter frames (24 filters per frame) with two frames in Cell A and two frames in Cell B.

In 1972, the original HEPA filters were replaced before LSFF operations began. From 1972 to 1982, the exhaust traveled from the LSFF through underground 7-ft by 7-ft concrete tunnels (Figure 2-6) to a spray scrubber and the HEPA filters before exiting through the stack. In 1982, a submerged gravel scrubber was added to vent the exhaust (instead of the underground HEPA filters) as part of a filter development program. At the completion of tests or waste burning, the 117-DR HEPA filter building was bypassed, and the scrubber water effluent pH level was confirmed to be between 2.0 and 12.5 before discharge to the 116-DR-8 Crib. The exhaust system now allows the use of either the HEPA filter system and ventilation scrubber or the submerged water scrubber, but not both.

About 5,000 gal (39,000 lb) of sodium that was procured for testing construction materials is stored in a tank that is located in a locked

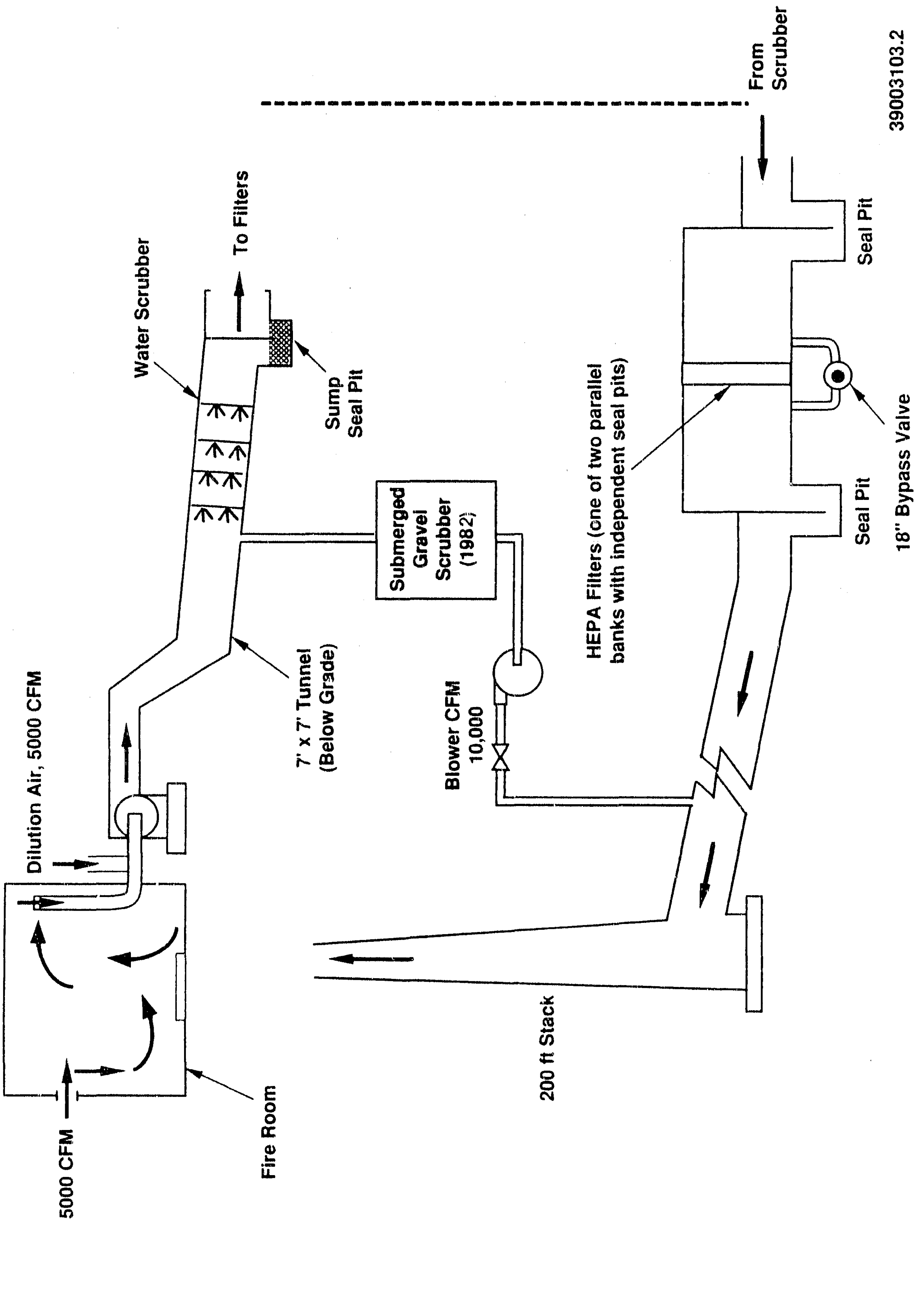

Figure 2-5. A Schematic of the Overall Large Sodium Fire Facility Exhaust System.

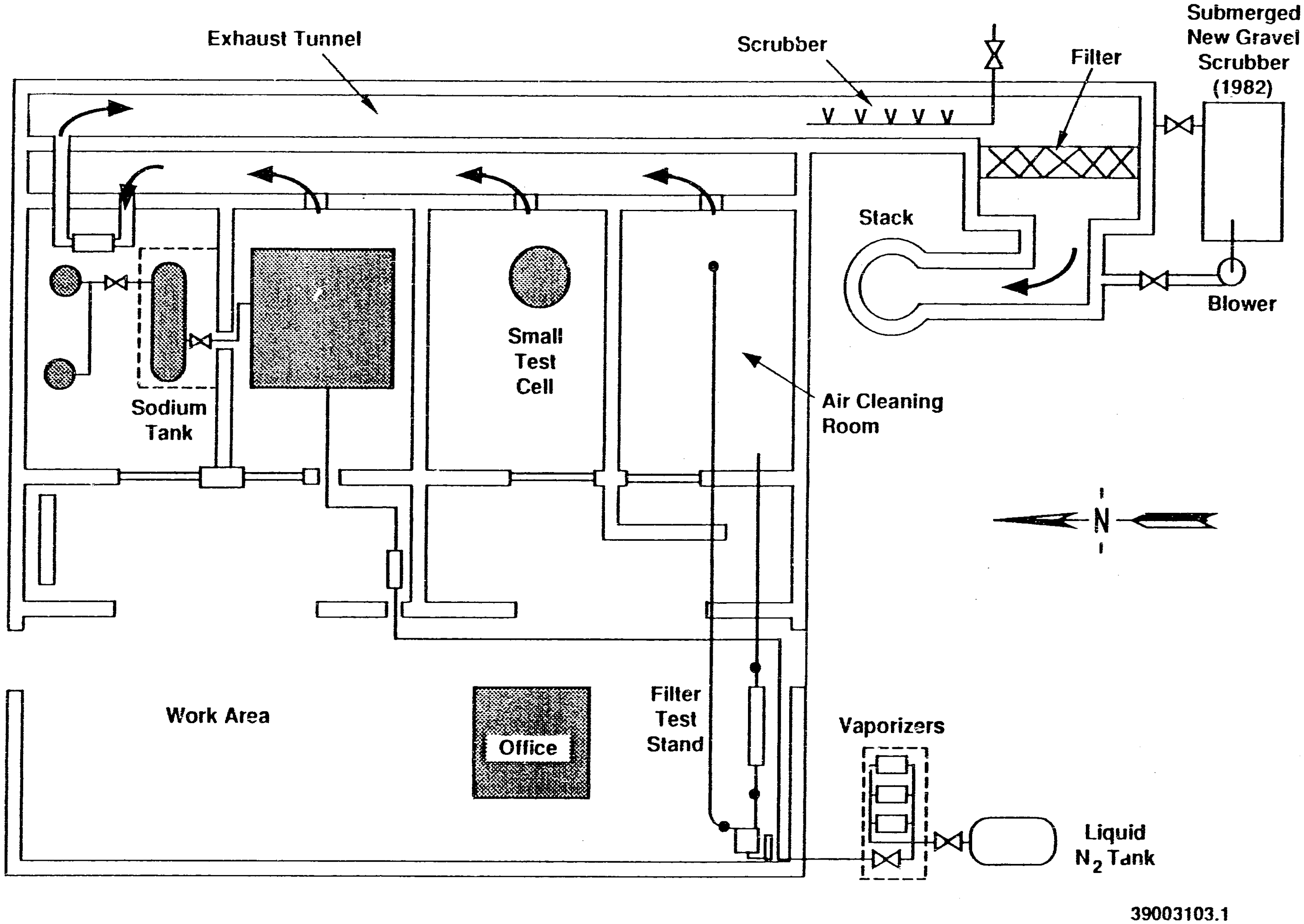

Figure 2-6. A Schematic of the 117-DR Filter Building Exhaust System.

metal building (1720-DR) near the LSFF. The sodium and sodium tank have never been used in the LSFF. This sodium will be removed through a project separate from the closure plan.

Miscellaneous alkali metal handling equipment to facilitate the testing program included sodium test spill tanks with capacities of 900 gal (1,200 °F, maximum holding temperature), 10 gal (1,600 °F), and 55 gal (400 °F) and lithium test spill tanks with capacities of 10 gal (1,600 °F) and 55 gal (400 °F). Sodium test spill rates are up to 300 gal/min, while lithium test spill rates are up to 5 gal/min.

Testing area capabilities included the following:

- Alkali metal spills up to 5,000 lbs at 1600 °F and up to 300 ft^2 of pool surface
- Demonstration of various fire extinguishing concepts
- Study of small- and large-scale effects of chemical reactivity of alkali metals under accidental spill conditions
- Sodium-concrete reaction tests
- Cell liner test design
- Postaccident cleanup development
- Lithium fire and reaction testing.

The Part A permit application (Appendix A) allowed for the treatment and storage of up to 20,000 L (5,284 gal) of nonradioactive sodium, lithium, and sodium-potassium metal wastes each year (Dangerous Waste No. D003). The Part A permit described the treatment of up to 100 L (26.42 gal) per day of alkali metal dangerous wastes. Treatment consisted of heating the waste to the point of oxidation in the exhaust fan room. Emissions were then routed to an offgas recovery system. The facility was used for dangerous waste treatment as needed during the operation of the testing program from 1972 to 1986.

2.3 SECURITY

The following sections describe the 24-h surveillance system and entry-control measures used to provide security and to restrict access to the 105-DR LSFF.

2.3.1 24-Hour Surveillance System

The entire Hanford Site is a Controlled-Access Facility and is expected to remain so during the 105-DR LSFF closure. The Hanford Site maintains around-the-clock surveillance for the protection of government property, classified information, and special nuclear materials. The Hanford Patrol maintains a continuous presence of armed guards to provide security.

2.3.2 Barrier and Means to Control Entry

Within the Hanford Site are operational areas to which access is restricted. One such operational area, the 100 Area, is the location of the 105-DR LSFF. Access to the LSFF site at the 105-DR Reactor facility is limited to assigned personnel and visitors under escort. The doors to the 105-DR, 117-DR, and 1720-DR buildings are locked and keys are assigned to approved operations staff members, Westinghouse Hanford Security Patrol, and the 100-Area Fire Department.

A 30-in.-thick concrete wall separates the front face work area of the 105-DR Reactor from the nearest portion of the LSFF and sodium handling room. A 5-ft-wide by 8-ft-high doorway through this wall is closed by an existing locked steel door and a new wall of 8-in. concrete blocks. All other entries to the reactor from the LSFF have been barricaded.

3.0 PROCESS INFORMATION

The LSFF has been used primarily to conduct experiments for studying the behavior of molten alkali metals (sodium and lithium) and alkali metal fires. The wastes generated at the facility include alkali metal oxides, hydroxides, silicates, and carbonates, and residual alkali metal waste (RCRA Part B Permit Application, Alkali Metal Treatment and Storage Facilities, D-2, 1985) associated with the tests. The sodium carbonate was formed from the reaction of the oxides and hydroxides with air. Similarly, both purchased and waste lithium also were burned at the site, producing lithium carbonate, oxide, hydroxide, and silicate as aerosol by-products.

The laboratory tests conducted at the LSFF can be grouped into the following general types by the test purpose:

- The formation of alkali metal aerosols in air, steam, nitrogen, or carbon dioxide atmospheres for the purpose of determining aerosol properties and release ratios, using both pool and spray fires
- The reaction of an alkali metal with concrete and insulation (Kaylo* heat insulation and Super-X block** insulation, both fiberglass) to study corrosion rates and to determine the reaction products formed
- The generation of aerosols to be used for testing and measurement of air cleaning filter and scrubber performance and for evaluating hydrogen ignition characteristics
- The production of fire and smoke to test alkali metal fire extinguishing methods and equipment, testing of protective equipment, and for training in equipment use
- The testing of purchased lithium-lead alloy reaction rates and aerosol formation in various atmospheres
- The development tests using cesium and zinc metal to demonstrate aerosol generation techniques
- The thermal treatment of sodium residue (sodium wastes) generated in other facilities.

The lithium-lead alloy was tested by its reaction with air and steam (not by burning) in the small fire room (Jeppson 1978). In these tests, the surface lithium converted to a gray coating of lithium carbonate (air reaction) and lithium hydroxide (water reaction). The reactions were limited because less than stoichiometric amounts of steam were used in the tests.

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*Kaylo is a trademark of Owens Corning.

**Super-X block is a trademark of John Mansfield.

The dangerous waste shipment records indicate that the lithium-lead alloy was disposed of in two 440-lb masses and placed in steel drums and sent for offsite disposal through the 340 Facility which was the central waste accumulation area for the operating contractor. In 1986, the test equipment for the lithium-lead test was relocated to the 221-T Facility, where the testing program continued.

A secondary mission of the LSFF was to burn alkali metal waste generated at the LSFF, the 221-T Containment Systems Test Facility, and 300 Area sodium and lithium facilities. When the LSFF was being used to treat alkali metal waste, the waste was burned until the reaction was not sustainable. The residues were then reacted with water. The waste products from this process were also alkali metal oxides, hydroxides, and carbonates. None of the wastes treated in the facility were radioactive.

Only the exhaust fan room was used to burn waste sodium and lithium. The exhaust fan room and small fire room were both used for the metal reaction tests. The sodium handling room was used for mixing and transferring sodium for the tests. The large fire room was used for burning sodium associated with the testing program.

While burning, waste metal was stirred to ensure a complete burn, and the scrubber system controls were monitored. At the completion of a burn, the equipment was checked for unburned metal, washed down, and inspected again to ensure that no residual unreacted metal remained (RCRA Part B Permit Application, Alkali Metal Treatment and Storage Facilities, pp D-20 and F-11). Wash water from the cleanup was monitored for corrosivity (kept below a pH level of 12.5) and drained through the sump in the exhaust fan room to the 116-DR-8 Crib.

In 1987, samples of the residues were collected from the lower exhaust tunnel wall and analyzed. Locations of the sampling points are shown in Appendix B. While the sample results for lithium and carbonates were expected, the lead content in some of the samples was high (the highest, from a concrete scraping, was 1,300 ppm). The lithium-lead alloy was reacted in the small fire room; inside a closed containment pressure vessel. The lead content in the samples from different locations [low content in the small fire room; higher content in the exhaust fan room upwind of the tests; very low content in the tunnel immediately downwind of the tests; and the highest content in scrapings near the wall constructed between the tunnel and rest of the reactor (see Appendix B)] indicates that the lead may be from a lead-based primer used to paint the tunnel rather than associated with the testing. The analysis performed also reflects total lead content and not the results of an extraction procedure toxicity test. According to information from former reactor workers currently employed in the surplus facilities decommissioning program (R.K. Wahlen and R.A. Winship, March 12, 1990), the tunnels had been painted to minimize the possibility of radioactivity penetrating into the porous concrete. Paints used during that era (1947 to 1964) commonly contained lead. Thus, it can be assumed that the high level of lead found in the concrete scrape sample is from the lead-based paints used during reactor operations.

No radioactivity is expected in the work areas of the LSFF because there was no exchange of air with the reactor. However, contaminated air was previously carried from the reactor, through the exhaust tunnels, through the underground 117-DR HEPA filter building, and to the stack (Dorian and Richards 1978). When the reactor first began operations, reactor exhaust went directly from the tunnels to the stack. The extent of decontamination activity performed in the mid-1970's to support the establishment of the LSFF is not known.

In 1987, four of the seven samples from the lower tunnel in the 105-DR Reactor tested for reaction by-products were also tested for radioactivity (see Appendix B). Only one sample showed radioactivity at significant (but low) levels (Table 3-1).

Table 3-1. Radioactivity in Waste Samples.

Sample	(d/min)/g (disintegrations per minute per gram)				
	Alpha	Beta	Gamma		
			^{137}Cs	^{60}Co	^{152}Eu
2	< 6	330	70	50	48
4	<13	<30	<14		
6	<19	<47	<18		
7	<14	<35	<10		

The upper exhaust tunnel was not sampled in 1987 because of inaccessibility.

4.0 WASTE CHARACTERISTICS

4.1 ESTIMATE OF MAXIMUM INVENTORY OF WASTE

The estimated maximum inventory (based on facility operating information) of sodium and lithium wastes stored at the 105-DR LSFF was approximately 1,000 lb stored during December 1982 and January 1983.

4.2 WASTES STORED AT THE FACILITY

Sodium has been designated as a dangerous waste because of its ignitable and reactive characteristics. All sodium handled in the LSFF (both purchased for the tests, and wastes from other Hanford Site operations) was treated by burning, which produces sodium oxide (Na_2O), sodium hydroxide (NaOH), and sodium carbonate (Na_2CO_3). Sodium oxide and hydroxide are strong alkalis, but readily absorb carbon dioxide from the atmosphere and convert to sodium carbonate. Sodium carbonate is typically called soda ash and is found naturally. Similarly, both purchased and waste lithium were also burned at the site, with lithium carbonate as the main final product. Lithium nitride was also produced, however, and records show that it was drummed and sent to the 340 Building (300 Area) for eventual disposal. Several tests of zinc and cesium (nonradioactive) sprays were also conducted, producing trace quantities of zinc oxide and cesium carbonate, respectively.

Because the sodium and lithium burn tests were conducted on concrete (conventional and magnetite concrete), reaction by-products of the concrete constituents were also produced (i.e., silicon dioxide, sodium and lithium silicates, aluminum oxide, magnesium oxide, iron oxides). Other trace inorganic compounds may also have been produced because of impurities in the concrete.

The overwhelming majority of the residues, both sodium and lithium carbonate, are characteristic category D (least toxic) dangerous wastes. The LD_{50} (lethal dose) for oral exposure to rats of sodium carbonate is 4,090 ppm [Material Safety Data Sheets (MSDS)]; for lithium carbonate the same LD_{50} is 525 ppm. Compounds with LD_{50}s at concentrations of from 500 to 5,000 ppm are category D dangerous waste as established by WAC 173-303-101. Levels of lead in wastes extract greater than 500 mg/L are considered to be an extremely hazardous waste (EHW); and levels of lead from 5 to 500 mg/L are considered to be a dangerous waste (DW) (WAC 173-303-090). The MSDS for lead, sodium carbonate, and lithium carbonate have been included in Appendix D.

The LSFF ventilation tunnels contain mostly deposits of sodium carbonate that formed from sodium oxides and hydroxides reacting with air. Other deposits include lithium carbonate, lithium nitride, and sodium and lithium silicates.

5.0 GROUNDWATER

Groundwater protection regulations established in WAC 173-303-645 only pertain to land treatment units (i.e., surface impoundments, waste piles, land treatment units, or landfills). Also, in accordance with the Tri-Party Agreement (Ecology et al. 1989), groundwater in the 100-D Area will be included in the 100-HR-3 operable unit and investigated under the RFI/CMS process. Therefore, groundwater is not included as part of the LSFF closure plan. The RFI/CMS draft work plan (DOE/RL 1989) is currently under review by Ecology.

6.0 CLOSURE PERFORMANCE STANDARDS

6.1 GENERAL CLOSURE STRATEGY

The primary strategy of this closure activity is clean closure. Clean closure of the LSFF is contingent on verification that constituents originating from the LSFF are not present in concentrations that represent a threat to human health or the environment. This contingency will be assessed using information obtained from implementation of sampling activities outlined in Chapter 7.0. No future use of the DR reactor or LSFF is planned or expected.

Washington State Department of Ecology closure performance standards [WAC 173-303-610 (2)(a)] require that the owner/operator close a facility in a manner that:

- Minimizes the need for further maintenance
- Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, postclosure escape of dangerous waste and dangerous constituents, leachate, contaminated run-off, or dangerous waste decomposition products to the ground, surface water, groundwater, or the atmosphere
- Returns the land to the appearance and use of surrounding land areas to the degree possible given the nature of the previous dangerous waste activity.

However, Federal Regulations in 40 CFR 265.381 ["Thermal Treatment Facility Closure," p. 685 (EPA 1988b)] state the following:

> "At closure, the owner or operator must remove all hazardous waste and hazardous waste residues (including, but not limited to, ash) from the thermal treatment process or equipment."

Special conditions at the LSFF were important considerations in developing this closure plan. These considerations are past use as part of a nuclear production reactor, other near-future characterization and remediation programs (see Section 6.5, Coordination with Other Projects), the low level of hazard associated with the residues from wastes burned at the LSFF, and the inaccessibility of the residues to humans and the environment.

Clean closure will be achieved by removing surface deposits of sodium and lithium carbonates and verifying that the equivalent concentrations of carbonates embedded in the concrete and soil are either (1) below dangerous waste levels for mixtures, (2) not statistically greater than baseline levels for these media (baseline being defined as the concrete or soil used for, and possibly impacted by, reactor operations but unimpacted by the LSFF, or (3) at concentrations that require no further activities for the protection of human health and the environment. These performance standards are referred to as action levels in this plan.

6.2 PROPOSED CLEANUP ACTION LEVELS

All surface carbonates, above action levels, will be removed after characterization sampling. The proposed action levels for verification cleanup are based on WAC 173-303-084, "Dangerous Waste Mixtures" (p. 23) and baseline levels. Any carbonates that may have penetrated concrete walls will be verified to be classed as undesignated waste according to WAC 173-303-9906, "Toxic Dangerous Waste Mixtures Graph," using the formula

Equivalent concentration (%) = percent category D waste/10,000

(per WAC 173-303-084 (5)(b)). Results from baseline sampling will also be compared to results from contaminated areas if its equivalent concentration classifies it as dangerous waste. This comparison will verify that carbonates in the affected concrete are not statistically above baseline levels.

With these action levels, the concrete will pose no significant hazard to humans or the environment from either toxic effects or potential irritation from direct exposure with any of the residuals. Eventually, the concrete will be disposed of with the rest of the 105-DR Reactor under the decommissioning program. The carbonates do not penetrate the surface of the metal components; thus these materials will be considered clean once surface carbonates have been removed by the methods described in Section 7.4.

These action levels will also be used for soil removal or treatment. Scrubber gravel and cleanup residue disposal will depend on equivalent concentrations of dangerous waste and the levels of lead as determined per WAC 173-303-090, "Dangerous Waste Characteristics" [using the Toxicity Characteristic Leaching Procedure, 40 CFR 261 (EPA 1988a)].

If verification sampling shows the concentration of carbonates to be significantly above the action levels, continued efforts toward clean closure will be pursued only if further assessment of action levels is warranted. This measure is proposed because contaminant concentrations for soil and concrete that may exceed an action level may also be significantly below any health or environmental-based risk. Reevaluation of the action levels could be considered in the event that the action levels are exceeded and further assessment of the action levels is warranted. Any additional evaluation would be based on (1) the extent to which action levels are exceeded and (2) the assessment of health-based risk using toxicity criteria guidance such as the EPA *Integrated Risk Information System (IRIS)* database (EPA 1989a), the *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual* (EPA 1989b), and other appropriate information.

6.3 GENERAL CLOSURE PROCEDURES

The LSFF will be closed in a manner consistent with Washington State guidelines and regulations. The general closure procedures are shown in Figure 6-1 and listed below (see Chapter 7.0 for complete explanation of procedures).

- Sample the areas of the facility to:
  - Determine reaction by-product deposit composition
  - Confirm that the source of previously detected lead contamination is from paint used to seal the reactor tunnel walls and not from LSFF waste treatment-related activities
  - Verify the absence of contamination (for soils, see Section 7.3.1).

- Decontaminate the structures as specified.

- Verify cleanup and certify that all closure activities were completed in accordance with the approved plan.

6.4 MINIMIZE THE NEED FOR FURTHER MAINTENANCE

Clean closure of the facility by removing or decontaminating equipment, structures, and soils to the levels specified will eliminate the need for further maintenance specific to the LSFF. Regardless of closure actions associated with the LSFF, however, general maintenance of the 105-DR Reactor structure will continue until final decommissioning.

6.4.1 Waste Alkali Metals

No waste sodium or lithium remains at the site.

6.4.2 Remaining Sodium

About 5,000 gal (39,000 lb) of sodium (procured for tests of construction materials) are stored in a tank that is located in a locked metal building (1720-D) near the LSFF. This sodium will be removed for other use or excessed for sale through a project separate from this closure plan.

6.4.3 Other Materials

Other materials associated with the LSFF and remaining on the site are electrical equipment (mostly wires and conduit, but no transformers or polychlorinated biphenyls), burn pans from sodium fires, metal burn cells,

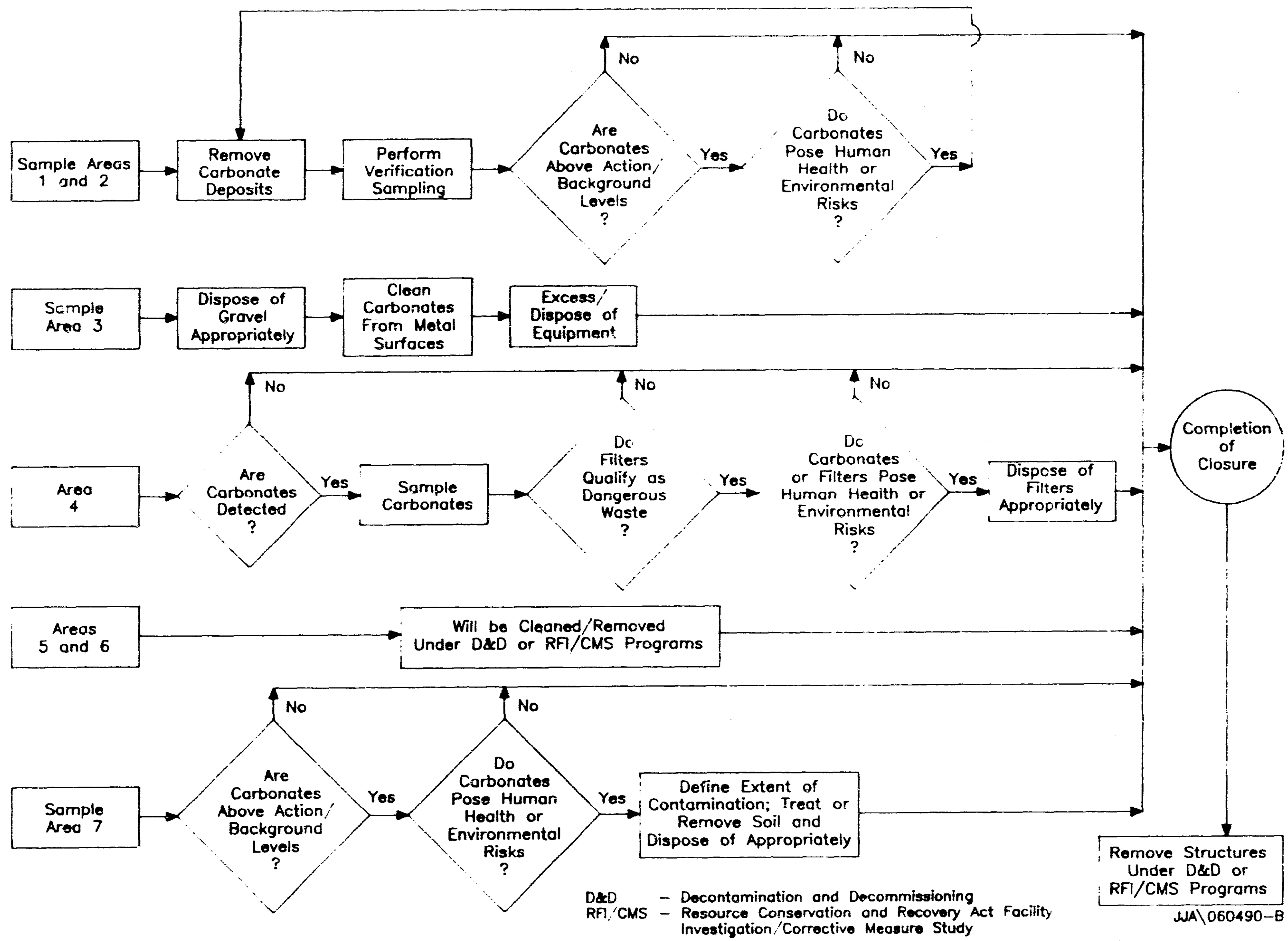

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Figure 6-1. Closure Flowchart for the 105-DR Large Sodium Fire Facility.

and an empty liquid nitrogen tank (vendor owned). These materials will be cleaned as appropriate (see Section 7.4.5) and disposed of as surplus property or placed in the appropriate landfill.

6.5 COORDINATION WITH OTHER PROJECTS

The LSFF is located within the 100-DR-2 (source) and 100-HR-3 (groundwater) operable units designated in the Tri-Party Agreement (Ecology et al. 1989). These operable units will be addressed through the RFI/CMS process. The 100-DR-2 operable unit is expected to begin characterization work in FY 1992; the 100-HR-3 operable unit is expected to begin characterization work in FY 1991.

In addition, consistent with the Tri-Party Agreement (Ecology et al. 1989, page 6-4), once any dangerous wastes associated with the LSFF are removed, the entire reactor will remain for future decontamination and decommissioning [also see the draft EIS for decommissioning eight surplus production reactors (DOE 1989, pp 1.7 through 1.13)].

Thus, any remedial action with respect to contaminants not associated with the LSFF, or associated with the LSFF and unable to be cleaned to action levels under this closure plan, will be deferred to the reactor decommissioning EIS (the 105-DR Reactor building, stack, and 117-DR filter building) or the RCRA process (116-DR-8 Crib and soil).

6.6 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Any carbonates remaining embedded in the concrete walls will be below dangerous waste levels and of no risk to human health or the environment. Surface contamination will be removed. Thus, human health and the environment will be fully protected.

6.7 RETURN LAND TO THE APPEARANCE AND USE OF SURROUNDINGS

Following clean closure, the 105-DR Reactor will have been restored to the condition of the other closed production reactors of the same age (e.g., 105-H, 105-F, 105-C).

7.0 CLOSURE ACTIVITIES

7.1 INTRODUCTION

The strategy for closure of the LSFF is clean closure. The following steps are needed to perform clean closure.

1. Sample the areas of the LSFF:

   - To determine reaction by-product deposit composition
   - To confirm that the source of previously detected lead contamination is from paint used to seal the reactor tunnel walls and not from LSFF waste treatment-related activities
   - To verify that contamination does not exceed action levels in soils (see Section 7.3.1, Area 7).

2. Evaluate the data for quality assurance/quality control (QA/QC) reliability and significance of contamination levels in comparison with baseline data and/or action levels.

3. Clean or remove the structures and equipment as specified and dispose of residues in accordance with applicable regulations as determined by sampling.

4. Sample concrete walls to verify that the embedded carbonates are below dangerous waste levels.

5. Evaluate the data for QA/QC reliability and significant contamination levels in comparison with baseline data and/or action levels.

6. Conduct additional decontamination of LSFF, as required.

7. Certify that closure activities were completed in accordance with the approved closure plan.

In the event that clean closure is not possible or practical, the remaining activities for final closure/postclosure monitoring will be performed in conjunction with the activities planned for the reactor decommissioning program or the RCRA operable units 100-DR-2 and 100-HR-3.

7.2 REMOVAL OF DANGEROUS WASTE INVENTORY

No unreacted waste metals are now at the site. Removal of waste residues from the LSFF cleanup operations is described in Section 7.4.

7.3 FACILITY SAMPLING

This waste sampling and analysis plan has been prepared to evaluate contamination with the parts of the LSFF that treated (burned) waste sodium and lithium metals or that received residue from these burns. This plan is primarily based on the history of the processes associated with the LSFF (Sections 2.0, 3.0, and 4.0).

7.3.1 Characterization Sampling

The LSFF can be logically divided into seven areas according to use and deposition of reaction by-products; therefore, these areas will be considered separately. Separate sampling schemes will allow for more definitive data for determining what focused cleanup measures must be taken to ensure that the specific closure requirements are achieved in an efficient and cost-effective manner.

The seven areas of the LSFF considered under closure activities are the exhaust fan room and two other fire rooms, sodium handling room, and offices (Area 1); the interior reactor exhaust tunnels (upper and lower), underground tunnel to the HEPA filter, and duct to gravel scrubber (Area 2); the gravel scrubber and downgradient duct (Area 3); the HEPA filters and filter pit (Area 4); the reactor exhaust stack (Area 5); the 116-DR-8 Crib (Area 6); and the soil between the LSFF entrance and the filter pit (Area 7) (see Figure 2-4).

Before sampling begins, all areas will be surveyed for radioactivity according to established Westinghouse Hanford procedures [Environmental Investigations Instructions (EII) 2.3, WHC 1988]. See Section 7.3.7 for specific equipment and procedures for dangerous waste sampling, and Section 7.3.5 for the location of sampling points.

<u>Area 1</u>: Area 1 consists of the exhaust fan room, two fire rooms, the sodium handling room, and an office area. The sump in the exhaust fan room contains about 1 gal of crusty powder and reaction by-products from past burns. Old burn pans stored in this room still have residues. A composite sample of the deposits in the burn pans and a sample of the deposits in the sump will be taken and analyzed to determine the corrosivity of the deposits and the concentrations of lithium, sodium, and lead. Target analyte list (TAL) inorganics will also be reported for use in determining residue disposal.

The exhaust fan room, the only room used to burn waste sodium and lithium, has visible, mostly thin layers (< 1/16 in.) of reaction by-products in a few places. These deposits are evident as a white film on sections of the walls. Authoritative wipe samples will be taken of four of the deepest areas of these deposits and analyzed for the presence of lead using field screening techniques (e.g., X-ray fluorescence). Three baseline wipe samples will be taken from the concrete wall on the outside of the exhaust fan room of the 105-DR Reactor and also analyzed for the presence of lead using field screening techniques.

Area 2: Area 2 consists of the upper and lower exhaust tunnel, the blower that moved LSFF exhaust from the lower to the upper tunnel, the exterior underground tunnel to the 117-DR HEPA Filter building (south of the LSFF), and the ducts to the submerged gravel scrubber. This tunnel had low but measurable radioactivity when sampled in 1987 (see Appendix B).

Five authoritative samples of the deposits in this area will be taken, seeking out the largest of the deposits. Two samples from the center of each deposit will be analyzed for corrosivity and lead and scanned for radioactivity. Other TAL inorganics will also be reported for use in residue disposal. The first sample will be of the deposits only (avoiding the concrete surface), and the other will be a scraping of both the deposits and the concrete surface. This dual-level sampling will help verify that the origin of the lead is from paint used to coat the tunnel walls, assuming that fugitive dust containing lead has not mixed with the upper layers of deposits. Because access to these tunnels will be difficult, the sampling team will also make estimates of the relative extent of surface deposits for later cleanup.

Areas 1 and 2 will be remediated as specified in the record-of-decision (ROD) for the reactor decommissioning EIS.

Area 3: Area 3 consists of the gravel scrubber and ducts, which were installed in 1982, 16 years after the 105-DR Reactor ceased operations; consequently, no radioactivity is expected. The scrubber and duct walls are metal; thus the carbonates will not have penetrated the wall surfaces. Removal of any surface deposits through cleaning (e.g., acid or water wash, high-pressure steam cleaning) is easily accomplished and will decontaminate these surfaces to below dangerous waste levels. Three random samples of the gravel in the 2-ft-thick gravel bed will be crushed and analyzed for the percent soluble alkalinity (as a measure of carbonates) and lead. The gravel will then be disposed of appropriately.

Area 4: Area 4 consists of the 117-DR HEPA filter building and the downstream tunnel to the reactor stack. The original HEPA filters from the DR Reactor were reportedly replaced for the LSFF. However, remnant radioactivity from the exhaust tunnels or filter holders has probably been picked up by the new filters. Radioactive surveys will be taken of the filters and filter pit before and during sampling. Because the exhaust from the LSFF went through 200 to 300 ft of tunnels and baffles before reaching the HEPA filters, little to no carbonates are expected on the filters. However, a sample of any visible deposits on the filters will be collected and analyzed for the percent of soluble alkalinity and concentrations of sodium, lithium, and lead. The 117-DR Building will be decontaminated and demolished under the surplus facilities decommissioning program.

Area 5: Area 5 consists of the reactor exhaust stack. Over the life of the LSFF facility, there were two routes for the exhaust to take before entering the reactor exhaust stack. Before 1982, the exhaust traveled from the LSFF through underground concrete tunnels to a spray scrubber and HEPA filters before exiting through the stack. The HEPA filters have a 99.95% efficiency rating; thus, no measurable amounts of reaction by-products are expected in the stack from this route. In 1982, a submerged gravel scrubber with an efficiency rating of approximately 99% was used to vent the exhaust instead of the underground HEPA filters. Similarly, no measurable deposits are expected from this route. The stack will be decontaminated and demolished under the surplus facilities decommissioning program.

Area 6: Area 6 consists of the 116-DR-8 Crib. The 116-DR-8 Crib, was originally used from 1960 to 1964 to percolate low-level waste drainage from the 117-DR Building seal pits. When used for the LSFF, the 116-DR-8 Crib received only water reported not to have been corrosive (the pH level was less than 12.5). In these tests, it was the lithium that was depleted by the moisture; the lead had little participation in the reaction or loss to the crib. Because of this and the treatment of the crib under the 100-HR-3 RFI/CMS (Ecology et al. 1989, p. C-7) (operable unit work is expected to begin in 1990), it will not be sampled or treated under this closure plan.

Area 7: Area 7 consists of the area to the north and west of the 117-DR HEPA filter building. The burn pans used in the alkali metal fires were sometimes stored in this area. However, because of (1) the passage of time, (2) low levels of carbonates that may have drained to the soil, (3) dissolving effects of rain, and (4) natural levels of carbonates in the soil, no significant concentrations levels above baseline are expected. Consequently, this characterization sampling also will be used for verification sampling. Four random soil samples will be taken from this area and analyzed for percent of soluble alkalinity. The soil will be sampled at a depth of 6 to 12 in.

Baseline alkalinity levels for the soil will be obtained from three random locations, and at a depth of 6 to 12 in. on the southwest corner of the LSFF. The soil here should be substantially similar to that at the south side of the LSFF, between the entrance and the filter building.

7.3.2 Verification Sampling

Verification sampling is used to determine that cleanup was completed to the required levels. In areas with metal surfaces, cleanup is the removal of all surface carbonates because carbonates will not have penetrated the metal surfaces. The only reliable information that could be obtained from wipe-sample verification of these metal surfaces is the presence or absence of a material and not the relative quantity with which to determine dangerous waste equivalent concentrations. In addition, because of the wide variety of many odd-shaped small pieces, a random sampling scheme for verification is impractical. However, because these carbonates are dangerous only in large quantities and concentrations (see Section 4.2 and the MSDS in Appendix D), and the concentrations will be extremely small relative to the bulk and weight of the waste metal, removal of surface deposits will ensure safe decontamination of the surfaces.

While the action level for the concrete walls is all surface carbonate deposits, unlike the metal walls, the possibility exists that the carbonates have penetrated and embedded in the concrete. Thus, verification is necessary to ensure that any carbonates remaining within the concrete are below the levels listed by the state for dangerous waste mixtures (WAC 173-303-084). Random cores of the concrete will be taken: 6 in the exhaust fan room (the only place waste metals were burned); 11 throughout the tunnel system; and 3 baseline samples from outside the exhaust fan room). A concrete coring device will cut the core (approximately 3-in. wide) from the wall; the top 1-in. depth of this core will be crushed and analyzed for percent of soluble alkalinity and concentrations of sodium and lithium to determine the concentrations of sodium and lithium carbonates. If the concentrations of carbonates in the concrete are below or equal to dangerous waste levels for mixtures or baseline levels (whichever is greater), the facility will be considered to be clean.

7.3.3 Quality Assurance/Quality Control Procedures

All procedures will be performed in accordance with the attached Quality Assurance Project Plan (Appendix F), *Environmental Investigations and Site Characterization Manual* (WHC 1988), *Quality Assurance Manual* (WHC 1989a), *Environmental Compliance Manual* (WHC 1989b), and pertinent EPA guidance [e.g., SW-846 (EPA 1986, p. 1-11)].

7.3.3.1 Field Quality Assurance/Quality Control Procedures. Field QA/QC will be assured through the use of sampling duplicates and blanks as described below. The QC samples will be collected once a day during sampling operations as determined by the cognizant engineer.

Field duplicate samples will be taken for concrete cores, soil, and powdered deposits. Duplicate samples are two separate samples taken from the same sampling point in the field, placed in separate containers, and sent to separate laboratories for analysis. The duplicates will be used as an indication of the repeatability of the analytical data.

Field split samples are collected by homogenizing a field sample and separating the material into two equal aliquots. Field split samples are usually routed to separate laboratories for independent analysis, generally to audit the performance of the primary laboratory.

Field blanks consist of pure deionized, distilled water, which is transferred to a sample container at the site and preserved with the reagent specified for the analytes of interest. They will be used to check for possible contamination originating with the reagent or the sampling environment and will be collected daily when the cleaning rinsate is sampled. Wipe-sample blanks consist of filter paper that has been laboratory-prepared with the appropriate solution and placed in a sample container in the field. This blank will be collected with the wipe samples to determine if contaminants were introduced by the paper, preparation solution, or sampling environment.

Equipment blanks are pure deionized distilled water washed through decontaminated sampling equipment and placed in containers identical to those for actual field samples. Equipment blanks are used to verify the adequacy of sampling equipment decontamination procedures.

7.3.3.2 Laboratory Quality Assurance/Quality Control Procedures. The analytical laboratories will ensure the integrity and validity of test results through use of an internal quality control program. The program will meet the criteria of SW-846 (EPA 1986). A system of reviewing and analyzing the results of these samples will be maintained to detect problems caused by contamination, inadequate calibrations, miscalculations, improper procedures, or other factors. Standard methods will be used and alternate methods that are developed or adapted will be tested and completely documented. All methods and method changes will be approved by a Westinghouse Hanford.

The QC procedures for hazardous chemical analysis will include [as appropriate to each analysis and as specified in Section 1.2 of SW-846 (EPA 1986)] evaluation of blanks, random matrix spikes (for 10% of the samples), internal standards, surrogates, and standard calibration curves. Spikes will be added in amounts comparable to the amount of analyte present in the sample. The QC procedures specific to individual methods will be detailed in the laboratory's documented analytical procedures and will be included with each batch of samples analyzed.

7.3.3.3 Field Logbook. The personnel conducting sampling will maintain an official logbook during the sampling activities, as described in EII 1.5, "Field Logbooks" (WHC 1988). The book will be bound and will have consecutively numbered pages. All information pertinent to the sampling must be legibly recorded in the logbook. If changes are necessary, they will be indicated by a single line drawn through the affected text. The individual responsible for the change will initial and date the entry. Each day's activities or separate sampling episodes must be signed. The logbook should be protected, stored in a safe file or other repository, and kept as a permanent record.

7.3.4 Parameters and Analysis Methods

Because only one organic compound may have been used for waste treatment at the LSFF, and because of the heat of reaction (sodium and lithium burn greater than 1300 °F), no organics are reasonably expected to be in the facility. The one organic that may have been used is Saran (vinylidene chloride acrylonitrile copolymer), an ingredient (7%) in the Met-L-X* fire extinguisher, used to extinguish alkali fires. However, the waste burns in the fire facility were allowed to burn themselves to completion. The only MSDS-listed dangerous decomposition product of Met-L-X is "possibly traces

*Met-L-X is a trademark of Ansul.

of HCl." [The other ingredients in Met-L-X are sodium chloride (85%), magnesium aluminum silicate (greater than 10%) and magnesium stearate (greater than 1%).]

The samples to be collected from the structures will be analyzed for the dangerous waste reaction by-products of sodium and lithium burns, which are sodium and lithium carbonates, and for lead because of the effect it may have on residue disposal. Lead and sodium will be laboratory analyzed for in these deposits and in the crushed gravel using atomic absorption and/or direct aspiration [SW-846, method 1310/6010, (EPA 1986)]. Cleanup residue and wipe samples will be analyzed for lead with field screening techniques (e.g., X-ray fluorescence), with 10% to be laboratory validated. Levels of other TAL inorganics (see Table 7-1) will also be reported with the results for all samples analyzed per SW-846 methods (EPA 1986). These elements, however, are not by-products of waste burns at the LSFF and will not directly affect closure activities. A method comparable to SW-846 standards for TAL inorganics will be used for lithium analysis.

The percent of soluble alkalinity (a measure of the carbonates) of the deposits, crushed gravel, and soil will be determined according to WAC 173-303-090 (6)(a)(iii). Equivalent weights of water and the media will be mixed and the pH of the solution will be tested. A pH of 12.5 or greater will classify the deposits, gravel, or soil as corrosive and a dangerous waste for use in developing a health and safety plan and for determining proper disposal. The corrosivity of liquid cleanup residue will be analyzed using SW-846 method 9041 (EPA 1986).

Concrete cores will be crushed and analyzed for percent of soluble alkalinity and sodium and lithium concentrations to measure the equivalent concentrations of carbonates.

Table 7-1. Other Target Analyte List Inorganics to be Reported.

Aluminum	Magnesium
Antimony	Manganese
Arsenic	Mercury
Barium	Nickel
Beryllium	Potassium
Cadmium	Selenium
Calcium	Silver
Chromium	Thallium
Cobalt	Vanadium
Copper	Zinc
Iron	Cyanide

Scans for radiation will be made according to established Westinghouse Hanford procedures [EII 2.3, "Administration of Radiation Surveys to Support Environmental Characterization Work on the Hanford Site," (WHC 1988)] in all areas for worker protection and facility characterization. In areas where scans show measurable radioactivity, the samples collected and residue removed will also be surveyed for radiation.

7.3.5 Selection of Verification Sampling Locations for Rooms, Tunnels, and Soil

The tunnels from the fire rooms to the filter systems do not lend themselves to grid-point sampling techniques because of intricate construction. To validate a clean closure, a combination of authoritative (biased) and random sampling will be used. The authoritative sampling will consist of taking two concrete cores from areas where carbonate deposits are visibly thick, such as the tunnel shelf and wall above the shelf, located outside the exhaust fan room.

The random samples will be taken from three locations along the lengths of each of the three tunnels (upper and lower interior tunnels and underground exterior tunnel). The wall to be sampled, the height and the distance from the north (reactor) end of the tunnel, have been randomly chosen for each point (see Appendix C, Table C-5). The heights shown in Table C-1 are either 0 to 20 ft or 0 to 7 ft, depending on the tunnel. The walls are designated 1 for the east wall and 2 for the west wall. Three extra points have been chosen in case the walls have openings where the original sampling point lands. Lotus* 1-2-3 software was used to select all random points.

The six concrete core samples in the exhaust fan room have been chosen randomly, by laying out the six sides of the room in a grid with points approximately 1 yd apart. The grid points were numbered left to right in each row, starting with the upper left corner for each wall, northwest corner for the ceiling, and northeast corner for the floor. The first point on the north wall is point Number 1 and the numbering system continues on the east, south, and west walls; ceiling; and floor, in that order. One point was randomly chosen for each wall (see Appendix C, Figure C-1).

The baseline core and wipe samples were also chosen randomly from the wall on the south side of the door to the exhaust fan room. An identical grid-point method was used (see Appendix C, Figure C-2).

Soil samples were chosen by a random grid-point method, with the grid points 1 yd apart (see Appendix C, Figure C-3). The gravel was laid out in a 3-dimensional grid, with horizontal (flat) points 2 ft apart and vertical (elevation) points 1 ft apart (see Appendix C, Figure C-4).

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*Lotus is a trademark of Lotus Development Corporation.

7.3.6 Evaluation of Data

7.3.6.1 General Evaluation. After receiving the analytical results, the data will be judged for reliability; reviewed and summarized to eliminate constituents with all results below detection limits to make the data more manageable; and statistically evaluated according to procedures in EII 1.11, "Control and Transmittal of Laboratory Analytical Data" (WHC 1988). The following is an outline of how sampling data will be evaluated.

- Evaluate the quality control of the sampling, handling, and analyses to assess the reliability of the data.
- Prepare summary statistics for constituents as described in Section 7.3.6.2.
- Compare the sample results with the baseline sample results.

If significant differences in mean concentrations are found between facility and baseline samples, or if insufficient data are available for a statistical comparison of results from the facility and baseline results for a constituent, comparison with various standards will be performed to define action levels by: (1) examining significant results for comparison with accepted regulatory standards (WAC 173-303-084 and baseline levels) and; (2) making an assessment as to whether the levels of various constituents in the media are a health or environmental concern.

7.3.6.2 Statistical Treatment. All data collected, including baseline data, will be analyzed and tabulated for dangerous constituents and will include the following:

- Number of 'less than' detection limit values
- Total number of values
- Mean
- Standard deviation
- Coefficient of variation
- Method detection limit or practical qualification limit
- Representative method accuracy
- Representative method precision
- Minimum value
- Maximum value.

7.3.6.3 Data Reliability. Data reliability will be assessed by evaluating the sample handling and analysis quality control according to procedures in EII 1.11 "Control and Transmittal of Laboratory Analytical Data" (WHC 1988). Sample-handling quality control will be evaluated by reviewing field documentation and results of quality assurance samples to establish that sampling error was minimized. The review will be conducted to verify that decontaminated equipment was used, that cross-contamination was minimized, that samples were preserved properly, and that the chain of custody of the samples was not broken.

7.3.7 Sampling Equipment and Procedures

Sampling equipment will be appropriate to the media sampled, which are crusted powder (carbonates), concrete surfaces (wiped and scraped), concrete cores, and soils. All samples (except concrete cores) will be collected in 60-mL precleaned bottles; reusable sampling equipment (stainless steel) will be decontaminated and wrapped to ensure cleanliness before each use. The following are examples of some of the other sampling equipment to be used to sample the media:

Powder	Wipe samples of concrete	Concrete scrapes	Soils
Stainless-steel spoon	Filter paper	Stainless-steel putty knife	Stainless-steel shovel and spoons

Wipe samples will be collected according to standard sampling techniques (EPA 1987) using Whatman* No. 42 filter paper. The papers will be laboratory prepared with dilute (1:100) nitric acid solution. One filter paper will be used to wipe down the wall surface from a 6-in. by 6-in. section over the carbonate deposit. The entire 36 in.^{2} area, covered with a disposable template, will be carefully wiped, using vertical strokes, starting at the top left corner and progressing to the bottom right corner. The filter paper will be held with clean gloves to prevent contamination. A new pair of gloves will be used for each wipe sample. Care will be taken to wipe the surface only once throughout the sampling effort. After the area is wiped, the filter paper will be folded with the exposed side in and folded again to form a 90° angle in the center of the paper. All wipe samples will be field screened by X-ray fluorescence for lead; one sample will then be placed in a 60-mL glass container and sealed for laboratory validation analysis.

Concrete cores will be collected with an approximately 3-in.-dia diamond bit coring device, penetrating at least 2 in. into the concrete. Distilled water will be used as a cutting lubricant to minimize dust generation. The top 1 in. of the core will be removed with a concrete saw and placed in a decontaminated container for crushing and analysis.

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*Whatman is a trademark of Whatman Incorporated.

To collect soil samples, a cleaned stainless-steel shovel will be used to remove the top 6 in. of soil; then a clean, stainless-steel sampling spoon will be used to fill a 60-mL glass jar with soil from a depth of 6 to 12 in.

All equipment will be decontaminated between samples in accordance with procedures outlined in EII 5.5 "Decontamination of Equipment for Resource Conservation and Recovery Act/Comprehensive Environmental Response Compensation and Liability Act (RCRA/CERCLA) Sampling" (WHC 1988).

7.3.8 Reporting

After completion of the sampling effort, verification and analytical result reports will be provided and will include the following at a minimum:

- Actual sample locations, number of samples, and specific collection methods
- A list of results with constituents or parameters of concern, sample number, reporting units, and detection limits
- A signed statement certifying that each type of analysis (e.g., atomic absorption) was conducted in accordance with the procedure specified
- A description of unusual circumstances or situations that may have made the analytical results questionable
- A review, analysis, and statistical summary of data received from the laboratory.

The results will be used to provide further closure evaluations.

7.3.9 Summary of Sampling Effort

Table 7-2 shows the number of samples to be collected and analyzed for LSFF characterization and validation. This table does not include the samples to be taken for QA/QC requirements (see Section 7.3.3.1); these will be collected once each sampling day.

7.3.10 Modifications to the Sampling Plan

The optimal aspects of sample design are sometimes not achievable because of unanticipated situations or changing condition. Factors adversely influencing sampling efforts can include equipment malfunction or breakdown,

Table 7-2. Summary of Sampling Effort.*

Area	Purpose	Media	Number
1	Characterization	Powder	2
	Characterization	Wipe	4
	Verification	Concrete core	6
2	Characterization	Powder	5
	Characterization	Powder/concrete scrape	5
	Verification	Concrete core	6
3	Characterization	Gravel (crushed)	3
4	Characterization	Powder (if present)	1
7	Verification	Soil	4
<u>Outside affected areas</u>			
Concrete wall to the right of the exhaust fan room entrance	Baseline	Wipe	3
	Baseline	Concrete core	3
Southwest corner of DR reactor	Baseline	Soil	3

*QA Samples (see Section 7.3.3.1) will be taken once each sampling day.

physical barriers to accessing sampling locations, and an overly optimistic evaluation of other physical conditions at the site. When modifications to the sampling plan are necessary, they will be recorded in the field logbook along with the circumstances requiring the modification. The field logbook will be reviewed and signed by the project engineer daily. This will provide an accurate record of modifications and Westinghouse Hanford approval, while allowing sampling to proceed safely and maintaining efficient manpower and equipment usage. When modifications to an established procedure are needed, procedures outlined in EII 1.4 "Deviations from Environmental Investigations Instructions" (WHC 1988) will be followed.

7.3.11 Health and Safety Plan

A Health and Safety Plan (HASP) is required for all dangerous waste sampling sites. The HASP is intended to specify information pertinent to field assignments and to be a guide in times of unusual situations or emergencies. A site-specific version of the general *Industrial Safety Manual* (WHC 1989c) will be developed for the LSFF closure before field activities are initiated, in accordance with EII 2.1 "Preparation of Hazardous Waste Operations Permits" (WHC 1988).

7.4 REMOVAL OF REGULATED MATERIAL AND WASTE RESIDUE

The methods of residue removal may include acid and water washes and high-pressure steam. All regulated materials packaged for shipment offsite will be in U.S. Department of Transportation-approved containers that are compatible with the waste contents (e.g., 55-gal drums). All containers will be labeled and shipped under manifest as necessary according to WAC 173-303-075 (Figure 7-1).

7.4.1 Buildings

The reaction by-product deposits will be removed from the walls, ceilings, and floors of the experiment rooms and tunnels. Cleaning methods may include acid and/or water washes or high-pressure steam. The residue will be drummed; sampled for corrosivity, lead (using field-screening methods such as X-ray fluorescence), and radioactivity (as indicated by the initial surveys); and disposed of appropriately.

7.4.2 Scrubber

After sampling to determine the equivalent concentrations of carbonates and levels of lead (see Section 6.2), the gravel in the scrubber will be drummed and disposed of at the appropriate landfill or burial ground. The interior walls of the scrubber and ducts will be washed with water or acid or cleaned with high-pressure steam. The residual liquid will be drummed, sampled for corrosivity, and disposed of appropriately. Cleaned metal scrubber materials will be excessed or disposed of at the Central Waste Complex, located in the 200 Area.

7.4.3 Filters

The presence of carbonates embedded in the HEPA filters will be evaluated to determine if the filters are considered dangerous mixed waste under WAC 173-303-084. If they are not dangerous waste, they will remain at the 117-DR Building for disposal under the ongoing decontamination and decommissioning program for reactor facilities. If, after initial sampling, the filters are expected to qualify as dangerous waste, removal will be negotiated with regulating agencies (Ecology and EPA). Human health and environmental risks and applicable waste minimization regulations will help guide how and when the filters will be removed.

7.4.4 Soil

If sampling proves that the percent of soluble alkalinity in the soil is above baseline or the action level described in Section 6.2, additional sampling will be used to determine the extent of contamination and levels (if any) of radioactivity. The affected soil will then be drummed and

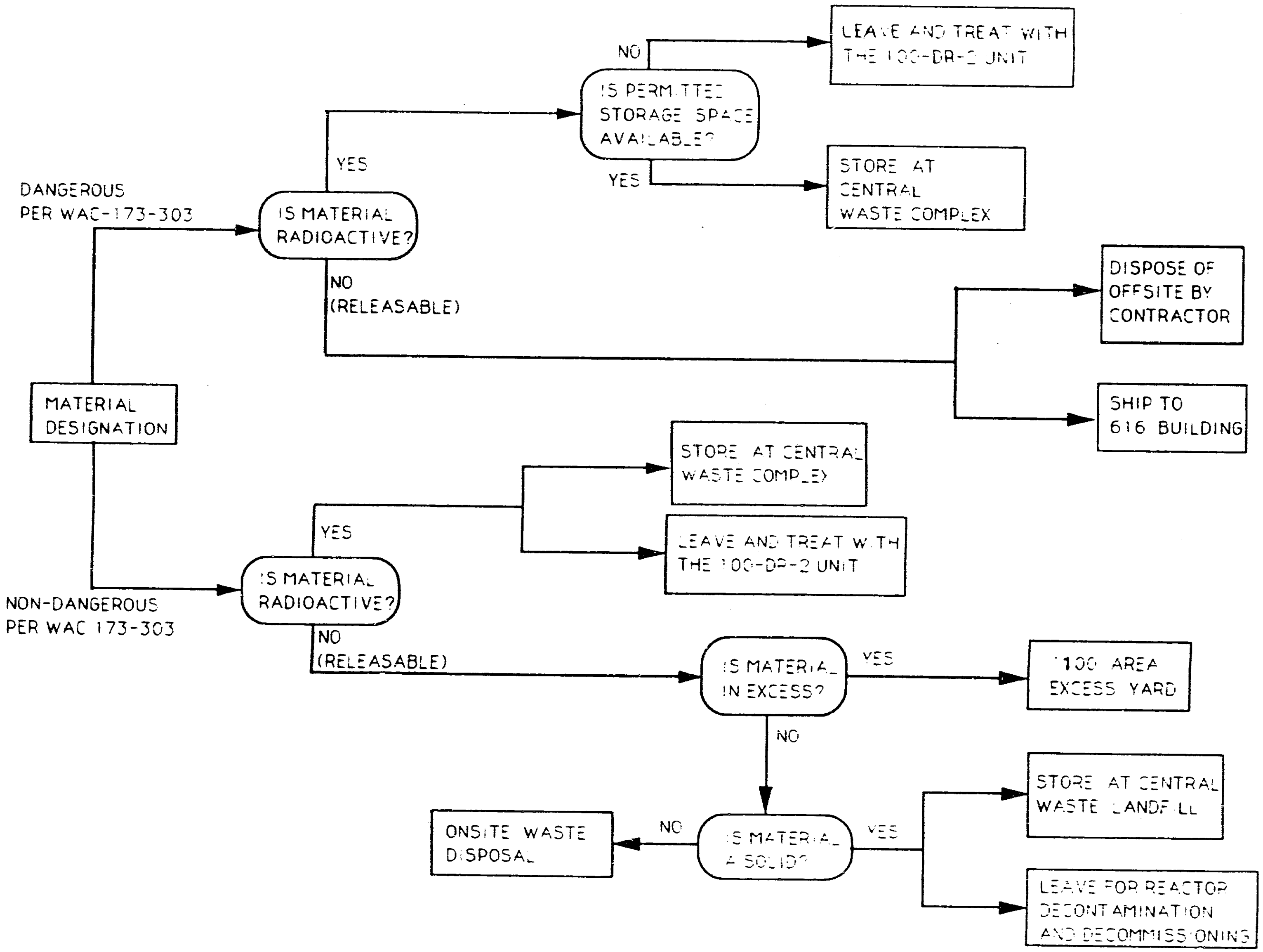

Figure 7-1. Flowchart for Removal of Contaminated Material and Waste Residue.

1

disposed of offsite in accordance with the site disposal contract that is in place at the time of removal if sampling proves it to be dangerous but uncontaminated by radioactivity. If the soil has low-level radioactivity, it will be held onsite until a permitted TSD facility is available.

7.4.5 Equipment

The equipment used for the LSFF and in contact with waste sodium or lithium burn exhaust gases, and equipment used during the closure activities, will be either cleaned with water or acid, or high-pressure steam cleaned. The cleaning will be performed over a solid sheet of durable plastic either 8 mL or 12 mL thick, depending on the equipment and amount of potential abrasion resulting from cleaning activities. The rinsate will be collected in 55-gal steel drums, sampled for corrosivity, and disposed of appropriately. After cleaning, all equipment and materials originating from the LSFF will be surplused or disposed of.

7.5 OTHER ACTIVITIES REQUIRED FOR CLOSURE

No other activities are required for clean closure.

7.6 SCHEDULE FOR CLOSURE

Closure activities will begin within 30 days after notification by Ecology that this closure plan has been approved. Closure will proceed according to the schedule in Figure 7-2.

7.7 AMENDMENT OF PLAN

The LSFF closure plan will be amended whenever changes in operating plans affect the closure or if, when conducting final closure activities, unexpected events require a modification of the closure plan. This plan may be amended any time before certification of final closure of the LSFF. If amendment to the approved plan is required, DOE-RL will submit a written request to Ecology to authorize the change.

7.8 CERTIFICATION OF CLOSURE AND SURVEY PLAT

Within 60 days of final closure of the LSFF, DOE-RL will submit to Ecology a certification of closure. The certification will be signed by both DOE-RL and an independent professional engineer registered in the state of Washington. The certification will state that the facility has been closed in accordance with the approved plan. The certification will be submitted by registered mail. Documentation supporting the closure

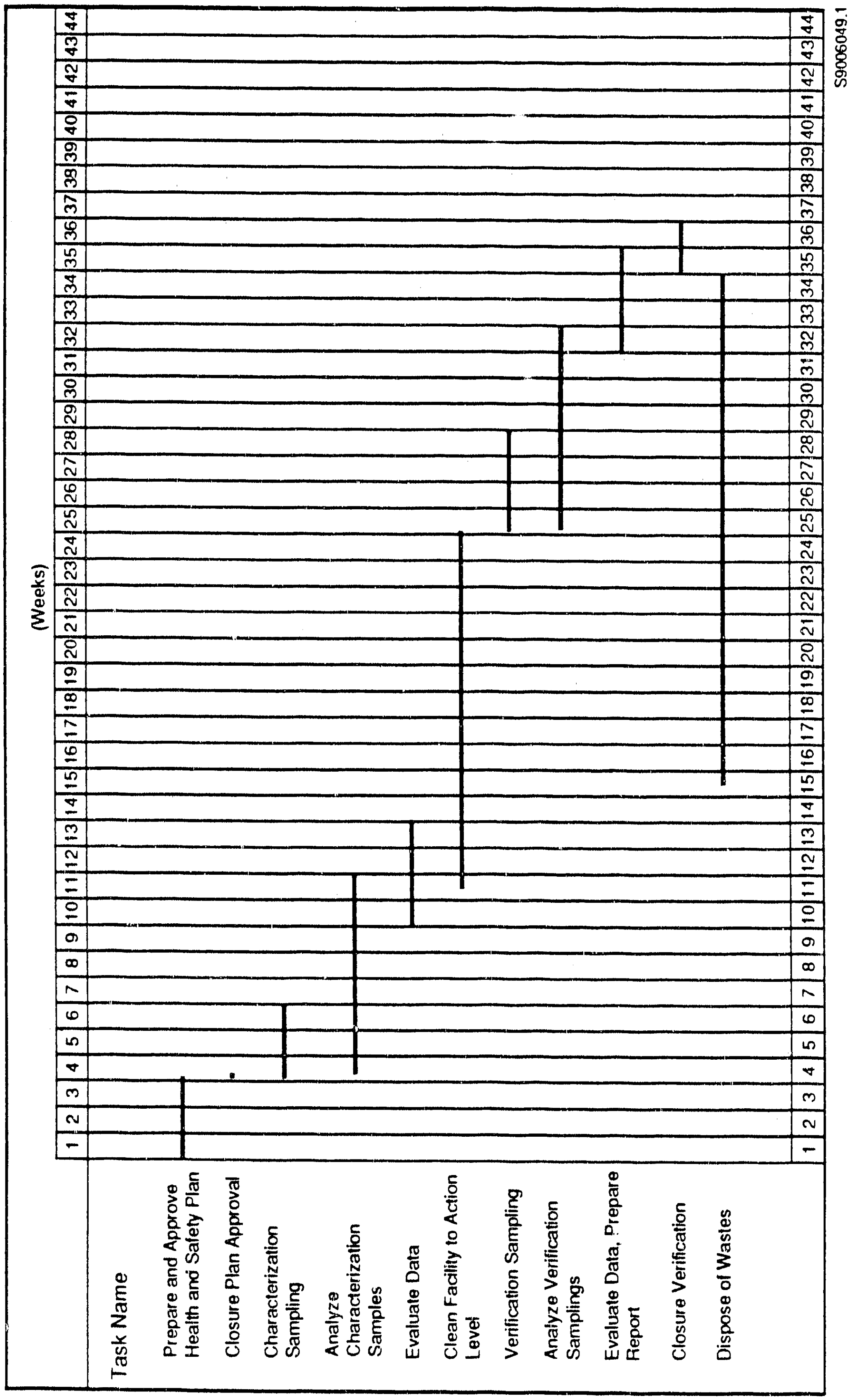

Figure 7-2. Large Sodium Fire Facility Closure Schedule.

certification will be retained and furnished to Ecology upon request. The DOE-RL will self-certify with the following document or a document similar to it:

> The undersigned, the owner and operator of the Large Sodium Fire Facility, hereby certifies that I have reviewed the approved closure plan for the Large Sodium Fire Facility and, to the best of my information and belief, all closure activities were performed in accordance with the specifications identified in the approved closure plan. (Signature and date).

The DOE-RL will engage an independent professional engineer registered in the state of Washington to certify that the LSFF has been closed in accordance with the approved plan. The DOE-RL will require the engineer to sign the following document or a document similar to it:

> The undersigned, an independent registered professional engineer, hereby certifies that I have reviewed the approved closure plan for the Large Sodium Fire Facility and, to the best of my information and belief, all closure activities were performed in accordance with the specifications identified in the approved closure plan. (Signature, date, professional engineer license number, business address, and telephone number.)

If clean closure is not attained, the owner or operator will submit to the local zoning authority or to the authority with jurisdiction over local land use, a survey plat indicating the location and dimensions of the LSFF. The EPA will also be provided with a survey plat. The plat will show the facility location with respect to permanently surveyed benchmarks and will be prepared and certified by a professional land surveyor. The plat will also contain a note, prominently displayed, stating the owner's obligation to restrict disturbance of the surveyed area.

8.0 POSTCLOSURE

8.1 NOTICE IN DEED BOOK

This closure plan is proposing clean closure of the 105-DR Large Sodium Fire Facility. However, if clean closure cannot be obtained, the following action will be taken in accordance with WAC 173-303-610 (1)(b). Within 60 days of the certification of closure, DOE-RL will sign, notarize, and file for recording the notice indicated below. The notice will be sent to the Auditor of Benton County, P.O. Box 470, Prosser, Washington, with instructions to record this notice in the deed book.

TO WHOM IT MAY CONCERN

The United States Department of Energy-Richland Operations Office, an operations office of the United States Department of Energy, which is a department of the United States government, the undersigned, whose local address is the Federal Building, 825 Jadwin Avenue, Richland, Washington, hereby gives the following notice as required by 40 CFR 265.120 and WAC 173-303-610(10) (whichever is applicable):

(a) The United States of America is, and since April 1943, has been in possession in fee simple of the following described lands: (legal description of 105-DR Large Sodium Fire Facility).

(b) The United States Department of Energy-Richland Operations Office, by operation of the 105-DR Large Sodium Fire Facility, has disposed of hazardous and/or dangerous waste under the terms of regulations promulgated by the United States Environmental Protection Agency and Washington Department of Ecology (whichever is applicable) at the above described land.

(c) The future use of the above described land is restricted under terms of 40 CFR 264.117(c) and WAC 173-303-610(7)(d) (whichever is applicable).

(d) Any and all future purchasers of this land should inform themselves of the requirements of the regulations and ascertain the amount and nature of wastes disposed on the above described property.

(e) The United States Department of Energy-Richland Operations Office has filed a survey plat with the Benton County Planning Department and with the United States Environmental Protection Agency, Region 10, and the Washington Department of Ecology (whichever are applicable) showing the location and dimensions of the 105-DR Large Sodium Fire Facility and a record of the type, location, and quantity of waste treated.

8.2 POSTCLOSURE CARE

Postclosure care is generally required when a waste management facility cannot attain a clean closure. If the LSFF cannot attain clean closure under this plan, closure may be deferred until the reactor building, underground tunnels, filter building, stack, and crib characterization and disposal are addressed under concurrent and future programs.

If it is determined that the LSFF cannot be remediated under these programs, a postclosure plan will be prepared for the facility at that time. The postclosure plan will include:

- Inspection plan
- Monitoring plan
- Maintenance plan
- Personnel training
- Postclosure contact
- Provisions to amend the postclosure plan
- Provisions to certify the postclosure plan.

9.0 REFERENCES

DOE, 1985, *RCRA Part B Permit Application, Alkali Metal Treatment and Storage Facilities*, D-2, DOE 150, U.S. Department of Energy-Richland Operations, Richland, Washington.

DOE, 1989, *Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington*, DOE/EIS-0119D, U.S. Department of Energy, Richland, Washington.

DOE/RL, 1989, *Draft Resource Conservation Recovery Act Facility Investigation/Corrective Measures Study Work Plan for the 100-HR-3 Operable Unit Hanford Site, Richland, Washington*, Department of Energy-Hanford Operations, Richland, Washington.

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Ecology, EPA, and DOE 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

Ecology 1989, *Dangerous Waste Regulations*, Washington Administrative Code, Title 173-303, Washington State Department of Ecology, Olympia, Washington.

EPA, 1986, *Test Methods for Evaluating Solid Waste*, SW-846, Third Edition, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1987, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988a, *Identification and Listing of Hazardous Waste*, Title 40, Code of Federal Regulations, Part 261, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988b, *Interim Status Standards for Owners and Operators of Hazardous Waste, Treatment, Storage, and Disposal Facilities*, Title 40, Code of Federal Regulations, Part 265, as amended, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1989a, *Integrated Risk Information System (IRIS)*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1989b, *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual*, Part A, Chapter 6, *Exposure Assessment*, U.S. Environmental Protection Agency, Washington, D.C.

Jeppson, D.W., 1978, *Test Plan, 189a WH014/EDD*, Subtask B, Lithium-Atmosphere Reactions, Westinghouse Hanford Company, Richland, Washington.

Resource Conservation Act of 1976, as amended, Public Law 94-580, 90 Stat. 2795, 42 USC 6901 et seq.

WHC, 1988, *Environmental Investigations and Site Characterization Manual*, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989a, *Quality Assurance Manual*, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989b, *Environmental Compliance Manual*, WHC-CM-7-5, Westinghouse Hanford Company, Richland, Washington.

WHC 1989c, *Industrial Safety Manual*, WHC-CM-4-3, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

LARGE SODIUM FIRE FACILITY PART A PERMIT APPLICATION

FORM 3

DANGEROUS WASTE PERMIT APPLICATION

I. EPA/STATE I.D. NUMBER: W A 7 8 9 0 0 0 8 9 6 7

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (mo., day, & yr.)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA/STATE I.D. Number, or if this is a revised application, enter your facility's EPA/STATE I.D. Number in Section I above.

A. FIRST APPLICATION (place an "X" below and provide the appropriate date)

☐ 1. EXISTING FACILITY (See instructions for definition of "existing" facility. Complete item below.)

☐ 2. NEW FACILITY (Complete item below.)

* MO. ___ DAY ___ YR. 7 2 — FOR EXISTING FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED (use the boxes to the left)

MO. ___ DAY ___ YR. ___ — FOR NEW FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION (place an "X" below and complete Section I above)

☐ 1. FACILITY HAS AN INTERIM STATUS PERMIT

☐ 2. FACILITY HAS A FINAL PERMIT

III. PROCESSES — CODES AND DESIGN CAPACITIES

A. PROCESS CODE — Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process (including its design capacity) in the space provided on the (Section III-C).

B. PROCESS DESIGN CAPACITY — For each code entered in column A enter the capacity of the process.

1. AMOUNT — Enter the amount.
2. UNIT OF MEASURE — For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PRO-CESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER (barrel, drum, etc.)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D80	GALLONS OR LITERS
LANDFILL	D81	ACRE-FEET (The volume that would cover one acre to a depth of one foot) OR HECTARE-METER
LAND APPLICATION	D82	ACRES OR HECTARES
OCEAN DISPOSAL	D83	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D84	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Section III-C.)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING SECTION III (shown in line numbers X-1 and X-2 below): A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 1	20,000	L		7				
2	T 0 4	100	V		8				
3		*Information concerning the month of initial operation of this unit is			9				
4		not available			10				

CONTINUE ON REVERSE

Continued from the front

III. PROCESSES (continued)

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESS (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

S01, T04

The 105-DR Large Sodium Fire Facility is a research laboratory located in the 105-DR building in the 100-D Area of the Hanford Site. The facility is used to conduct experiments for studying the behavior of molten alkali metals and alkali metal fires. This facility is also used for the treatment of alkali metal dangerous wastes. Treatment consists of heating the waste to the point of oxidation. Up to 100 liters per day of dangerous wastes can be treated in the facility in a system equipped with an off-gas system The 105-DR facility is also used to store up to 20,000 liters of dangerous wastes.

IV. DESCRIPTION OF DANGEROUS WASTES

A. DANGEROUS WASTE NUMBER — Enter the four digit number from Chapter 173-303 WAC for each listed dangerous waste you will handle. If you handle dangerous wastes which are not listed in Chapter 173-303 WAC, enter the four digit number(s) that describes the characteristics and/or the toxic contaminants of those dangerous wastes.

B. ESTIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non—listed waste(s) that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed dangerous wastes: For each listed dangerous waste entered in column A select the code(s) from the list of process codes contained in Section III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non—listed dangerous wastes: For each characteristic or toxic contaminant entered in Column A, select the code(s) from the list of process codes contained in Section III to indicate all the processes that will be used to store, treat, and/or dispose of all the non—listed dangerous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: DANGEROUS WASTES DESCRIBED BY MORE THAN ONE DANGEROUS WASTE NUMBER — Dangerous wastes that can be described by more than one Waste Number shall be described on the form as follows:

1. Select one of the Dangerous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other Dangerous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other Dangerous Waste Number that can be used to describe the dangerous waste.

EXAMPLE FOR COMPLETING SECTION IV (shown in line numbers X-1, X-2, X-3, and X-4 below) — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non—listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. DANGEROUS WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
X-2	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2			T 0 3 D 8 0	included with above

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER (enter from page 1)

W A 7 8 9 0 0 0 8 9 6 7

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

LINE NO.	A. DANGEROUS WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	D003	20,000	K	S01 T04	Thermal treatment
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

Continued from the front.

V. DESCRIPTION OF DANGEROUS WASTES *(continued)*

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM SECTION D(1) ON PAGE 3.

The 105-DR Large Sodium Fire Facility is used for the treatment and storage of alkali metal wastes. These wastes consists of sodium, lithium, and sodium-potassium alloy. Approximately 20,000 kilograms are managed at this facility each year. These wastes are not radioactive.

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail)*.

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail)*.

VII. FACILITY GEOGRAPHIC LOCATION *This information appears on the attached drawing and photograph

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*

VIII. FACILITY OWNER

[X] A. If the facility owner is also the facility operator as listed in Section VII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME *(print or type)*	SIGNATURE	DATE SIGNED
Michael J. Lawrence Manager, Richland Operations United States Department of Energy	Michael J. Lawrence	November 16, 1987

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME *(print or type)*	SIGNATURE	DATE SIGNED
SEE ATTACHMENT		

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Michael J. Lawrence
Manager, Richland Operations
United States Department of Energy

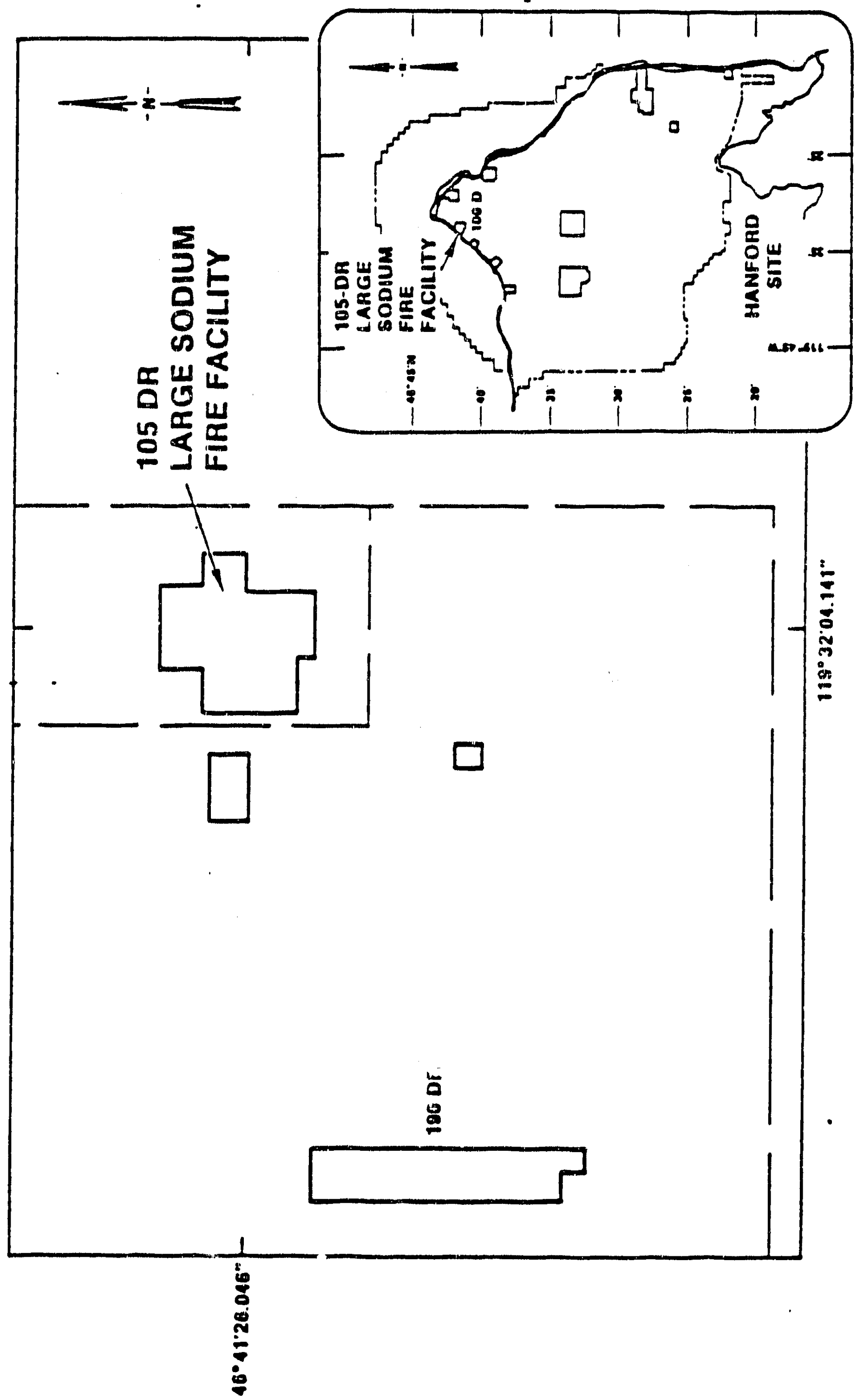
Date: 11-16-87

William M. Jacobi
President
Westinghouse Hanford Company

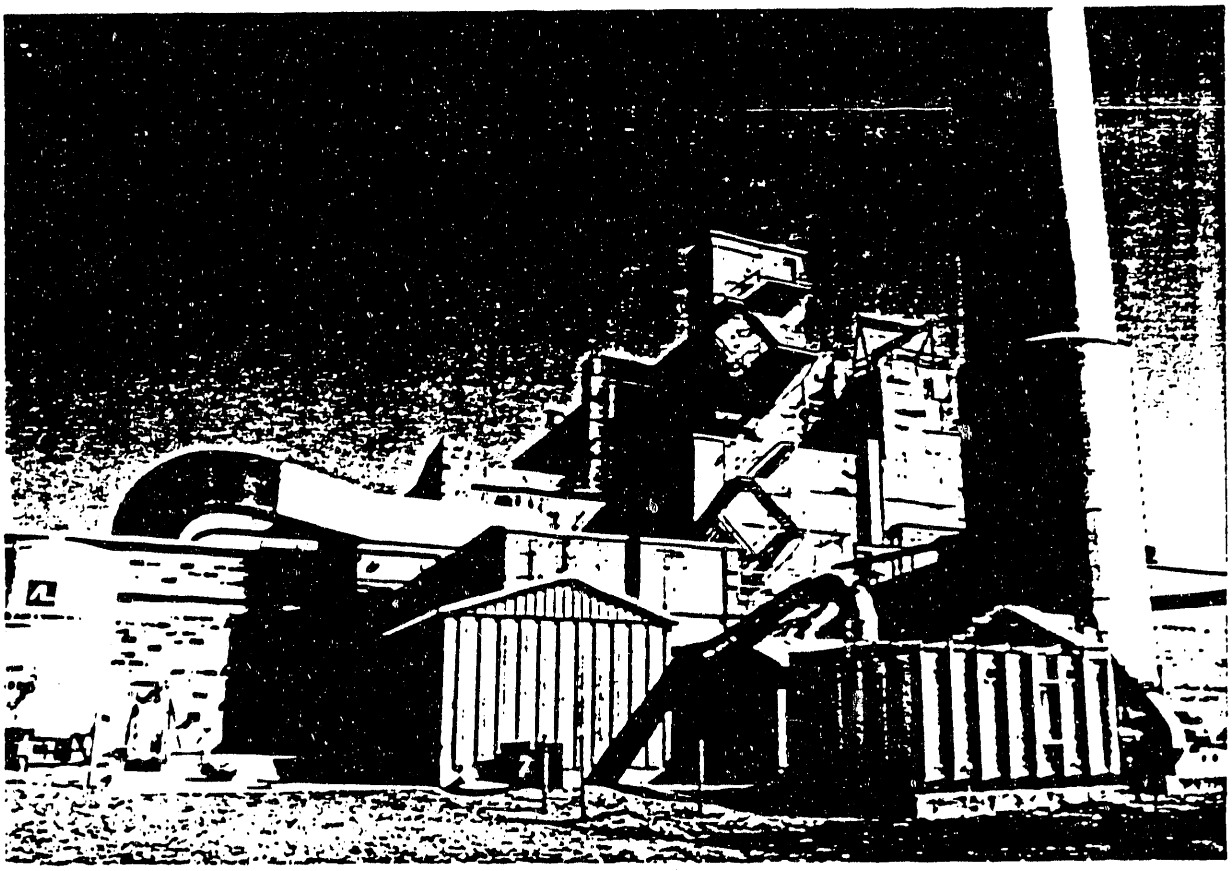
Date: 11/16/87

WA7890008967

105-DR/100-D AREA
LARGE SODIUM FIRE FACILITY



LARGE SODIUM FIRE FACILITY
105-DR/100-DR AREA



46°41'26.046"
119°32'04.141"

8503045-B20CN
(PHOTO TAKEN 1985)

2B8707-13.37

APPENDIX B

1987 SAMPLING ACTIVITIES

Battelle
Pacific Northwest Laboratories
P.O. Box 999
Richland, Washington U.S.A. 99352
Telephone (509) 376-3564
Telex 15-2874

August 18, 1987

7 Seal Pit sludge
6 Tunnel Dead end
5 Tunnel Near Batch Tank Room
4 Batch Tank entry chamber floor
3 Water Pool in Mid Tunnel
2 Small Fire Room entry chamber [illegible]
1 [illegible] Room " "

John Biglin
W/221T
Westinghouse Hanford Company
P. O. Box 1970
Richland, WA 99352

Dear Mr. Biglin:

ANALYSIS OF CLEANUP RESIDUES

All materials had been exposed to air long enough prior to sampling that any hydroxide had reacted with carbon dioxide of the air to form carbonate.

pH of 0.1% Solution:

1 = 10.1, 2 = 10.2, 3 = 9.5, 4 = 10.1, 5 = 10.1, 6 = 10.0, 7 = 9.4

Soluble Alkalinity (as sodium carbonate)

1 = 57%, 2 = 62%, 3 = 0.2%, 4 = 63%, 5 = 0.4%, 6 = 67%, 7 = 0.3%
scrape sludge

Total Lead (ppm)

1 = 125, 2 = 60, 3 = <0.5, 4 = 40, 5 = 1300, 6 = 35, 7 = 780
scrape

Total Lithium (ppm)

1 = 7500, 2 = 1600, 3 = 105, 4 = 11000, 5 = 2400, 6 = 10000, 7 = 2100

Very truly yours,

Bob Keough
R. F. Keough

RFK/tts

Battelle
Pacific Northwest Laboratories
P.O. Box 999
Richland, Washington U.S.A. 99352
Telephone (509) 376-3564
Telex 15-2874

September 17, 1987

J. W. Biglin
221T/23/200W
Westinghouse Hanford Company
P. O. Box 1970
Richland, WA 99352

Dear Mr. Biglin:

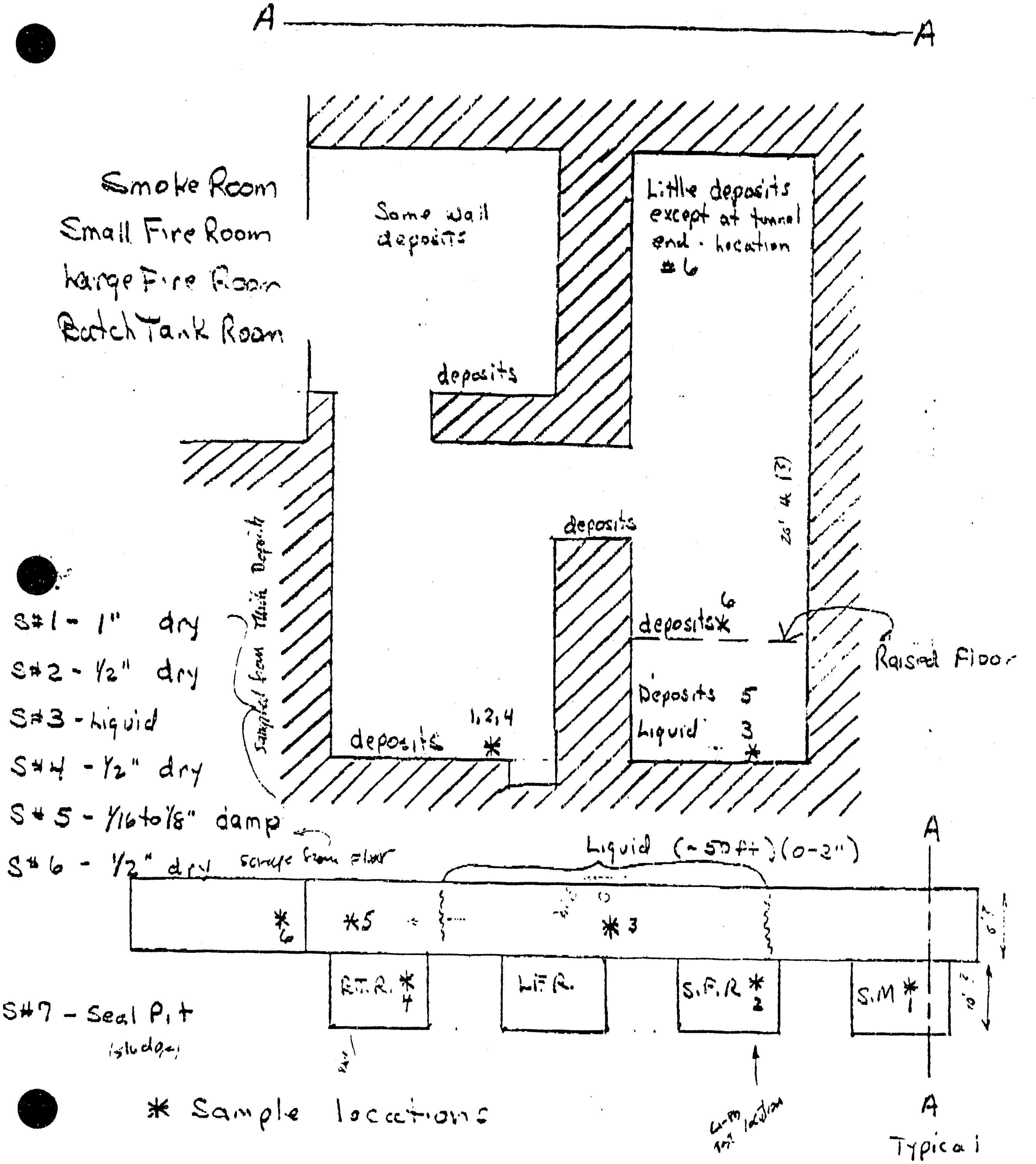
RADIOACTIVITY IN WASTE SAMPLES

	d/m/g				
			Gamma		
Sample	Alpha	Beta	Cs-137	Co-60	Eu-152
#2	< 6	330	70	50	48
#4	< 13	< 30	< 14		
#6	< 19	< 47	< 18		
Pit	< 14	< 35	< 10		

Bob Keough
R. F. Keough

RFK/tts

105 DR Tunnel Sampling 7-27-87



J W Biglin

APPENDIX C

SAMPLING LOCATIONS

105-DR LARGE SODIUM FIRE FACILITY
RANDOM NUMBER GENERATOR

GRAVEL BED SAMPLING POINTS Figure C4

1 Sample for Bottom (5X6) Grid

X-coordinate	Y-coordinate
1	0

1 Sample for Top (5X6) Grid

X-coordinate	Y-coordinate
0	2

1 Sample for Middle (5X6) Grid

X-coordinate	Y-coordinate
1	0

SOIL SAMPLING POINTS Figure C3

Section A (3X10) Grid

X-coordinate	Y-coordinate
1	5

Section B (12X9) Grid

X-coordinate	Y-coordinate
7	7

Section C (15X9) Grid

X-coordinate	Y-coordinate
9	7
0	5

EXHAUST FAN ROOM SAMPLING POINTS Figure C1

NORTH WALL (9X7) GRID

X-coordinate	Y-coordinate
6	6

CEILING (9X7) GRID

X-coordinate	Y-coordinate
0	6

SOUTH WALL (9X7) GRID

X-coordinate	Y-coordinate
5	2

FLOOR (9X7) GRID

X-coordinate	Y-coordinate
7	3

EAST WALL (7X7) GRID

X-coordinate	Y-coordinate
3	5

WEST WALL (7X7) GRID

X-coordinate	Y-coordinate
0	2

BASELINE SOIL SAMPLING POINTS FROM (12X9) GRID
Figure C2

X-coordinate	Y-coordinate
9	6
6	4
4	2

CONCRETE BASELINE SAMPLING POINTS Figure C2
(3X5) GRID (3 wipe samples, 3 core)

Wipe Samples

X-coordinate	Y-coordinate
2	4
0	0
0	1

Core Samples

X-coordinate	Y-coordinate
1	2
0	4
2	2

105-DR LARGE SODIUM FIRE FACILITY
EXHAUST TUNNELS RANDOM NUMBER GENERATOR

LOWER TUNNEL (3 SAMPLES)

RANDOM WALL (1 or 2)	RANDOM HEIGHT (0-20 FT.)	RANDOM LENGTH (0-100 FT.)
2	2	75
1	17	58
2	4	44

Alternate Samples

RANDOM WALL (1 or 2)	RANDOM HEIGHT (0-20 FT.)	RANDOM LENGTH (0-100 FT.)
2	18	19
2	19	84
1	9	57

UPPER TUNNEL (3 SAMPLES)

RANDOM WALL (1 or 2)	RANDOM HEIGHT (0-7 FT.)	RANDOM LENGTH (0-100 FT.)
2	1	23
2	2	3
2	1	93

Alternate Samples

RANDOM WALL (1 or 2)	RANDOM HEIGHT (0-7 FT.)	RANDOM LENGTH (0-100 FT.)
2	6	90
2	6	66
1	0	97

UNDERGROUND TUNNEL TO FILTER BUILDING (3 SAMPLES)

RANDOM WALL (1 or 2)	RANDOM HEIGHT (0-7 FT.)	RANDOM LENGTH (0-100 FT.)
2	2	31
1	4	92
1	0	45

Alternate Samples

RANDOM WALL (1 or 2)	RANDOM HEIGHT (0-7 FT.)	RANDOM LENGTH (0-100 FT.)
1	4	15
2	6	29
2	0	85

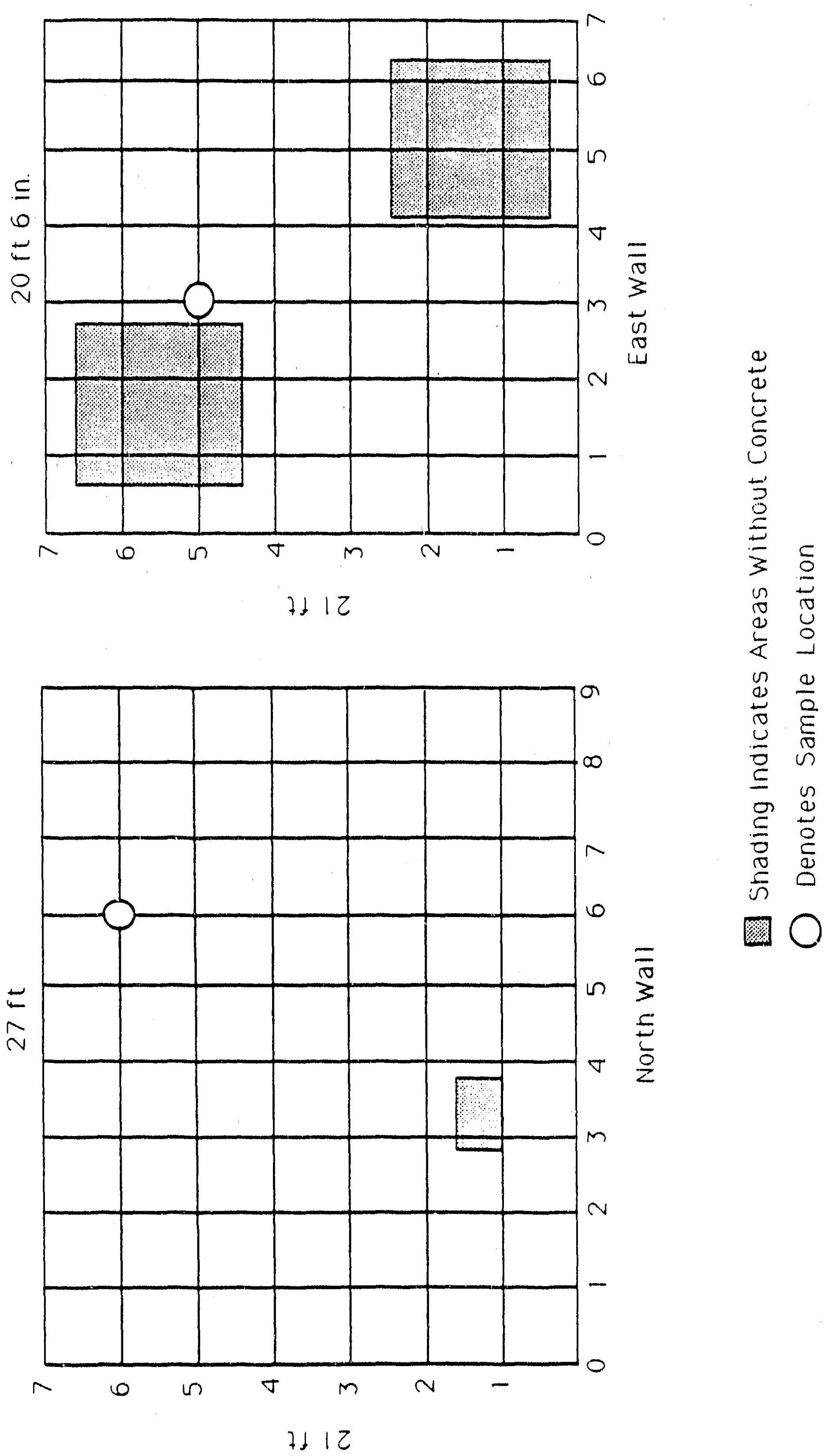


Figure C-1. Area 1 Exhaust Fan Room Verification Concrete Core Samples. (sheet 1 of 3)

1

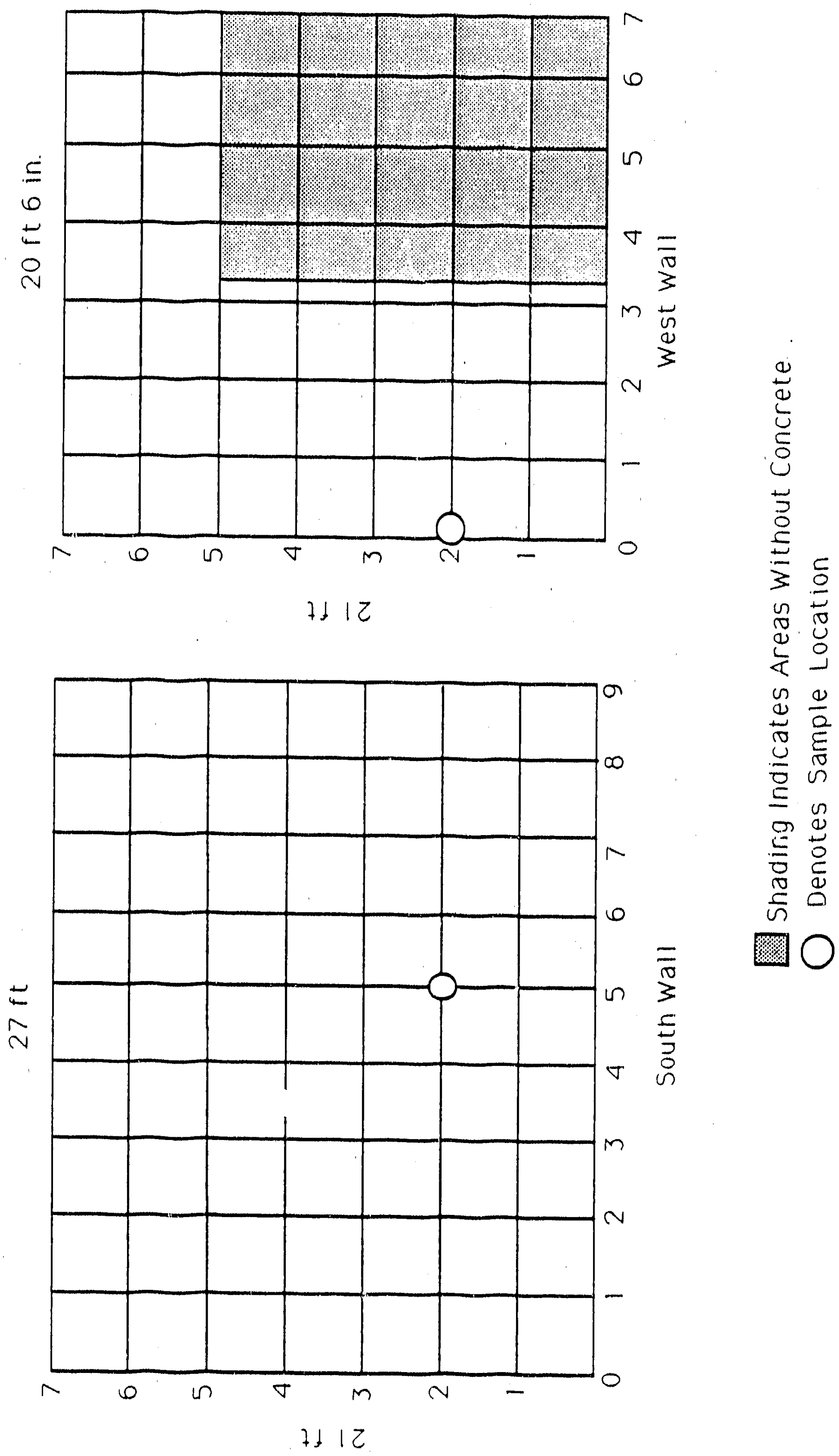
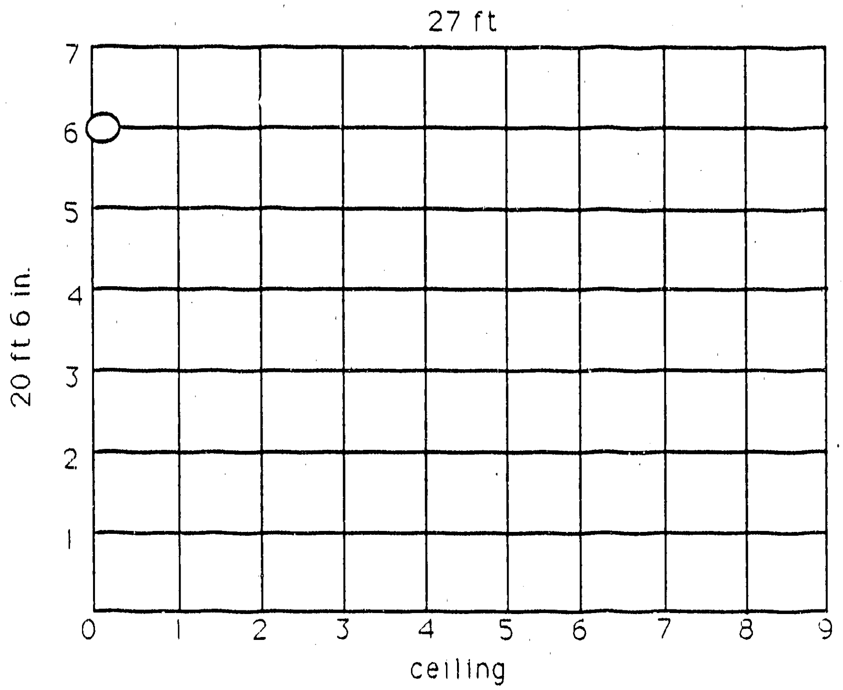
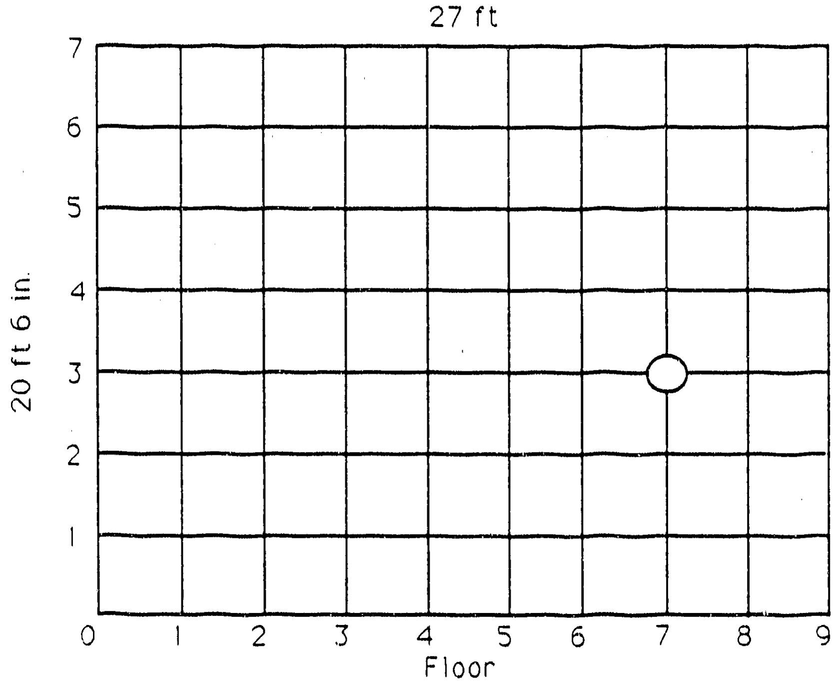


Figure C-1. Area 1 Exhaust Fan Room Verification Concrete Core Samples. (sheet 2 of 3) 1





○ Denotes Sample Location

Figure C-1. Area 1 Exhaust Fan Room Verification Concrete Core Samples. (sheet 3 of 3)

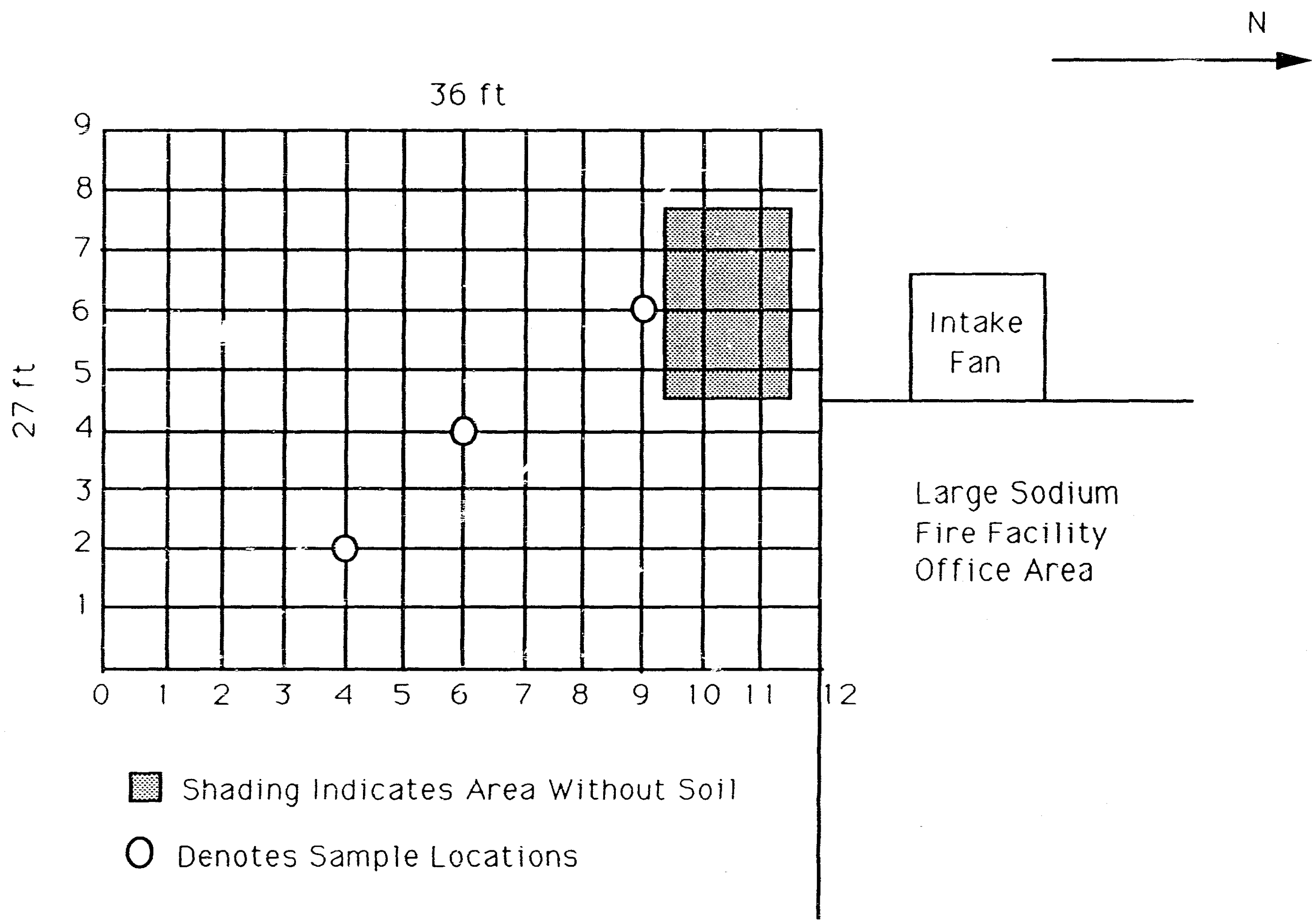


Figure C-2. Baseline Soil Locations for Area 7. (sheet 1 of 2)

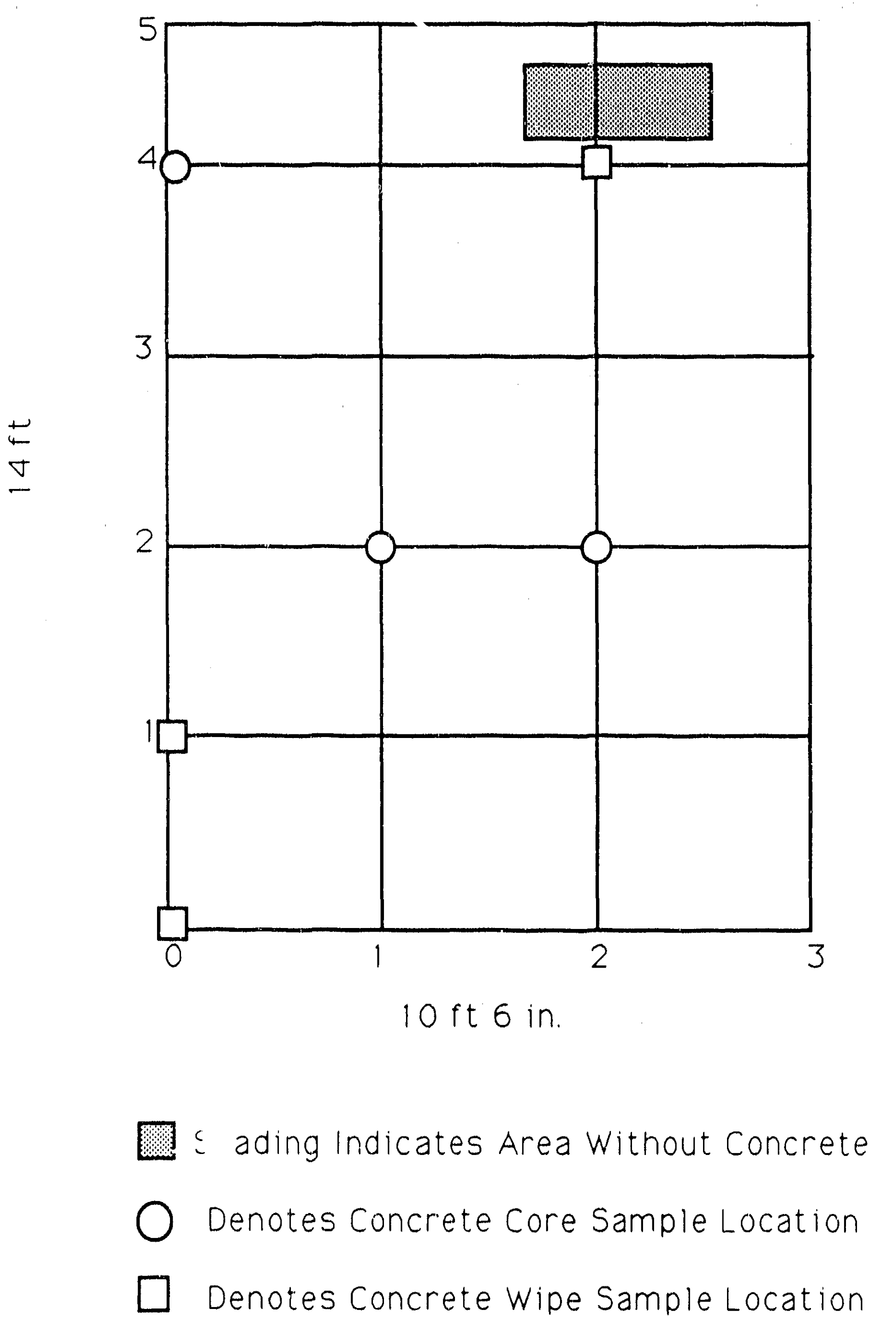


Figure C-2. Baseline Concrete Locations for Area 7. (sheet 2 of 2)

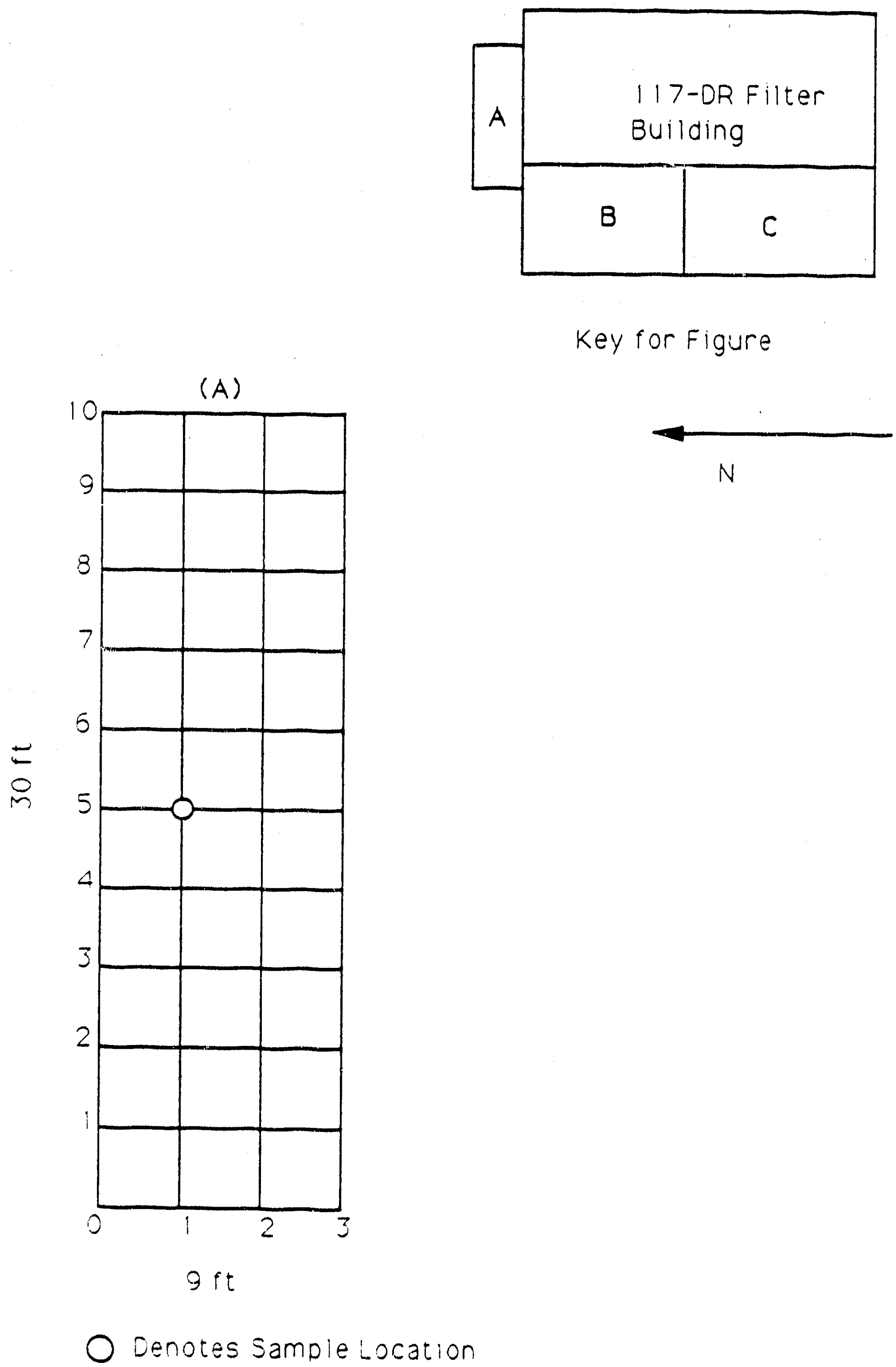


Figure C-3. Area 4 Soil Sampling Locations. (sheet 1 of 2)

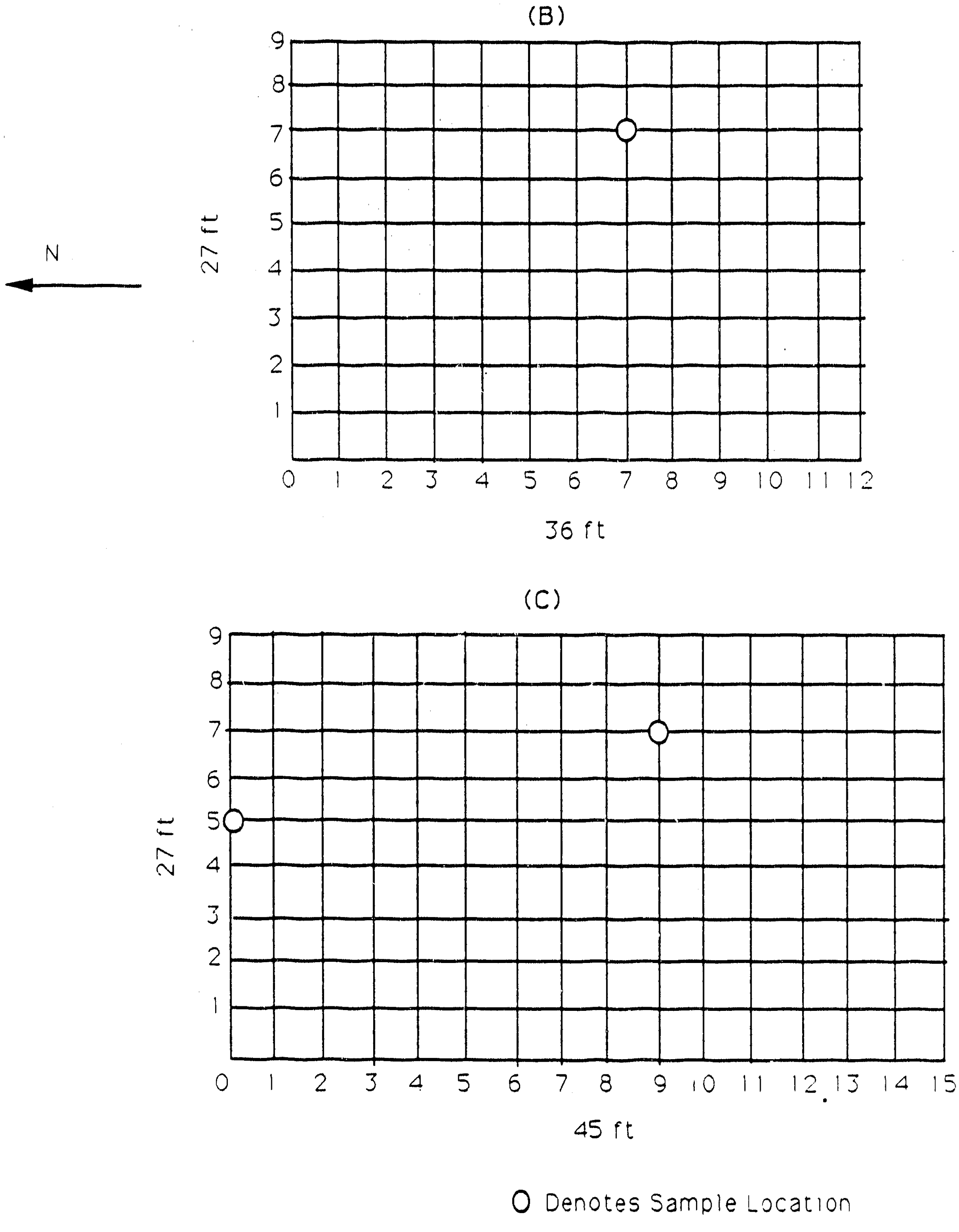
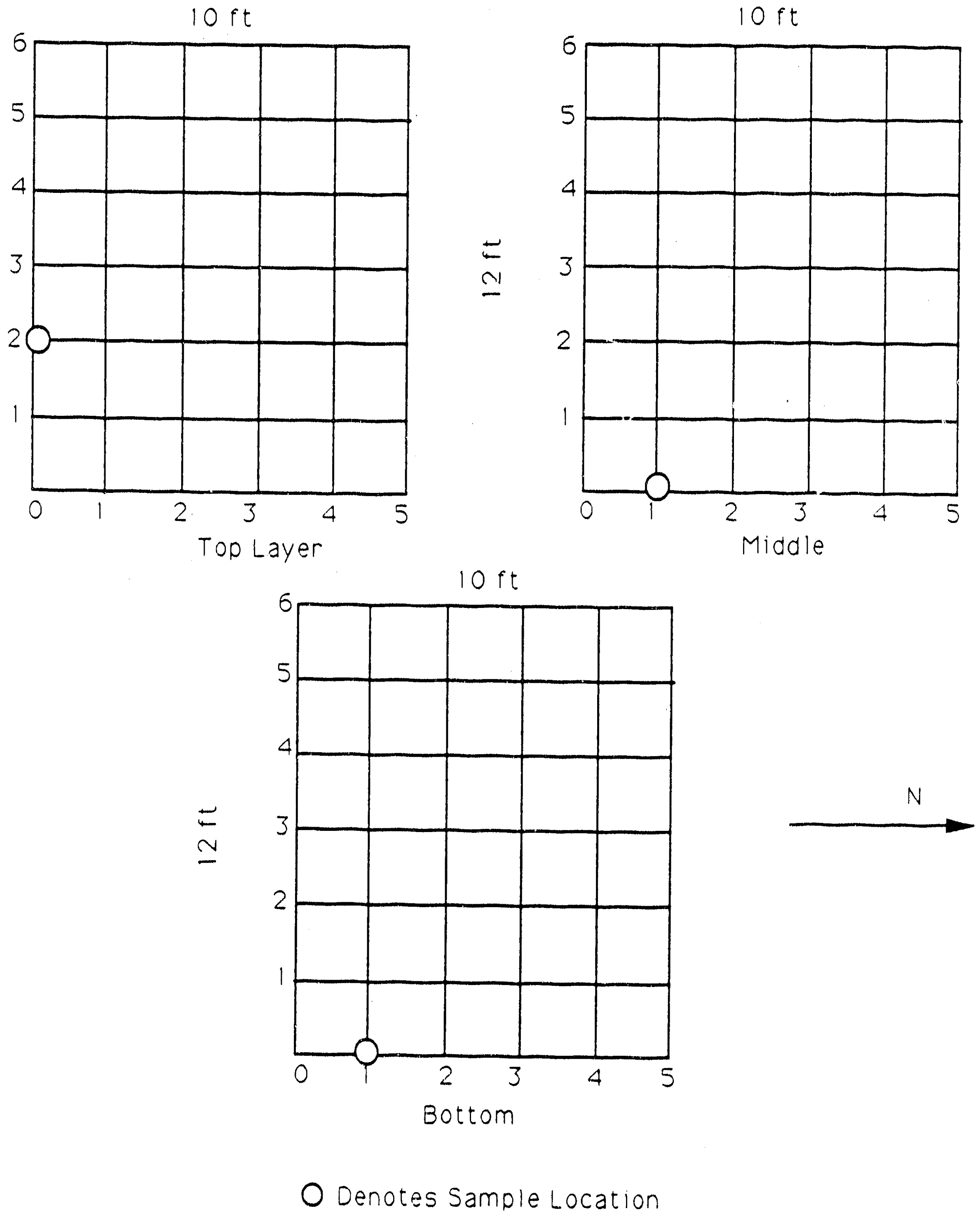


Figure C-3. Area 4 Soil Sampling Locations. (sheet 2 of 2)



1 Figure C-4. Area 3 Gravel Bed Sampling Points.

APPENDIX D

SELECTED MATERIAL SAFETY DATA SHEETS

MSDS # 1288
OHS12510

MATERIAL SAFETY DATA SHEET

OCCUPATIONAL HEALTH SERVICES, INC.
450 SEVENTH AVENUE, SUITE 2407
NEW YORK, NEW YORK 10123
(800) 445-MSDS (212) 967-1100

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615) 292-1180

SUBSTANCE IDENTIFICATION

MSDS # 1288

CAS-NUMBER 7439-92-1
RTEC-NUMBER OF7525000

SUBSTANCE: LEAD

TRADE NAMES/SYNONYMS:
C.I. PIGMENT METAL 4: C.I. 77575: LEAD FLAKE: KS-4: LEAD S 2: SI: SO: PLUMBUM: SO: PB-S 100: LEAD ELEMENT: L-18: L-24: L-29: L-27: T-134: PB: OHS12510

CHEMICAL FAMILY:
METAL

MOLECULAR FORMULA: PB

MOLECULAR WEIGHT: 207.19

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=0 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: LEAD

PERCENT: 99.8

OTHER CONTAMINANTS: BISMUTH, COPPER, ARSENIC, ANTIMONY, TIN, IRON, SILVER, ZINC

EXPOSURE LIMIT:
LEAD, INORGANIC FUMES AND DUST (AS PB):
50 UG(PB)/M3 OSHA 8 HOUR TWA
30 UG(PB)/M3 OSHA 8 HOUR TWA ACTION LEVEL
IF AN EMPLOYEE IS EXPOSED TO LEAD FOR MORE THAN 8 HOURS PER DAY THE FOLLOWING FORMULA IS USED:
MAXIMUM PERMISSIBLE LIMIT (IN UG/M3)= 400 DIVIDED BY HOURS WORKED IN THE DAY
0.15 MG(PB)/M3 ACGIH TWA
<0.10 MG(PB)/M3 NIOSH RECOMMENDED 10 HOUR TWA

1 POUND CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING
SUBJECT TO CALIFORNIA PROPOSITION 65 CANCER AND/OR REPRODUCTIVE TOXICITY WARNING AND RELEASE REQUIRMENTS- (FEBRUARY 27, 1987)

PHYSICAL DATA

DESCRIPTION: BLUISH-WHITE, SILVERY GRAY, HEAVY, MALLEABLE METAL

BOILING POINT: 3164 F (1740 C)

MELTING POINT: 622 F (328 C)

SPECIFIC GRAVITY: 11.3

SOLUBILITY IN WATER: INSOLUBLE

MSDS #1288

VAPOR PRESSURE: 1.3 MMHG @ 970 C

OTHER SOLVENTS (SOLVENT - SOLUBILITY):
SOLUBLE IN NITRIC ACID, HOT CONCENTRATED SULFURIC ACID

OTHER PHYSICAL DATA
HARDNESS: 1.5 MOHS

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD
NEGLIGIBLE FIRE HAZARD IN METALLIC FORM; HOWEVER, POSSIBLE FIRE AND EXPLOSION HAZARD IN DUST FORM WHEN EXPOSED TO HEAT OR FLAME.

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
NO ACUTE HAZARD. MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. AVOID BREATHING VAPORS OR DUSTS; KEEP UPWIND.

USE AGENTS SUITABLE FOR TYPE OF SURROUNDING FIRE. AVOID BREATHING HAZARDOUS VAPORS, KEEP UPWIND.

TOXICITY

LEAD:
450 MG/KG/6 YEAR ORAL-WOMAN TDLO; 10 UG/M3 INHALATION-HUMAN TCLO; 1000 MG/KG INTRAPERITONEAL-RAT LDLO; 160 MG/KG ORAL-PIGEON LDLO; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS).
CARCINOGEN STATUS: HUMAN INADEQUATE EVIDENCE, ANIMAL SUFFICIENT EVIDENCE (IARC CLASS-2B FOR INORGANIC LEAD COMPOUNDS). RENAL TUMORS WERE PRODUCED IN ANIMALS BY LEAD ACETATE, SUBACETATE AND PHOSPHATE GIVEN ORALLY, SUBCUTANEOUSLY OR INTRAPERITONEALLY. NO EVALUATION COULD BE MADE OF THE CARCINOGENICITY OF POWDERED LEAD.
LEAD IS A NEUROTOXIN, NEPHROTOXIN, TERATOGEN, AND A CUMULATIVE POISON WHICH MAY ALSO AFFECT THE BLOOD, HEART, ENDOCRINE, AND IMMUNE SYSTEMS. PERSONS WITH NERVOUS SYSTEM OR GASTROINTESTINAL DISORDERS, ANEMIA, OR CHRONIC BRONCHITIS MAY BE AT AN INCREASED RISK FROM EXPOSURE.

HEALTH EFFECTS AND FIRST AID

INHALATION:
LEAD:

MSDS #1288

NEUROTOXIN/NEPHROTOXIN/TERATOGEN.

ACUTE EXPOSURE- INHALATION OF LARGE AMOUNTS OF LEAD MAY CAUSE A METALLIC TASTE, THIRST, A BURNING SENSATION IN THE MOUTH AND THROAT, SALIVATION, ABDOMINAL PAIN WITH SEVERE COLIC, VOMITING, BLOODY DIARRHEA, CONSTIPATION FATIGUE, SLEEP DISTURBANCES, DULLNESS, RESTLESSNESS, IRRITABILITY, MEMORY LOSS, LOSS OF CONCENTRATION, DELIRIUM, OLIGURIA OFTEN WITH HEMATURIA AND ALBUMINURIA, ENCEPHALOPATHY WITH VISUAL FAILURE, PARESTHESIAS, MUSCLE PAIN AND WEAKNESS, CONVULSIONS, AND PARALYSIS. DEATH MAY RESULT FROM CARDIORESPIRATORY ARREST OR SHOCK. SURVIVORS OF ACUTE EXPOSURE MAY EXPERIENCE THE ONSET OF CHRONIC INTOXICATION. LIVER EFFECTS MAY INCLUDE ENLARGEMENT AND TENDERNESS AND JAUNDICE. THE FATAL DOSE OF ABSORBED LEAD IS APPROXIMATELY 0.5 GRAMS. PATHOLOGICAL FINDINGS INCLUDE GASTROINTESTINA INFLAMMATION AND RENAL TUBULAR DEGENERATION. METAL FUME FEVER, AN INFLUENZA-LIKE ILLNESS, MAY OCCUR DUE TO THE INHALATION OF FRESHLY FORMED METAL OXIDE PARTICLES SIZED BELOW 1.5 MICRONS AND USUALLY BETWEEN 0.02-0.05 MICRONS. SYMPTOMS MAY BE DELAYED 4-12 HOURS AND BEGIN WITH A SUDDEN ONSET OF THIRST AND A SWEET, METALLIC OR FOUL TASTE IN THE MOUTH. OTHER SYMPTOMS MAY INCLUDE UPPER RESPIRATORY TRACT IRRITATION ACCOMPANIED BY COUGHING AND A DRYNESS OF THE MUCOUS MEMBRANES, LASSITUDE AND A GENERALIZED FEELING OF MALAISE. FEVER, CHILLS, MUSCULAR PAIN, MILD TO SEVERE HEADACHE, NAUSEA, OCCASIONAL VOMITING, EXAGGERATED MENTAL ACTIVITY PROFUSE SWEATING, EXCESSIVE URINATION, DIARRHEA, AND PROSTRATION MAY ALSO OCCUR. TOLERANCE TO FUMES DEVELOPS RAPIDLY, BUT IS QUICKLY LOST. ALL SYMPTOMS USUALLY SUBSIDE WITHIN 24-36 HOURS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO LOW LEVELS OF LEAD MAY RESULT IN AN ACCUMULATION IN BODY TISSUES AND EXERT ADVERSE EFFECTS ON THE BLOOD, NERVOUS SYSTEMS, HEART, ENDOCRINE AND IMMUNE SYSTEMS, KIDNEYS, AND REPRODUCTION. EARLY STAGES OF LEAD POISONING, "PLUMBISM", MAY BE EVIDENCED BY PALLOR, ANOREXIA, WEIGHT LOSS, CONSTIPATION, APATHY OR IRRITABILITY, OCCASIONAL VOMITING, FATIGUE, HEADACHE, WEAKNESS, METALLIC TASTE IN THE MOUTH, GINGIVAL LEAD LINE IN PERSONS WITH POOR DENTAL HYGIENE, AND ANEMIA. LOSS OF RECENTLY DEVELOPED MOTOR SKILLS IS GENERALLY OBSERVED ONLY IN CHILDREN. MORE ADVANCED STAGES OF POISONING MAY BE CHARACTERIZED BY INTERMITTENT VOMITING, IRRITABILITY AND NERVOUSNESS, MYALGIA OF THE ARMS, LEGS, JOINTS, AND ABDOMEN, PARALYSIS OF THE EXTENSOR MUSCLES OF THE ARMS AND LEGS WITH WRIST AND/OR FOOT DROP, AND INTESTINAL SPASMS WHICH CAUSE SEVERE ABDOMINAL PAIN. SEVERE "PLUMBISM" MAY RESULT IN PERSISTENT VOMITING, ATAXIA, PERIODS OF STUPOR OR LETHARGY, ENCEPHALOPATHY WITH VISUAL DISTURBANCES WHICH MAY PROGRESS TO OPTIC NEURITIS AND ATROPHY, HYPERTENSION, PAPILLEDEMA, CRANIAL NERVE PARALYSIS, DELIRIUM, CONVULSIONS, AND COMA. NEUROLOGIC SEQUELAE MAY INCLUDE MENTAL RETARDATION, SEIZURES, CEREBRAL PALSY, AND DYSTONIA MUSCULORAM DEFORMANS. IRREVERSIBLE KIDNEY DAMAGE HAS BEEN ASSOCIATED WITH INDUSTRIAL EXPOSURE. REPRODUCTIVE EFFECTS HAVE BEEN EXHIBITED IN BOTH MALES AND FEMALES. PATERNAL EFFECTS MAY INCLUDE DECREASED SEX DRIVE, IMPOTENCE, STERILITY, AND ADVERSE EFFECTS ON THE SPERM WHICH MAY INCREASE THE RISK OF BIRTH DEFECTS. MATERNAL EFFECTS MAY INCLUDE MISCARRIAGE AND STILLBIRTHS IN EXPOSED WOMEN OR WOMEN WHOSE HUSBANDS WERE EXPOSED, ABORTION, STERILITY OR DECREASED FERTILITY, AND ABNORMAL MENSTRUAL CYCLES. LEAD CROSSES THE PLACENTA AND MAY AFFECT THE FETUS CAUSING BIRTH DEFECTS, MENTAL RETARDATION, BEHAVIORAL DISORDERS, AND DEATH DURING THE FIRST YEAR OF CHILDHOOD. ANIMAL STUDIES INDICATE THAT REPRODUCTIVE EFFECTS MAY BE ADDITIVE IF BOTH PARENTS ARE EXPOSED TO LEAD.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:

MSDS #1288

LEAD:
ACUTE EXPOSURE- DIRECT CONTACT WITH LEAD POWDERS OR DUST MAY CAUSE IRRITATION. LEAD IS NOT ABSORBED THROUGH THE SKIN, BUT MAY BE TRANSFERRE TO THE MOUTH INADVERTENTLY BY CIGARETTES, CHEWING TOBACCO, FOOD, OR MAKE-UP.
CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO THE POWDER OR DUST MAY RESULT IN DERMATITIS. SYSTEMIC TOXICITY MAY DEVELOP IF LEAD IS TRANSFERR TO THE MOUTH BY CIGARETTES, CHEWING TOBACCO, FOOD, OR MAKE-UP.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
LEAD:
ACUTE EXPOSURE- LEAD DUST OR POWDERS MAY CAUSE IRRITATION. METALLIC LEAD PARTICLES MAY CAUSE AN INFLAMMATORY FOREIGN BODY REACTION; INJURY IS GENERALLY THOUGHT TO BE MECHANICAL AND NOT TOXIC.
CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
LEAD:
NEUROTOXIN/NEPHROTOXIN/TERATOGEN.
ACUTE EXPOSURE- ABSORPTION OF LARGE AMOUNTS OF LEAD FROM THE INTESTINAL TRACT MAY CAUSE SYSTEMIC EFFECTS AS DETAILED IN ACUTE INHALATION. THE FATAL DOSE OF ABSORBED LEAD IS APPROXIMATELY 0.5 GRAMS.
CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO LOW LEVELS OF LEAD MAY RESULT IN AN ACCUMULATION IN BODY TISSUES AND ADVERSE EFFECTS ON THE KIDNEYS, HEART, AND BLOOD, AND ON THE NERVOUS, REPRODUCTIVE, ENDOCRINE, AND IMMUNE SYSTEMS AS DETAILED IN CHRONIC INHALATION.

FIRST AID- DO NOT INDUCE VOMITING. QUALIFIED MEDICAL PERSONNEL SHOULD REMOVE CHEMICAL BY GASTRIC LAVAGE OR CATHARSIS. ACTIVATED CHARCOAL IS USEFUL. GET MEDICAL ATTENTION IMMEDIATELY.

ANTIDOTE:
THE FOLLOWING ANTIDOTE HAS BEEN RECOMMENDED. HOWEVER, THE DECISION AS TO WHETHER THE SEVERITY OF POISONING REQUIRES ADMINISTRATION OF ANY ANTIDOTE AND ACTUAL DOSE REQUIRED SHOULD BE MADE BY QUALIFIED MEDICAL PERSONNEL.

FOR LEAD POISONING:
INITIATE URINE FLOW FIRST. GIVE 10% DEXTROSE IN WATER INTRAVENOUSLY, 10-20 ML/KG BODY WEIGHT, OVER A PERIOD OF 1-2 HOURS. IF URINE FLOW DOES NOT START, GIVE MANNITOL, 20% SOLUTION, 5-10 ML/KG BODY WEIGHT INTRAVENOUSLY OVER 20 MINUTES. FLUID MUST BE LIMITED TO REQUIREMENTS AND CATHERTIZATION MAY BE NECESSARY IN COMA. DAILY URINE OUTPUT SHOULD BE 350-500 ML/M2/24 HOURS. EXCESSIVE FLUIDS FURTHER INCREASE CEREBRAL EDEMA.
FOR ADULTS WITH ACUTE ENCEPHALOPATHY, GIVE DIMERCAPROL, 4 MG/KG, INTRAMUSCULARLY EVERY 4 HOURS FOR 30 DOSES. BEGINNING 4 HOURS LATER, GIVE CALCIUM DISODIUM EDETATE AT A SEPERATE INJECTION SITE, 12.5 MG/KG INTRAMUSCULARLY EVERY 4 HOURS AS A 20% SOLUTION, WITH 0.5% PROCAINE ADDED, FOR A TOTAL OF 30 DOSES. IF SIGNIFICANT IMPROVEMENT HAS NOT OCCURRED BY THE FOURTH DAY, INCREASE THE NUMBER OF INJECTIONS BY 10 FOR EACH DRUG.
FOR SYMPTOMATIC ADULTS, THE COURSE OF DIMERCAPROL AND CALCIUM DISODIUM EDETATE CAN BE SHORTENED OR CALCIUM DISODIUM EDETATE ONLY CAN BE GIVEN IN

MSDS #1288

DOSAGE OF 50 MG/KG INTRAVENOUSLY AS 0.5% SOLUTION IN 5% DEXTROSE IN WATER OR NORMAL SALINE BY INFUSION OVER NOT LESS THAN 8 HOURS FOR NOT MORE THAN 5 DAYS. FOLLOW WITH PENICILLAMINE, 500-750 MG/DAY, ORALLY FOR 1-2 MONTHS OR UNTIL URINE LEAD LEVELS DROPS BELOW 0.3 MG/24 HOURS (DREISBACH, HANDBOOK OF POISONING, 11TH ED.). ANTIDOTE SHOULD BE ADMINISTERED BY QUALIFIED MEDICAL PERSONNEL.

REACTIVITY SECTION

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

MSDS #1288

INCOMPATIBILITIES:
LEAD:

- AMMONIUM NITRATE: VIOLENT OR EXPLOSIVE REACTION.
- CHLORINE TRIFLUORIDE: VIOLENT REACTION.
- DISODIUM ACETYLIDE: TRITURATION IN MORTAR MAY BE VIOLENT AND LIBERATE CARBON.
- HYDROGEN PEROXIDE (52% OR GREATER): VIOLENT DECOMPOSITION.
- HYDROGEN PEROXIDE (60% SOLUTION) AND TRIOXANE: SPONTANEOUSLY DETONABLE.
- METALS (ACTIVE): INCOMPATIBLE.
- NITRIC ACID: LEAD-CONTAINING RUBBER MAY IGNITE.
- OXIDIZERS (STRONG): INCOMPATIBLE.
- SODIUM AZIDE: FORMS LEAD AZIDE AND COPPER AZIDE IN COPPER PIPE.
- SODIUM CARBIDE: VIGOROUS REACTION.
- SULFURIC ACID (HOT): REACTS.
- ZIRCONIUM-LEAD ALLOYS: IGNITION ON IMPACT.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS ARE TOXIC OXIDES OF LEAD.

POLYMERIZATION:
HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE-DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

STORAGE

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY.

MSDS # 1288

SPILLS AND LEAKS

WATER-SPILL:
THE CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (PROPOSITION 65) PROHIBITS CONTAMINATING ANY KNOWN SOURCE OF DRINKING WATER WITH SUBSTANCES KNOWN TO CAUSE CANCER AND/OR REPRODUCTIVE TOXICITY.

OCCUPATIONAL-SPILL:
DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR SMALL DRY SPILLS, WITH A CLEAN SHOVEL PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER. MOVE CONTAINERS FROM SPILL AREA. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY.

RESIDUE SHOULD BE CLEANED UP USING A HIGH-EFFICIENCY PARTICULATE FILTER VACUUM.

REPORTABLE QUANTITY (RQ): 1 POUND
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT SECTION

VENTILATION:
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

LEAD (ELEMENTAL, INORGANIC, AND SOAPS):
VENTILATION SHOULD MEET THE REQUIREMENTS IN 29CFR1910.1025(E).

RESPIRATOR:
THE FOLLOWING RESPIRATORS ARE THE MINIMUM LEGAL REQUIREMENTS AS SET FORTH BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION FOUND IN 29 CFR 1910, SUBPART Z.

RESPIRATORY PROTECTION FOR LEAD AEROSOLS

AIRBORNE CONCENTRATION OF LEAD OR CONDITION OF USE	REQUIRED RESPIRATOR
NOT IN EXCESS OF 0.5 MG/M3 (10X PEL)	HALF-MASK, AIR PURIFYING RESPIRATOR EQUIPPED WITH HIGH-EFFICIENCY FILTERS.
NOT IN EXCESS OF 2.5 MG/M3 (50X PEL)	FULL FACEPIECE, AIR-PURIFYING RESPIRATOR WITH HIGH EFFICIENCY FILTERS.

MSDS #1288

NOT IN EXCESS OF 50 MG/M3 (1000X PEL)	ANY POWERED AIR-PURIFYING RESPIRATOR WITH HIGH EFFICIENCY FILTERS; OR HALF-MASK SUPPLIED-AIR RESPIRATOR OPERATED IN POSITIVE-PRESSURE MODE.
NOT IN EXCESS OF 100 MG/M3	SUPPLIED-AIR RESPIRATORS WITH FULL FACEPIECE, HOOD OR HELMET OR SUIT, OPERATED IN POSITIVE PRESSURE MODE.
GREATER THAN 100 MG/M3, UNKNOWN CONCENTRATIONS OR FIREFIGHTING	FULL FACEPIECE, SELF-CONTAINED BREATHING APPARATUS OPERATED IN POSITIVE-PRESSURE MODE.

(RESPIRATORS SPECIFIED FOR HIGHER CONCENTRATIONS CAN BE USED AT LOWER CONCENTRATIONS OF LEAD).
(FULL FACEPIECE IS REQUIRED IF THE LEAD AEROSOLS CAUSE EYE OR SKIN IRRITATION AT THE USE CONCENTRATIONS.)
A HIGH EFFICIENCY PARTICULATE FILTER MEANS 99.97% EFFICIENT AGAINST 0.3 MICRON PARTICLES.)

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS OR NIOSH CRITERIA DOCUMENTS.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION.

LEAD, INORGANIC FUMES AND DUSTS (AS PB):

0.50 MG(PB)/M3- ANY SUPPLIED-AIR RESPIRATOR.
ANY AIR-PURIFYING RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY SELF-CONTAINED BREATHING APPARATUS.

1.25 MG(PB)/M3- ANY POWERED AIR-PURIFYING RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.

2.50 MG(PB)/M3- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY POWERED AIR-PURIFYING RESPIRATOR WITH A TIGHT-FITTING FACEPIECE AND A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A TIGHT-FITTING FACEPIECE OPERATED IN A CONTINUOUS FLOW MODE.

50.0 MG(PB)/M3- ANY SUPPLIED-AIR RESPIRATOR WITH A HALF-MASK AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

100.0 MG(PB)/M3- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A

MSDS # 1288

HIGH-EFFICIENCY PARTICULATE FILTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITION.

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

LEAD (ELEMENTAL, INORGANIC, AND SOAPS):
PROTECTIVE CLOTHING SHOULD MEET THE REQUIREMENTS FOR PROTECTIVE WORK CLOTHING AND EQUIPMENT IN 29 CFR 1910.1025(G).

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

LEAD (ELEMENTAL, INORGANIC & SOAPS):
PROTECTIVE GLOVES SHOULD MEET THE REQUIREMENTS FOR PROTECTIVE WORK CLOTHING AND EQUIPMENT IN 29 CFR 1910.1025(G).

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

LEAD (ELEMENTAL, INORGANIC, AND SOAPS):
PROTECTIVE EYE EQUIPMENT SHOULD MEET THE REQUIREMENTS FOR PROTECTIVE WORK CLOTHING AND EQUIPMENT IN 29 CFR 1910.1025(G).

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 12/10/84 REVISION DATE: 10/13/89

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MATERIAL SAFETY DATA SHEET OHS21080

OCCUPATIONAL HEALTH SERVICES, INC.
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(800) 445-MSDS (212) 967-1100

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615) 292-1180

SUBSTANCE IDENTIFICATION

CAS-NUMBER 497-19-8
RTEC-NUMBER VZ4050000

SUBSTANCE: SODIUM CARBONATE

TRADE NAMES/SYNONYMS:
CARBONIC ACID, DISODIUM SALT: BISODIUM CARBONATE: CALCINED SODA: CARBONIC ACID SODIUM SALT: CARBONIC ACID SODIUM SALT (1:2): DISODIUM CARBONATE: NA-X: SODA: SODA ASH: OHS21080

CHEMICAL FAMILY:
INORGANIC SALT

MOLECULAR FORMULA: C-O3.2NA MOLECULAR WEIGHT: 105.99

CERCLA RATINGS (SCALE 0-3): HEALTH=2 FIRE=0 REACTIVITY=1 PERSISTENCE=0
NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=0 REACTIVITY=1

COMPONENTS AND CONTAMINANTS

COMPONENT: SODIUM CARBONATE PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMIT:
NO OCCUPATIONAL EXPOSURE LIMITS ESTABLISHED BY OSHA, ACGIH, OR NIOSH.

PHYSICAL DATA

DESCRIPTION: ODORLESS, COLORLESS TO WHITE, HYGROSCOPIC CRYSTALLINE POWDER, SMALL CRYSTALS, OR GRANULES WITH AN ALKALINE TASTE.

BOILING POINT: DECOMPOSES MELTING POINT: 1564 F (851 C)

SPECIFIC GRAVITY: 2.536 SOLUBILITY IN WATER: 7.1% @ 0 C

PH: 11.5 @ 1% AQ SOLN

OTHER SOLVENTS (SOLVENT - SOLUBILITY):
SOLUBLE IN GLYCEROL; INSOLUBLE IN ALCOHOL, ACETONE

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD
NEGLIGIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR STANDARD FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
NO ACUTE HAZARD. MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. AVOID BREATHING VAPORS OR DUSTS; KEEP UPWIND.

TOXICITY

SODIUM CARBONATE:
ANHYDROUS: 500 MG/24 HOURS SKIN-RABBIT MILD IRRITATION; 100 MG/24 HOURS EYE-RABBIT MODERATE IRRITATION; 100 MG RINSED EYE-RABBIT MILD IRRITATION; 4090 MG/KG ORAL-RAT LD50; 2300 MG/M3/2 HOURS INHALATION-RAT LC50; 1200 MG/M3/2 HOURS INHALATION-MOUSE LC50; 2210 MG/KG SUBCUTANEOUS-MOUSE LD50; 117 MG/KG INTRAPERITONEAL-MOUSE LD50; 800 MG/M3/2 HOURS INHALATION-GUINEA PIG LC50; REPRODUCTIVE EFFECTS DATA (RTECS).
MONOHYDRATE: NO DATA AVAILABLE.
DECAHYDRATE: NO DATA AVAILABLE.
CARCINOGEN STATUS: NONE.
SODIUM CARBONATE IS TOXIC AND A SEVERE EYE, SKIN, AND MUCOUS MEMBRANE IRRITANT.

HEALTH EFFECTS AND FIRST AID

INHALATION:
SODIUM CARBONATE:
IRRITANT/TOXIC.
ACUTE EXPOSURE- DUSTS OR VAPORS MAY CAUSE MUCOUS MEMBRANE IRRITATION WITH COUGHING, SHORTNESS OF BREATH, AND GASTROINTESTINAL CHANGES. EXPOSURE TO 1200 MG/M3/2 HOURS WAS THE LETHAL CONCENTRATION IN MICE TESTED.
CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE PERFORATION OF THE NASAL SEPTUM. EXPOSURE TO A CONCENTRATION OF 10 TO 20 MG/M3 OF A 2% AQUEOUS SOLUTION OF SODIUM CARBONATE FOR 4 HOURS/DAY, 5 DAYS/WEEK, FOR 3 AND A HALF MONTHS CAUSED NO PRONOUNCED EFFECTS IN MALE MICE. HOWEVER, AT HIGHER CONCENTRATIONS, A DECREASE IN WEIGHT GAIN WAS RECORDED. HISTOLOGICAL EXAMINATIONS SHOWED THICKENING OF THE INTRA-ALVEOLAR WALLS, HYPEREMIA, LYMPHOID INFILTRATION, AND DESQUAMATION OF THE LUNGS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
SODIUM CARBONATE:
IRRITANT.
ACUTE EXPOSURE- CONTACT MAY CAUSE IRRITATION AND REDNESS. CONCENTRATED

SOLUTIONS MAY CAUSE ERYTHEMA, BLISTERING AND SKIN NECROSIS. 500 MG APPLIED TO RABBIT SKIN FOR 24 HOURS PRODUCED MILD IRRITATION. A SINGLE APPLICATION OF A 50% WEIGHT BY VOLUME AQUEOUS SOLUTION OF SODIUM CARBONATE TO INTACT SKIN OF RABBITS, GUINEA PIGS, AND HUMANS SHOWED NO ERYTHEMA, EDEMA, OR CORROSION. HOWEVER, WHEN APPLIED TO ABRADED SKIN, MODERATE ERYTHEMA AND EDEMA RESULTED IN RABBITS AND HUMANS, WITH NEGLIGIBLE EFFECTS IN GUINEA PIGS. IN ONE-THIRD OF THE HUMAN VOLUNTEERS, TISSUE DESTRUCTION WAS SEEN AT THE ABRADED SITES.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE DERMATITIS AND POSSIBLE "SODA ULCERS" OF THE HANDS AND WRISTS. SENSITIVITY REACTIONS MAY OCCUR FROM REPEATED EXPOSURES.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
SODIUM CARBONATE:
IRRITANT.

ACUTE EXPOSURE- CONTACT WITH DUSTS MAY CAUSE SEVERE IRRITATION WITH REDNESS, PAIN, AND BLURRED VISION. APPLICATION OF 100 MG TO RABBIT EYES AND THEN RINSED CAUSED ONLY MILD IRRITATION. IN SOLUTION, SODIUM CARBONATE IS SUFFICIENTLY ALKALINE TO DAMAGE THE CORNEAL EPITHELIUM, BUT IF PROMPTLY WASHED FROM THE EYES WITH WATER IT IS UNLIKELY TO CAUSE PERMANENT DAMAGE TO THE CORNEAL STROMA. AN APPLICATION OF SEVERAL DROPS OF A 10% SOLUTION (PH 10.7) TO A RABBIT'S EYE FOLLOWED BY IRRIGATION WITH WATER FOR 30 SECONDS CAUSED NO DETECTABLE INJURY. CONCENTRATED SOLUTIONS MAY CAUSE NECROSIS OF THE EYE.

CHRONIC EXPOSURE- DEPENDING UPON CONCENTRATION AND DURATION, SYMPTOMS MAY BE THOSE AS FOR ACUTE EXPOSURE.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL THE PH HAS RETURNED TO NORMAL (30-60 MINUTES). COVER WITH STERILE BANDAGES. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
SODIUM CARBONATE:
CORROSIVE.

ACUTE EXPOSURE- INGESTION MAY CAUSE CORROSION OF THE GASTRIC MUCOSA WITH SORE THROAT AND PAIN. IT MAY CAUSE GASTROINTESTINAL DISTURBANCES SUCH AS NAUSEA, VOMITING, ABDOMINAL PAIN, AND DIARRHEA. DEATH IS GENERALLY DUE TO CIRCULATORY COLLAPSE. THE ESTIMATED LETHAL HUMAN DOSE IS APPROXIMATELY 30 GRAMS.

CHRONIC EXPOSURE- SODIUM CARBONATE IS USED AS A GENERAL PURPOSE FOOD ADDITIVE. NO ADVERSE EFFECTS HAVE BEEN REPORTED FROM EXPOSURE TO SMALL AMOUNTS.

FIRST AID- DILUTE THE ALKALI BY GIVING WATER OR MILK IMMEDIATELY AND ALLOW VOMITING TO OCCUR. AVOID GASTRIC LAVAGE OR EMETICS. ESOPHAGOSCOPY IS THE ONLY WAY TO EXCLUDE THE POSSIBLITY OF CORROSION IN THE UPPER GASTROINTESTINAL TRACT; IF CORROSION IS SUSPECTED, ESOPHAGOSCOPY SHOULD USUALLY BE PERFORMED WITHIN 24 HOURS (DREISBACH, HANDBOOK OF POISONING, 12TH ED.). MAINTAIN AIRWAY AND TREAT SHOCK. IF VOMITING OCCURS, KEEP HEAD BELOW HIPS TO HELP PREVENT ASPIRATION. GET MEDICAL ATTENTION IMMEDIATELY.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY SECTION

REACTIVITY:
REACTS WITH WATER WITH THE EVOLUTION OF HEAT.

INCOMPATIBILITIES:
SODIUM CARBONATE:
ACIDS (STRONG): MAY REACT VIOLENTLY.
ALUMINUM (HOT): EXPLOSIVE REACTION.
AMMONIA + SILVER NITRATE: EXPLOSIVE REACTION UPON HEATING.
AN AROMATIC AMINE + A CHLORONITRO COMPOUND: EXOTHERMIC REACTION.
2,4-DINITROTOLUENE: INCREASES EXPLOSIVENESS.
FLUORINE: VIOLENT IGNITION.
LITHIUM (BURNING): RELEASES REACTIVE SODIUM.
PHOSPHORUS PENTOXIDE: HIGHLY EXOTHERMIC REACTION.
SODIUM SULFIDE (HOT): EXPLOSIVE REACTION ON CONTACT WITH WATER.
SULFURIC ACID: VIOLENT ERUPTION.
2,4,6-TRINITROTOLUENE: REDUCED EXPLOSION TEMPERATURE.
ZINC: CORROSIVE.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC SODIUM OXIDE AND TOXIC OXIDES OF CARBON.

POLYMERIZATION:
HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE-DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE.

STORAGE

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

CONDITIONS TO AVOID

NONE REPORTED.

SPILLS AND LEAKS

OCCUPATIONAL-SPILL:

SWEEP UP AND PLACE IN SUITABLE (FIBERBOARD) CONTAINERS FOR RECLAMATION OR LATER DISPOSAL.

PROTECTIVE EQUIPMENT SECTION

VENTILATION:
PROVIDE LOCAL EXHAUST OR GENERAL DILUTION VENTILATION SYSTEM.

RESPIRATOR:
THE FOLLOWING RESPIRATORS ARE RECOMMENDED BASED ON INFORMATION FOUND IN THE PHYSICAL DATA, TOXICITY AND HEALTH EFFECTS SECTIONS. THEY ARE RANKED IN ORDER FROM MINIMUM TO MAXIMUM RESPIRATORY PROTECTION.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

DUST AND MIST RESPIRATOR WITH A FULL FACEPIECE.

AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.

POWERED AIR-PURIFYING RESPIRATOR WITH A TIGHT-FITTING FACEPIECE AND HIGH-EFFICIENCY PARTICULATE FILTER.

TYPE 'C' SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE OR WITH A FULL FACEPIECE, HELMET OR HOOD OPERATED IN CONTINUOUS-FLOW MODE.

SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES:

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 12/19/84 REVISION DATE: 10/13/89

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MATERIAL SAFETY DATA SHEET OHS12880

OCCUPATIONAL HEALTH SERVICES, INC.
450 SEVENTH AVENUE, SUITE 2407
NEW YORK, NEW YORK 10123
(800) 445-MSDS (212) 967-1100

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615) 292-1180

SUBSTANCE IDENTIFICATION

CAS-NUMBER 554-13-2
RTEC-NUMBER OJ5800000

SUBSTANCE: LITHIUM CARBONATE

TRADE NAMES/SYNONYMS:
CARBONIC ACID, DILITHIUM SALT: DILITHIUM CARBONATE: CARBONIC ACID, LITHIUM SALT: LITHIUM CARBONATE (LI2CO3): CARBOLITH: ESKALITH: HYPNOREX: LITHONATE: LITHOTABS: PLENUR: L-119: CLI2O3: OHS12880

CHEMICAL FAMILY:
INORGANIC SALT

MOLECULAR FORMULA: LI2-C-O3 MOLECULAR WEIGHT: 73.89

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=0 PERSISTENCE=0
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=0 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: LITHIUM CARBONATE PERCENT: 100

EXPOSURE LIMIT:
NO OCCUPATIONAL EXPOSURE LIMITS ESTABLISHED BY OSHA, ACGIH, OR NIOSH.

PHYSICAL DATA

DESCRIPTION: WHITE CRYSTALLINE POWDER.

BOILING POINT: 2390 F (1310 C)
(DECOMPOSES)

MELTING POINT: 1333 F (723 C)

SPECIFIC GRAVITY: 2.11

SOLUBILITY IN WATER: 1.54% @ 0 C

PH: 11.2 @ 1% SOLUTION

OTHER SOLVENTS (SOLVENT - SOLUBILITY):
INSOLUBLE IN ALCOHOL, ACETONE, AMMONIA.

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD
NEGLIGIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FIREFIGHTING MEDIA:
EXTINGUISH USING AGENT SUITABLE FOR TYPE OF SURROUNDING FIRE.

FIREFIGHTING:
[illegible] ACUTE HAZARD. MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. AVOID BREATHING VAPORS OR DUSTS; KEEP UPWIND.

TOXICITY

LITHIUM CARBONATE:
4111 MG/KG ORAL-HUMAN TDLO; 54 MG/KG ORAL-MAN TDLO; 8 MG/KG ORAL-MAN TDLO; 1080 MG/KG/13 WEEKS INTERMITTENT ORAL-MAN TDLO; 120 MG/KG/10 DAYS INTERMITTENT ORAL-WOMAN TDLO; 525 MG/KG ORAL-RAT LD50; 531 MG/KG ORAL-MOUSE LD50; 556 MG/KG/32 DAYS UNREPORTED-WOMAN TDLO; 500 MG/KG ORAL-DOG LD50; 156 MG/KG INTRAPERITONEAL-RAT LD50; 241 MG/KG INTRAVENOUS-RAT LD50; 434 MG/KG SUBCUTANEOUS-RAT LD50; 236 MG/KG INTRAPERITONEAL-MOUSE LD50; 497 MG/KG INTRAVENOUS-MOUSE LD50; 413 MG/KG SUBCUTANEOUS-MOUSE LD50; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS).
CARCINOGEN STATUS: NONE.
LITHIUM CARBONATE IS AN EYE IRRITANT AND MAY IRRITATE THE SKIN AND MUCOUS MEMBRANES. POISONING MAY AFFECT THE NERVOUS SYSTEM, KIDNEYS AND THYROID. PERSONS AT INCREASED RISK FROM EXPOSURE MAY INCLUDE INDIVIDUALS WITH SIGNIFICANT CARDIOVASCULAR OR RENAL DISEASE; SODIUM AND WATER IMBALANCE; AND PREEXISTING HYPOTHYROIDISM. TASKS REQUIRING ALERTNESS MAY BE IMPAIRED.

HEALTH EFFECTS AND FIRST AID

INHALATION:
LITHIUM CARBONATE:
ACUTE EXPOSURE- INHALATION MAY CAUSE COUGHING, SORE THROAT AND IRRITATION.
CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
LITHIUM CARBONATE:
ACUTE EXPOSURE- APPLICATION OF 0.5 GRAMS TO RABBIT SKIN UNDER OCCLUSIVE WRAP FOR 4 HOURS PRODUCED MINIMAL IRRITATION. A GRADE OF 0.3 ON A SCALE OF 0 TO 8 WAS REPORTED FOLLOWING A 30 MINUTE INTERVAL AFTER THE SKIN WAS RINSED. ONE RABBIT IN THE STUDY HAD SLIGHT ERYTHEMA ON DAYS 1-4 FOLLOWING THE EXPOSURE.
CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

LITHIUM CARBONATE:
IRRITANT.

ACUTE EXPOSURE- INSTILLATION OF 0.10 GRAMS INTO RABBIT EYES PRODUCED MODERATE IRRITATION. SLIGHT TO MILD CORNEAL OPACITIES, IRITIS, SLIGHT TO MODERATE CONJUNCTIVITIS, HEMORRHAGES AND WHITE AREAS ON THE CONJUNCTIVA WERE NOTED. A GRADE OF 41 ON A SCALE OF 0-110 WAS REPORTED AFTER 24 HOURS. NO EFFECTS WERE NOTED BY DAY 7 OF THE STUDY. WASHING THE EYES WITH TAP WATER SHORTLY AFTER EXPOSURE DECREASED BOTH THE SEVERITY AND DURATION OF EFFECTS WITH RECOVERY OCCURRING IN 4 DAYS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO IRRITANTS MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
LITHIUM CARBONATE:

ACUTE EXPOSURE- INGESTION OF A LARGE DOSE MAY CAUSE SEVERE GASTROENTERITIS AND EFFECTS ON THE CENTRAL NERVOUS SYSTEM, RENAL FUNCTION AND FLUID AND ELECTROLYTE BALANCE. SYMPTOMS, POSSIBLY DELAYED, MAY INCLUDE NAUSEA, VOMITING, THIRST, ANOREXIA, DIARRHEA, BLURRED VISION, DROWSINESS, WEAKNESS, TREMOR, STAGGERING, BRADYCARDIA AND COMA. MORE UNUSUAL REACTIONS MAY INCLUDE DELIRIUM WITH EEG CHANGES, ACTION MYOCLONUS, RHABDOMYOLYSIS, ECG CHANGES, GLYCOSURIA, AND ALLERGIC ERYTHEMA. A PAINFUL DISCOLORATION OF THE FINGERS AND TOES AND COLDNESS OF THE EXTREMITIES WITHIN 1 DAY OF THERAPEUTIC USE HAS BEEN REPORTED. IN SEVERE CASES, DEATH MAY OCCUR DUE TO RENAL FAILURE OR CARDIAC OR PULMONARY COMPLICATIONS. SOME SURVIVORS MAY HAVE LONG-LASTING OR PERMANENT SEQUELAE, MOSTLY OF CEREBELLAR NATURE BUT, SOMETIMES WITH PERIPHERAL NEUROPATHY OR PARKINSONISM.

CHRONIC EXPOSURE- REPEATED OR PROLONGED INGESTION MAY CAUSE SYMPTOMS AS DETAILED IN ACUTE INGESTION. IN ADDITION, A METALLIC TASTE, DRY MOUTH, EXCESSIVE THIRST, ABDOMINAL PAIN AND INCONTINENCE OF URINE AND FECES MAY OCCUR. NERVOUS SYSTEM EFFECTS MAY INCLUDE A DAZED FEELING, CONFUSION, GIDDINESS, MENTAL LAPSES, DYSPRAXIA, DROWSINESS, VERTIGO, HEADACHE, APATHY, RESTLESSNESS, ANXIETY, SOME SUPPRESSION OF THE REM PHASES OF SLEEP, POSITIVE ROMBERG SIGN, BLACKOUT SPELLS, STUPOR, TINNITUS, AND UNCONSCIOUSNESS. NEUROLOGIC ASYMMETRY, PSYCHOMOTOR RETARDATION, SLURRED SPEECH, NYSTAGMUS AND EPILEPTIFORM SEIZURES MAY OCCUR. PSEUDOTUMOR CEREBRI (INCREASED INTRACRANIAL PRESSURE AND PAPILLEDEMA) HAS BEEN REPORTED AND MAY POSSIBLY RESULT IN ENLARGEMENT OF THE BLIND SPOT, CONSTRICTION OF VISUAL FIELDS AND EVENTUAL BLINDNESS DUE TO OPTIC ATROPHY. PHOTOPHOBIA HAS BEEN REPORTED. MUSCULAR EFFECTS MAY INCLUDE TREMORS, ATAXIA, MUSCULAR AND REFLEX HYPERIRRITABILITY WITH FASCICULATIONS, TWITCHING AND SPASTIC OR CHOREO-ATHETOTIC MOVEMENTS, COGWHEEL RIGIDITY, PARKINSONISM AND DYSTONIA. TWO CASES INVOLVING SEVERE GENERALIZED SENSORIMOTOR PERIPHERAL NEUROPATHY HAVE BEEN REPORTED. CARDIAC ARRHYTHMIAS, HYPOTENSION, PERIPHERAL CIRCULATORY COLLAPSE, AND INTERSTITIAL MYOCARDITIS ARE POSSIBLE. LEUKOCYTOSIS IS FAIRLY COMMON. ENDOCRINE EFFECTS MAY INCLUDE DISTURBED IODINE METABOLISM, STIMULATION OF ANTITHYROIDAL AUTO-ANTIBODIES, HYPOTHYROIDISM WITH MYXEDEMA, OR RARELY HYPERTHYROIDISM. OSTEOPOROSIS, AN INCREASE IN SERUM TOTAL CALCIUM, IONIZED CALCIUM AND PARATHYROID HORMONE AND INDEPENDENTLY FUNCTIONING PARATHYROID ADENOMAS HAVE BEEN REPORTED. TRANSITORY NEPHROTIC SYNDROME AND ACQUIRED NEPHROGENIC DIABETES INSIPIDUS MAY OCCUR. TRANSIENT HYPERGLYCEMIA, LOWERED URINARY CONCENTRATING ABILITY LEADING TO HYPERNATREMIA AND HYPEROSMOLALITY, SODIUM DEPLETION, POLYURIA,

GLYCOSURIA, OLIGURIA, ANURIA, AND AZOTEMIA ARE POSSIBLE. MORPHOLOGIC CHANGES WITH GLOMERULAR AND INTERSTITIAL FIBROSIS AND NEPHRON ATROPHY HAVE BEEN REPORTED. HOWEVER, A CAUSAL RELATIONSHIP HAS NOT BEEN ESTABLISHED. DERMATOLOGIC EFFECTS MAY INCLUDE CUTANEOUS HYPERALGESIA OR ANESTHESIA, XEROSIS CUTIS, CHRONIC FOLLICULITIS, GENERALIZED PRURITUS WITH OR WITHOUT RASH, DEVELOPMENT OR EXACERBATION OF ACNE OR PSORIASIS, CUTANEOUS ULCERS AND ALOPECIA. HYPER- OR HYPOTHERMIA, WEIGHT GAIN, EDEMA OF THE ANKLES AND WRISTS, AND SEXUAL DYSFUNCTION HAVE BEEN REPORTED. DEATH MAY OCCUR DUE TO RENAL FAILURE, BRAIN DAMAGE OR PULMONARY COMPLICATIONS. LITHIUM READILY CROSSES THE PLACENTAL BARRIER AND IS EXCRETED IN BREAST MILK. THE USE OF LITHIUM IN PREGNANCY HAS BEEN ASSOCIATED WITH NEONATAL GOITER, CARDIAC ANOMALIES, ESPECIALLY EBSTEIN'S, CENTRAL NERVOUS SYSTEM DEPRESSION AND HYPOTONIA. MARKED FUNCTIONAL AND STRUCTURAL CHANGES IN THE KIDNEYS OF NEWBORN RATS EXPOSED TO LITHIUM VIA THEIR MOTHER'S MILK HAVE BEEN REPORTED. ADVERSE EFFECTS ON NIDATION IN RATS AND EMBRYO VIABILITY IN MICE HAVE BEEN ATTRIBUTED TO LITHIUM, AS HAVE TERATOGENICITY IN SUBMAMMALIAN SPECIES AND CLEFT PALATES IN MICE. HOWEVER, OTHER STUDIES IN RATS, RABBITS AND MONKEYS HAVE SHOWN NO EVIDENCE OF LITHIUM-INDUCED DEVELOPMENTAL DEFECTS. LEUKEMIA HAS BEEN REPORTED DURING LITHIUM TREATMENT. HOWEVER, AN EPIDEMIOLOGIC STUDY INVOLVING A POPULATION OF 173,000 PERSONS YEILDED NEGATIVE RESULTS.

FIRST AID- IF VICTIM IS CONSCIOUS AND PRODUCTIVE VOMITING HAS NOT ALREADY OCCURRED, REMOVE POISON BY IPECAC EMESIS OR GASTRIC LAVAGE. (GOSSELIN, SMITH AND HODGE, CLINICAL TOXICOLOGY OF COMMERCIAL PRODUCTS, 5TH EDITION) MAINTAIN AIRWAY, RESPIRATION AND BLOOD PRESSURE. GET MEDICAL ATTENTION. ADMINISTRATION OF GASTRIC LAVAGE SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY SECTION

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:
LITHIUM CARBONATE:
ACIDS (DILUTE): DECOMPOSES.
ACIDS (STRONG): MAY REACT VIOLENTLY.
FLUORINE: DECOMPOSES WITH INCANDESCENCE.
METALS: MAY BE CORROSIVE IN THE PRESCENCE OF MOISTURE.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF CARBON.

POLYMERIZATION:
HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE-DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

STORAGE

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

CONDITIONS TO AVOID

PREVENT DISPERSION OF DUST IN AIR.

SPILLS AND LEAKS

OCCUPATIONAL-SPILL:
FOR LARGE SPILLS, SWEEP UP WITH A MINIMUM OF DUSTING AND PLACE INTO SUITABLE CLEAN, DRY CONTAINERS FOR RECLAMATION OR LATER DISPOSAL.

RESIDUE SHOULD BE CLEANED UP USING A HIGH-EFFICIENCY PARTICULATE FILTER VACUUM.

PROTECTIVE EQUIPMENT SECTION

VENTILATION:
PROVIDE LOCAL EXHAUST OR GENERAL DILUTION VENTILATION SYSTEM.

RESPIRATOR:
THE FOLLOWING RESPIRATORS ARE RECOMMENDED BASED ON INFORMATION FOUND IN THE PHYSICAL DATA, TOXICITY AND HEALTH EFFECTS SECTIONS. THEY ARE RANKED IN ORDER FROM MINIMUM TO MAXIMUM RESPIRATORY PROTECTION.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

DUST AND MIST RESPIRATOR.

AIR-PURIFYING RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.

POWERED AIR-PURIFYING RESPIRATOR WITH A DUST AND MIST FILTER.

POWERED AIR-PURIFYING RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.

TYPE 'C' SUPPLIED-AIR RESPIRATOR OPERATED IN THE PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE OR CONTINUOUS-FLOW MODE.

SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
PROTECTIVE CLOTHING NOT REQUIRED. AVOID REPEATED OR PROLONGED CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 10/23/84 REVISION DATE: 09/07/89

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APPENDIX E

PHOTOGRAPHS

1 Figure E-1. A View of 105-DR Reactor Building
2 from the LSFF (Fan Room) Side.

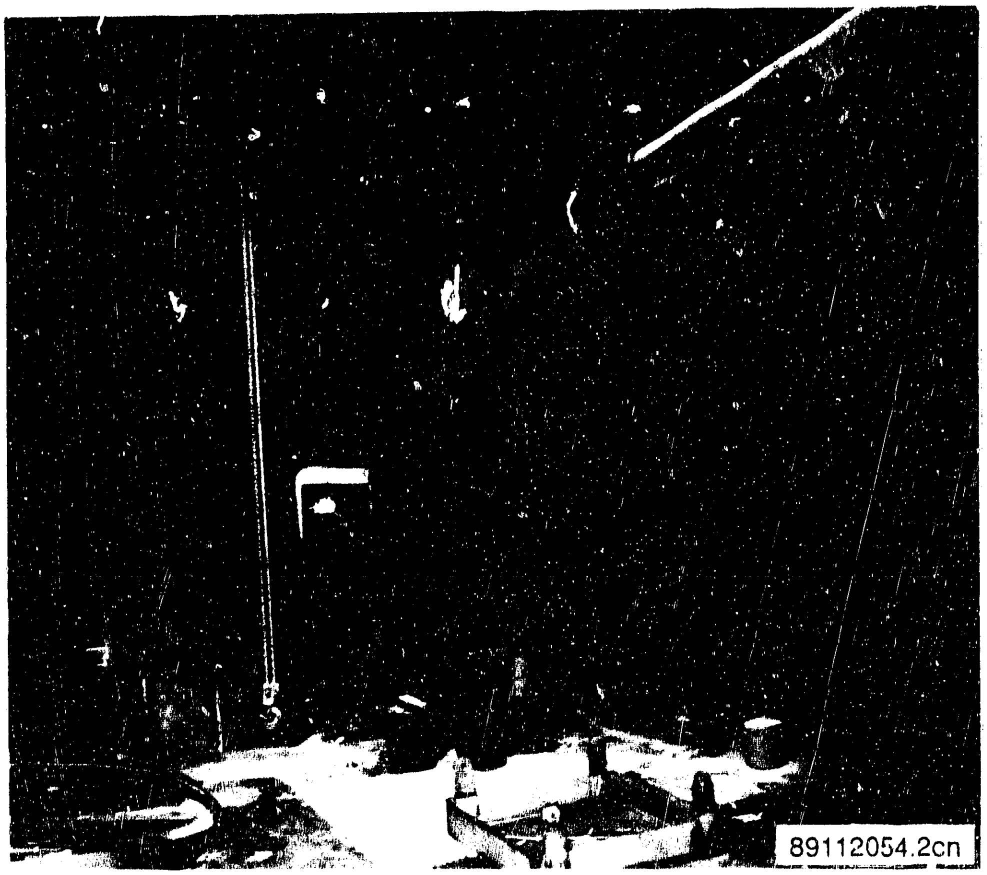


Figure E-2. The Exhaust Fan Room of the LSFF.

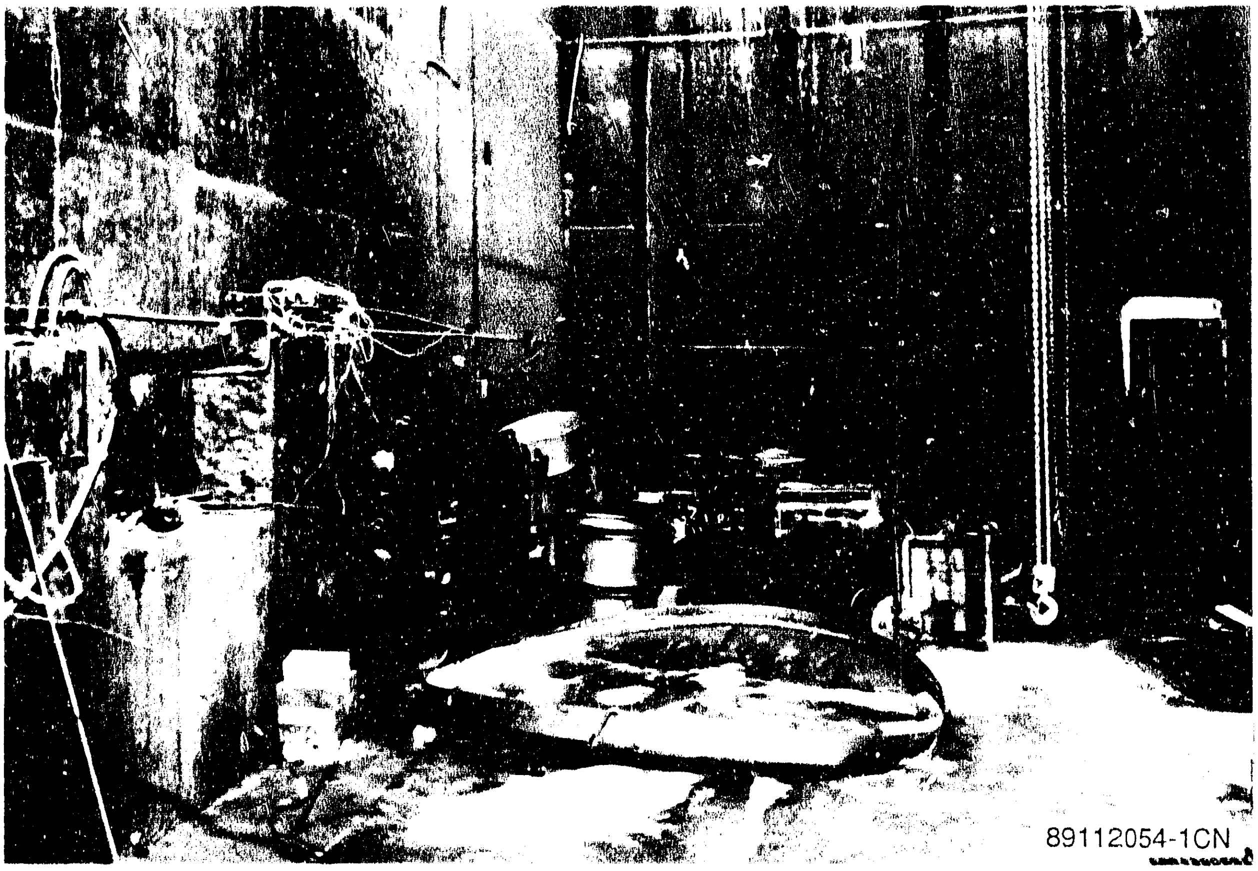


Figure E-3. The Exhaust Fan Room of the LSFF.
(Looking at the Southeast Corner)

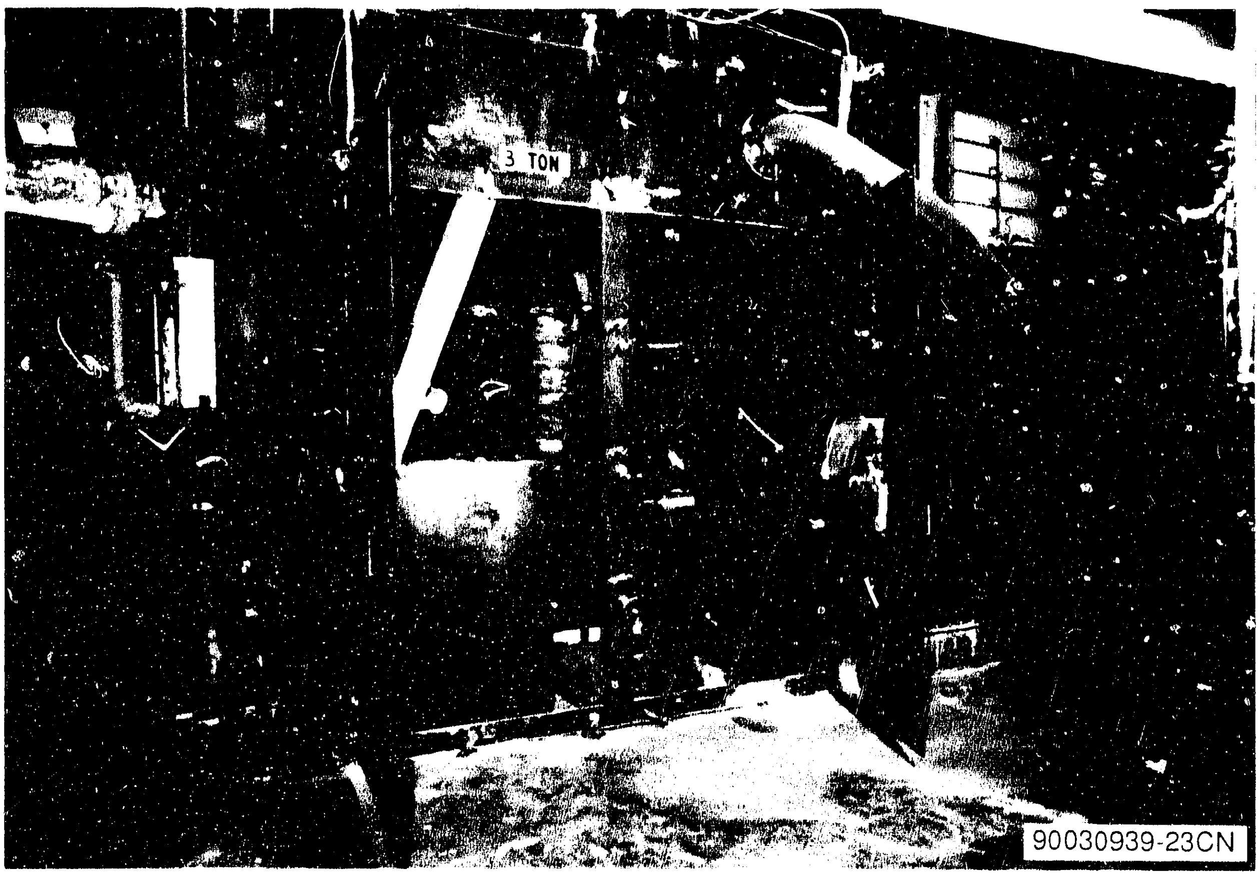
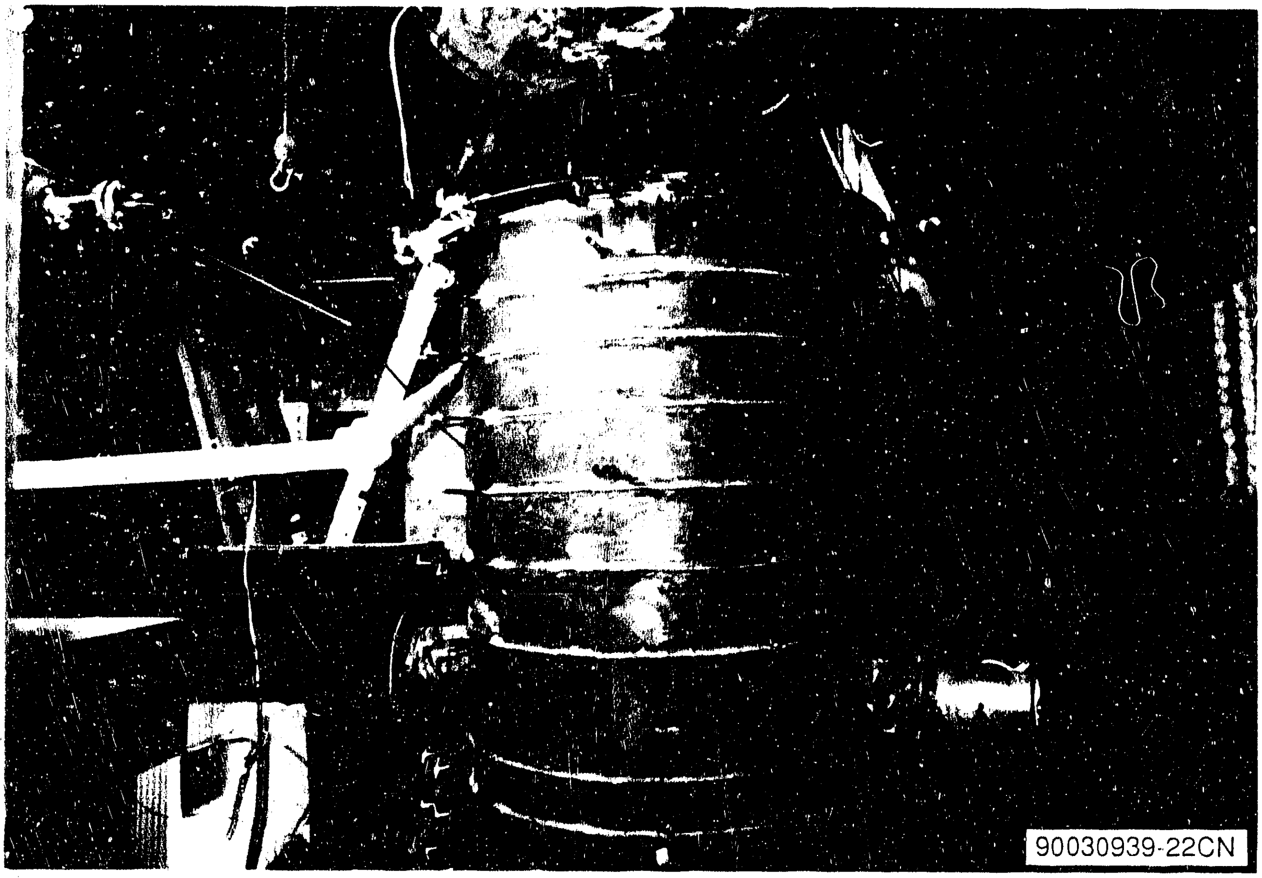
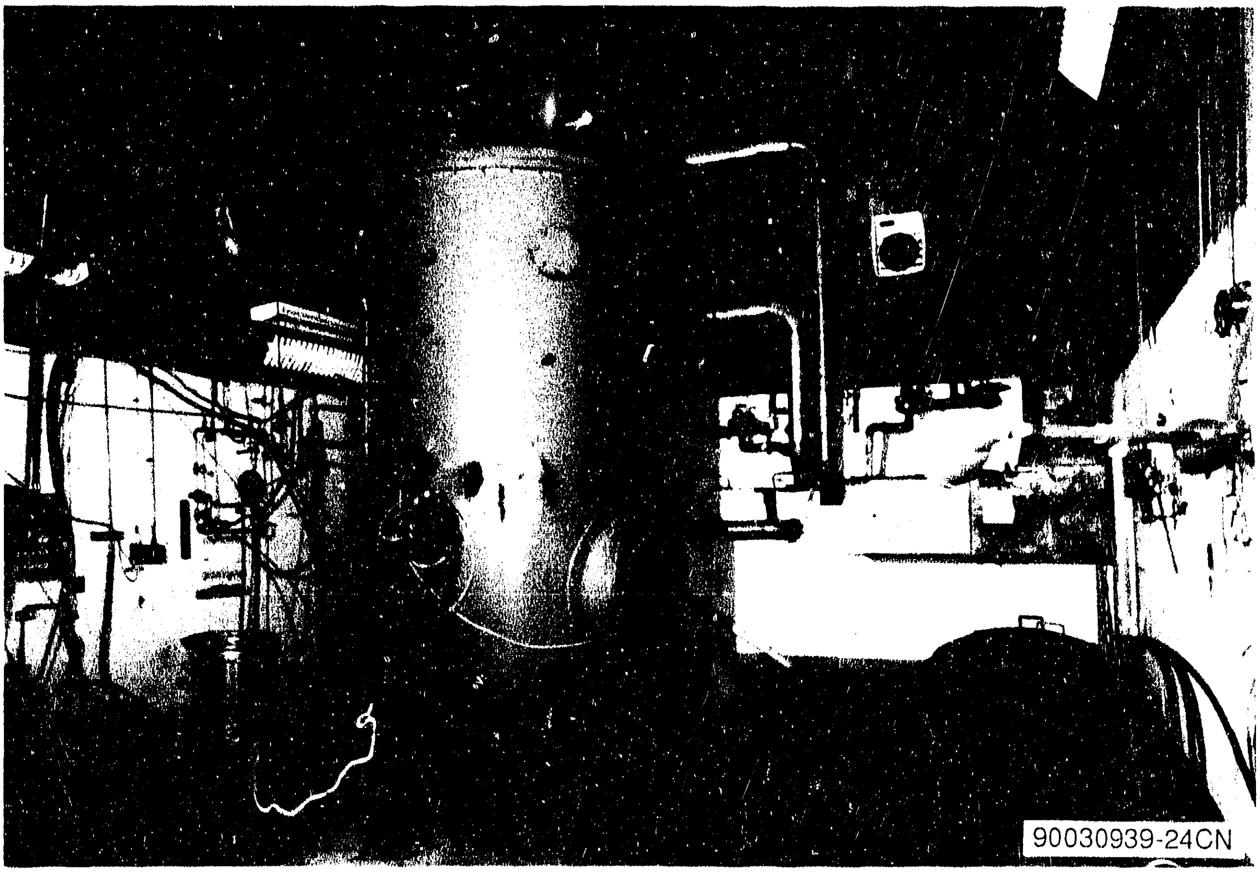


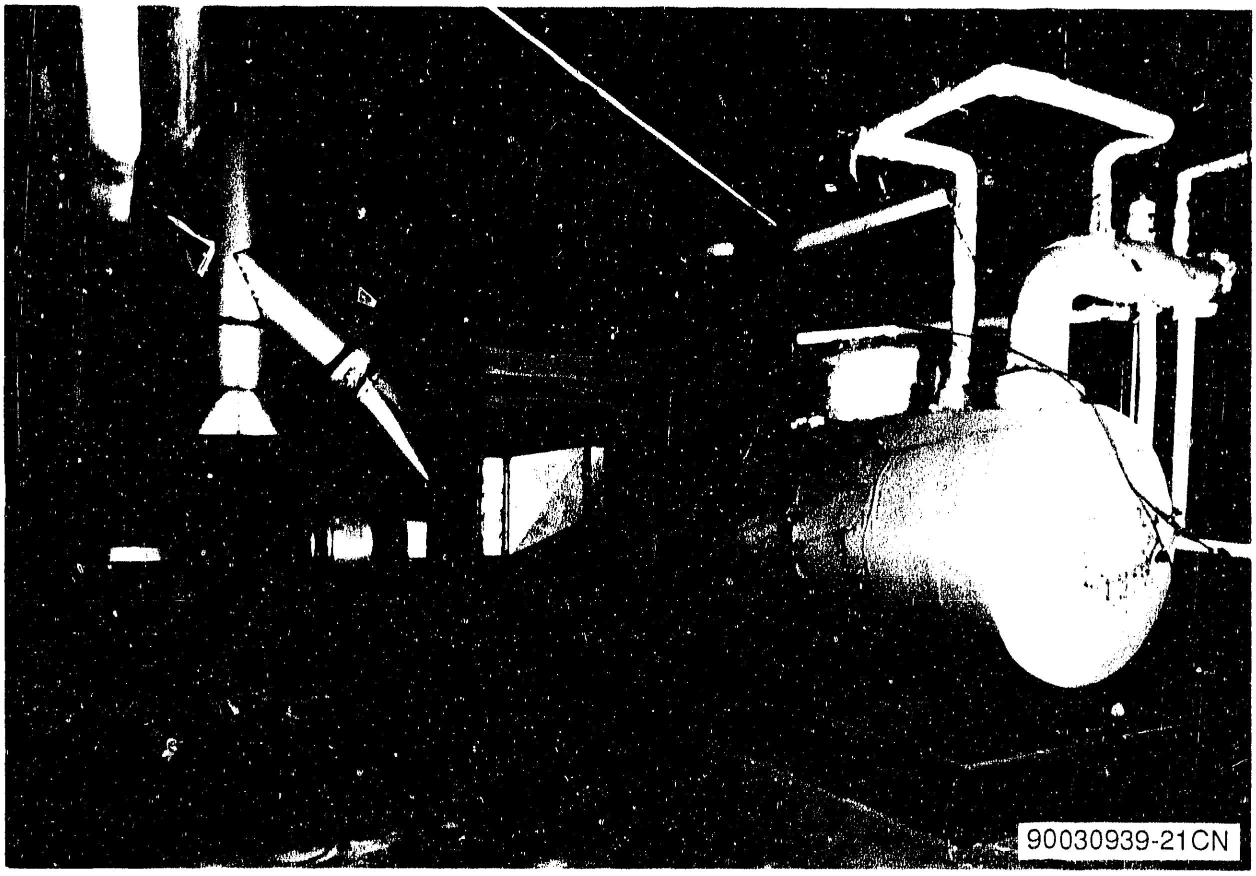
Figure E-4. The Large Fire Test Room of the LSFF.



1 Figure E-5. The Large Fire Test Room and Apparatus of the LSFF.



1 Figure E-6. The Small Fire Test Room of the LSFF.



1 Figure E-7. The Sodium Handling Room of the LSFF.

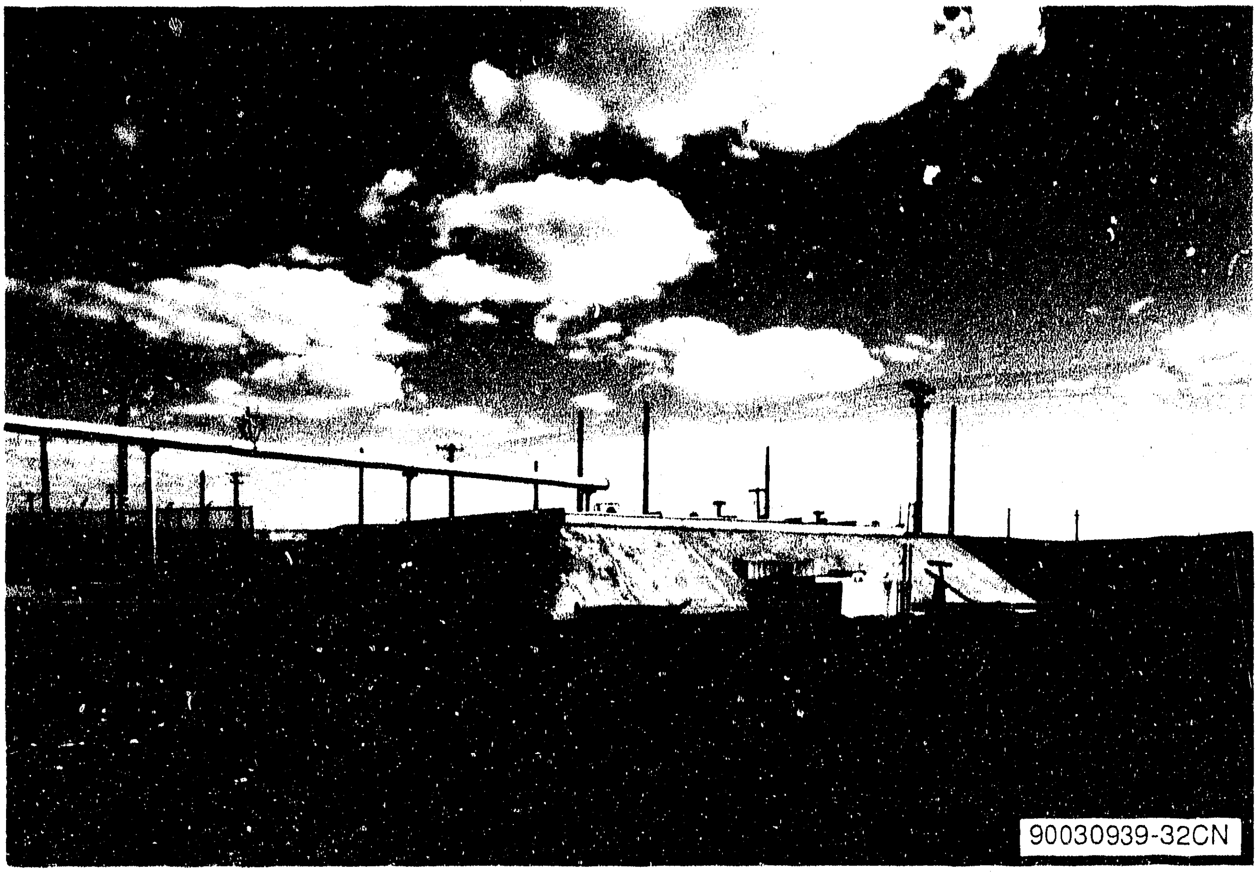


Figure E-8. Filter Building (117-DR) Used to Clean up the LSFF Exhaust Before 1983.

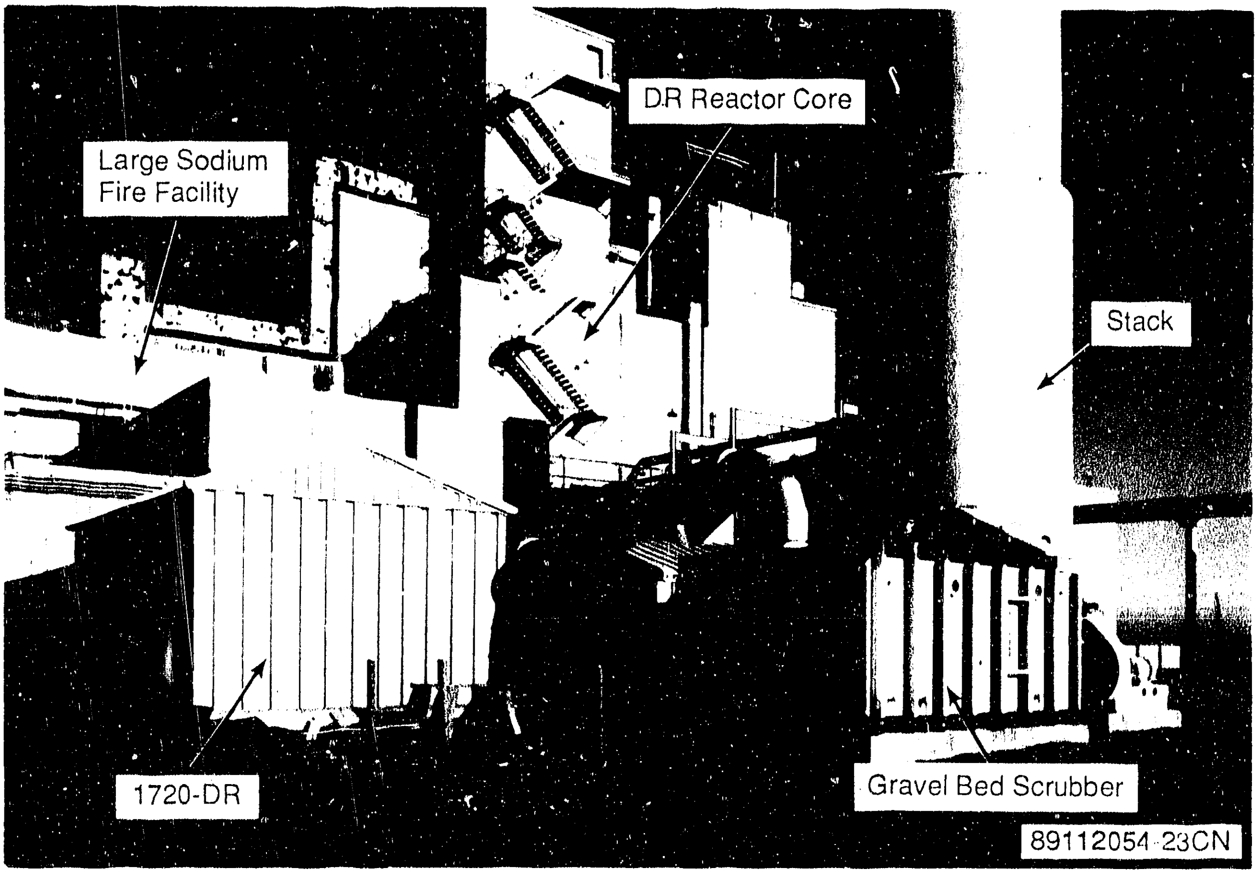


Figure E-9. The Gravel Scrubber (Installed in 1982) is the Metal Building to the Right. The 1720-DR Building is the Metal Storage Building to the Left.

Figure E-10. The Office Area of the LSFF.

APPENDIX F

QUALITY ASSURANCE PROJECT PLAN FOR CHARACTERIZATION AND VALIDATION SAMPLING AT THE LARGE SODIUM FIRE FACILITY

QUALITY ASSURANCE PROJECT PLAN FOR CHARACTERIZATION AND VALIDATION SAMPLING AT THE LARGE SODIUM FIRE FACILITY

Revision A

Westinghouse Hanford Company
Environmental Engineering and Technology Function
Richland, Washington

Approved by:

State of Washington Department of Ecology Unit Manager	Date
State of Washington Department of Ecology Quality Assurance Manager	Date
U.S. Department of Energy Unit Manager	Date
U.S. Department of Energy Quality Assurance Officer	Date
Westinghouse Hanford EE&T Technical Lead	Date
Westinghouse Hanford Quality Assurance Officer	Date

CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY

Accuracy: For the purposes of closure activities, accuracy is interpreted as the measure of the bias in a system. Analytical accuracy is normally assessed through the evaluation of matrix spiked samples and reference samples.

Audit: For the purposes of closure activities, audits are considered to be systematic checks to verify the quality of operation of one or more elements of the total measurement system. In this sense, audits may be of two types: (1) performance audits, in which quantitative data are independently obtained for comparison with data routinely obtained in a measurement system, or (2) system audits, involving a qualitative on-site evaluation of laboratories or other organizational elements of the measurement system for compliance with established quality assurance program and procedure requirements. For environmental investigations at the Hanford Site, performance audit requirements are fulfilled by periodic submittal of blind samples to the primary laboratory, or the analysis of split samples by an independent laboratory. System audit requirements are implemented through the use of standard surveillance procedures.

Blind Sample: A blind sample refers to any type of sample routed to the primary laboratory for purposes of auditing performance relative to a particular sample matrix and analytical method. Blind samples are not specifically identified as such to the laboratory; they may be made from traceable standards, or may consist of sample material spiked with a known concentration of a known compound. See the glossary entry for audit above.

Comparability: For the purposes of closure activities, comparability is an expression of the relative confidence with which one data set may be compared with another.

Completeness: For the purposes of closure activities, completeness may be interpreted as a qualitative parameter expressing the percentage of measurements judged to be valid.

Deviation: For the purpose of closure activities, deviation refers to a planned departure from established criteria that may be required as a result of unforeseen field situations or that may be required to correct ambiguities in procedures that may arise in practical applications.

Equipment Blanks: Equipment blanks consist of pure deionized, distilled water washed through decontaminated sampling equipment and placed in containers identical to those used for actual field samples; they are used to verify the adequacy of sampling equipment decontamination procedures, and are normally collected at the same frequency as field duplicate samples.

Field Blanks: Field blanks consist of pure deionized, distilled water, transferred to a sample container at the site and preserved with the reagent specified for the analytes of interest; they are used to check for possible contamination originating with the reagent or the sampling environment, and are normally collected at the same frequency as field duplicate samples.

Field Duplicate Sample: Field duplicate samples are samples retrieved from the same sampling location using the same equipment and sampling technique, placed in separate identically prepared and preserved containers, and analyzed independently. Field duplicate samples are generally used to verify the repeatability or reproducibility of analytical data, and are normally analyzed with each analytical batch or every 20 samples, whichever is greater.

Matrix Spiked Samples: Matrix spiked samples are a type of laboratory quality control sample; they are prepared by splitting a sample received from the field into two homogenous aliquots (i.e., replicate samples), and adding a known quantity of a representative analyte of interest to one aliquot in order to calculate percentage of recovery.

Nonconformance: A nonconformance is a deficiency in characteristic, documentation, or procedure that renders the quality of material, equipment, services, or activities unacceptable or indeterminate. When the deficiency is of a minor nature, does not effect a permanent or significant change in quality if it is not corrected, and can be brought into conformance with immediate corrective action, it shall not be categorized as a nonconformance. However, if the nature of the condition is such that it cannot be immediately and satisfactorily corrected, it shall be documented in compliance with approved procedures and brought to the attention of management for disposition and appropriate corrective action.

Precision: Precision is a measure of the repeatability or reproducibility of specific measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value. Precision is normally expressed in terms of standard deviation, but may also be expressed as the coefficient of variation (i.e., relative standard deviation) and range (i.e., maximum value minus minimum value). Precision is assessed by means of duplicate/replicate sample analysis.

Quality Assurance: For the purposes of closure activities, QA refers to the total integrated quality planning, quality control, quality assessment, and corrective action activities that collectively ensure that the data from monitoring and analysis meets all end user requirements and/or the intended end use of the data.

Quality Assurance Project Plan: The QAPP is an orderly assembly of management policies, project objectives, methods, and procedures that defines how data of known quality will be produced for a particular project.

Quality Control: For the purposes of closure activities, QC refers to the routine application of procedures and defined methods to the performance of sampling, measurement, and analytical processes.

Reference Samples: Reference samples are a type of laboratory quality control sample prepared from an independent, traceable standard at a concentration other than that used for analytical equipment calibration, but within the calibration range. Such reference samples are required for every analytical batch or every 20 samples, whichever is greater.

Replicate Sample: Replicate samples are two aliquots removed from the same sample container in the laboratory and analyzed independently.

Representativeness: For the purposes of closure activities, representativeness may be interpreted as the degree to which data accurately and precisely represent a characteristic of a population parameter, variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of a sampling program.

Split Sample: A split sample is produced through homogenizing a field sample and separating the sample material into two equal aliquots. Field split samples are usually routed to separate laboratories for independent analysis, generally for purposes of auditing the performance of the primary laboratory relative to a particular sample matrix and analytical method. See the glossary entry for audit above. In the laboratory, samples are generally split to create matrix spiked samples; see the glossary entry above.

Validation: For the purposes of closure activities, validation refers to a systematic process of reviewing a body of data against a set of criteria to provide assurance that the data are acceptable for their intended use. Validation methods may include review of verification activities, editing, screening, cross-checking, or technical review.

Verification: For the purposes of closure activities, verification refers to the process of determining whether procedures, processes, data, or documentation conform to specified requirements. Verification activities may include inspections, audits, surveillances, or technical review.

1.0 PROJECT DESCRIPTION

1.1 PROJECT OBJECTIVE

The purpose of characterization and validation sampling at the Large Sodium Fires Facility (LSFF) will be to ensure that performance standards for closure of the facility are satisfied.

1.2 BACKGROUND INFORMATION

The location of the LSFF and general background information are provided in the Closure Plan developed for the facility.

1.3 QUALITY ASSURANCE PROJECT PLAN APPLICABILITY AND RELATIONSHIP TO THE WESTINGHOUSE HANFORD COMPANY QUALITY ASSURANCE PROGRAM

This Quality Assurance Project Plan (QAPP) applies specifically to the field activities and laboratory analyses performed as part of sampling and testing investigations supporting the closure of the LSFF at the Hanford Site. It is designed to be implemented in conjunction with the specific requirements of the LSFF Closure Plan. The QAPP is prepared in compliance with the Westinghouse Hanford QA program plan for CERCLA RI/FS activities. This plan describes the means selected to implement the overall QA program requirements defined by the *Westinghouse Hanford Company Quality Assurance Manual* (WHC-CM-4-2) (WHC 1989a), as applicable to CERCLA RI/FS closure activities, while accommodating the specific requirements for project plan format and content agreed upon in the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989). Although specific to CERCLA RI/FS activities, the implementing procedures, plans, and instructions invoked by CERCLA RI/FS in the QA program plan are appropriate for the control of investigations requiring compliance with RCRA guidelines. The program plan contains a matrix of procedural resources [from WHC-CM-4-2 and from the *Westinghouse Hanford Closure activities and Site Characterization Manual* (WHC-CM-7-7) (WHC 1989b)] that have been drawn upon to support this QAPP. This QAPP is subject to mandatory review and revision prior to use on subsequent phases of the investigation. Distribution and revision control of this plan shall be in compliance with procedures QR 6.0, "Document Control," and QI 6.1, "Quality Assurance Document Control," all from WHC-CM-4-2 (WHC 1989a). The QAPP distribution shall routinely include all review/approval personnel indicated on the title page of the document and all other individuals designated by the Westinghouse Hanford Technical Lead. All plans and procedures referenced in the QAPP are available for regulatory review on request by the direction of the Technical Lead.

1.4 SAMPLING AND TESTING ACTIVITIES

Field sampling activities include characterization of the LSFF waste-burn-related deposits, soil and concrete verification sampling, and cleanup-residue sampling for material disposal; a complete description of all test activities is provided in Section 7.0 of the LSFF Closure Plan.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 PROJECT MANAGEMENT RESPONSIBILITIES

The Environmental Engineering and Technology Function of Westinghouse Hanford has primary responsibilities for conducting the sampling and analysis for the LSFF (see Figure F-1 for the organizational chart). Responsibilities of key personnel and organizations are described below:

- **Closure Plan Lead (Regulatory Permitting/NEPA Group).** The Closure Plan Lead is responsible for overall project organization and interface with regulatory agencies and DOE.

- **Technical Lead.** The Technical Lead will be responsible for overall direction of sampling and testing activities; responsibilities include the planning and authorization of all work and management of any subcontracted activities, as well as overall technical schedule and budgetary performance.

- **Quality Assurance Officer.** The Quality Assurance Officer is responsible for oversight of performance to the QAPP requirements by means of internal auditing and surveillance techniques. The Quality Assurance Officer retains the necessary organizational independence and authority to identify conditions adverse to quality and to inform the Technical Lead of needed corrective action.

- **Health and Safety Officer (Environmental Division/Environmental Field Services).** The Health and Safety Officer is responsible for determining potential health and safety hazards from radioactive, volatile, and/or toxic compounds during sample handling and sampling decontamination activities and has the responsibility and authority to halt field activities due to unacceptable health and safety hazards.

- **Field Team Leader.** The field team leader is responsible for onsite direction of sampling technicians in compliance with the requirements of the Closure Plan, this QAPP, and all implementing Environmental Investigation Instructions (EIIs).

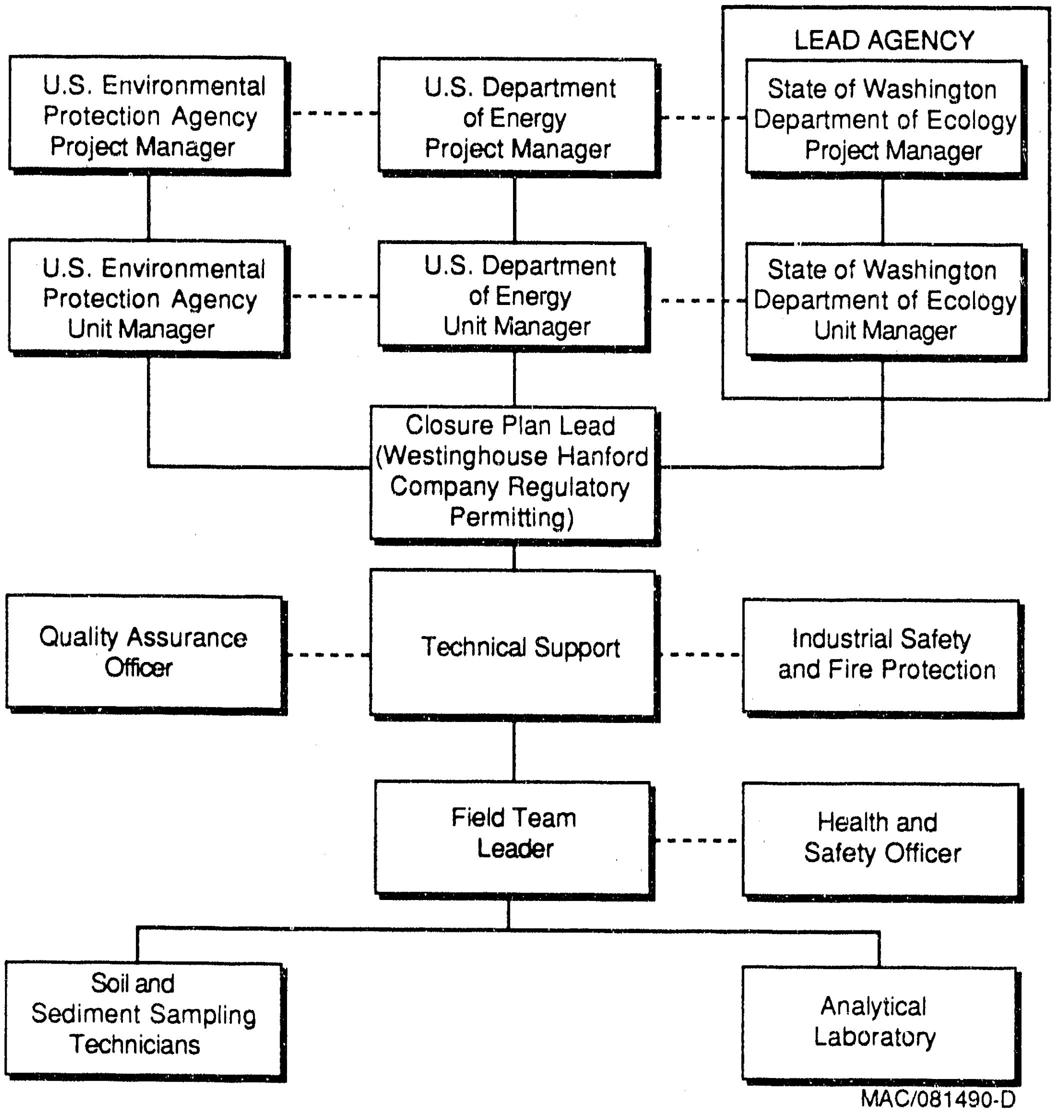


Figure F-1. Project Organization, Vadose Zone Testing and Sampling at the Large Sodium Fire Facility.

- **Office of Sample Management (OSM).** The Westinghouse Hanford OSM is responsible for coordinating sample shipments between the field team and the analytical laboratory, resolution of any chain of custody issues, and for validation of all analytical data as discussed in Section 8.0 below.

2.2 ANALYTICAL LABORATORIES

Soil samples shall be routed to an approved Westinghouse Hanford, participant contractor, or subcontractor laboratory, which shall be responsible for performing the analyses identified in this plan in compliance with work order or contractual requirements and Westinghouse Hanford-approved procedures; see Section 4.1.2 below. At the Technical Lead's option, services of alternate qualified laboratories may be procured for the performance of split sample analyses for performance audit purposes, or for confirmatory analysis of duplicate soil gas samples. If such an option is selected, the QA plan and applicable analytical procedures from the alternate laboratory shall also be approved by Westinghouse Hanford prior to their use in compliance with Section 4.1.2 requirements. All analytical laboratory work shall be subject to the surveillance controls invoked by QI 7.3, "Source Surveillance and Inspection" (WHC 1989a).

2.3 OTHER SUPPORT CONTRACTORS

Procurements of other support contractors may be assigned project responsibilities at the direction of the Technical Lead. Such services shall be in compliance with standard Westinghouse Hanford procurement procedures requirements as discussed in Section 4.1.2 below. All work shall be performed in compliance with Westinghouse Hanford-approved QA plans and/or procedures, subject to controls of QI 7.3, "Source Surveillance and Inspection" (WHC 1989a).

3.0 OBJECTIVES FOR MEASUREMENTS

The purposes of the sampling activities are to determine reaction by-product deposit composition, confirm that the lead discovered (in the 1987 sampling activities) is from paint used to seal reactor tunnel walls, and verify that any contamination remaining is below action levels.

As noted in Section 4.6 of *Data Quality Objectives for Remedial Response Activities: Volume I, Development Process* (EPA 1987), universal goals for precision, accuracy, representativeness, completeness, and comparability cannot be practically established at the outset of an investigation. Data are available, however from previously negotiated analytical contracts for Hanford site investigations, the Data Quality Objectives guidance document cited above (EPA 1987), and from typical capabilities currently expected for laboratories involved in environmental analyses, that may be used as minimum guidelines for the selection of analytical methods appropriate for this investigation. Table F-1 provides preliminary target values for detection limits, precision, and accuracy that are intended for use in initial procurement negotiations with the analytical laboratory that will routinely perform chemical analyses for this investigation. After an individual laboratory statement of work is negotiated, and procedures are developed and approved as noted in Section 4.1, Table F-1 and this section shall be revised to reference approved detection limit, precision, and accuracy criteria as project requirements.

Table F-1. Analytes of Interest and Analytical Methods for 105-DR Large Sodium Fire Facility Sampling.[b,d]

Analytical category	Analyte of interest	Standard reference method	Minimum detection limit[c]	Precision[c]	Accuracy[c]
Inorganics	Sodium	7770[a]	0.002 mg/L	± 25% RPD	± 25%
	Lithium	6010[a]	5 mg/L[e]		± 25%
	Lead	7421[a]	1.0 mg/kg	± 25% RPD	± 25%

[a]Methods specified are from *Test Methods for Evaluating Solid Waste (SW-846)* (U.S. Environmental Protection Agency, 1986).

[b]Analytical methods shall be in compliance with approved Westinghouse Hanford or Westinghouse Hanford-approved participant contractor or subcontractor procedures. All procedures shall be reviewed and approved in compliance with requirements specified in the Westinghouse Hanford QA program plan for CERCLA RI/FS activities.

[c]Minimum requirements for method detection levels, precision, and accuracy will be method-specific, and shall be negotiated and established in the procedure review and approval process. Target values are indicated where appropriate; precision is expressed in terms of relative percent different (RPD) and accuracy as percentage recovery.

[d]Analyses shall be performed by an approved participant contractor of subcontractor laboratory.

[e]Estimated instrumental detection limit. Actual method detection limits are sample and matrix dependent and may vary.

Goals for data representativeness are addressed qualitatively by the specification of sampling locations and intervals within Section 7.0 of the Closure Plan. Objectives for completeness for this investigation shall require that contractually or procedurally established requirements for precision and accuracy be met for at least 90% of the total number of requested determinations. Failure to meet this criterion shall be documented in data summary reports as described in Section 8.1 of this QAPP, and shall be considered in the validation process discussed in Section 8.2. Corrective action measures shall be initiated by the Technical Lead as appropriate, as noted in Section 13.0 below. Approved analytical procedures shall require the use of the reporting techniques and units consistent with the EPA reference methods listed in Table F-1 in order to facilitate the comparability of data sets in terms of precision and accuracy.

4.0 SAMPLING PROCEDURES

4.1 PROCEDURE APPROVALS AND CONTROL

4.1.1 Westinghouse Hanford Procedures

The Westinghouse Hanford procedures that will be used to support the Closure Plan have been selected from the Quality Assurance Program Index (QAPI) included in the Westinghouse Hanford quality assurance program plan for CERCLA RI/FS activities. Selected procedures include Closure activities Instructions (EIIs) from the *Environmental and Site Characterization Manual* (WHC 1989b), and Quality Requirements (QRs) and Quality Instructions (QIs), from the *Westinghouse Hanford Quality Assurance Manual* (WHC 1989a).

Procedure approval, revision, and distribution control requirements applicable to EIIs are addressed in EII 1.2, "Preparation and Revision of Environmental Investigation Instructions" (WHC 1989b); requirements applicable to QIs and QRs are addressed in QR 5.0, "Instructions, Procedures, and Drawings;" QI 5.1, "Preparation of Quality Assurance Documents;" QR 6.0, "Document Control;" and QI 6.1, "Quality Assurance Document Control" (WHC 1989a). Other procedures applicable to the preparation, review, approval, and revision of OSM and other Hanford analytical laboratory procedures shall be as defined in the various procedures and manuals identified in the QA program plan for CERCLA RI/FS activities under criteria 5.00 and 6.00. All procedures are available for regulatory review on request.

4.1.2 Participant Contractor/Subcontractor Procedures

As noted in Section 2.1, participant contractor and/or subcontractor services may be procured at the direction of the Technical Lead. All such procurements shall be subject to the applicable requirements of QR 4.0, "Procurement Document Control;" QI 4.1, "Procurement Document Control;" QI 4.2, "External Services Control;" QR 7.0, "Control of Purchased Items and Services;" QI 7.1, "Procurement Planning and Control;" and/or QI 7.2, "Supplier Evaluation" (WHC 1989a). Whenever such services require procedural controls, requirements for use of Westinghouse Hanford procedures, or for submittal of contractor procedures for Westinghouse Hanford review and approval prior to use, shall be included in the procurement document or work order, as applicable. In addition to the submittal of analytical procedures, analytical laboratories shall be required to submit the current version of their internal QA program plans. All analytical laboratory plans and procedures shall be reviewed and approved prior to use by qualified personnel from the OSM, Westinghouse Hanford analytical laboratories organizations, or other qualified personnel. All reviewers shall be qualified under the requirements of EII 1.7, "Indoctrination, Training, and Qualification" (WHC 1989b). All participant contractor or subcontractor procedures, plans, and/or manuals shall be retained as project quality records in compliance with EII 1.6, "Records Management" (WHC 1989b); QR 17.0, "Quality Assurance

Records;" and QI 17.1, "Quality Assurance Records Control" (WHC 1989a). All such documents are available for regulatory review on request.

4.2 SAMPLING AND INVESTIGATIVE PROCEDURES

All sampling activities shall be performed in compliance with EII 5.2, "Soil and Sediment Sampling" and EII 5.13, "Drum Sampling" (WHC, 1989b). Samples shall routinely be routed to offsite analytical laboratories for chemical analyses. Additional EIIs that have been selected to support the test activity are identified in Table F-2. Sample identification requirements and container type, preparation, and preservation requirements shall be as specified in EII 5.2. All sampling equipment decontamination shall be in compliance with EII 5.5, "Decontamination of Equipment for RCRA/CERCLA Sampling" (WHC 1989b). Other procedures required to support characterization and verification activities and data interpretation will be incorporated as addenda to this QAPP, or as additional EIIs, as necessary to support the detailed requirements of the LSFF Closure Plan.

4.3 PROCEDURE ADDITIONS AND CHANGES

Additional EIIs or EII updates that may be required as a consequence of the LSFF Closure Plan requirements shall be developed in compliance with EII 1.2, "Preparation and Revision of Closure activities Instructions" (WHC 1989b). Should deviations from established EIIs be required to accommodate unforseen field situations, they may be authorized by the Field Team Leader in accordance with the requirements of EII 1.4, "Deviation from Closure activities Instructions" (WHC 1989b). Documentation, review, and disposition of instruction change authorization forms are defined within EII 1.4. Other types of document change requests shall be completed as required by the Westinghouse Hanford procedures governing their preparation and revision.

5.0 SAMPLE CUSTODY

All samples obtained during the implementation of the sampling and analysis plan shall be controlled as required by EII 5.1 "Chain of Custody," (WHC 1989) from the point of origin to the analytical laboratory. Laboratory chain of custody procedures shall be reviewed and approved as required by Westinghouse Hanford procurement control procedures as noted in Section 4.1, and shall ensure the maintenance of sample integrity and identification throughout the analytical process. At the direction of the Technical Lead, requirements for return of residual sample materials after completion of

Table F-2. Investigative Procedures for the 105-DR LSFF Sampling.

Procedure	Title[a]	Wipe sampling	Powder sampling	Soil/Gravel sampling	Core sampling
EII 1.2	Preparation and Revision of Environmental Investigation Instructions	X	X	X	X
EII 1.4	Deviation from Environmental Investigation Instructions	X	X	X	X
EII 1.5	Field Logbooks	X	X	X	X
EII 1.6	Records Management	X	X	X	X
EII 1.7	Indoctrination, Training, and Qualification	X	X	X	X
EII 1.11	Control and Transmittal of Laboratory Analytical Data	X	X	X	X
EII 2.1	Preparation of Health and Safety Plans	X	X	X	X
EII 2.3	Administration of Radiation Surveys to Support Environmental Characterization Work on the Hanford Site	X	X	X	X
EII 3.1	User Calibration of Health and Safety M&TE	X	X	X	X
EII 5.0	Sample Identification and Entry Into the HEIS	X	X	X	X
EII 5.1	Chain of Custody	X	X	X	X
EII 5.2	Soil and Sediment Sampling			X	
EII 5.5	Decontamination of Equipment for RCRA/CERCLA		X	X	X
EII 5.11	Sample Packaging and Shipping	X	X	X	X
EII 5.13	Drum Sampling	X	X	X	X
TBD	Concrete/Asphalt Core Sampling				X
TBD	Wipe Sampling	X			

[a]Procedures are Westinghouse Hanford Closure activities Instructions (EIIs) selected from the latest approved version of WHC-CM-7-7, *Closure activities and Site Characterization Manual*.

analysis shall be defined in maintenance of sample integrity and identification throughout the analytical process. At the direction of the Technical Lead, requirements for return of residual sample materials after completion of analysis shall be defined in accordance with those procedures defined in the procurement documentation to subcontractor or participant contractor laboratories. Chain of custody forms shall be initiated for returned residual samples as required by the approved procedures applicable within the participating laboratory. Results of analyses shall be traceable to original samples through a unique code or identifier documented in the field logbook. All results of analyses shall be controlled as permanent project quality records as required by QR 17.0, "Quality Assurance Records" (WHC 1989a) and EII 1.6, "Records Management" (WHC 1989b).

6.0 CALIBRATION PROCEDURES

Calibration of all Westinghouse Hanford measuring and test equipment, whether in existing inventory or purchased for this investigation, shall be controlled as required by QR 12.0, "Control of Measuring and Test Equipment;" QI 12.1, "Acquisition and Calibration of Portable Measuring and Test Equipment" (WHC 1989a); QI 12.2, "Measuring and Test Equipment Calibration by User" (WHC 1989a); and/or EII 3.1, "User Calibration of Health and Safety Measuring and Test Equipment" (WHC 1989b). Routine operational checks for Westinghouse Hanford field equipment shall be as defined within applicable EIIs or procedures; similar information shall be provided in Westinghouse Hanford-approved participant contractor or subcontractor procedures.

Calibration of Westinghouse Hanford, participant contractor, or subcontractor laboratory analytical equipment shall be as defined by applicable standard analytical methods, subject to Westinghouse Hanford review and approval.

7.0 ANALYTICAL PROCEDURES

Analytical methods or procedures, based on the reference methods identified in Table F-1 and Section 3.0, shall be selected or developed and approved before use in compliance with appropriate Westinghouse Hanford procedure and/or procurement control requirements as noted in Section 4.1.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 DATA REDUCTION AND DATA PACKAGE PREPARATION

All analytical laboratories shall be responsible for preparing a report summarizing the results of analysis and for preparing a detailed data package that includes all information necessary to perform data validation to the extent indicated by the minimum requirements of Section 8.2 below. Data summary report format and data package content shall be defined in procurement documentation subject to Westinghouse Hanford review and approval as noted in Section 4.1 above. At a minimum, laboratory data packages shall include the following:

- Sample receipt and tracking documentation, including identification of the organization and individuals performing the analysis, the names and signatures of the responsible analysts, sample holding time requirements, references to applicable chain of custody procedures, and the dates of sample receipt, extraction, and analysis;

- Instrument calibration documentation, including equipment type and model, with continuing calibration data for the time period in which the analysis was performed;

- Quality control data, as appropriate for the methods used, including matrix spike/matrix spike duplicate data, recovery percentages, precision data, laboratory blank data, and identification of any nonconformances that may have affected the laboratory's measurement system during the time period in which the analysis was performed; and,

- The analytical results or data deliverables, including reduced data, reduction formulas or algorithms, and identification of data outliers or deficiencies.

Other supporting information, such as initial calibration data, reconstructed ion chromatographs, spectrograms, traffic reports, and raw data, need not be included in the submittal of individual data packages unless specifically requested. All sample data, however, shall be retained by the analytical laboratory and made available for systems or program audit purposes upon request by Westinghouse Hanford, DOE-RL, or regulatory agency representatives; see Section 10.0 below. Such data shall be retained by the analytical laboratory through the duration of their contractual statement of work, at which point it shall be turned over to Westinghouse Hanford for archiving.

The completed data package shall be reviewed and approved by the analytical laboratory's QA Manager prior to submittal to OSM for validation as discussed in Section 8.2. The requirements of this section shall be included in procurement documentation or work orders, as appropriate, in compliance with the standard Westinghouse Hanford procurement control procedures referenced in Section 4.1 above.

8.2 VALIDATION

Validation of the completed data package shall be performed by qualified Westinghouse Hanford OSM personnel. Validation requirements will be defined within approved OSM data validation procedures, but at a minimum will include the requirements defined within this section.

For inorganic analyses, validation reports shall be prepared documenting overchecks of the following areas, as recommended in *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (EPA 1988b):

- Data summary narrative
- Sample holding times
- Continuing calibration requirements
- Method blank sample requirements
- Interference check sample requirements
- Laboratory control sample requirements
- Duplicate sample analysis
- Matrix spike sample requirements
- Atomic absorption quality control requirements
- Inductively coupled plasma serial dilution requirements
- Overall data assessment requirements.

8.3 FINAL REVIEW AND RECORDS MANAGEMENT CONSIDERATIONS

All validation reports and supporting analytical data packages shall be subjected to a final technical review by a qualified reviewer prior to submittal to regulatory agencies or inclusion in reports or technical memoranda. All validation reports, data packages, and review comments shall be retained as permanent project quality records in compliance with EII 1.6, "Records Management" (WHC 1989b) and QA 17.0, "Quality Assurance Records" (WHC 1989a).

9.0 INTERNAL QUALITY CONTROL

All analytical samples shall be subject to in-process quality control measures in both the field and laboratory. Unless superseded by specific directions provided in Section 7.0 of the Closure Plan, the following minimum field quality control requirements apply. These requirements are adapted from "*Test Methods for Evaluating Solid Waste*" (SW-846) (EPA 1986a), as modified by the proposed rule changes included in the "*Federal Register,*" Volume 54, No. 13 (EPA 1989b).

- Field duplicate samples. For each shift of sampling activity under an individual sampling subtask, a minimum of 5% of the total collected samples shall be duplicated, or one duplicate shall be collected for every 20 samples, whichever is greater. Duplicate samples shall be retrieved from the same sampling location using the same equipment and sampling technique, and shall be placed into two identically prepared and preserved containers. All field duplicates shall be analyzed independently as an indication of gross errors in sampling techniques.

- Split samples. At the Technical Lead's direction, field or field duplicate samples may be split in the field and sent to an alternative laboratory as a performance audit of the primary laboratory. Frequency shall meet the minimum schedule requirements of Section 10.0 below.

- Blind samples. At the Technical Lead's direction, blind reference samples may be introduced into any sampling round as a performance and audit of the primary laboratory. Blind sample type shall be as directed by the Technical Lead.

- Field blanks. Field blanks shall consist of pure deionized distilled water, transferred into a sample container at the site and preserved with the reagent specified for the analytes of interest. Field blanks are used as a check on reagent and environmental contamination, and shall be collected at the same frequency as field duplicate samples.

- Equipment blanks. Equipment blanks shall consist of pure deionized distilled water washed through decontaminated sampling equipment and placed in containers identical to those used for actual field samples. Equipment blanks are used to verify the adequacy of sampling equipment decontamination procedures, and shall be collected at the same frequency as field duplicate samples.

The internal quality control checks performed by analytical laboratories laboratory analyses shall meet the following minimum requirements:

- Matrix spiked and matrix spiked duplicate samples. Matrix spiked and matrix spiked duplicate samples require the addition of a known quantity of a representative analyte of interest to the sample as a measure of recovery percentage. The spike shall be made in a replicate of a field sample. Replicate samples are separate aliquots removed from the same sample container in the laboratory. Spike compound selection, quantities, and concentrations shall be described in the laboratory's analytical procedures. One sample shall be spiked per analytical batch, or once every 20 samples whichever is greater.

- Quality control reference samples. A quality control reference sample shall be prepared from an independent standard at a concentration other than that used for calibration, but within the calibration range. Reference samples are required as an independent check on analytical technique and methodology, and shall be run with every analytical batch, or every 20 samples, whichever is greater.

Other requirements specific to laboratory analytical equipment calibration are included in Section 6.0. The minimum requirements of this section shall be invoked in procurement documents or work orders in compliance with standard Westinghouse Hanford procedures as noted in Section 4.1 above.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audit requirements are implemented in accordance with standard operating procedure QI 10.4, "Surveillance" (WHC 1989). Surveillances will be performed regularly throughout the course of the work plan activities. Additional performance and system 'surveillances' may be scheduled as a consequence of corrective action requirements, or may be performed upon request. All quality affecting activities are subject to surveillance.

All aspects of interoperable unit activities also will be evaluated as part of routine environmental restoration program-wide QA audits under the standard operating procedural requirements of WHC-CM-4-2 (WHC 1989). Program audits shall be conducted in accordance with QR 18.0. "Audits"; QI 18.1, "Audit Programming and Scheduling"; and QI 18.2, "Planning, Performing, Reporting, and Follow-up of Quality Audits" by auditors qualified in accordance with QI 2.5, "Qualification of Quality Assurance Audit Personnel" (WHC 1989).

11.0 PREVENTIVE MAINTENANCE

All measurement and testing equipment used in the field and laboratory that directly affects the quality of the analytical data shall be subject to preventive maintenance measures that ensure minimization of measurement system downtime. Field equipment maintenance instructions shall be as defined by the approved procedures governing their use. Laboratories shall be responsible for performing or managing the maintenance of their analytical equipment; maintenance requirements, spare parts lists, and instructions shall be included in individual methods or in laboratory QA plans, subject to Westinghouse Hanford review and approval. When samples are analyzed using EPA reference methods, the requirements for preventive maintenance of laboratory analytical equipment as defined by the reference method shall apply.

12.0 DATA ASSESSMENT PROCEDURES

Test data from this investigation will be assessed as required by Section 7.0 of the Closure Plan. Analytical data shall first be compiled and summarized by the laboratory and validated in compliance with approved OSM procedures meeting all minimum requirements of Section 8.0 above.

13.0 CORRECTIVE ACTION

Corrective action requests required as a result of surveillance reports, nonconformance reports, or audit activity shall be documented and dispositioned as required by QR 16,0, "Corrective Action;" QI 16.1, "Trending/Trend Analysis;" and QI 16.2, Corrective Action Reporting," (WHC 1989a). Primary responsibilities for corrective action resolution are assigned to the Technical Lead and the QA Coordinator. Other measurement systems, procedures, or plan corrections that may be required as a result of routine review processes shall be resolved as required by governing procedures or shall be referred to the Technical Lead for resolution. Copies of all surveillance, nonconformance, audit, and corrective action documentation shall be routed to the project QA records upon completion or closure.

14.0 QUALITY ASSURANCE REPORTS

As previously stated in Sections 10.0 and 13.0, project activities shall be regularly assessed by auditing and surveillance processes. Surveillance, nonconformance, audit, and corrective action documentation shall be routed to the project quality records upon completion or closure of the activity. A report summarizing all audit, surveillance, and instruction change authorization activity (see Section 4.4), as well as any associated corrective actions, shall be prepared by the QA Coordinator at the completion of the activity or annually beginning 1 year after approval of the Closure Plan, whichever is sooner. The report(s) shall be submitted to the Technical Lead for incorporation into the final report prepared at the end of the Closure Activities. The final report shall include an assessment of the overall adequacy of the total measurement system with regard to the data quality objectives of the investigation.

15.0 REFERENCES

WHC, 1989, *Westinghouse Hanford Company Quality Assurance Manual*, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington.

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