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DOE/RL-90-25
Revision 2
03/27/95

UC-630, 721

# 105-DR Large Sodium Fire Facility Closure Plan

Date Published
March 1995

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

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1. General Comments - Table 7-2 states that at least one samples will be taken from each of the listed sampling locations. For sound sampling practices, at least two samples should be collected from each of the listed points. Under most circumstances more samples are desirable, but due to the limited amount of contamination at this facility, combined with the low hazard presented by it, two samples will be sufficient.

Several major areas of the facility will be closed in conjunction with either a RCRA past practice unit, CERCLA operable unit, or 105-DR reactor D&D. However, there is no mention made in the closure plan as to how these portions of the facility will be monitored and secured during the interim. A section should be added to chapters 6 and 7 that outlines the activities that will occur during this interim period. For example, when the gravel scrubber is removed and disposed, how will the access to the tunnel be closed to prevent intrusion by either humans, animal life, rainwater, etc.? What steps will be taken to protect human health and the environment while these portions are held for later remediation?

WHC RESPONSE: Table 7-2 has been removed from closure plan due to the small number of samples (two soil samples) to be taken at the 105-DR LSFF. A summary of sampling numbers has been added to Section 7.3 to replace Table 7-2. Agreements reached with Ecology through Unit Manager Meetings allowed the use of approved treatment standards to remove wastes associated with the LSFF, which resulted in decreasing the total number of samples needed at 105-DR LSFF.

See revised Sections 6.1.1, 6.4 and 7.3 for text added on integration of interim activities.

The 105-DR reactor is managed by the Environmental Restoration Operations group (ERO), where as the LSFF is managed by Fast Flux Test Facility/Fuels and Materials Examination Facility (FFTF/FMEF) programs. Actual maintenance inspections are contracted out to BHI D&D. Maintenance inspections and radiological inspections are required every 6 months. Structural and maintenance inspections are both conducted by walking through the facility and checking a regular list of items, such as lighting, doors, wall and roof integrity (no leaks, etc.), and so on. The radiological survey consists of the Health Physics Technicians (HPT) surveying the building with specific procedures and

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the Radiation Work Procedure (RWP) to make sure it remains within the required boundaries. See revised Section 6.4 for exact wording of additional text.

These tunnels are currently isolated by steel plates so no connection can be made between the two sides of the building. See revised Section 7.3 for exact wording of additional text.

2. Page 2-1, line 29 - The units of measure given in this sentence do not make sense. The text is describing a cubicle, but the measurements are given in square feet. Judging by the numbers presented it should be cubic feet (3,743 square feet in area is larger than the entire 105-DR large fire room). Correct the measurements and units.

   **WHC RESPONSE: Correction has been made, units changed from area to volume.**

3. Page 2-1, line 35 - This line appears to have the same problem (i.e, volume presented as square feet). Correct the measurements and units.

   **WHC RESPONSE: Correction has been made, units change from area to volume.**

4. Page 6-1, line 43 - Health-based levels are discussed. The health-based cleanup levels will be determined by using the Model Toxics Control Act (MTCA), method A or method B process, as referenced by WAC 173-303. Reference doses for carcinogens under MTCA are derived from the IRIS database.

   **WHC RESPONSE: MTCA method B levels is referenced. See modified Section 6.1.1.**

5. Page 7-2, line 46 - For each of the two fire rooms and the exhaust fan room, add two authoritative samples of visible deposits on the walls, floor, or ceiling. It is possible, even likely that random sampling will miss the obvious areas with the visible contamination on them. Authoritative sample points will be decided by the sampling team during sampling.

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**WHC RESPONSE: Agreements reached with Ecology through Unit Manager Meetings has allowed the use of approved decontamination techniques for equipment and structures instead of sampling. See revised Section 7.3 for changes in decontamination and sample strategy.**

6. Page 7-3, line 40 - The water released to the 116-DR-8 crib is reported to have been below the pH level of 12.5. Are there documents that verify this? If there are, then an argument could be made that this crib did not receive wastes from the 105-DR facility, and therefore does not need to be considered within this closure plan. Please provide any documentation of the pH levels, as well as any other chemical data, of waste water released to the crib as early as possible.

**WHC RESPONSE: The logbook for 116-DR-8 crib has been referenced in the 105-DR LSFF Closure Plan, but will not be part of the closure plan. A copy of the logbook has been added to the Administrative record for 105-DR LSFF.**

7. Page 7-4, line 2 - At least two samples should be taken from the soil, based on best sampling practices. The samples should be analyzed for total sodium and lithium at least, if not the Target Analyte List (TAL). These levels will be compared to sitewide background levels for statistically elevated levels of these two constituents.

**WHC RESPONSE: Agreements reached with Ecology through Unit Manager Meetings has allowed the use of approved decontamination techniques for equipment and structures instead of sampling. See revised Section 7.3 for changes in decontamination and sampling strategy.**

8. Page 7-4, line 42 - This statement is unclear. Is it intended to state that all sampling events will be appropriately documented, and that any changes to the sampling plan will also be noted? Please clarify this section.

**WHC RESPONSE: This statement has been revised. New text reads as follows: "As sampling activities occur, a logbook will be maintained to document all sampling activities. This will include actual sampling locations, number of samples, specific methods as well as any changes that may have occurred during the sampling exercise".**

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9. Page 7-5, line 33 - This line states that sampling times in SW-846 will be used as goals. The requirements in SW-846 must be adhered to in order to make the analyses valid. This section must be reworded to reflect the SW-846 requirements.

**WHC RESPONSE: The phrase "as goals" has been removed from sentence.**

10. Page 7-6, line 24 - Specify test method for lithium?

**WHC RESPONSE: The test method to be used for analyzing lithium is as an ICP metal, method 6010 in accordance with SW-846. This method had been added to the closure plan.**

11. Page 7-6, line 46 - Add to this sentence: "...or the Unit Managers believe that a constituent may exceed the TCLP limits."

**WHC RESPONSE: Due to Ecology approved changes in sampling strategy this text has been deleted. See revised sampling strategy in Section 7.3.**

12. Page 7-7, line 5 - This sentence has a typo. Change the word <u>detection</u> to <u>designation</u>.

**WHC RESPONSE: Due to Ecology approved changes in sampling strategy this text has been deleted. See revised sampling strategy in Section 7.3.**

13. Page 7-9, line 45 - There is a reference here to WAC 173-303-075. This appears to be in error. The reference should be to WAC 173-303-180 and -190 (Manifest and Preparing dangerous waste for transport, respectively).

**WHC RESPONSE: Reference has been corrected to read WAC 173-303-180 & -190.**

14. Page 7-10, line 34 - How will the rinsate be disposed? Provide the various disposal scenarios for the rinsate, depending on the designation status.

**WHC RESPONSE: The rinsate will be placed in drums and analyzed to determine proper designation for disposal as the closure plans states. It is probable that the rinsate will be treated as a radioactive, hazardous liquid. Such rinsate would probably be sent to Tank**

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**Farms, where it is analyzed for specific hazardous constituents and then processed accordingly. See revised Section 7.3 for exact text.**

15. Page 7-11, line 4 - This section should include partial closure, in addition to final closure.

    **WHC RESPONSE: Partial closure has been included.**

16. Page 7-11, line 27 - Ecology must receive a copy of the survey plat as well.

    WHC RESPONSE: Ecology has been added to receive a copy of the survey plat.

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# STATE ENVIRONMENTAL POLICY ACT
# ENVIRONMENTAL CHECKLIST FORMS

FOR

# 105-DR LARGE SODIUM FIRE FACILITY CLOSURE

REVISION 1

May, 1993

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

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# A. BACKGROUND

**1. Name of proposed project, if applicable:**

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 only to 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 Office (DOE-RL) and Westinghouse Hanford Company (Westinghouse Hanford).

**3. Address and phone number of applicants and contact persons:**

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:

J. E. Rasmussen, Acting Program Manager
Office of Environmental Assurance,
Permits, and Policy
(509) 376-2247

R. E. Lerch, Deputy Director
Restoration and Remediation
(509) 376-5556

**4. Date checklist prepared:**

May 10, 1993

**5. Agency requesting the checklist:**

Washington State
Department of Ecology
P.O. Box 47600
Olympia, Washington 98504-7600

**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) Practice Operable Unit 100-DR-2. Decommissioning activities will be conducted in accordance

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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 final surplus production reactor decommissioning EIS (DOE 1992; 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 U.S. 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.

Final Environmental Impact Statement - *Decommissioning of Eight Surplus Production Reactors at the Hanford Site*, Richland, Washington DOE/EIS-0119D, U.S. Department of Energy, 1992, Washington, D.C.

General information concerning the Hanford Facility environment can be found in the *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Revision 5, December 1992. This document is updated annually by Pacific Northwest Laboratory, and provides current information concerning climate and meteorology; ecology; history and archeology; socioeconomic; land use and noise levels; and geology and hydrology. This baseline data for the Hanford Site and its past activities are useful for evaluating proposed activities and their potential environmental impacts.

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

No applications to government agencies are known to be pending.

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

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Ecology is the lead regulatory 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 brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.**

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 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, an exhaust gravel scrubber, and office space directly connected to the 105-DR Reactor.

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, soil and gravel 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. **Location of the proposal. Give sufficient information for a person to understand the precise location of your 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. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.**

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

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105-DR LSFF is connected to the 105-DR Reactor. It is in the W 1/2, NW 1/4, section T14N, R26E. A location map and site plans are included in the closure plan.

TO BE COMPLETED BY APPLICANT

EVALUATIONS FOR AGENCY USE ONLY

## B. ENVIRONMENTAL ELEMENTS

### 1. Earth

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other_____.

Flat.

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

The approximate slope of the land is less than 2 percent.

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

Soil types consist mainly of eolian and fluvial sands and gravel. More detailed information concerning specific soil classifications can be found in the *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Revision 5, December 1992. Farming is not permitted on the Hanford Facility.

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 source of fill.

No filling or grading is required.

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

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No.

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

Not applicable. No construction would occur.

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

Not applicable. Earth would not be disturbed.

2. Air

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 would 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?

Good engineering practices would be followed, and actions would comply with onsite procedures designed to protect the environment and worker safety and health.

3. Water

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.

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There is no surface water body on or in the immediate vicinity of the 105-DR LSFF. However, the Columbia River is approximately 0.75 mile (1.2 kilometer) away. No perennial streams originate within the Columbia Plateau.

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

The work would not require any activity in or near the described waters.

**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. There would be no dredging or filling.

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

The water supply for the 100-D Area is pumped from the Columbia River. The 105-DR LSFF closure activities would use insignificant amounts of this overall withdrawal.

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

The 105-DR LSFF is not within the 100 year floodplain (*Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Revision 5, December 1992).

**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

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

No groundwater would be withdrawn in support of this project, and water would not be discharged to the aquifer.

2) **Describe waste material that will be discharged into the ground from septic 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.**

Sanitary waste from the 105-DR LSFF is discharged to the 105-D Area sanitary trench. Closure of the 105-DR LSFF will not impact the existing sanitary waste sewer system.

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

1) **Describe the source of run-off (including storm water) and method 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 Facility receives only 6 to 7 inches (15.2 to 17.8 centimeters) of annual precipitation. Precipitation runs off the existing buildings and seeps into the soil on and near the buildings. This precipitation does not reach the groundwater or surface waters.

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

Waste materials would not enter ground or surface waters. All waste materials would be contained.

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

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No surface, ground, or run-off water impacts are expected.

4. Plants

a. Check or circle the types of vegetation found on the site.

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

The most common vegetation community in the 100-D Area is the sagebrush/cheatgrass or Sandberg's bluegrass. Native vegetation in the immediate vicinity of the 105-DR LSFF has been eradicated.

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

No native vegetation alteration would occur.

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

The 105-DR LSFF is located within a previously disturbed area that has been heavily industrialized since the mid 1940's, and biological survey personnel indicate that no sensitive species occur in the general vicinity.

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

Not applicable.

5. Animals

a. Indicate (by underlining) 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,

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other:.....
mammals: deer, bear, elk, beaver,
other:.....
fish: bass, salmon, trout, herring, shellfish,
other:.....

Raptors (burrowing owls, ferruginous, redtail, and Swainson's hawks) are rarely seen in the 100-D Area Area. Small passerines (sparrows, finches) are present in the general vicinity of the 105-DR LSFF. Rabbits and coyotes occasionally are seen in the general area.

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

Two federal and state listed threatened or endangered species have been identified on the Hanford Site along the Columbia River; the bald eagle and peregrine falcon. In addition, the state listed white pelican, sandhill crane, and ferruginous hawk also occur on or migrate through the Hanford Site. Of these five species, none is likely to use the shrub-steppe habitat of the 100-D Area.

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

The Hanford Site is a part of the broad Pacific Flyway.

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

This project contains no specific measures to preserve or enhance wildlife.

## 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 is used at the 105-DR LSFF for heating, lighting, and other power needs.

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

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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:**

Energy consumption is not anticipated to be significant, and energy conservation features are not easily applicable to the 105-DR LSFF closure.

## 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.**

Possible environmental health hazards to workers could arise from activities at the 105-DR LSFF. The hazard could come from exposure to dangerous, radioactive, and/or mixed waste. Stringent administrative controls and engineered barriers are employed to minimize the probability of even a minor incident and/or accident. A chemical spill, release, fire, or explosion could occur only as a result of a simultaneous breakdown in multiple barriers or a catastrophic natural forces event.

**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. Hanford Site emergency services personnel are specially trained to manage a variety of circumstances involving chemical and/or radioactive constituents and situations.

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

All personnel are trained to follow proper procedures during the storage and treatment operations to minimize potential exposure. The 105-DR LSFF has systems for ventilation, fire protection, and alarm capability.

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Chemical safety hazards would be mitigated by preventing direct contact with the residual chemical constituents. Protective clothing, appropriate training, and respiratory protection would be used by onsite personnel as necessary.

b. Noise

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

Equipment noise in the vicinity, it is not expected to affect personnel at the 105-DR LSFF.

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.**

Noise from some operations (e.g., sand-blasting) is expected.

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

If Occupational Safety and Health Administration noise standards are exceeded, appropriate measures to protect workers would be employed.

8. Land and Shoreline Use

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

The Hanford Site houses reactors, chemical separation systems, waste management facilities, and related facilities that have been used for the production of special nuclear materials. Other scientific and engineering programs are also carried out. Lands north and east of the Columbia River are public lands, including river lands, and wildlife preserves or are used for farming. Some lands contiguous to or surrounded by the Hanford Site are owned by the Bonneville Power Administration, or leased to the Washington

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Public Power Supply System, or are owned by or leased to the state of Washington.

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

No portion of the 100-D Area Area has been used for agricultural purposes since 1943, if ever.

**c. Describe any structures on the site.**

The facility consists of three fire rooms, a Sodium Handling Room, the Supply fan room, the gravel scrubber, and the office space directly connected to the 105-DR Reactor.

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

No.

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

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

**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 Hanford Site may be used for "activities nuclear in nature". Nonnuclear 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.**

The entire Hanford Site was designated a National Environmental Research Park in 1977, for use as an outdoor laboratory for ecological research. However, the 100-D Area is fenced and is a

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previously disturbed industrial area with little or no environmental significance.

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

Approximately 10 people would work at the 105-DR LSFF closure.

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.

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:**

None.

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?**

No construction would take place.

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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?

Not applicable.

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:

None.

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.

No.

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

None.

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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.**

The White Bluffs road is considered eligible for the National Register of Historic Places. This road is about 5 miles (8 kilometers) from the 105-DR LSFF. Additional information concerning Hanford Site cultural resources can be found in *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Revision 5, December 1992.

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 landmarks or evidence of historic, archaeological, scientific, or cultural importance at the 105-DR LSFF.

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

Where appropriate, a cultural resource review would provide the vehicle for necessary approvals required under the *National Historic Preservation Act of 1966*.

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.**

Not applicable to the proposed project.

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

The 105-DR LSFF is not accessible to the public and is not served by public transit.

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

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Not applicable to the proposed project.

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.

Traffic and parking would not change from existing traffic patterns.

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

Not necessary.

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.

Not applicable to the proposed project.

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

Not applicable to the proposed project.

16. Utilities

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

Electricity, potable water, steam, refuse service, telephone, and a septic system are available in the 100-D Area.

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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 proposed. No construction.

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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.

James E. Rasmussen — 6/24/93

James E. Rasmussen, Acting Program Manager — Date
Office of Environmental Assurance,
Permits, and Policy
U.S. Department of Energy
Richland Operations Office
Richland, Washington
(509) 376-2247

Ronald E. Lerch — 6-22-93

R. E. Lerch, Deputy Director — Date
Restoration and Remediation
Westinghouse Hanford Company
Richland, Washington
(509) 376-5556

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# 105-DR LARGE SODIUM FIRE FACILITY CLOSURE PLAN

## FOREWORD

The Hanford Site is owned by the U.S. Government and operated by the U.S. Department of Energy, Richland Operations Office. The Hanford Site produces and manages dangerous waste and mixed waste (containing both radioactive and dangerous components). The dangerous waste is regulated in accordance with the *Resource Conservation and Recovery Act of 1976* and the *State of Washington Hazardous Waste Management Act of 1976* (as administered through the Washington State Department of Ecology *Dangerous Waste Regulations*, Washington Administrative Code 173-303). The radioactive component of mixed waste is interpreted by the U.S. Department of Energy to be regulated under the *Atomic Energy Act of 1954*; the nonradioactive dangerous component of mixed waste is interpreted to be regulated under the *Resource Conservation and Recovery Act* and Washington Administrative Code 173-303.

For purposes of the *Resource Conservation and Recovery Act* and the Washington State Department of Ecology *Dangerous Waste Regulations*, the Hanford Site is considered to be a single facility. The single dangerous waste permit identification number issued to the Hanford Facility by the U.S. Environmental Protection Agency and the Washington State Department of Ecology is U.S. Environmental Protection Agency/State Identification Number WA7890008967. This identification number encompasses over 60 treatment, storage, and/or disposal units within the Hanford Facility.

Westinghouse Hanford Company is a major contractor to the U.S. Department of Energy, Richland Operations Office and serves as co-operator of the 105-DR Large Sodium Fire Facility, the unit addressed in this closure plan.

Westinghouse Hanford Company is identified in the closure plan as a 'co-operator' and signs in that capacity. Any identification of Westinghouse Hanford Company as an 'operator' elsewhere in this closure plan is not meant to conflict with Westinghouse Hanford Company's designation as a co-operator but rather is based on Westinghouse Hanford Company's contractual status for the U.S. Department of Energy.

The *105-DR Large Sodium Fire Facility Closure Plan* consists of a Part A Permit Application, Form 3 (Revision 2) and a closure plan. The closure plan consists of nine chapters and five appendices.

This submittal contains information current as of March 27, 1995.

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| CERCLA | *Comprehensive Environmental Response Compensation and Liability Act* |
| 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 Instruction |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| ERHP | Environmental Restoration Health Physics |
| ERO | Environmental Restoration Operations |
| FFTF | Fast Flux Test Facility |
| FMEF | Fuels and Materials Examination Facility |
| FY | fiscal year |
| HEPA | High-Efficiency Particulate Air (Filter) |
| $LD_{50}$ | lethal dose at 50 percent mortality |
| LMFBR | liquid metal fast breeder reactor |
| LSFF | Large Sodium Fire Facility |
| MSDS | Material Safety Data Sheet |
| MTCA | Model Toxics Control Act |
| QA/QC | quality assurance/quality control |
| QAPI | Quality Assurance Program Index |
| QAPjP | Quality Assurance Project Plan |
| QI | Quality Instruction |
| QR | Quality Requirement |
| RCA | Radiologically Controlled Area |
| RCRA | *Resource Conservation and Recovery Act of 1976* |
| RI/FS | remedial investigation/feasibility study |
| RFI/CMS | RCRA Facility Investigation/Corrective Measures Study |
| ROD | Record of Decision |
| TCLP | Toxicity Characteristic Leaching Procedure |
| Tri-Party Agreement | *Hanford Federal Facility Agreement and Consent Order* |
| TSD | treatment, storage, and/or disposal |
| WAC | Washington Administrative Code |
| Westinghouse Hanford | Westinghouse Hanford Company |

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1

# PART A, FORM 3

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Please print or type in the unshaded areas only.
(Shaded areas are spaced for elite type, i.e., 12 characters/inch.)

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.)

* 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)

☐ 2. NEW FACILITY (Complete item below.)

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 | PROCESS 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 |

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

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 CA

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 syster 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 handl 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 con taminants 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 appropri le 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 de sity or specific gravity of the waste.

D. **PROCESSES**

1. **PROCESS CODES:**

For listed dangerous waste: 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 th 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 I 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 Ite 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 West 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 th 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 sha ings 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 estimate 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 ar 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 | | | | | | | | |
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| 25 | | | | | | | | |
| 26 | | | | | | | | |

Continued from the front.

## IV. 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<br>Manager, Richland Operations<br>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 | | |

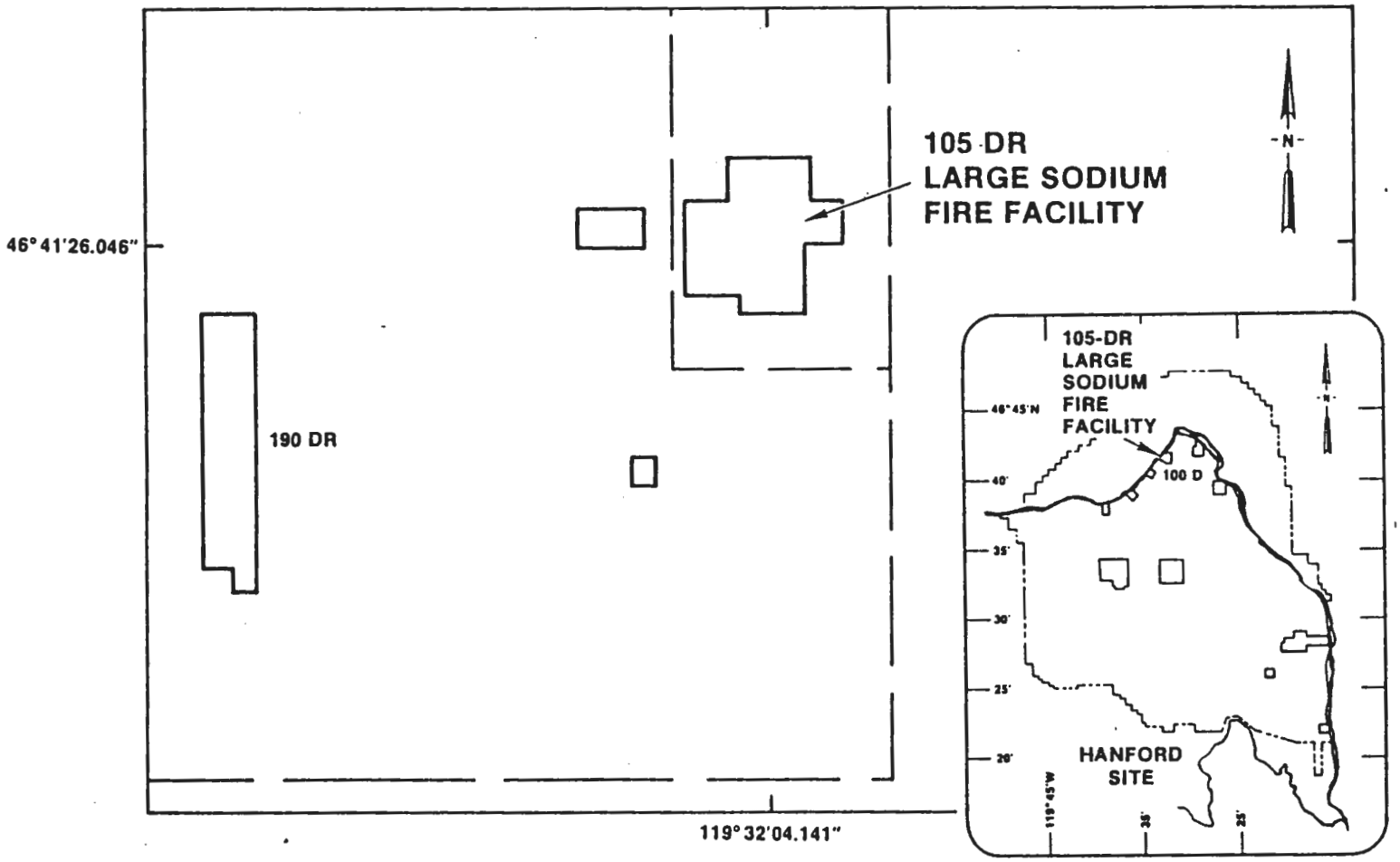
## X. OPERATOR CERTIFICATION

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 — 11-16-87
Michael J. Lawrence
Manager, Richland Operations
United States Department of Energy
Date

W.M. Jacobi — 11/16/87
William M. Jacobi
President
Westinghouse Hanford Company
Date

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




2B8707-13.55

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

46°41'26.046"
119°32'04.141"

8503045-820CN

(PHOTO TAKEN 1985)

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# 1.0 INTRODUCTION

The Hanford Site, located north of the city of Richland, Washington, houses reactors, chemical-separation systems, and related facilities used for the production of special nuclear materials, and 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 105-DR defense reactor, which was shut down in 1964.

The LSFF initially was used only for engineering-scale alkali metal reaction studies. Additionally, the Fusion Safety Support Studies program sponsored intermediate-size safety reaction tests in the LSFF with lithium and lithium lead compounds. The facility also has been used to store and treat alkali metal waste; therefore, the LSFF is subject to the regulatory requirements for the storage and treatment of dangerous waste. Closure will be conducted pursuant to the requirements of the Washington Administrative Code (WAC) 173-303-610.

This closure plan presents a description of the unit, the history of waste 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. 1994) 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.

Consistent with the Tri-Party Agreement (Ecology et al. 1994), after any dangerous waste associated with the LSFF is 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 1992).

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 (ROD) or the RFI/CMS process.

## 1.1 PERMITTING HISTORY

The RCRA Part A, Form 1, "Dangerous Waste Permit General Information" was submitted to the Washington State Department of Ecology in May 1988 and a revised Part A, Form 1 was submitted in January 1995. The revised Part A, Form 1, now consists of four pages.

As a result of storage and treatment of dangerous waste, a RCRA Part A, Form 3 and a Part B (Alkali Metal Treatment and Storage Facilities) permit application were submitted to the Washington State Department of Ecology (Ecology) in November 1985. Subsequent to the submittal of the Part B permit application, it was decided to close the LSFF under interim status. Revision 2 of the Part A permit application, Form 3 was submitted in November 1987. The Part A permit application, Form 3 was submitted under the single Dangerous Waste Permit Identification Number, WA7890008967, issued to the Hanford Facility by the U.S. Environmental Protection Agency (EPA) and Ecology. The Part A permit application, Form 3 describes the LSFF as a thermal treatment facility, subject to RCRA regulations for treatment, storage, and/or disposal (TSD) units. This closure plan is being submitted to provide site characterization information and a closure strategy for the LSFF.

## 1.2 CLOSURE PLAN CONTENTS

The LSFF closure plan consists of nine chapters.

- Introduction (Chapter 1.0)
- Unit Description (Chapter 2.0)
- Process Information (Chapter 3.0)
- Waste Characteristics (Chapter 4.0)
- Groundwater Monitoring (Chapter 5.0)
- Closure Performance Standards (Chapter 6.0)
- Closure Activities (Chapter 7.0)
- Postclosure Plan (Chapter 8.0)
- References (Chapter 9.0)

A brief description of each chapter is provided in the following sections.

### 1.2.1 Unit Description (Chapter 2.0)

This chapter provides a brief description of the Hanford Site and the location and description of the LSFF. Information on Hanford Site security also is provided.

### 1.2.2 Process Information (Chapter 3.0)

This chapter describes how the LSFF processed material and explains the overall waste treatment system.

### 1.2.3 Waste Characteristics (Chapter 4.0)

This chapter discusses the waste inventory and the characteristics of the waste that was treated at the LSFF.

### 1.2.4 Groundwater Monitoring (Chapter 5.0)

This chapter explains why groundwater monitoring will not be included in this closure plan.

### 1.2.5 Closure Performance Standards (Chapter 6.0)

This chapter discusses the closure strategy, performance standards for protection of health and the environment, and closure activities.

### 1.2.6 Closure Activities (Chapter 7.0)

This chapter discusses sampling and analysis activities for closure. A closure schedule and a certification are included.

### 1.2.7 Postclosure Plan (Chapter 8.0)

This chapter outlines provisions for postclosure care if required.

### 1.2.8 References (Chapter 9.0)

References used throughout this closure plan are listed in this chapter. All references listed here, which are not available from other sources, will be made available for review, upon request, to any regulatory agency or public commentor. References can be obtained by contacting the following.

Administrative Records Specialist
Public Access Room H6-08
Westinghouse Hanford Company
P.O. Box 1970
Richland, Washington 99352

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# 2.0 UNIT 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 1450 $km^2$ (560-$mi^2$) tract of semiarid land that is owned by the U.S. Government and operated by the U.S. Department of Energy (DOE).

## 2.2 UNIT DESCRIPTION AND OPERATIONS

The LSFF occupies the former supply fan room of the 105-DR Reactor Facility, and covers approximately 1,400 $m^2$ (15,000 $ft^2$) of floor space. 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. The 105-DR Reactor building is a nonairtight industrial structure built 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.

Alkali metal tests were conducted in three different rooms: the large fire room, the small fire room, and the exhaust fan room (Figure 2-3). Each room is 6.2 m (20.5 ft) wide, 8.2 m (27 ft) long, and 6.4 m (21 ft) high. The large fire room houses the Large Test Cell, which is a steel cubicle 110 $m^3$ (3,700 $ft^3$) in volume. There are two 25-cm (10-in) square, 0.6-cm (1/4-in) thick Pyrex* glass observation windows located in the large fire room doors. These windows are 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 14 $m^3$ (500 $ft^3$), and is pressure rated at 950 kPa (absolute) (140 $lb/in^2$). Both the Large Test Cell and the pressure vessel in the small fire room could be purged with nitrogen or argon to maintain a controlled atmosphere.

In the exhaust fan room, alkali metal reactions were conducted at atmospheric pressure. Waste alkali metals from various sources, including residuals from tests, failed equipment, and drum heals, were reacted in the exhaust fan room. The burn pans and equipment were cleaned periodically, using water as the cleaning solution. The rinsate from cleaning was collected in the sump. The liquid effluent from the cleaning operations was drained to the sump, which is a 56-cm (22-in) deep catch basin with an 46-cm by 46-cm (18-in by 18-in) opening fed by a trough 3 m (10 ft) long, 18 cm (7 in) deep, and 23 cm (9 in) wide (see lower right portion of Appendix D, Figure D-2). During unit operations, a sump pump was placed in the sump and the wash water was pumped through a hose into the sloped tunnel area that drains directly to

*Pyrex is a trademark of Corning Glass Works.

the seal pit. The pH of the rinsate was monitored and neutralized to a pH of less than 12.5 before it was discharged to the 116-DR-8 Crib (Figure 2-3). The collected liquid was neutralized with acetic acid in the 1970's. In the 1980's, the pH of the liquid rarely, if ever, exceeded 12 and therefore neutralization was usually not necessary.

Adjacent to the large fire room is the sodium handling room that serviced the large fire room with a 3,400-L (900-gal) Type-304 stainless-steel sodium batch tank and drum melters. The tank was resupplied from sodium drums that were heated to liquify the sodium, which was then discharged into the batch tank with inert gas. Other rooms provided space for office work and storage of nondangerous material. Storage areas contained primarily new materials including stainless steel tubing, small-diameter piping made of stainless and carbon steel, electrical supplies (wiring, extension cords, heaters, etc.), new process equipment, fans, blowers, metal sheeting, new light bulbs, lighting equipment, portable lights, new containers, various fire extinguishing materials, lubricating grease, and lubricating oil. The office area contained only papers, operating records, a few tools, and some small portable monitoring instruments.

The LSFF was equipped with an offgas treatment system that served the test vessels and the exhaust fan room. The overall exhaust system is shown in Figure 2-3. The exhaust route travels from the lower tunnel through the upper tunnel to underground concrete tunnels via a 25-cm (10-in) duct with a 280-$m^3$/min (10,000-$ft^3$/min) per minute blower and test filters. Steel barricades at the north end of the tunnels block air flow to and from the reactor. The system consists of a 2,800 $m^3$/min (100,000-$ft^3$/min) capacity filter building, a gravel bed exhaust scrubber (450-L/min, [120-gal/min] high-efficiency particulate air (HEPA) filters, and a 60-m [200-ft] stack 2.7-m [9-ft, 6-in] internal diameter) located next to the 105-DR Building (Figures 2-3 through 2-5). Test room ventilation rates were 0 to 280-$m^3$/min (0 to 10,000-$ft^3$/min). Only the submerged gravel bed exhaust scrubber and the ducts connecting the LSFF and the scrubber were constructed for the LSFF.

The 117-DR Filter Building (Figure 2-5) houses the exhaust air filters, while the exhaust air tunnel just upstream from the filter building contains the smoke scrubber. The building is about 18 m (59 ft) long, 12 m (39 ft) wide, and 11 m (35 ft) high. The scrubber circulating pump and the waste discharge pump are located in the filter building. The 117-DR Filter Building is below-grade and constructed from reinforced concrete. The Filter Building is located about 30 m (100 ft) from the 105-DR exhaust duct system and the 116-DR exhaust stack and is 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 2-m by 2-m (7-ft by 7-ft) concrete tunnels (Figure 2-5) to a spray scrubber and the HEPA filters before exiting through the stack. As part of a filter development program in 1982, a submerged gravel scrubber was added (instead of the underground HEPA filters) to vent the exhaust. As a result of

the new gravel scrubber construction, at the completion of tests or waste burning, the 117-DR HEPA filter building can be bypassed. 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 19,000 L (5,000 gal) of sodium, weighing 18,000 kg, (39,000 lb) that was procured for testing construction materials is stored in a tank housed in a locked 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 used to facilitate the testing program included sodium test spill tanks with capacities of 3,400 L (900 gal) at a maximum holding temperature of 650 °C (1200 °F), 38 L (10 gal) at a maximum holding temperature of 870 °C (1600 °F), and 210 L (55 gal) at a maximum holding temperature of 200 °C (400 °F). The early spill tanks were made from thick carbon steel piping, and the later tanks from stainless steel. These tanks were completely airtight, so there was no possibility for alkali metal to escape into the work rooms. Sodium test spill rates were up to 1,100 L/min (300 gal/min), while lithium test spill rates were up to 20 L/min (5 gal/min).

Testing area capabilities for the LSFF included the following:

- Alkali metal spills up to 2,000 kg (5,000 lb) at 870 °C (1600 °F) and up to 28 $m^2$ (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
- Post-accident cleanup development
- Lithium fire and reaction testing.

The Part A permit application, Form 3 allowed for the treatment and storage of up to 20,000 L (5,300 gal) of nonradioactive sodium, lithium, and sodium-potassium metal waste each year. The Part A permit application, Form 3 described the treatment of up to 100 L/day (26 gal/day) of alkali metal dangerous waste. Treatment consisted of heating the waste to the point of oxidation in the exhaust fan room. Emissions were then routed to an off-gas treatment system. The facility was used to treat alkali metal waste as needed during the operation of the testing program from 1972 to 1986.

## 2.3 SECURITY INFORMATION

The following sections describe the 24-hour surveillance system, warning signs, and barriers used to provide security and controlled access to the Hanford Facility.

The entire Hanford Facility is a controlled access area. The Hanford Facility maintains around-the-clock surveillance for protection of government property, classified information, and special nuclear materials. The Hanford Patrol maintains a continuous presence of armed guards to provide additional security.

Manned barricades are maintained around the clock at checkpoints on vehicular access roads leading to the 100 and 200 Areas (Yakima and Wye Barricades, Figure 2-1). All personnel accessing the Hanford Facility areas must have a U.S. Department of Energy-issued security identification badge indicating the appropriate authorization. Personnel also might be subject to a random search of items carried into or out of the Hanford Facility.

Signs are posted at area boundaries within the Hanford Facility stating "NO TRESPASSING. SECURITY BADGES REQUIRED BEYOND THIS POINT. VEHICLES ONLY. PUBLIC ACCESS PROHIBITED" (or an equivalent legend).

In addition, warning signs stating "DANGER--UNAUTHORIZED PERSONNEL KEEP OUT" (or an equivalent legend) are posted at TSD units within the Hanford Facility. These signs are written in English, legible from a distance of 7.6 m (25 ft), and visible from all angles of approach.

LSFF is locked around the clock and only authorized plant operations personnel have access. A 76-cm (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 1.5-m- (5-ft)-wide by 2.4-m- (8-ft)-high doorway through this wall is closed by an existing locked steel door and a new wall of 20-cm (8-in) concrete blocks. Two other entries to the reactor portion of 105-DR have been sealed by concrete blocks. One entry area through steel panels is sealed by a steel plate welded over the opening.

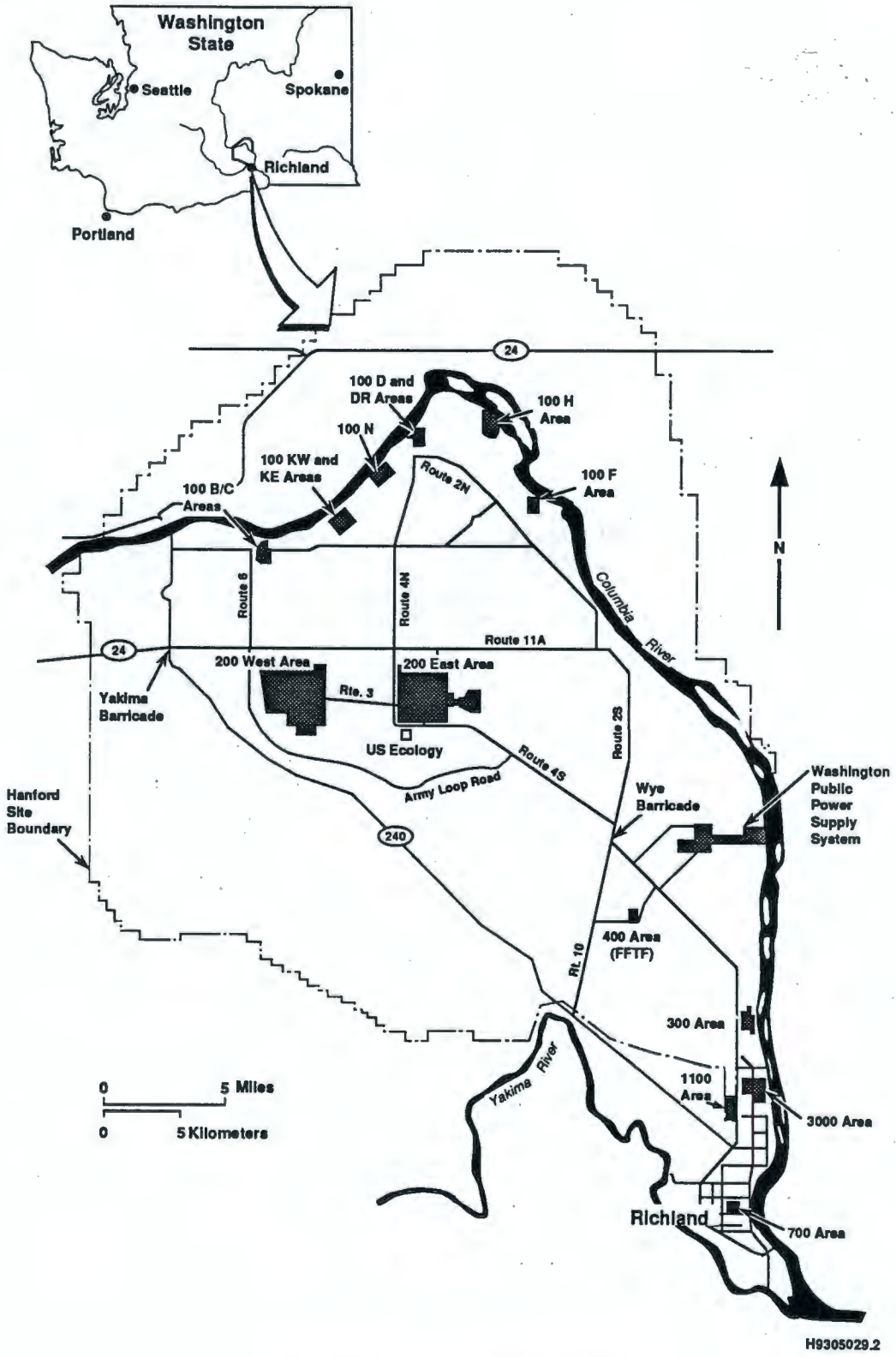


Figure 2-1. Hanford Site.

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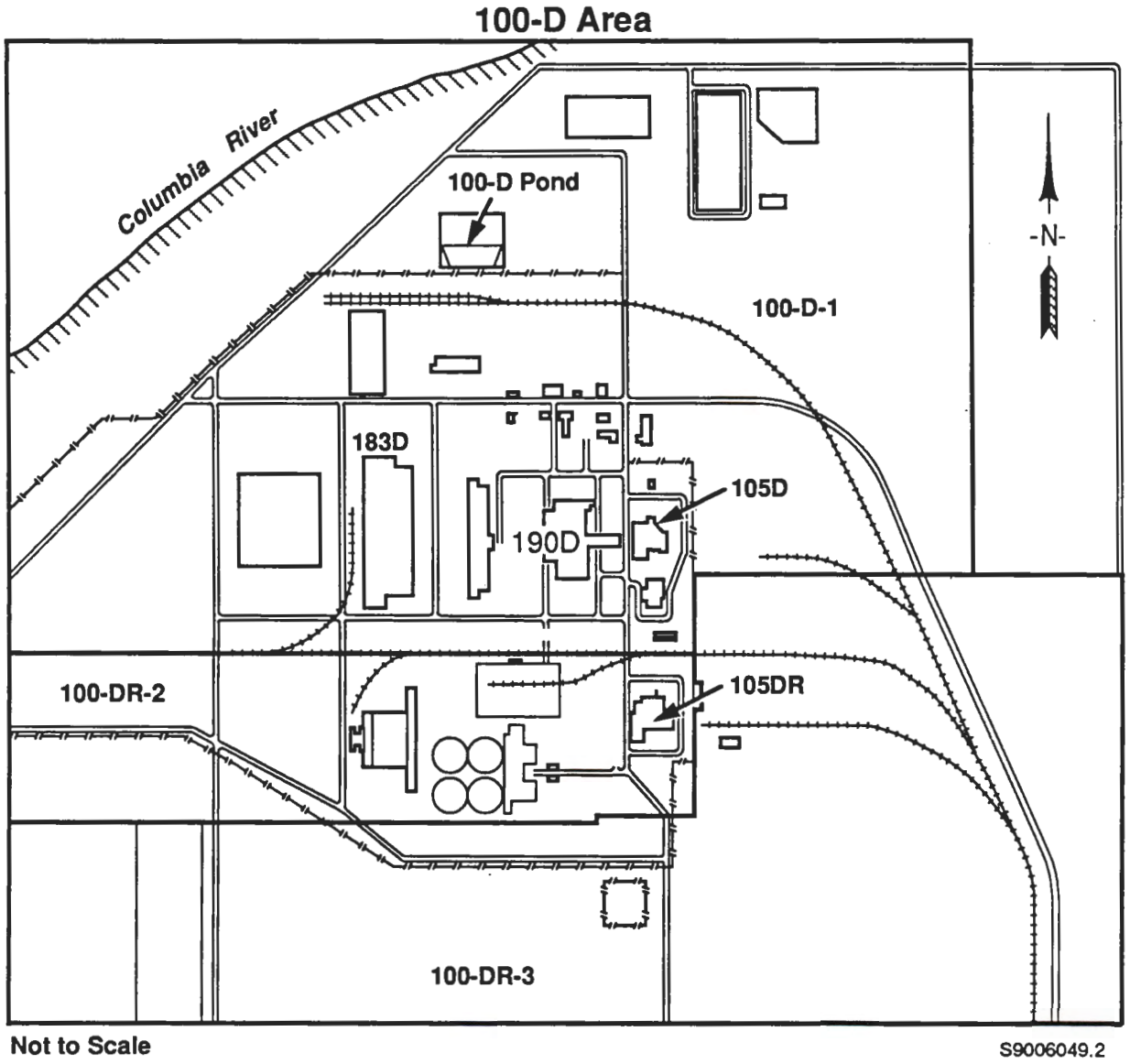


Figure 2-2. The 100-D Area of the Hanford Site.

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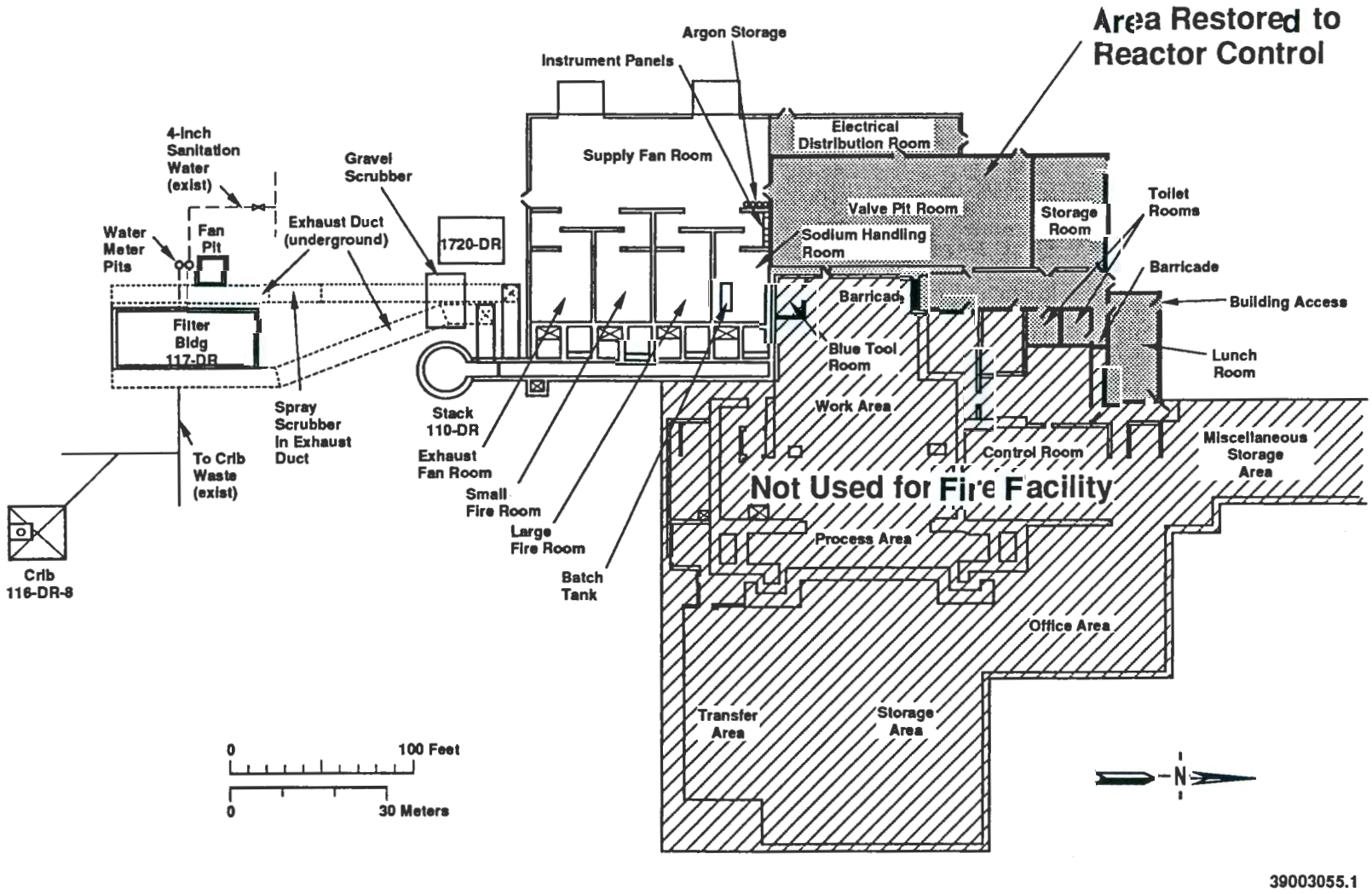


Figure 2-3. A Schematic of 105-DR Reactor Building Including the Large Sodium Fire Facility.

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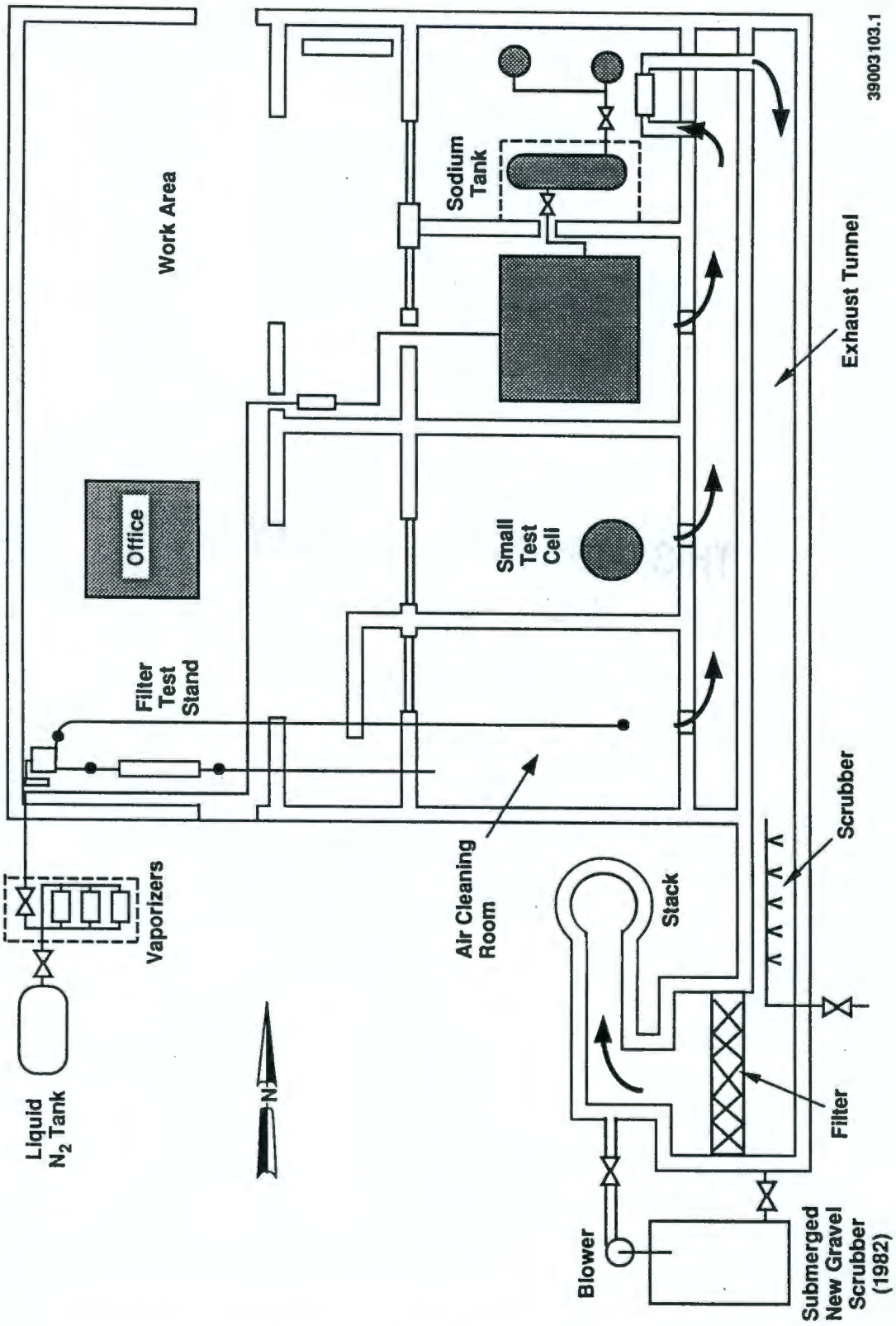


Figure 2-4. A Schematic of the Overall Large Sodium Fire Facility Exhaust System.

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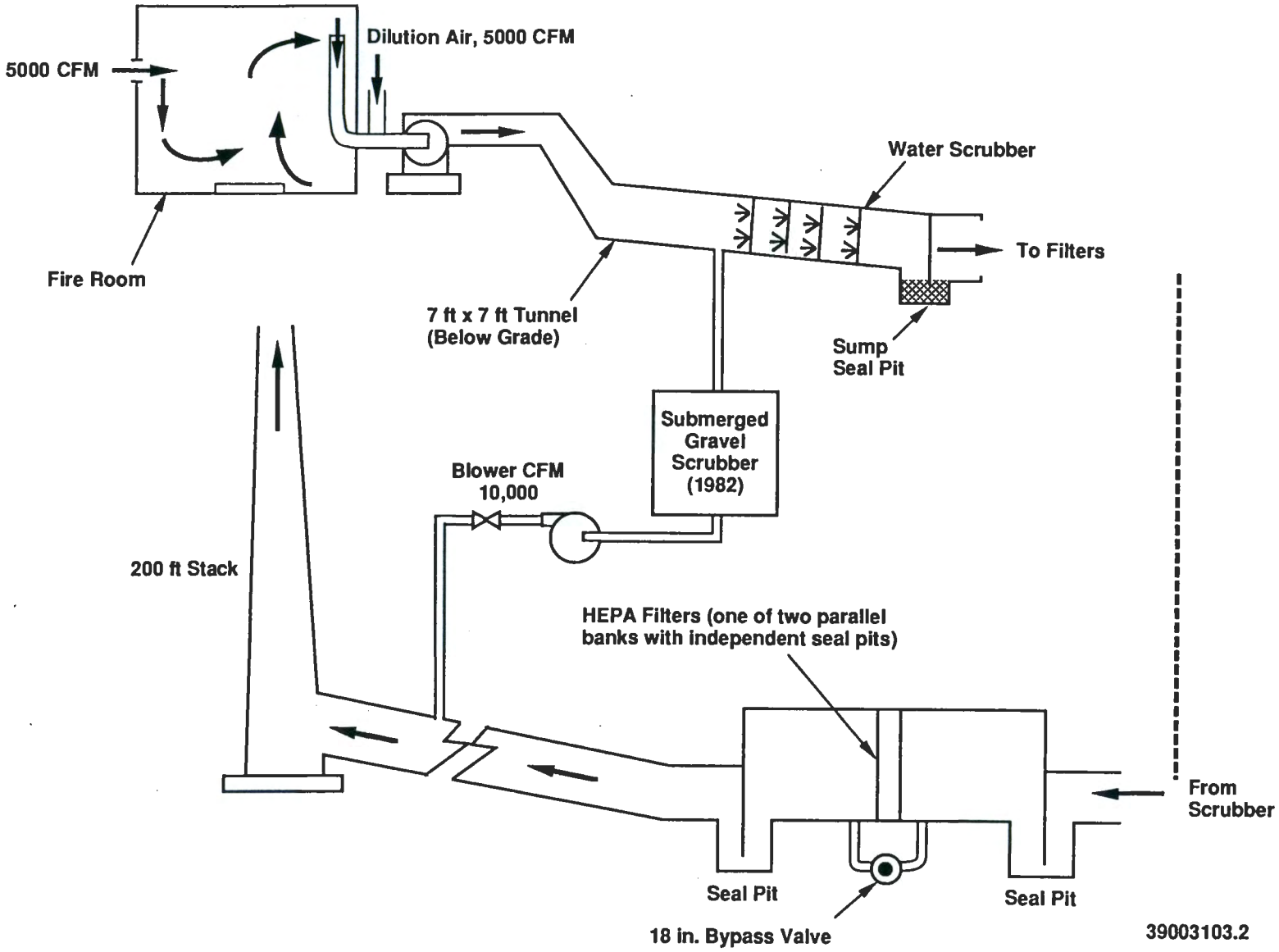


Figure 2-5. A Schematic of the 117-DR Filter Building Exhaust System.

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## TABLE

3-1. Radioactivity in Waste Samples . . . . . T3-1

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# 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 waste generated at the facility includes 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 (DOE 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 as follows:

- 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

- 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

- Generation of aerosols to be used for testing and measurement of air-cleaning filter and scrubber performance and for evaluating hydrogen ignition characteristics

- Production of fire and smoke to test alkali metal fire extinguishing methods and equipment, to test protective equipment, and for training in equipment use

- Testing of purchased lithium-lead alloy reaction rates and aerosol formation in various atmospheres

- Development tests using cesium and zinc metal to demonstrate aerosol generation techniques

- Thermal treatment of sodium residue (sodium waste) 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. The dangerous waste shipment records indicate that the lithium-lead alloy was

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*Kaylo is a trademark of Owens Corning.

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

disposed of in two 200-kg (440-lb) masses which were 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 waste treated in the facility was 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 (DOE 1985, pp. D-20 and F-11). Wash water from the cleanup was collected in the sump and monitored for corrosivity. The sump was pumped via a sump pump and hose to the tunnel bed which drains directly to the seal pit. The water was collected in the seal pit, monitored for pH, neutralized if needed, and then pumped from the seal pit 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 A. While the analytical results for lithium and carbonates were expected, the total lead concentration in some of the samples was higher than expected (the highest concentration, from a concrete scraping, was 1,300 parts per million). The lithium-lead alloy was reacted in the small fire room, inside a closed containment pressure vessel. The varying lead concentrations in the samples from different locations [low concentration in the small fire room; higher concentration in the exhaust fan room upwind of the tests; very low concentration in the tunnel immediately downwind of the tests; and the highest concentration in scrapings near the wall constructed between the tunnel and rest of the reactor (see Appendix A)] indicate that the lead may be from a lead-based primer used to paint the tunnel rather than associated with the testing. According to information from former reactor workers, 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. 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 also were tested for radioactivity (see Appendix A). Only one sample showed radioactivity above the sample detection limit (Table 3-1).

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

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Table 3-1. Radioactivity in Waste Samples.

| disintegrations per minute per gram (d/min/g) | | | | | |
|---|---|---|---|---|---|
| Sample | 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 | * | * |

* = No data available
< = Detection limit

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**CONTENTS**

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4.2 WASTE STORED AT THE UNIT . . . . . 4-1

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# 4.0 WASTE CHARACTERISTICS

## 4.1 ESTIMATE OF MAXIMUM INVENTORY OF WASTE

The estimated maximum inventory (based on unit operating information) of sodium and lithium wastes stored at the 105-DR LSFF was approximately 450 kg (1,000 lb) stored during December 1982 and January 1983.

## 4.2 WASTE STORED AT THE UNIT

Sodium has been designated as a dangerous waste because of its ignitable and reactive characteristics. The sodium handled in the LSFF was either purchased for the tests or was waste from other Hanford Site operations. At least 95 percent of all the waste materials are residues of sodium, which is now sodium carbonate (see Appendix A for a partial analysis of waste). Approximately 4 percent of the waste is other alkali metal carbonates, including lithium carbonate, residual lithium nitride, and cesium carbonate. Approximately 1 percent or less are sodium and lithium silicates and miscellaneous materials described elsewhere in this chapter.

The material 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 a naturally occurring compound. Similarly, both purchased and waste lithium also were burned at the site, with lithium carbonate as the main final product. Lithium nitride also was produced, however, and records show that it was drummed and sent to the 340 Building (300 Area) for eventual disposal.

Two cesium and zinc aerosol tests were conducted at the LSFF in the Small Fire Room steel vessel. During these tests, a total of approximately 1 kg (2 lb) of cesium metal and about 110 g (0.25 lb) of zinc metal were used; about half of the metal was consumed during the tests. Most of the test residues were collected and disposed of at that time. There have been two small cesium burns in the Exhaust Fan Room, but no zinc was involved in those tests. Compared with the other materials burned, the quantity of cesium released is very small, less than 1 percent. Cesium is readily oxidized and any unreacted cesium is now an oxide and/or complexed with other materials, such as hydroxides and silicates, which would be codeposited with the sodium carbonate matrix. In the unlikely event that any zinc was released, zinc also would be codeposited within the sodium carbonate matrix.

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

The lithium-lead alloy test was conducted only once. This test was performed in the Small Fire Room inside the steel burn vessel. The waste has been removed.

The overwhelming majority of the residues, both sodium and lithium carbonate, is characteristic category D (least toxic) dangerous waste. The lethal dose ($LD_{50}$) for oral exposure to rats of sodium carbonate is 4,090 parts per million (see Appendix C); for lithium carbonate, the $LD_{50}$ is 525 parts per million. Compounds with lethal doses at concentrations of from 500 to 5,000 parts per million are category D dangerous waste as established by WAC 173-303-101. Lead concentrations in TCLP extract greater than 500 milligrams per liter are considered to be an extremely hazardous waste (EHW); and levels of lead from 5 to 500 milligrams per liter are considered to be a dangerous waste (DW) (WAC 173-303-090). The MSDSs for lead, sodium carbonate, and lithium carbonate have been included in Appendix C.

The LSFF ventilation tunnels predominantly contain 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.

# CONTENTS

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# 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. 1994), groundwater in the 100-D Area will be included in the 100-HR-3 operable unit and investigated under the RFI/CMS process. Therefore, a groundwater discussion is not included as part of the LSFF closure plan.

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## FIGURE

6-1. Closure Flowchart for the 105-DR Large Sodium Fire Facility . . . . F6-1

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# 6.0 CLOSURE STRATEGY AND PERFORMANCE STANDARDS

## 6.1 CLOSURE STRATEGY

The strategy of this closure activity is partial clean closure of 105-DR LSFF. Partial 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 activities outlined in Chapter 7.0. No future use of the 105-DR reactor or LSFF is planned or expected.

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 characterization and remediation programs (see Section 6.4), the low level of hazard associated with the residues from waste burned at the LSFF, and the inaccessibility of the residues to humans and the environment.

Partial clean closure will be achieved by removing surface deposits of sodium and lithium carbonates from the concrete structures and associated equipment and by determining if the equivalent concentrations of carbonates in the soil are either: (1) below dangerous waste levels for mixtures, (2) not statistically greater than Hanford Site background levels, 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.

### 6.1.1 Action Levels

Action levels are defined as concentrations above *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes* (DOE-RL 1994) concentrations and *Model Toxics Control Act* (MTCA) (WAC 173-340) Method B. If analysis determines that concentrations are above both guidelines, a Phase II investigation will be developed. This is not anticipated, however, because of the characteristics of the waste associated with the test burns at the 105-DR LSFF.

The health-based level will be based on equations and exposure assumptions presented in MTCA. For noncarcinogenic substances, the principal variable relating human health to action levels is the oral reference dose. The reference dose is defined as the level of daily human exposure at or below which no adverse effect is expected to occur during a lifetime. For carcinogens, the cancer slope factor is the basis for determining human health effects; it is a measurement of risk per unit dose. The oral reference dose and cancer slope factor are chemical-specific and are obtained from the *Integrated Risk Information System* (IRIS) and other health-based EPA-approved databases, which are updated periodically by the EPA. *Model Toxics Control Act* Method B action levels will be based on values that are current at the time of approval of this closure plan.

Action levels will not be applied to contaminated equipment. Equipment that has contacted LSFF dangerous waste will be decontaminated (Bracken 1991; or other appropriate procedure) or disposed of in compliance with applicable regulations. Lithium and sodium will be decontaminated as described in Section 7.5, whereas lead will be treated by use of the hazardous debris rule as described in Section 7.3.

### 6.1.2 Analytes of Concern

The principal analytes of concern for decisions of remediation are lead, lithium, and sodium. These analytes are related to products of test burns conducted at the LSFF.

Analysis of total lead, lithium, and sodium will be performed by SW-846, method 6010, inductively coupled plasma metals.

These analyses are discussed in Chapter 7.0, Section 7.3.

## 6.2 CLOSURE PERFORMANCE STANDARDS

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 does the following:

- 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 for Thermal Treatment Facility Closure 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."

### 6.2.1 Minimizing the Need for Future Maintenance

The closure performance standard in WAC 173-303-610(2)(a)(i) requires the owner or operator of a TSD unit to close the site in a manner that minimizes the need for further maintenance. Closure of the LSFF by removing or decontaminating equipment (to proposed action levels) and, as necessary, the

surrounding soils, will eliminate the need for further maintenance. Regardless of closure actions associated with the LSFF, however, general maintenance of the 105-DR Reactor structure will continue until final decommissioning.

### 6.2.2 Protection of Human Health and the Environment

WAC 173-303-610(2)(a)(ii) requires a closure plan to provide for the protection of human health and the environment. As discussed previously, the LSFF will be closed by removing or decontaminating, to action levels, all dangerous waste and waste residues and any contaminated soils to protect human health and the environment.

### 6.2.3 Return of the Land to the Appearance and Use of Surrounding Land

In accordance with WAC 173-303-610(2)(a)(iii), the owner or operator of a TSD unit is required to close the unit in a manner that 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. Following partial 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).

### 6.2.4 Waste Alkali Metals

No waste sodium or lithium remains at the site.

### 6.2.5 Remaining Sodium

About 19,000 L (5,000 gal) of sodium weighing 18,000 kg (39,000 lb) 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.

### 6.2.6 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, and an empty liquid nitrogen tank (vendor owned). These materials will be decontaminated and disposed of as surplus property or placed in the appropriate landfill.

## 6.3 CLOSURE ACTIVITIES

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).

The following closure activities will be implemented:

- Decontaminate the structures and equipment as specified.
- Sample to determine if contamination remains in the soil (see Chapter 7.0, Section 7.3.2).
- Verify cleanup by visual inspection or sampling, as needed.
- Certify that all closure activities were completed in accordance with the approved plan.

All equipment used in performing closure activities will be decontaminated or disposed of at a RCRA-compliant facility.

Closure activities will be monitored by an independent registered professional engineer who will certify that closure activities are accomplished in accordance with the specifications of the approved closure plan. The certification will be sent to Ecology by registered mail or an equivalent delivery service.

Two official copies of this closure plan will be located at the following office: U.S. Department of Energy, Richland Operations Office, Federal Building, Environmental Assurance, Permits, and Policy, 825 Jadwin Avenue, P.O. Box 550, Richland, Washington 99352. The DOE-RL will be responsible for amending this plan as amendments become necessary, according to the amendment procedure identified in WAC 173-303-610. The plan will be kept at DOE-RL until closure is completed and certified.

## 6.4 COORDINATION WITH OTHER PROJECTS

The 105-DR Facility houses two different physical areas of concern: (1) the 105-DR defense reactor, which occupies most of the building; and (2) the LSFF, which occupies the former ventilation supply room of the reactor building.

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. 1994). These operable units will be addressed through the RFI/CMS process. After all dangerous waste associated with the LSFF is removed, the entire reactor will remain for future decontamination and decommissioning [also see the draft EIS for decommissioning eight surplus production reactors (DOE 1992)].

The LSFF, with the exception of the external buildings, is currently designated as a Radiologically Controlled Area (RCA). This RCA is managed in accordance with Radiation Protection, WHC-CM-4-10.

The 105-DR reactor is managed by the Environmental Restoration Operations group (ERO), whereas the LSFF is managed by Fast Flux Test Facility/Fuels and Materials Examination Facility (FFTF/FMEF) Programs. Each of the managing groups will maintain individual access to their respective portions of the facility. This will include physical locks installed in compliance with fire protection requirements to prevent unplanned entry into the other part of the facility. Any access to the other portion of the facility will be coordinated in advance with the ERO and FFTF/FMEF point of contact and Environmental Restoration Health Physics (ERHP).

FFTF/FMEF Programs will maintain control of and responsibility for the LSFF and external buildings as defined in the RCRA closure plan. This group will assume the responsibility for all activities that are specified in the closure plan. Any action required during the closure activity, such as tours or audit finding responses, are included.

FFTF/FMEF Programs will maintain this control with the following conditions: (1) ERO will provide the required biannual building surveillances of the production reactor facility; (2) ERO will provide the required biannual radiological inspections, and; (3) FFTF/FMEF Programs and ERHP will provide surveillance and radiological inspections of the LSFF and associated facilities.

Thus, remedial action with respect to contaminants associated with the LSFF and not covered 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 corrective action process (116-DR-8 Crib and soil).

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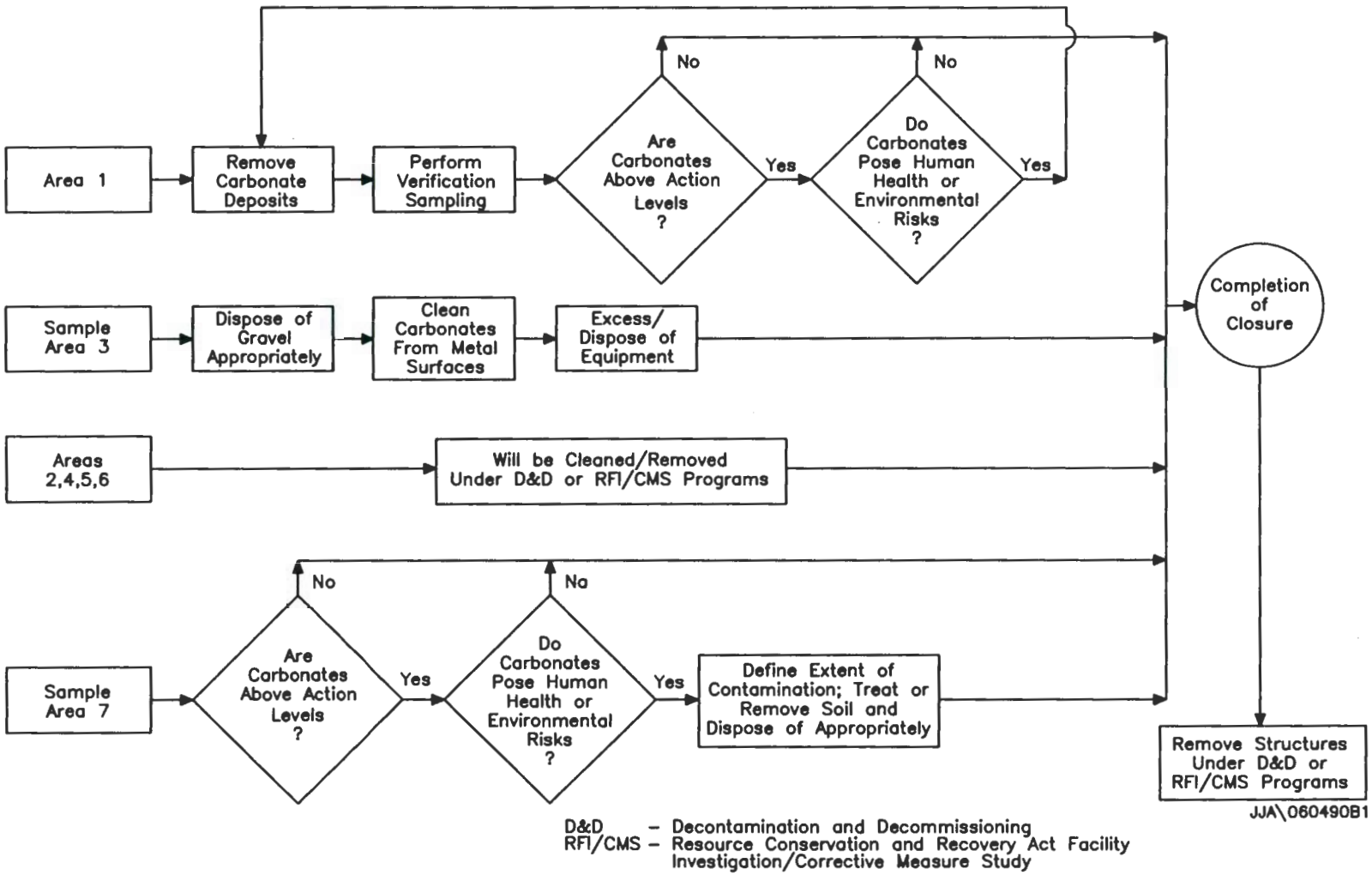


Figure 6-1. Closure Flowchart for the 105-DR Large Sodium Fire Facility, (see Section 7.3 for a Description of Areas 1 through 7).

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# 7.0 CLOSURE ACTIVITIES

## 7.1 INTRODUCTION

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

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

2. Sample soil to determine if sodium and lithium are below dangerous waste levels.

3. Evaluate the data for QA/QC reliability and significant contamination levels in comparison with background data and/or MTCA Method B action levels.

4. Conduct additional decontamination of LSFF, as required.

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

## 7.2 REMOVAL OF DANGEROUS WASTE INVENTORY

No unreacted waste metals are now at the unit. Removal of waste residues from the LSFF cleanup operations is described in Section 7.5.

## 7.3 UNIT SAMPLING

A sampling and analysis plan will be prepared to evaluate contamination associated with the parts of the LSFF that treated (burned) waste sodium and lithium metals or that received residue from these burns. This plan will be primarily based on the history of the processes associated with the LSFF (Chapters 2.0, 3.0, and 4.0) and associated decontamination and sampling information from Chapters 6.0 and 7.0 of this closure plan. After this sampling and analysis plan has been completed, it will be added as an appendix to the 105-DR LSFF Closure Plan.

### 7.3.1 Regulatory Basis for Approach

Because lithium and sodium carbonate are Washington State criteria characteristic category D (least toxic) dangerous waste (Section 4.2) with designation levels of 10 percent weight volume of the contaminated material, visual inspection will be performed to determine if contamination exists inside the unit. All concrete structures and equipment associated with the 105-DR LSFF will be inspected for visible carbonate deposits. If the concrete walls or associated equipment have visible carbonate deposits, the surfaces will be cleaned as discussed in Section 7.5. When all visible deposits have

been removed, the structures and equipment will be deemed free of contamination. Treatment residue generated during this process will be collected and analyzed to determine corrosivity and concentrations of lithium, sodium, and lead. The treatment residue then will be disposed of in accordance with appropriate regulations.

Any contaminated structures or equipment can be treated using the hazardous debris rule to reduce the volume of material going to a hazardous waste landfill. The hazardous debris rule will be used to address the possible threat of lead contamination. The 105-DR LSFF log books document that lithium-lead alloy was burned only in the small fire room (Section 4.2). Debris is described by 40 CFR 268.2(g) as the following:

> As a solid material exceeding a 60 mm particle size that is: "A manufactured object; or plant or animal matter; or natural geologic material."

While 40 CFR 268.2(h) states:

> "Hazardous debris means debris that contains a hazardous waste listed in subpart D of part 261 of this chapter, or that exhibits a characteristic of hazardous waste identified in subpart C of part 261."

The hazardous debris rule offers several options for managing hazardous waste depending on the type of waste contaminating the debris. Most characteristic hazardous debris can be treated using a specific technology from the following general categories of technologies: extraction, destruction or immobilization. The treatment selected must meet certain performance standards, in this case defined by 40 CFR 268.45, Table 1 as the following:

> "'Clean debris surface' means the surface, when viewed without magnification, shall be free of all visible contaminated soil and hazardous waste except that residual staining from soil and waste consisting of light shadows, slight streaks, or minor discolorations, and soil and waste in cracks, crevices, and pits, may be present provided that such staining and waste and soil in cracks, crevices, and pits shall be limited to no more than 5% of each square inch of surface area."

An extraction treatment will be used at the 105-DR LSFF Facility. Any treatment residue generated during this process will be collected and analyzed to determine corrosivity and concentrations of lithium, sodium, and lead. The treatment residue then will be disposed of in accordance with appropriate regulations.

### 7.3.2 Sampling Strategy

The LSFF can be divided logically into seven areas according to use and deposition of reaction by-products; therefore, these areas will be considered separately. The areas of the LSFF are: the exhaust fan room, 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).

Areas 2, 4, and 5 are deferred to reactor decontamination and decommissioning activities of the 105-DR Reactor. The tunnels, ducts, and stack contained in these areas would be difficult to access in the personal protective equipment necessary to work in these areas. Cleaning activities in these areas would present a safety hazard and for these reasons will be deferred. Area 6, the 116-DR-8 Crib, is part of the 100-DR-2 operable unit and the 100-HR-3 groundwater operable unit and will be remediated separately from the 105-DR LSFF.

To isolate the 105-DR LSFF from the rest of the 105-DR Reactor Facility, all points of entry between the LSFF and the reactor will be sealed. There are five points of entry from the LSFF into the exhaust tunnels as depicted in Figure 2-4. There is one entrance each in the exhaust fan room, the large fire room, and the small fire room. There are two entrances via the duct work in the sodium handling room. These entrances will be sealed after waste removal to prevent access and air exchange between the LSFF and the exhaust tunnels. The gravel scrubber is connected to the 117-DR HEPA filter room and the exhaust stack via duct work. These ducts will be removed and all openings will be sealed to prevent incursion of water, plants, and animals.

Before decontamination and sampling begin, all areas will be surveyed for radioactivity according to established procedures (Environmental Investigations Instructions [EII] 2.3 [WHC 1988]). See Section 7.3.7 for general equipment and procedures for dangerous waste sampling.

Area 1: 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 4 L (1 gal) of crusty powder and reaction by-products from past burns. Old burn pans stored in this room still contain residues. These pans will be cleaned of sodium and lithium carbonates by using one of the decontamination methods mentioned in Section 7.5. Any treatment residue generated will be collected, analyzed, and disposed of in accordance with appropriate regulations.

The exhaust fan room, the only room used to burn waste sodium and lithium, has visible, mostly thin layers (less than 1.6 mm [1/16 in]) of reaction by-products in a few places. These deposits are evident as a white film on sections of the walls. All carbonate deposits will be cleaned by using one of the treatment methods mentioned in Section 7.5. Any treatment

residue generated will be collected, analyzed, and disposed of in accordance with appropriate regulations.

The sump in the exhaust fan room will be thoroughly cleaned and inspected for cracks through which carbonates could have penetrated. If cracks are found on or near the floor of the sump, a characterization sampling program to examine the underlying soil may be developed at a later date, if so directed by Ecology.

Both fire rooms and the sodium supply room will be cleaned using a treatment described in Section 7.5 to ensure the removal of any visible carbonate contamination. Decontamination will include inspecting and cleaning all concrete structures and associated burn equipment located within the two fire rooms and the sodium supply room. This equipment includes burn vessels, burn pans, and any other related equipment. An extraction treatment will be used to remove lead waste from the small fire room burn vessel, which is the only vessel used to burn the lithium-lead alloy (Section 4.2). When all decontamination activities in the fire rooms and sodium supply room are completed, all treatment residue will be collected, analyzed, and disposed of in accordance with appropriate regulations.

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 (Appendix A). All sampling is deferred to the reactor decontamination and decommissioning activity.

Area 3: Area 3 consists of the gravel scrubber and ducts, which were installed in 1982. Operation of the gravel scrubber and ducts occurred 16 years after the 105-DR Reactor ceased operations; consequently, no radioactivity is expected. Because the scrubber and duct walls are metal, the carbonates would not have penetrated the wall surfaces. Representative samples of the gravel in the 60-cm (2-ft) thick gravel bed will be analyzed to provide proper designation for disposal. The gravel will be analyzed for corrosivity and TCLP metals. If the gravel is designated as nondangerous, it will be disposed of in the Hanford Solid Waste Landfill. If the gravel is designated as a dangerous waste, it will be shipped offsite to a RCRA-permitted landfill.

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 105-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. All sampling is deferred to the reactor decontamination and decommissioning activity.

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 percent 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 percent was used to vent the exhaust instead of the underground HEPA filters. Similarly, no measurable deposits are expected from this route. All sampling is deferred to the reactor decontamination and decommissioning activity.

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) as documented in the field logbook (WHC 1983). 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 inclusion of the crib in the 100-HR-3 RFI/CMS (Ecology et al. 1994), the crib will not be sampled or remediated 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 above background are expected. Two random soil samples will be taken from this area and analyzed for total lithium and sodium. The results will be compared to sitewide background concentrations (DOE-RL 1994). The soil will be sampled at a depth of 0 to 20 cm (0 to 8 in).

Sampling the LSFF will consist of a total of two soil samples that will be collected and analyzed for lithium and sodium using SW-846, method 6010, inductively coupled plasma metals. Representative samples of the gravel will be taken and analyzed for corrosivity and TCLP metals to determine if the gravel is dangerous or nondangerous waste (i.e., to designate the gravel for proper disposal).

### 7.3.3 Reporting

As sampling activities occur, a logbook will be maintained to document all sampling activities. This documentation will include sampling locations, number of samples, specific methods, as well as any changes that may have occurred during the sampling. Data received from the laboratory will be reviewed, interpreted, and summarized statistically.

### 7.3.4 Quality Assurance/Quality Control Procedures

All procedures will be performed in accordance with the attached Quality Assurance Project Plan (Appendix E), *Environmental Investigations and Site Characterization Manual* (WHC 1988), *Quality Assurance Manual* (WHC 1989a), *Environmental Compliance Manual* (WHC 1989b), and pertinent RCRA requirements (i.e., SW-846 [EPA 1992]) and WAC 173-303-110(2).

### 7.3.5 Sample Quality Assurance and Quality Control

A quality assurance project plan for this project is given in Appendix E.

Quality assurance and quality control of sample analysis and results will be ensured by field and laboratory procedures. Procurement and/or coordination of laboratory services will be the responsibility of a sample management organization, which will ensure that contractor laboratories meet minimum QA/QC requirements. To expedite closure, reporting requirements, and/or site cleanup, analytical data will be provided to the cognizant engineer for immediate review. The sample management organization will be responsible for the review of all laboratory QA/QC programs.

**7.3.5.1 Field Quality Assurance and Quality Control.** Field QA/QC will require the collection of at least one duplicate sample for every 20 samples collected or one per day of sampling, whichever is more. Duplicate samples will only be identified as such in the field logbook. If possible, sampling equipment will be decontaminated in a laboratory as described in EII 5.5 (WHC 1988). If no field decontamination is performed, field blanks will be unnecessary for this project. If field decontamination of sampling equipment is required, EII 5.4 (WHC 1988) will be followed and an equipment blank will be taken for each medium sampled.

When samples have been collected, the samples will be controlled according to the requirements outlined in EII 5.2 "Soil and Sediment Sampling" (WHC 1988). All samples will be labeled, sealed, and placed in a container for preservation on ice or other appropriate cooling medium. Holding times are specified in SW-846 (EPA 1992).

**7.3.5.2 Field Logbooks.** All field activities will be recorded in a field logbook according to the protocols outlined in EII 1.5, "Field Logbooks" (WHC 1988). All entries will be made in ink, signed, and dated. Photographs should be taken of each sampling location and of any unusual circumstances encountered during the investigation.

**7.3.5.3 Chain of Custody.** Chain-of-custody will meet the requirements of EII 5.1, "Chain of Custody" (WHC 1988). The chain-of-custody form will establish the documentation necessary to ensure the traceability of the sample from time of collection to disposal.

**7.3.5.4 Sample Analysis Request.** A sample management organization-approved laboratory will be selected to conduct all analyses. The request for appropriate analyses will be included on the sample analysis request form as provided in EII 5.2 (WHC 1988). Laboratory-specific forms could be used in lieu of the sample analysis request form and will be made available by the sample management organization.

### 7.3.6 Parameters and Analysis Methods

Only one organic compound (i.e., Saran) may have been used for waste treatment at the LSFF. Because of the heat of reaction (sodium and lithium

burn greater than 700 °C [1300 °F]), no organics are reasonably expected to be in the unit. Saran (vinylidene chloride acrylonitrile copolymer) is an ingredient (7 percent) in the Met-L-X* fire extinguisher which is 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 of HCl." The other ingredients in Met-L-X are sodium chloride, 85 percent; magnesium aluminum silicate, greater than 10 percent; and magnesium stearate, greater than 1 percent.

The samples to be collected from the soil will be analyzed for total lithium and sodium. These constituents will be analyzed in accordance with SW-846, by method 6010, inductively coupled plasma metals.

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 unit characterization. In areas where scans show measurable radioactivity, the samples collected and residue removed also will be surveyed for radiation.

The corrosivity of liquid cleanup residue will be analyzed using SW-846, method 9040 (EPA 1992).

**7.3.6.1 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 medium sampled. All samples will be collected in precleaned bottles; if possible, stainless-steel sampling equipment will be decontaminated in the laboratory as described in EII 5.5 (WHC 1988) and wrapped to ensure cleanliness. If field decontamination of sampling equipment is necessary, procedures in EII 5.4 (WHC 1988) will be followed.

To collect soil samples, a clean, stainless-steel sampling spoon will be used to remove soil from a depth of 0 to 20 cm (0 to 8 in).

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

If sampling equipment is laboratory decontaminated in accordance with EII 5.5 (WHC 1988), no equipment blanks will be taken. If laboratory decontamination is not possible, at least one equipment blank will be taken on each day of sampling.

### 7.3.8 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, physical barriers to accessing sampling locations, and an overly optimistic evaluation of other physical conditions at the site. If field 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 for Ecology concurrence, 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. Copies of the field logbook will be made available to Ecology upon request.

### 7.3.9 Verification Sampling

Verification sampling is used to determine that cleanup was completed to the required levels. Because verification inside the LSFF consists of a visual inspection to determine if contamination remains, verification sampling of surfaces will not be necessary. Verification sampling of soil outside the LSFF will be performed only if soil remediation is necessary. This sampling will determine if residual concentrations of constituents of concern are below action levels (i.e., the objective of soil removal has been attained). Verification samples will be taken from the newly exposed surface area resulting from soil remediation. Verification samples will be analyzed in an offsite contracted laboratory. The scope of sample analysis will be limited to quantifying the residual concentrations of constituents of concern in order to compare these concentration values to the cleanup standards. Before verification sampling, the number and locations of the samples, and the analytical methods, will be submitted for regulatory concurrence.

## 7.4 SITE SAFETY

A dangerous waste operations plan is required for all dangerous waste sampling sites. It is intended to specify information pertinent to field assignments and serves as a guide in unusual situations or emergencies. A site-specific version of the general RCRA/CERCLA investigation health and safety manual will be developed for use during decontamination and sampling at the LSFF. The site-specific Health and Safety Plan will be prepared in accordance with EII 2.1, "Preparation of Hazardous Waste Operations Permits" (WHC 1988).

## 7.5 REMOVAL OF REGULATED MATERIAL AND WASTE RESIDUE

The possible methods of removal for sodium and lithium carbonate residues include sweeping, high-pressure steam, water washes, and acid washes (5 percent acetic acid in water). Lead residue removal will follow treatment standards associated with the hazardous debris rule as described in Section 7.3.1. All regulated materials will be packaged for shipment in U.S. Department of Transportation-approved containers that are compatible with the waste contents (e.g., 210-L [55-gal] drums). All containers will be labeled and shipped under manifest as necessary according to WAC 173-303-180 and -190 (Figure 7-1). All dangerous waste generated by the clean-up will be handled in accordance with WAC-173-303. Activities conducted within the Hanford Facility that only involve the management of radioactive waste are not regulated under RCRA or WAC-173-303 regulations. References to such activities are included for informational purposes only.

### 7.5.1 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, and radioactivity (as indicated by the initial surveys); and disposed of appropriately.

### 7.5.2 Soil

If sampling and analysis proves that the percent of soluble alkalinity in the soil is above background or the action level described in Chapter 6.0, 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 disposed appropriately. If analytical results indicate that the soil is dangerous waste only, the soil will be disposed of at a permitted RCRA facility. If the soil contains low-level radioactivity and is dangerous waste, the soil will be held onsite until a permitted TSD facility is available. If the soil contains low-level waste only, the soil will be disposed of at Low-Level Burial Grounds.

### 7.5.3 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 cleaned based on "Equipment Decontamination (Bracken 1991). The cleaning will be accomplished by sweeping, high-pressure steam cleaning, water washing, or acid washing. The acid wash will use a 5 percent solution of acetic acid in water. The cleaning will be performed over a solid sheet of durable plastic either 0.2 mm (0.008 in) or 0.3 mm (0.012 in) thick, depending on the equipment and amount of potential abrasion resulting from cleaning activities. The rinsate will be collected in 210-L (55-gal) steel drums, sampled for corrosivity, and disposed of appropriately. Lead residue removal

will follow treatment standards associated with the hazardous debris rule as described in Section 7.3.1. After cleaning, all equipment and materials originating from the LSFF will be disposed of or surplused.

## 7.6 OTHER ACTIVITIES REQUIRED FOR CLOSURE

No other activities are required for partial clean closure.

## 7.7 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.

## 7.8 AMENDMENT OF PLAN

The LSFF closure plan will be amended whenever changes in operating plans affect the partial clean 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.

## 7.9 CERTIFICATION OF CLOSURE AND SURVEY PLAT

Within 60 days of closure of the LSFF, DOE-RL will submit to the Benton County Auditor and to Ecology a certification of closure and a duly certified survey plat. The certification of closure will be signed by both DOE-RL and a registered independent professional engineer, stating that the unit has been closed in accordance with the approved closure plan. The certification will be submitted by registered mail or an equivalent delivery service.

The DOE-RL and the independent professional engineer will certify with a document similar to Figure 7-3.

If partial 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 unit location with respect to permanently surveyed benchmarks and will be prepared and certified by a professional land surveyor. The plat also will contain a note, prominently displayed, stating the owner's obligation to restrict disturbance of the surveyed area.

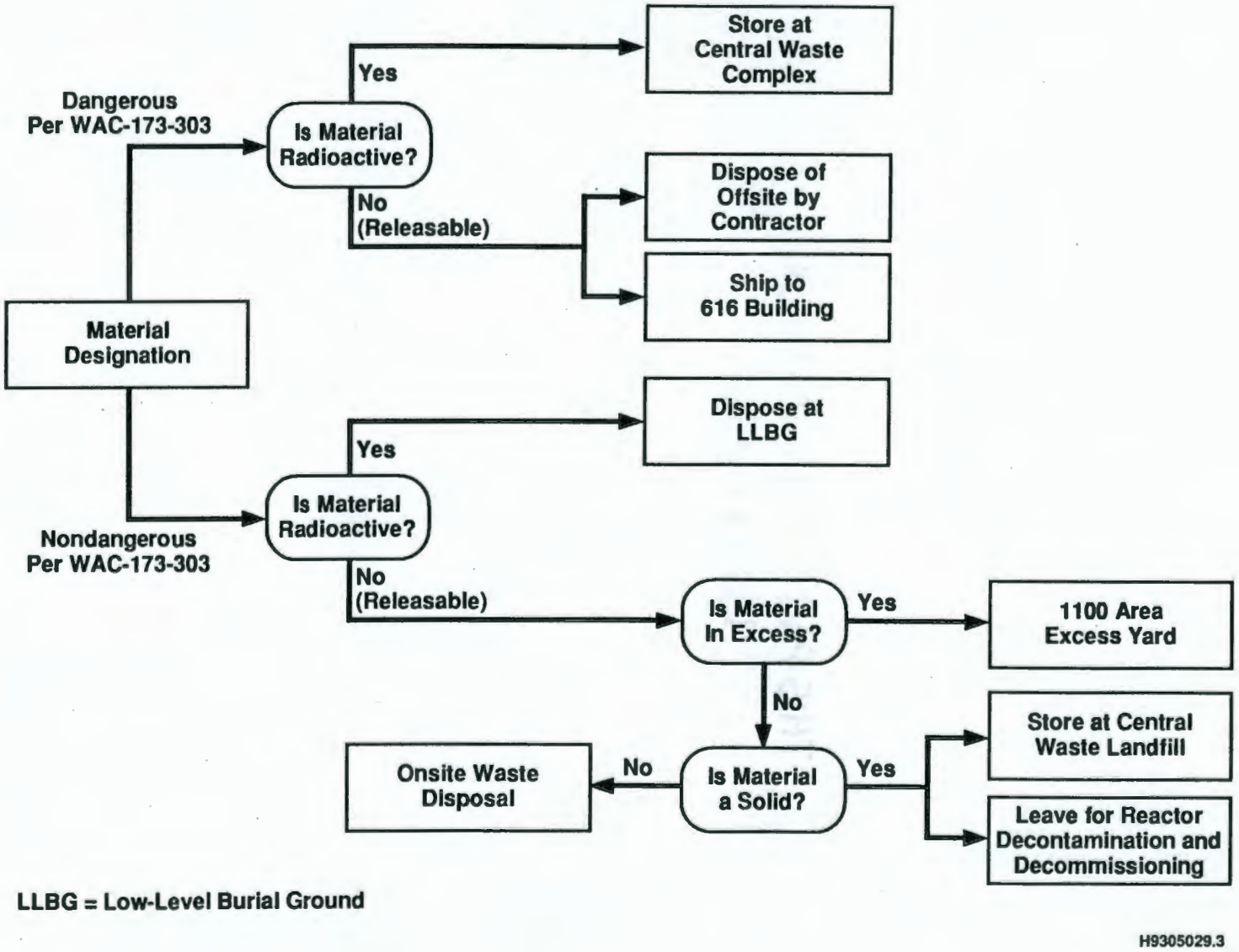


Figure 7-1. Flowchart for Removal of Contaminated Material and Waste Residue.

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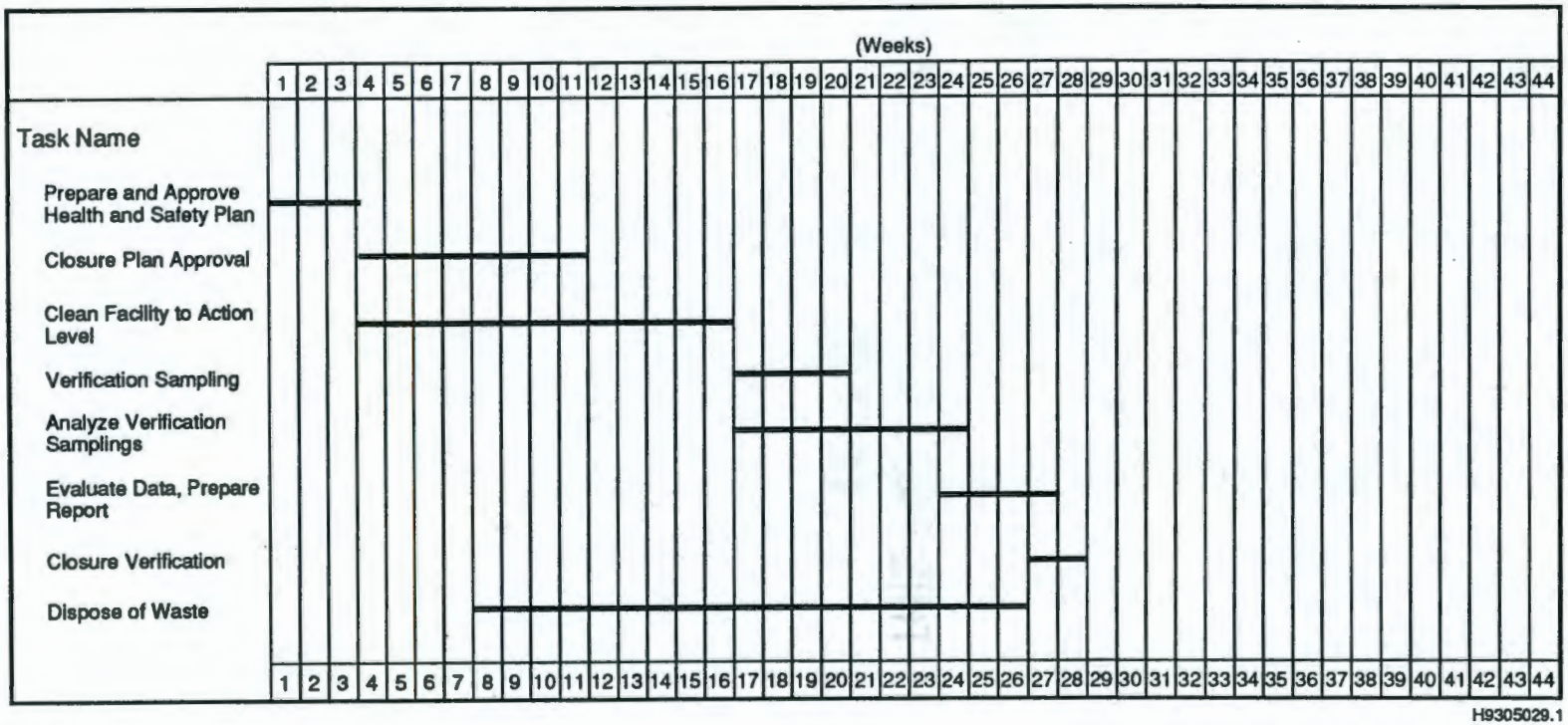


Figure 7-2. Large Sodium Fire Facility Closure Schedule.

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**CLOSURE CERTIFICATION**
**FOR**

_____

Hanford Site
U.S. Department of Energy, Richland Operations Office

We, the undersigned, hereby certify that all _____ _____ closure activities were performed in accordance with the specifications in the approved closure plan.

_____ _____
Owner/Operator Signature DOE-RL Representative Date
(Typed Name)

_____ P.E.#_____ State___ _____
Signature Independent Registered Professional Engineer Date
(Typed Name, Professional Engineer license number, state of issuance, and date of signature)

Figure 7-3. Closure Certification for the Large Sodium Fire Facility.

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8.1 NOTICE IN DEED BOOK . . . . . 8-1

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# 8.0 POSTCLOSURE

## 8.1 NOTICE IN DEED BOOK

This closure plan is proposing partial clean closure of the 105-DR Large Sodium Fire Facility. However, if partial 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 concurrently sent to Ecology and 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 State 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 waste disposed of 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 State 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 generally is required when a waste management facility cannot attain a clean closure. If the LSFF cannot attain partial 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 those programs, a postclosure plan will be prepared for the facility at that time. The postclosure plan will include the following:

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

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# 9.0 REFERENCES

## 9.1 DOCUMENTS

Bracken, E. A., 1991, "Equipment Decontamination," Letter to T. L. Nord, 9102456, U.S. Department of Energy, Richland Field Office, Richland, Washington.

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DOE, 1987, *Final Environmental Impact Statement - Disposal of Hanford Defense High-Level, Transuranic and Tank Waste, Hanford Site, Richland, Washington*, 5 vols, DOE/EIS, 0113, U.S. Department of Energy, Washington, D.C.

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Ecology, EPA, and DOE, 1994, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy.

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

WHC, 1983, *105-DR Large Sodium Fire Facility Logbook*, HEDL-N-3141, Westinghouse Hanford Company, Richland, Washington.

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

WHC, *Radiation Protection Manual*, WHC-CM-4-10, Westinghouse Hanford Company, Richland, Washington.

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

## 9.2 CODE OF FEDERAL REGULATIONS AND FEDERAL REGISTER

40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended, U.S. Environmental Protection Agency, Washington, D.C.

40 CFR 264, 1992, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, as amended.

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

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended, U.S. Environmental Protection Agency, Washington, D.C.

## 9.3 FEDERAL AND STATE ACTS

*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, as amended, 42 USC 9601 et seq.

*Resource Conservation Act of 1976*, as amended, 42 USC 6901 et seq.

## 9.4 REVISED CODE OF WASHINGTON AND WASHINGTON ADMINISTRATIVE CODE

WAC 173-303, *Dangerous Waste Regulations*, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340, *Model Toxics Control Act Cleanup Regulation*, as amended, Washington State Department of Ecology, Olympia, Washington.

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# APPENDICES

A 1987 SAMPLING ACTIVITIES

B SAMPLING LOCATIONS

C SELECTED MATERIAL SAFETY DATA SHEETS

D PHOTOGRAPHS

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



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# APPENDIX A

# 1987 SAMPLING ACTIVITIES

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DOE/RL-90-25, Rev. 2
03/27/95

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 Line Room entry chamber (Co-Pa int nov)
1 Aerosol 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.

<u>pH of 0.1% Solution:</u>

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

<u>Soluble Alkalinity (as sodium carbonate)</u>

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

<u>Total Lead (ppm)</u>

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

<u>Total Lithium (ppm)</u>

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:

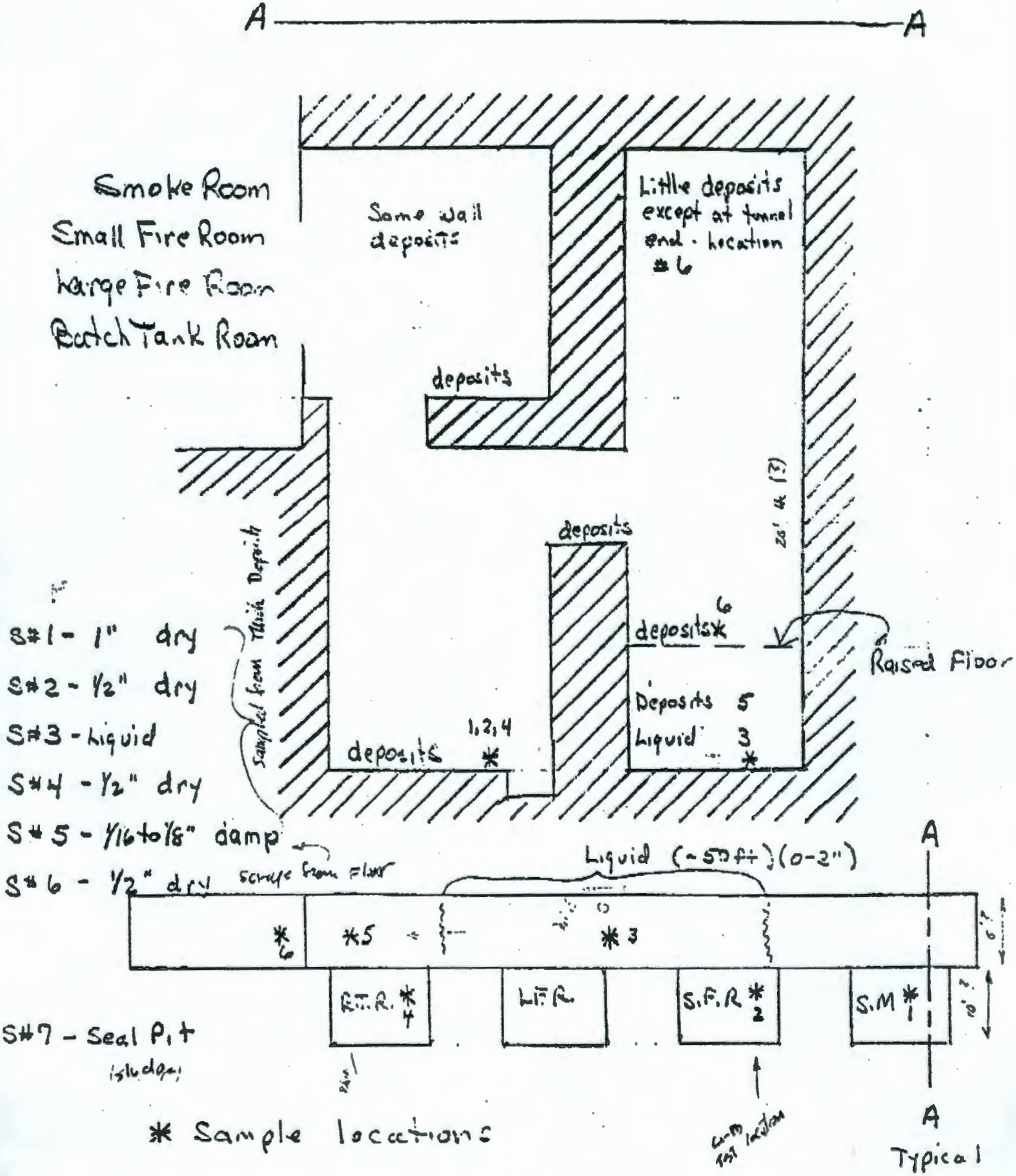
RADIOACTIVITY IN WASTE SAMPLES

| | 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 | | |

R. F. Keough

RFK/tts

# 105 DR Tunnel Sampling 7-27-87






JW Biolin

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# APPENDIX B

# SAMPLING LOCATIONS

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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 |

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

| X-coordinate | Y-coordinate |
|---|---|
| 9 | 6 |

| X-coordinate | Y-coordinate |
|---|---|
| 6 | 4 |





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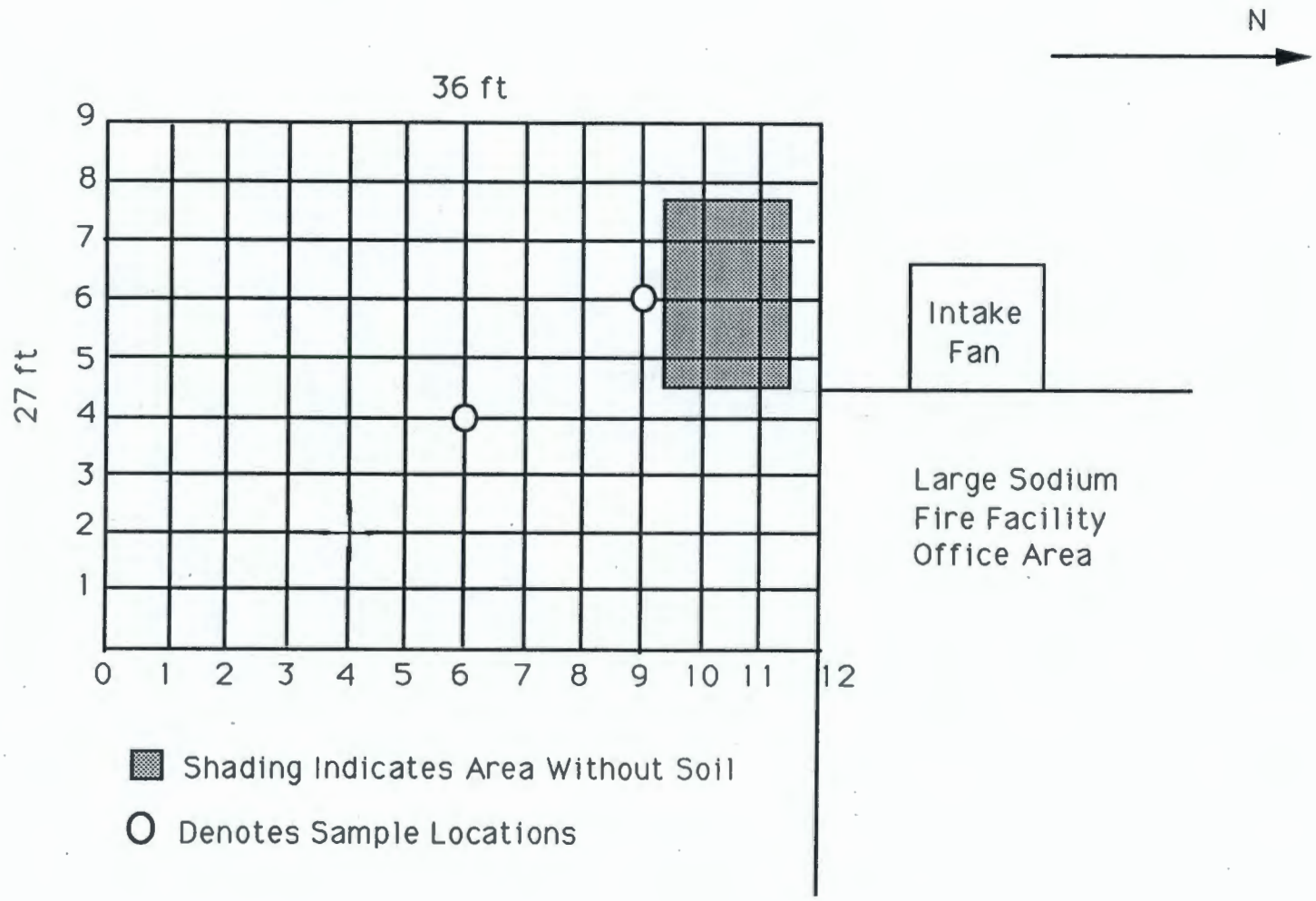
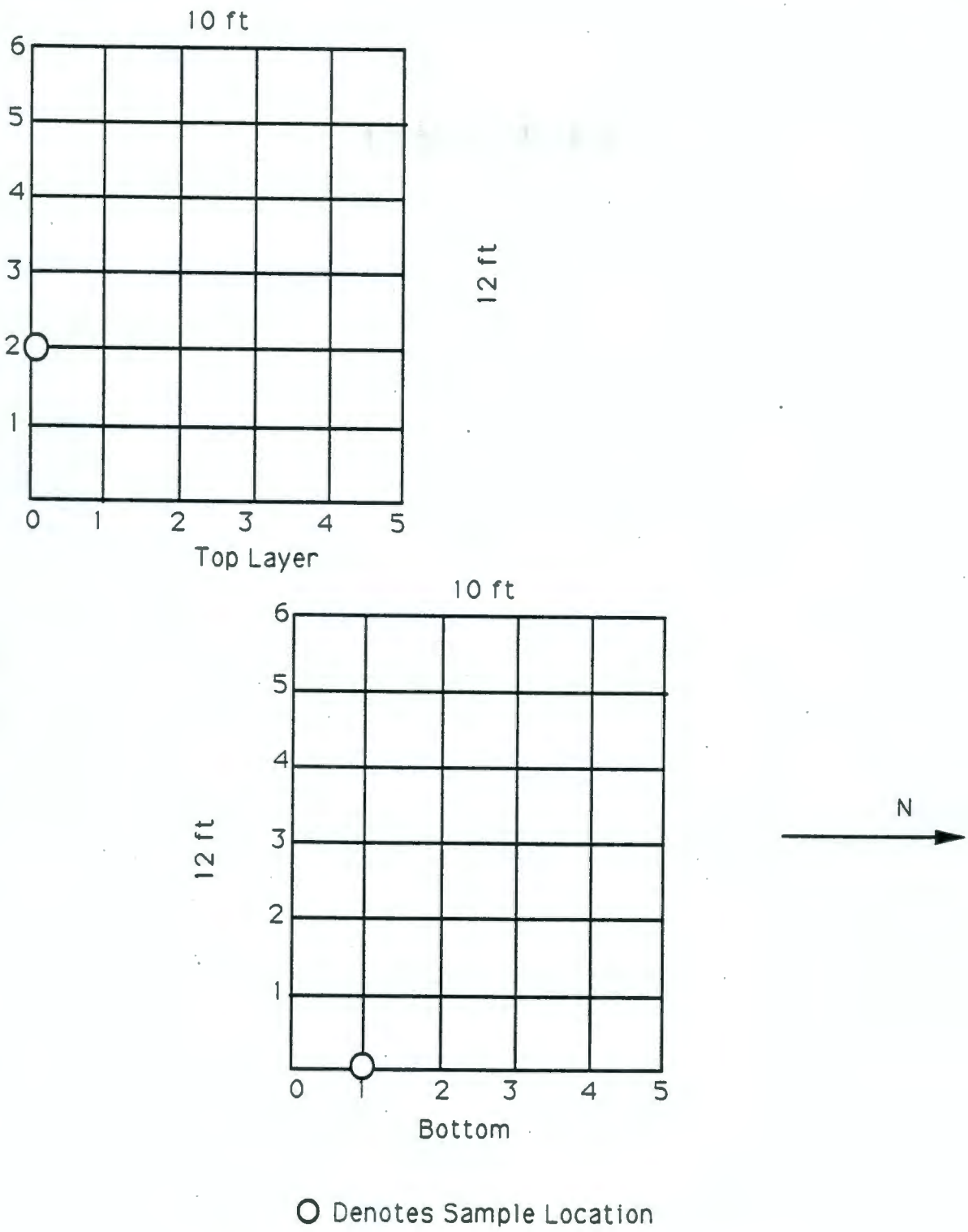



**Figure C-2. Baseline Soil Locations for Area 7.**




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

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# APPENDIX C

# SELECTED MATERIAL SAFETY DATA SHEETS

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MSDS # 1288

# MATERIAL SAFETY DATA SHEET

OHS12510

---

:CUPATIONAL 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

---

MSDS # 1288

## SUBSTANCE IDENTIFICATION

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

"TUROTOXIN/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 AS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. REAT 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 TH 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 R NORMAL SALINE BY INFUSION OVER NOT LESS THAN 8 HOURS FOR NOT MORE THAN 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.

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## 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.

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## 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.

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## CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY.

MSDS # 1288

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## 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 O THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPO CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 I METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

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## 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. |

| | |
|---|---|
| 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. |

MSDS #1288

(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 T 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

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EMERGENCY CONTACT:
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## 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

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## COMPONENTS AND CONTAMINANTS

COMPONENT: SODIUM CARBONATE PERCENT: 100

HER CONTAMINANTS: NONE

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

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## 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

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## 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.

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## 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.

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## 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.

ST 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:

SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

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## 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.

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## STORAGE-DISPOSAL

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

**STORAGE**

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

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## CONDITIONS TO AVOID

NONE REPORTED.

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## SPILLS AND LEAKS

OCCUPATIONAL-SPILL:

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

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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

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## 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

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## COMPONENTS AND CONTAMINANTS

COMPONENT: LITHIUM CARBONATE PERCENT: 100

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

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## 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.

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

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## 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.

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## 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.
IRONIC 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.

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## 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.

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## 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.

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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.

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PROTECTIVE EQUIPMENT SECTION

TILATION:
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.

--- 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 D

# PHOTOGRAPHS



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

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

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

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

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

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

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

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

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Figure D-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.

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1 Figure D-10. The Office Area of the LSFF.

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# APPENDIX E

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

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

This quality assurance project plan (QAPjP) has been prepared for regulatory review as part of the *105-DR Large Sodium Fire Facility Closure Plan* (DOE 1995) and in support of the sampling and analysis activities described in Section 7.0 of that closure plan. The QAPjP provides the generic quality assurance and quality control information for the closure activities defined by the closure plan.

## E1.0 PROJECT DESCRIPTION

The 105-DR Large Sodium Fire Facility is a storage and treatment unit for dangerous waste regulated under the Washington Administrative Code (WAC) 173-303 *Dangerous Waste Regulations*. The unit is no longer required and will be closed per WAC 173-303.

### E1.1 PROJECT OBJECTIVES

The sampling and analysis activities at this unit will support the closure activities defined in the unit closure plan. The ultimate goal is the partial clean closure of the unit.

### E1.2 APPLICABILITY AND RELATIONSHIP TO THE ONSITE CONTRACTOR'S QUALITY ASSURANCE PROGRAM

This QAPjP applies specifically to field activities and laboratory analyses performed in support of closure of the unit. This QAPjP has been prepared in compliance with the *Environmental Engineering, Geotechnology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a) and the *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (EPA 1980). This QAPjP describes the means selected to implement quality assurance program requirements, defined in the *Quality Assurance Manual* (WHC 1988b), as the requirements apply to environmental investigations. The QAPjP will accommodate the specific requirements for project plan format and content agreed upon in the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1994).

This QAPjP contains a matrix of procedural resources from *Environmental Engineering, Geotechnology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a) and *Environmental Investigations and Site Characterization Manual* (WHC 1988a). Distribution and revision control of this plan will be carried out in compliance with QR 6.0, "Document Control" (WHC 1988b). All plans and procedures referenced in this QAPjP are available for regulatory review.

## E2.0 DATA QUALITY OBJECTIVES FOR ANALYTICAL LABORATORY MEASUREMENTS

Data quality objectives for a given data collection activity describe the overall level of uncertainty that decision makers are prepared to accept in the analytical results deriving from the activity. Data quality requirements generally are defined in terms of specific objectives for precision, accuracy, representativeness, comparability, and completeness.

Precision typically is calculated either as a range (R), for duplicate measurements, or a standard deviation(s). Precision also can be expressed as a relative range (RR), for duplicates, or a relative standard deviation (RSD). When the precision for a method is not constant over the concentration range of interest, the reported range or standard deviation will describe the concentration dependence. The dependence alternatively could be described in terms of a slope and intercept for a linear relationship, an indicated function for a nonlinear relationship, or a tabulated set of precision values for specific indicated concentrations.

Accuracy usually is expressed as percent recovery (P) or as percent bias (P-100). When accuracy is observed to be significantly concentration dependent, it could be reported in terms of a linear relationship, an alternative functional relationship, or as a table of measured values.

The method detection limit (MDL) is the minimum concentration of a chemical constituent that can be measured reliably (i.e., it can be reported with 99 percent confidence that the analyte concentration is greater than zero). The method detection limit is determined from a minimum of seven analyses of samples of a given matrix type (e.g., water, soil, etc.) spiked with the analyte of interest at a concentration three to five times the estimated method detection limits. The method detection limit is the standard deviation of the replicate measurements (reported in concentration units) multiplied by the appropriate Student's t value for the number of replicates taken for a one-tailed test at the 99 percent level of confidence.
The practical quantitation limit is defined in *Test Methods for Evaluating Solid Waste* SW-846 (EPA 1990) as the lowest concentration level that can be determined reliably within specified limits of precision and accuracy during routine laboratory operating conditions. Practical quantitation limit values are tabulated in SW-846 for various U. S. Environmental Protection Agency (EPA)-approved analytical methods for evaluating solid waste. The practical quantitation limit values are matrix dependent and method-dependent. Typically, practical quantitation limits are listed as multiples of the method detection limits for specified methods and matrix types.

The performance of the analytical laboratory will be subject to method- and analyte-specific quantitation limits and minimum requirements for precision, accuracy, and completeness as follows:

- *Precision:* The agreement among a set of replicate measurements without assumption of knowledge of the true value. Precision is estimated by means of duplicate/replicate analyses. These samples should contain analyte concentrations above the MDL and may involve

the use of matrix spikes. The most commonly used estimates of precision are the RSD or the coefficient of variation (CV),

$$RSD = 100CV = 100\ s/\bar{x},$$

where:

$\bar{x}$ = the arithmetic mean of the $x_i$ measurements
s = standard deviation.

The relative percent difference (RPD) (EPA 1990) when only two samples are available is:

$$RPD = 100\ [(x_1 - x_2)/\{(x_1 + x_2)/2\}].$$

- Accuracy: The closeness of agreement between an observed value and an accepted reference value. When applied to a set of observed values, accuracy will be a combination of a random component and a common systematic error (or bias) component (EPA 1990).

- Completeness: Requirements for precision and accuracy will be met for at least 95 percent of the total number of determinations on routine and quality control samples.

More stringent requirements for precision and accuracy could be specified in procedures for individual laboratory methods. In that event, the more stringent requirements will apply as data quality objectives for this project.

Approved analytical procedures will adhere to reporting techniques and units that are consistent with EPA reference methods. This will facilitate the comparability of data sets in terms of precision and accuracy. Actual achieved and/or used detection limits, and values for precision, accuracy, and completeness will be provided in all summary analyses reports.

Goals for data representativeness for sampling are addressed qualitatively by the specification of sample locations and depth intervals (when applicable) in the unit closure plan and unit sampling and analysis plan. Sample data should be comparable with other measurement data for similar samples and sample conditions. Comparability will be achieved qualitatively by using standard techniques to collect and analyze representative samples and by reporting analytical results in appropriate units.

Failure to conform to these criteria will be documented in data summary reports (Section 7.1). Corrective actions will be initiated by the Technical Lead as appropriate (Section 12.0) in the event that the criteria initially are not achieved.

# E3.0 PROCEDURES

Section 3.0 discusses standardized sampling procedures that will be used and the approvals and control of these procedures.

## E3.1 PROCEDURE APPROVALS AND CONTROLS

The following sections describe the procedures referenced to support sampling and analysis activities.

### E3.1.1 Hanford Site Procedures

The Hanford Site procedures that have been referenced to support the unit sampling and analysis activities are listed in the quality assurance program index in the *Environmental Engineering, Geotechnology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a). Referenced procedures include Environmental Investigation Instructions (EII) (WHC 1988a) and Quality Requirements (QR) (WHC 1988b). Requirements relating to approval, revision, and distribution control of EIIs are addressed in EII 1.2, "Preparing and Revising of Procedures;" requirements applicable to Quality Instructions (QI) and QRs are addressed in QR 5.0, "Instructions, Procedures, and Drawings," and QR 6.0, "Document Control". Other controlling documents that apply to preparation, review, and revision of Hanford Site analytical laboratory procedures and sample management procedures are identified under Criteria 5.00 and 6.00 in the *Environmental Engineering, Geotechnology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a). All of the aforementioned procedures will be available on request for regulatory review.

### E3.1.2 Participating Contractor and/or Subcontractor Procedures

Participating contractor and/or subcontractor services may be procured for sampling or technical assistance. All such procurement will 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, "Preprocurement Planning and Proposal Evaluation;" and/or QI 7.2, "Supplier Evaluation" (WHC 1988b). Whenever such services require procedural controls, conformance to onsite procedures, or submittal of contractor procedures for onsite review and approval before implementation, the requirement(s) will be identified in the procurement document or work order. Contracting or subcontracting analytical laboratories will be required to submit their analytical procedures as well as the current version of their internal quality assurance program plans for review and approval. The subject plans and procedures will be reviewed and approved by the Management and Operations (M&O) contractor's quality assurance, sample management, and analytical laboratories organization personnel, and/or other qualified personnel as determined by the Technical Lead. If required, all reviewers will be qualified per the requirements of EII 1.7, "Qualification and Training" (WHC 1988a). All approved participating contractor or subcontractor procedures, plans, and/or manuals will be retained

as project quality records in compliance with the *Document Control and Record Management Manual*, Section 9.0 (WHC 1989); QR 17.0, "Quality Assurance Records;" and QI 17.1, "Quality Assurance Records Control" (WHC 1988b). All such documents will be available upon request for regulatory review.

### E3.2 SAMPLING PROCEDURES

As a minimum, sampling procedures will follow the guidelines and requirements of SW-846 (EPA 1990). Soil samples will be collected in compliance with EII 5.2, "Soil and Sediment Sampling" (WHC 1988a).

Where no standardized procedures for sampling or analysis exist (e.g., the sampling and analysis of asphalt or concrete), the best practice will be followed in collection and analysis of these samples. Specific sampling and analytical methodologies will be determined in concert with the appropriate regulatory agencies and documented in the unit closure plan, unit sampling and analysis plan, or other appropriate document.

Sample numbers will be assigned as indicated in EII 5.10, "Obtaining Sample Identification Numbers and Accessing HEIS Data" (WHC 1988a). Sampling activities will conform with the sample identification, container type, preparation, and preservation requirements of EII 5.11, "Sample Packaging and Shipping" (WHC 1988a).

### E3.3 PROCEDURE ADDITIONS AND CHANGES

Additional EIIs or modifications to existing EIIs that might be required as a consequence of sampling plan requirements will be developed in compliance with EII 1.2, "Preparing and Revising Procedures" (WHC 1988a). Should deviations from established EIIs be required to accommodate unforeseen situations, the Field Team Leader can authorize such deviations consistent with provisions and requirements in EII 1.4, "Instruction Change Authorizations" (WHC 1988a). As required by EII 1.4, deviations will be documented, reviewed, and dispositioned by means of instruction change authorization forms. Other types of document change requests will be completed as required by the procedures governing their preparation and revision.

## E4.0 SAMPLE CUSTODY

All samples obtained during the course of this investigation will be controlled from the point of origin to the analytical laboratory as stipulated in EII 5.1, "Chain of Custody" (WHC 1988a). Chain-of-custody documentation also will be maintained for the return of residual sample materials from the laboratory. Requirements and procedures will be defined in procurement documentation to subcontractor or participant contractor laboratories for the return of residual sample materials after completion of analysis. Laboratory chain-of-custody procedures will ensure that sample integrity and identification are maintained throughout the analytical process and will be

reviewed and approved in advance as required by onsite procurement control procedures (see Section 3.1.2).

Analytical results will be traceable to the original samples through a unique code or identifier (see Section 3.0). All analytical results will be controlled as permanent project quality records as required by QR 17.0 "Quality Assurance Records" (WHC 1988b), and EII 1.6 "Records Processing" (WHC 1988a).

Sample and/or data flow will be coordinated by the sample management organization. The sample management organization will be responsible for tracking, controlling, and verification of in-process samples and data per the *Sample Management And Administrative Manual*, WHC-CM-5-3, Section 1.0, "Sample Tracking;" Section 1.3, "Data Package Control;" and Section 1.1, "Data Package Verification" (WHC 1990b).

All samples will be screened in the field for beta/gamma and gross alpha radioactivity in compliance with approved Hanford Site health physics procedures (WHC 1990c). Health physics technicians must release samples before the samples can be transported to offsite laboratories for analysis of dangerous constituents.

## E5.0 CALIBRATION PROCEDURES

Calibration of the contracting laboratory analytical equipment will be performed per applicable standard methods. The standard methods will be subject to review and approval.

## E6.0 ANALYTICAL PROCEDURES

Specific analytical methods or procedures will be reviewed and approved before use in compliance with the procedures and procurement control requirements noted in Section 3.0.

## E7.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction, validation of completed laboratory data packages, reporting requirements are discussed in the following sections. This includes the review and records management for the data packages.

### E7.1 DATA REDUCTION AND DATA PACKAGE PREPARATION

When each group of analyses is completed, the analytical laboratory will prepare a report summarizing the analytical results. The analytical laboratory also will prepare a detailed data package. The data package will include all information necessary to perform data validation to the extent indicated by the minimum applicable requirements (Section 7.2). Data summary report format and data package content will be defined in procurement

documentation subject to review and approval (see Section 3.1). As a minimum, laboratory data packages will include the following:

- Sample receipt and tracking documentation. This will include 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. This will include equipment type and model, with continuing calibration data for the time period in which the analyses were performed.

- Quality control data. This will include quality control data appropriate for the methods used. This can including matrix-spike/ matrix-spike duplicate data, recovery percentages, precision data, laboratory blank data, and identification of any nonconformances that might have affected the laboratory's measurement system during the time in which the analyses were performed.

- Analytical results or data deliverables. This will include reduced data, reduction formulas or algorithms, and identification of data outliers and/or deficiencies.

Other supporting information (e.g., initial calibration data, reconstructed ion chromatographs, spectrograms, traffic reports, and raw data) are included in the individual data packages. All sample data, will be retained by the analytical laboratory and made available for systems or program audit purposes at the request of the M&O contractor, U.S. Department of Energy, or regulatory agency representatives (Section 9.0). Such data will be retained by the analytical laboratory through the duration of the contractual statement of work, at which time the data will be transmitted for archiving.

A completed data package will be reviewed and approved by the analytical laboratory quality assurance manager before the package is submitted to the sample management organization for validation.

The requirements of Section 7.1 will be included in procurement documents and/or work orders, as appropriate, in compliance with the procurement control procedures (Section 3.1).

## E7.2 VALIDATION

Completed laboratory data packages will be validated by the M&O Contractor's sample management organization. Data validation and reporting will be performed in conformance with requirements and procedures identified in *Sample Management and Administrative* (WHC 1990b) and the *Data Validation Procedures for Chemical Analyses* (WHC 1993).

Data validators will perform a number of tasks on each sample delivery group in response to general and specific requirements identified in the data validation procedures (WHC 1993). A sample delivery group is defined as a group of samples (usually 20 or fewer) reported within a single laboratory data package. These tasks are summarized as follows:

- Take delivery of the data package, stamp the receipt date on the package, and make duplicate copies of the sample concentration reports or report forms.

- Organize and review the data package for completeness as described in the data validation procedures (WHC 1993) and document the completeness review on the applicable data validation checklist.

- Validate the data package and qualify sample results according to the procedures and criteria described in the data validation procedures (WHC 1993). Data that are rejected at any point during validation will be eliminated from further review or consideration.

- Check for calculation and transcription errors, applying the frequency guidelines (Section 7.2.1).

- Resolve any discrepancies identified during the review of the data package, including any missing data, with the laboratory.

- Prepare a narrative summary of the acceptability of the data, and prepare a summary of the validated results in tabular and electronic formats after the data have been validated.

- Submit the data validation report. The report will include the narrative summary, an electronic media copy of the data, checklists, summary forms, and the qualified laboratory concentration reports to the Technical Lead within 21 days after receipt of the data package from the laboratory.

### E7.2.1 Frequencies for Checking Calculation and Transcription Errors

For this sampling and analysis project, the following frequencies will be used to check for calculation and transcription errors.

- Investigative samples and verification samples. All reported laboratory results for at least 20 percent of the samples contained in the sample delivery group and 100 percent of the reported quality control samples (duplicates, matrix spikes, field blanks, and any performance audit samples) will be recalculated and verified against the instrument printouts and bench sheet records (raw data). If possible, at least 50 percent of the samples selected for recalculation should contain positive results for the compounds analyzed.

- Confirmatory samples. All reported laboratory results for 100 percent of the samples contained in the sample delivery group and 100 percent of the reported quality control samples (duplicates, matrix spikes, field blanks, and any performance audit samples) will be calculated and verified against the raw data.

Reporting requirements for validation of data produced by routine and special analytical methods other than EPA reference methods (EPA 1990) will be established within applicable procedures for the individual methods, subject to review and approval (see Section 3.1). The reporting requirements will be in general compliance with the guidelines provided previously in Section 7.2.

## E7.3 FINAL REVIEW AND RECORDS MANAGEMENT CONSIDERATIONS

All validation reports and supporting analytical data packages will be subjected to a final technical review by a qualified reviewer at the direction of the Technical Lead before submittal to regulatory agencies or inclusion in reports or technical memoranda. All validation reports, data packages, and review comments will be retained as permanent project quality records in compliance with *Document Control and Records Management Manual*, Section 9.0 (WHC 1989), and QR 17.0, "Quality Assurance Records" (WHC 1988b).

# E8.0 INTERNAL QUALITY CONTROL

All analytical samples will be subject to in-process quality control measures both in the field and in the laboratory. The following types of control samples are specified in the unit sampling and analysis plan to maintain internal quality control.

- Duplicate Samples--Field duplicate samples are samples retrieved from a single sampling location using the same equipment and sampling technique but analyzed independently. Duplicate samples generally are used to assess sampling precision.

- Trip Blanks--A trip blank consists of a sample container of an appropriate media (e.g., pure silica sand or deionized water) that is prepared in the laboratory, transported to the sampling site, and returned unopened for analysis with the actual samples. Analysis of the trip blank will eliminate false positive results for the actual samples arising from contamination during shipment.

- Equipment Blanks--An equipment blank consists of an appropriate media (e.g., pure silica sand or deionized water) that is drawn through decontaminated sampling equipment and placed in a container identical to those used for the actual field samples. Equipment blanks are used to verify the adequacy of the decontamination procedures for sampling equipment.

Additional quality control checks will be performed by the analytical laboratories as follows.

- Duplicates or Matrix-Spiked Duplicates--Estimate analytical precision.
- Matrix-Spiked Samples--A known quantity of a representative analyte of interest is added to an aliquot (or a replicate) of an actual sample and analyzed to measure the recovery percentage. Spike compound selection, quantities, and concentrations will be described in the laboratory's analytical procedures.
- Laboratory Quality Control Samples--A quality control sample is prepared from an independent standard at a concentration within the calibration range. Reference samples provide an independent check on analytical instrument calibration.

The numbers and/or frequencies of quality control samples to be submitted and analyzed with each group of samples are specified in the analytical contract. The numbers of quality control samples proposed in the sampling plan have been determined based on guidance presented in SW-846 (EPA 1990) and the discussion during the meetings between the M&O Contractor, DOE, and regulatory agencies during the Data Quality Objectives process.

Detailed descriptions of internal quality control requirements for participating contractor or subcontractor laboratories will be provided in procurement documents or work orders in compliance with standard procedures (see Section 3.1).

## E9.0 PERFORMANCE AND SYSTEM AUDITS

Performance, system, and program audits will begin early in the execution of this sampling plan and continue through completion of activities. Collectively, the audits will address quality-affecting activities that include, but are not limited to, measurement accuracy; intramural and extramural analytical laboratory services; field activities; and data collection, processing, validation, and management.

Regarding offsite contractor laboratory analyses of confirmatory samples, performance audits of analytical accuracy will be implemented through the use of quality assurance and quality control samples.

System audit requirements will be implemented in accordance with QI 10.4, "Surveillance" (WHC 1988b). Surveillances will be performed regularly throughout the course of sampling activities. Additional performance and system 'surveillances' might be scheduled as a consequence of corrective action requirements or might be performed on request. All quality-affecting activities will be subject to surveillance.

Sampling plan activities could be evaluated as part of environmental restoration program-wide quality assurance audits under procedural requirements. Program audits will be conducted in accordance with QR 18.0, "Audits," and QI 18.1, "Audit Programming and Scheduling," (WHC 1988b).

## E10.0 PREVENTIVE MAINTENANCE

All measurement and testing equipment used in the field and the laboratory that directly affect the quality of analytical data will be subject to preventive maintenance measures that ensure minimization of measurement system downtime. Preventive maintenance instructions for field equipment will be as stipulated in approved operating procedures for the equipment. Laboratories will be responsible for performing or managing the maintenance of assigned analytical equipment. Maintenance requirements, spare parts lists, and preventive maintenance instructions will be included in individual laboratory procedures or in laboratory quality assurance plans, subject to review and approval. When samples are to be analyzed by a contractor or subcontractor laboratory, preventive maintenance requirements for laboratory analytical equipment will be as defined in the contractor laboratory's quality assurance plan(s).

## E11.0 DATA ASSESSMENT

Analytical data will be compiled and summarized by the laboratory and forwarded to the sample management organization for validation (see Section 7.2) before the data can be used in any assessment activities. Assessments could include various statistical and probabilistic techniques to compare and/or analyze data. The statistical methodologies and assumptions that are to be used to evaluate data will be identified in written instructions that are to be signed, dated, and retained as project quality records in compliance with EII 1.6, "Records Processing" (WHC 1988a), and QR 17.0, "Quality Assurance Records" (WHC 1988b). These instructions will be documented in the final report for each sampling and analysis project.

## E12.0 CORRECTIVE ACTION

Corrective actions required as a result of surveillance reports, nonconformance reports, or audit activities will be documented and dispositioned as required by QR 16.0, "Corrective Action"; QI 16.1, "Trend Analysis"; and QI 16.2, "Corrective Action Requests" (WHC 1988b). Primary responsibilities for corrective action resolution will be assigned to the Technical Lead and the quality assurance coordinator. Other needs for corrections to measurement systems, procedures, or plans that are identified as a result of routine review processes will be resolved as stipulated in applicable procedures or referred to the Technical Lead for resolution. Copies of all surveillance, nonconformance, audit, and corrective action documentation will be retained as project quality assurance records.

## E13.0 QUALITY ASSURANCE REPORTS

Project activities will be assessed regularly by audit and surveillance processes (see Sections 9.0 and 12.0). At the conclusion of a given sampling and analysis project, all related field and laboratory data, raw data, reports, surveillance reports, nonconformance reports, audit reports, and corrective action documentation will be transferred for archival to the Hanford Site Records Holding Area (if documentation has not been transmitted previously). In the event that original quality-affecting documents are to be retained and/or controlled by others, legible copies will be transmitted to the Records Holding Area for inclusion in the project record file.

## E14.0 REFERENCES

### E14.1 DOCUMENTS

Ecology, EPA, and DOE, 1994, *Hanford Federal Facility Agreement and Consent Order*, 2 vols, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

EPA, 1980, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, EPA-QAMS-005/80, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1990, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, Supplement 1990, U.S. Environmental Protection Agency, Washington, D.C.

DOE-RL, 1995, *105-DR Large Sodium Fire Facility Closure Plan*, DOE/RL-90-25, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

WHC, 1988b, *Quality Assurance Manual*, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989, *Document Control and Records Management Manual*, WHC-CM-3-5, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990a, *Environmental Engineering, Geotechnology, and Permitting Function Quality Assurance Program Plan*, WHC-EP-0330, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990b, *Sample Management and Administrative Manual*, WHC-CM-5-3, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990c, *Health Physics Procedures Manual*, WHC-IP-0692, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993, *Data Validation Procedures for Chemical Analyses*, WHC-SD-EN-SPP-002, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

## E14.2 CODE OF FEDERAL REGULATIONS AND FEDERAL REGISTER

None.

## E14.3 WASHINGTON ADMINISTRATIVE CODE AND REVISED CODE OF WASHINGTON

WAC 173-303, *Dangerous Waste Regulations*, Washington State Department of Ecology, Olympia, Washington.

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