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105-DR LARGE SODIUM FIRE FACILITY SOIL SAMPLING DATA EVALUATION REPORT

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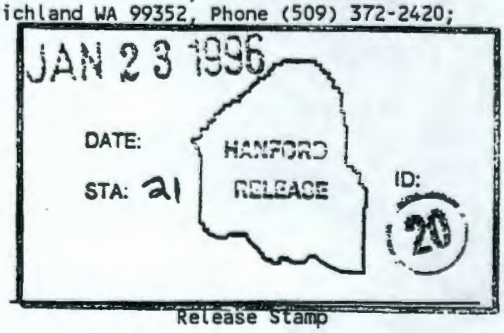
Abstract: This report evaluates the soil sampling activities, soil sample analysis, and soil sample data associated with the closure activities at the 105-DR Large Sodium Fire Facility. The evaluation compares these activities to the regulatory requirements for meeting clean closure. The report concludes that there is no soil contamination from the waste treatment activities.



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105-DR Large Sodium Fire Facility Soil Sampling Data Evaluation Report

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Westinghouse
Hanford Company Richland, Washington

Management and Operations Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

CONTENTS

FIGURES

TABLE

LIST OF TERMS

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DOE	U.S. Department of Energy
DQO	Data Quality Objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
HEIS	Hanford Environmental Information System
IRIS	Integrated Risk Information System
LSFF	Large Sodium Fire Facility
MTCA	Model Toxics Control Act
RCRA	*Resource Conservation and Recovery Act of 1976*
SAP	sampling and analysis plan
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TSD	treatment, storage, and/or disposal
WAC	*Washington Administrative Code*

105-DR LARGE SODIUM FIRE FACILITY SOIL SAMPLING DATA EVALUATION REPORT

1.0 INTRODUCTION

This report summarizes and evaluates the soil sampling and soil sample analysis performed in support of the closure of the 105-DR Large Sodium Fire Facility (LSFF). The evaluation is based on the validated data included in the data validation packages (DOE-RL 1995a) for the 105-DR LSFF. The results of this evaluation will be used in assessing contamination for the purpose of partially closing the 105-DR LSFF as described in the *105-DR Large Sodium Fire Facility Closure Plan*, DOE/RL-90-25 (DOE-RL 1995b).

The scope of this report is the evaluation of the analytical results for the constituents of concern from the six soil samples taken to represent the unit soil. This report does not describe analytical methodology, nor does it provide raw analytical data or the sampling validation report. The sampling plan is presented in the *105-DR Large Sodium Fire Facility Closure Plan*. The sampling plan was discussed and agreed to by all parties during the Data Quality Objective (DQO) process. All analytical data were validated according to *Data Validation Procedures for Chemical Analysis* (WHC 1993). The data validation packages (DOE-RL 1995a) already have been transmitted to Washington State Department of Ecology (Ecology).

1.1 SUMMARY OF RESULTS

To meet the criteria for clean closure of the 105-DR LSFF, analytical results must verify that the concentration of all treatment residues contained in the soil are at or below the action levels as specified in Chapter 6 of the closure plan. The concentration of the constituents of concern in the soil were to be well below the action levels (see Table 1). Therefore, the findings presented in this report will support partial clean closure of the 105-DR LSFF in accordance with Washington Administrative Code (WAC) 173-303-610 without further sampling or remediation activities in Closure Area 7.

1.2 REGULATORY BACKGROUND

The U.S. Environmental Protection Agency (EPA) and Ecology jointly administer the *Resource Conservation and Recovery Act of 1976* (RCRA) in the state of Washington. The EPA retains oversight authority while delegating to Ecology the enforcement of a state program that is consistent with or more stringent than the corresponding Federal program. The implementing regulations are in WAC 173-303, "Dangerous Waste Regulations." Ecology's authorization includes administering closure of dangerous waste treatment, storage, and/or disposal (TSD) units.

The U.S. Department of Energy (DOE), EPA, and Ecology have entered into an agreement called the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement [Ecology et al. 1995]). This agreement affects environmental regulation on the Hanford Facility. One purpose of this agreement is to ensure that environmental impacts associated with past activities are investigated and appropriate response actions taken, as necessary, to protect human health and the environment. The agreement seeks to promote this goal, in part, by identifying TSD units, identifying which units will undergo closure, and promoting compliance with relevant RCRA permitting requirements.

1.3 TREATMENT UNIT INFORMATION

The 105-DR LSFF occupied the former ventilation supply room on the southwest side of the 105-DR Reactor facility in the 100-D Area of the Hanford Site (Figure 1). The 105-DR LSFF operated from about 1972 to 1986. The LSFF was established as a research laboratory to investigate fire fighting and safety associated with alkali metal fires. This effort was in support of the liquid metal fast breeder reactor facilities. In addition to its alkali metal fire research, the unit also was used to treat alkali metal waste. All of the alkali metal burned in the 105-DR LSFF was nonradioactive material.

Alkali metal fires were conducted in three different rooms: the Large Fire Room, the Small Fire Room, and the Exhaust Fan Room. The Large Fire Room houses the Large Test Cell, which consists of a steel cubical that is 110 cubic meters (3,700 cubic feet) in volume. The Small Fire Room contains a Small Test Cell consisting of a steel cylindrical pressure vessel with a dished top. Both test cells 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. An overall schematic of the exhaust system for the 105-DR LSFF is presented in Figure 2.

Adjacent to the Large Fire Room is the Sodium Handling Room. The Sodium Handling Room contained a sodium storage tank that serviced the Large Fire Room. Other rooms provided office space and storage for nondangerous material. The storage areas contained primarily new materials including stainless steel tubing, small-diameter piping made of stainless and carbon steel, electrical supplies, 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 papers, operating records, a few tools, and some small portable monitoring instruments.

2.0 SAMPLING

Soil sampling was performed on July 18, 1995, following the sampling and analysis plan (SAP) described in *105-DR Large Sodium Fire Facility Closure Plan* (DOE-RL 1995b). The SAP provides justification for exclusion of certain closure areas from sample. The SAP identifies Closure Area 7 as being the only area to be sampled for closure determinations. All other closure areas either will be deferred to reactor decontamination and decommissioning activities of the 105-DR Reactor (Closure Areas 2, 4, 5, and 6) or will be decontaminated as described in the closure plan (Closure Areas 1 and 3). With the sampling approach developed in the SAP, leachable or windblown constituents of concern in the vicinity of the past treatment activities would be detected.

2.1 SAMPLE LOCATIONS CLOSURE AREA 7

Closure Area 7 is north and west of the 117-DR HEPA filter building. This area was used to rinse the burn pans used in the test sodium and lithium metal fires. A total of six soil samples were collected at the LSFF as follows: three random samples were collected (two samples and one co-located duplicate) and three extra authoritative samples in Closure Area 7. Figure 3 shows the locations of the soil samples and Figure 4 shows the specific locations of the random samples. The samples consisted of soil that had been collected over an interval of 0 to 20 centimeters.

The three extra authoritative samples were taken at three locations near burn pans to the south of the 105-DR LSFF. These areas, chosen by the Field Team Leader, were used to rinse burn pans that had been used in activities associated with the 105-DR LSFF. At the time of sampling, these locations were seen as likely areas of contamination and were select accordingly to ensure areas of contamination were not overlooked by the random generated sampling locations. These samples also consisted of soil collected over an interval of 0 to 20 centimeters.

2.2 SAMPLE COLLECTION

The six samples collected on July 18, 1995, were samples that had been assigned Hanford Environmental Information System (HEIS) numbers. The random samples were assigned the following HEIS numbers: Random Sample Number 1 is BOG979, Random Sample 2 is BOG980, and Duplicate Random Sample 2D is BOG981. The extra authoritative samples were assigned the following HEIS numbers: Authoritative Sample 1 is BOG983, Authoritative Sample 2 is BOG984, and Authoritative Sample 3 is BOG982.

The soil samples were collected using clean hand tools at each closure area. Samples were taken from the interval 0 to 20 centimeters, as specified in the SAP. Each sample was labeled and placed into a plastic bag. All samples were cooled to 4 °C during storage and transportation to the offsite laboratory. All samples were analyzed within the holding time requirement.

The sampling equipment was cleaned and decontaminated prior to use at the 1706 KE Laboratory in accordance with Environmental Investigation Instruction 5.5, "Laboratory Cleaning of RCRA/*Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) Sampling Equipment" (WHC 1988). There was no equipment decontamination in the field.

2.3 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

Duplicate Sample BOG981 was collected in Closure Area 7. This duplicate corresponds to Sample Number BOG980. Duplicate samples are collected as close as possible to the same point in space and time; however, they are stored in separate containers and analyzed independently. Duplicates are used to estimate the precision of the sampling process.

3.0 PERFORMANCE STANDARDS

The performance standards for closure of the 105-DR LSFF are defined in Chapter 6 of the closure plan and are based on the requirements of WAC 173-304-610(2)(b). This section references the use of parts of WAC 173-340, "Model Toxics Control Act (MTCA) Cleanup Regulations," to define the numerical cleanup standards for the soils. Also, WAC 173-340 allows the use of soil background values in addition to the health-based values. The soil background values on the Hanford Site are defined in the *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24 (DOE-RL 1995c). The higher of the WAC 173-340 health-based value or the sitewide soil background will be used to determine clean closure.

The MTCA health-based values require calculations that use information from the EPA's Integrated Risk Information System (IRIS) database (EPA 1994). An examination of the IRIS database found that there are no oral reference dose values for sodium and no oral reference dose or carcinogenic potency factors for lithium.

Since it is not possible to calculate the MTCA health-based values for lithium or sodium using information from the IRIS database, the soil background values will be used for the performance standard. The Hanford Site Background soil values are as follows:

- Sodium 1910 mg/kg
- Lithium 37.2 mg/kg.

Both the Hanford Site Background and the MTCA calculations are further discussed in Section 3.1 and Section 3.2 respectively.

3.1 HANFORD SITE BACKGROUND

The background action levels used in this report are based on a sitewide approach to determining background levels presented in *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes* (DOE 1995c). This approach was developed as an alternative to local unit-based background determinations. Using local background for each TSD unit can lead to different definitions of contamination and different assessments of remediation goals and risk for various TSD units. The Hanford Site Background approach is based on the premise that (1) the waste management units are located on or in a common sequence of vadose zone sediments, and (2) the basic characteristics that control the chemical composition of these sediments are similar throughout the Hanford Site. The range of natural soil compositions is used to establish a single set of soil background data. Use of the Hanford Site Background for environmental restoration on the Hanford Site is technically preferable to the use of the unit-based background because the former more accurately represents the natural variability in soil composition and also provides a more consistent and efficient basis for evaluating contamination in soil.

The Hanford Site soil background threshold is the concentration level that defines the upper limit of the background population. Background thresholds are based on a tolerance interval approach. The calculated threshold levels depend on the confidence interval and percentile used in the calculation. The WAC 173-340-708(11)(d) specifies a tolerance coefficient of 95 percent and a coverage of 95 percent. The Hanford Site Background threshold levels are based on this 95/95 confidence interval. Statistical calculations are described in the source document (DOE-RL 1995c).

3.2 HEALTH-BASED LEVELS

The MTCA calculated health-based cleanup levels are from the equations, risk levels, and exposure assumptions found in the MTCA Method B (WAC 173-340-740 [3][a][iii]). For noncarcinogens, the principal variable is the oral reference dose. The oral 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 the risk per unit dose. The oral reference dose and the cancer slope factor are chemical-specific and are obtained from the IRIS database (EPA 1995), if available. Secondary sources for these toxicity values are from EPA or Ecology.

4.0 ANALYSES

All samples were analyzed using SW-846 Method 6010, "Inductively Coupled Plasma-Atomic Emission Spectroscopy" (EPA 1986). Use of Method 6010 had been established during the DQO process for the 105-DR LSFF. All samples were sent to Quantera Incorporated in St. Louis, Missouri, for chemical analysis. All analytical data were validated according to *Data Validation Procedures for Chemical Analysis* (WHC 1993) (refer to Section 5.0). The analytical data for the constituents of concern are presented in Table 1.

5.0 DATA VALIDATION

Data validation was performed by Los Alamos Technical Associates, Inc., in accordance with Level D as defined in *Data Validation Procedures for Chemical Analysis* (WHC 1993). Level D validation includes evaluation and qualification of results based on analytical holding times, method blank results, matrix spikes and duplicates, surrogate recoveries, and analytical method blanks.

The criteria and limits for the validation procedures are listed in the source document. Results of the data validators' review of the quality control that was applied in this sampling event were transmitted to the regulators with the validated data packages (DOE-RL 1995c).

The data validation procedure establishes the following qualifier and definition to describe the sodium data:

J Indicates the compound or analyte was analyzed for and detected. The associated concentration is an estimate, but the data are usable for decision-making purposes.

The reason for assigning this qualifier to the sodium data is that a matrix spike for sodium was not performed.

The data validation procedure establishes the following qualifier and definition to describe the lithium data:

B Indicates that the analyte concentration is less than the contract required detection limit, but greater than the instrument detection limits.

The reason for assigning this qualifier to the lithium data is given in the definition of the qualifier.

6.0 DATA EVALUATION

The closure plan proposed the comparison of concentrations in soil to health-based action levels for the constituents of concern. Any analytical data below the detection limits are considered to signify that no contamination is present. The health-based action levels will be based on the Hanford Site Background threshold levels for soil (see Section 3.0). If the constituent of concern is found in concentrations greater than the health-based level, then further evaluation will be required.

The analytical data are summarized in Table 1. All but one sample (BOG984) were reported with the lithium analysis qualified as 'B'. This indicates that the lithium values in all but one sample are less than the contract required detection limit but greater than the instrument detection limit. All reported sodium analysis are qualified as 'J'. This indicates that the sodium values are estimated values but are considered useable for evaluation purposes.

The analytical values for lithium and sodium were compared to the Hanford Site Background threshold levels (Table 1). The maximum lithium value of 23.7 mg/kg is below the Hanford Site Background lithium value of 37.2 mg/kg. The maximum sodium value of 273 mg/kg is well below the Hanford Site Background sodium value of 1910 mg/kg.

7.0 CONCLUSIONS

The analytical results for the 105-DR LSFF soils verify that the concentrations of all treatment activity residues (sodium and lithium) are below action levels. No constituents of concern were found in concentrations indicating contamination of the soil at the 105-DR LSFF (i.e., concentrations above action levels). This supports the proposition that the 105-DR LSFF can be clean closed.

8.0 REFERENCES

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

8.2 FEDERAL AND STATE ACTS

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

Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq.

8.3 REVISED CODE OF WASHINGTON AND WASHINGTON ADMINISTRATIVE CODE

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WAC 173-340, "The Model Toxics Control Act Cleanup Regulations," *Washington Administrative Code*, as amended.

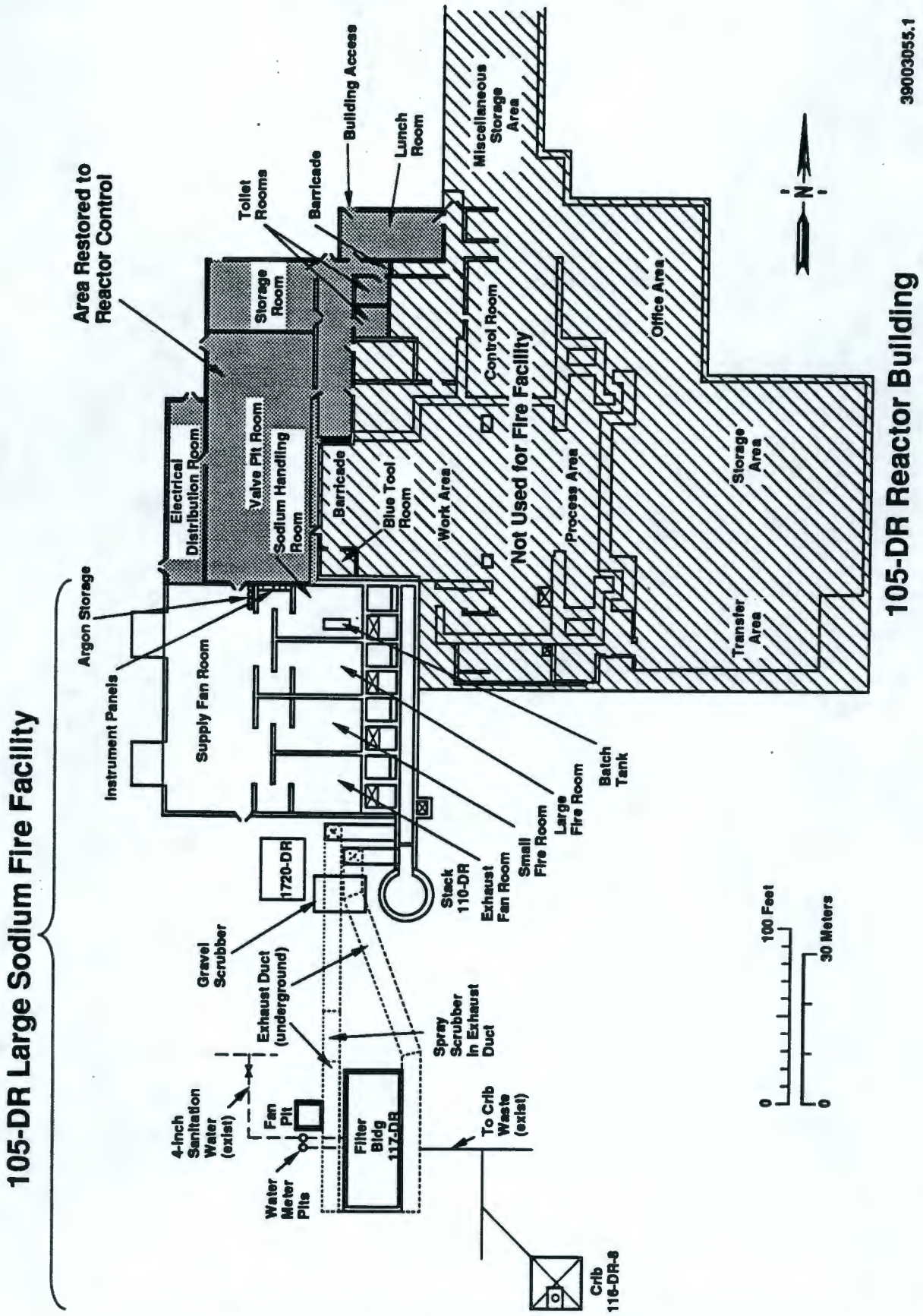

Figure 1. A Schematic of 105-DR Reactor Building Including the Large Sodium Fire Facility.

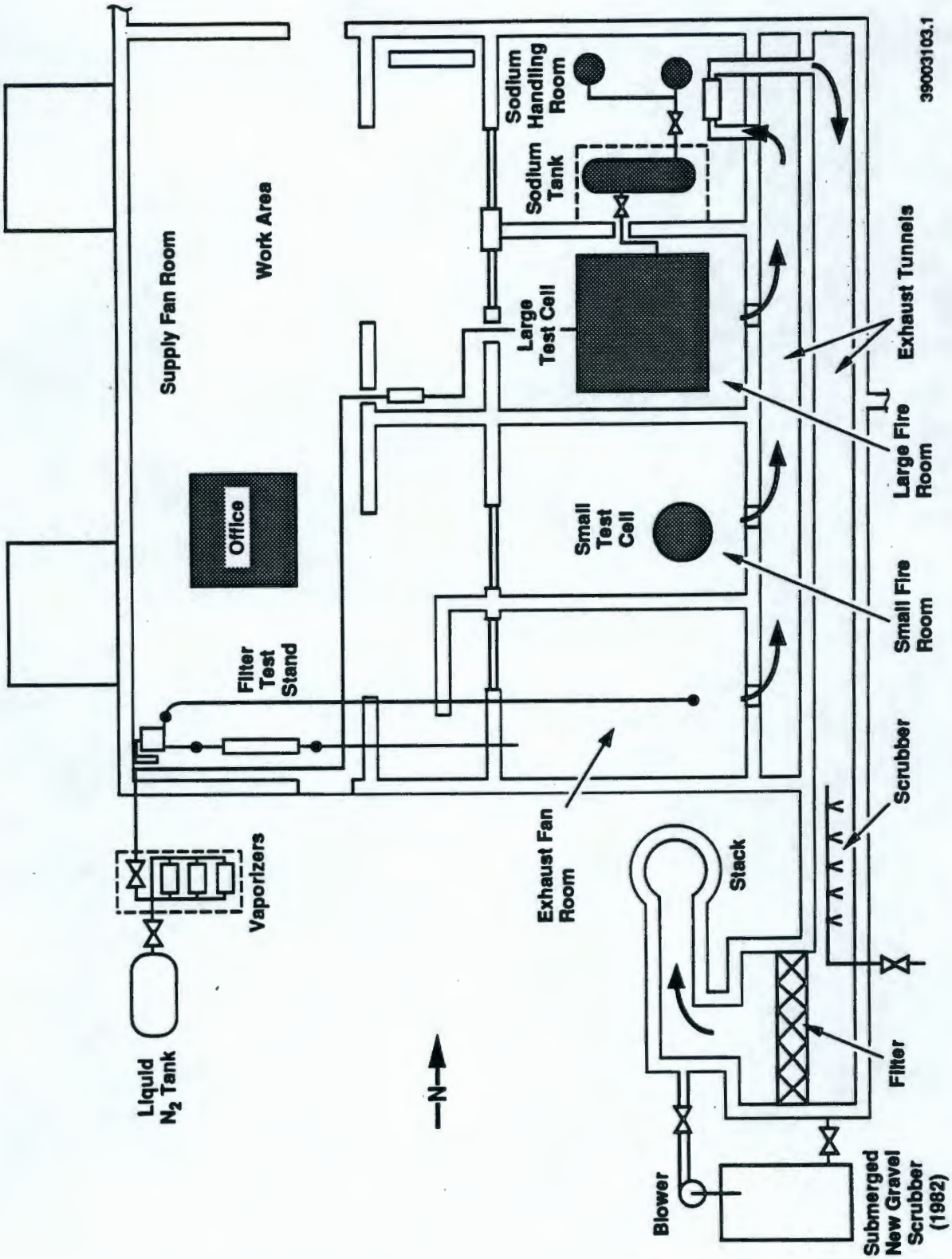

Figure 2. A Schematic of the Overall Large Sodium Fire Facility Exhaust System.

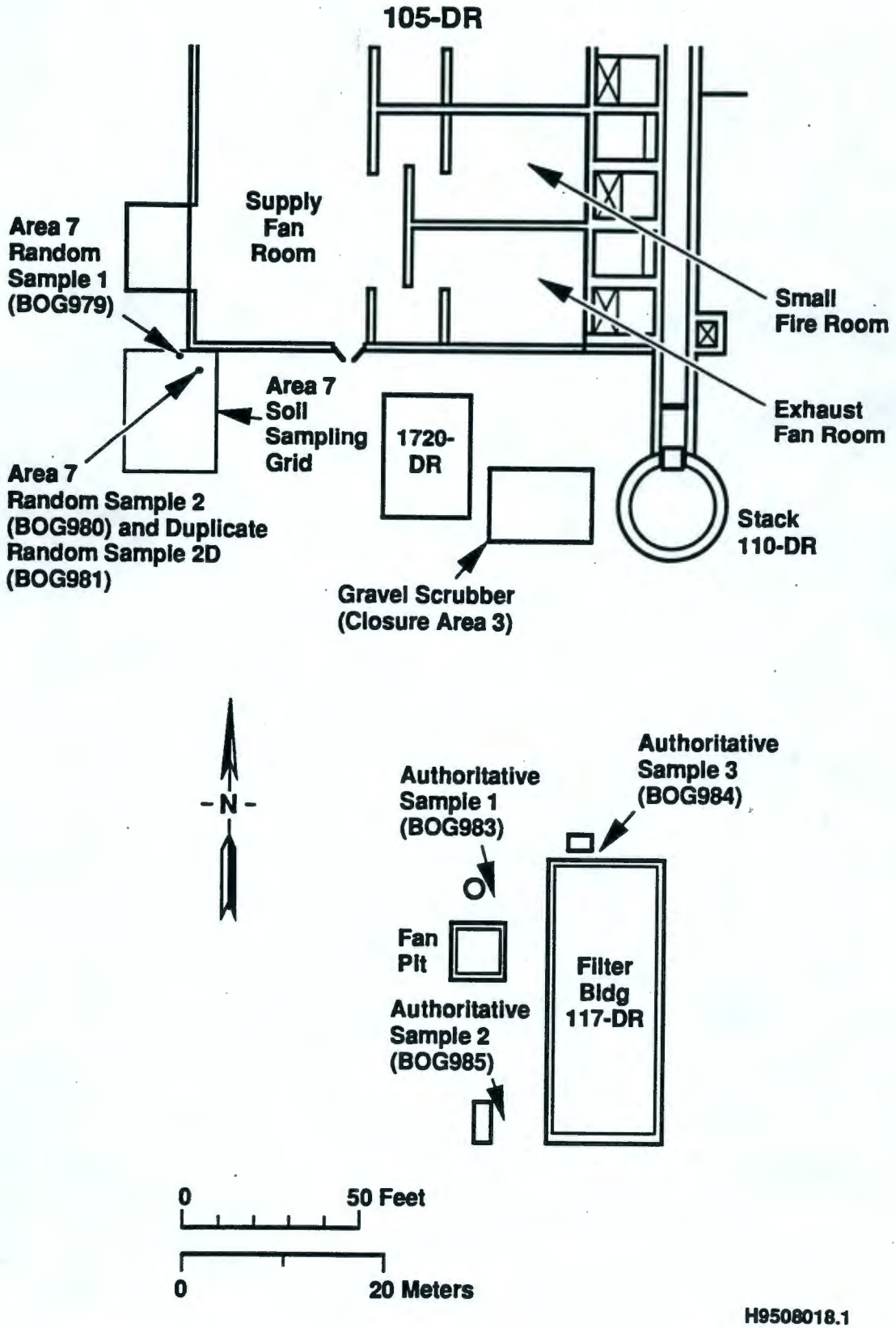

Figure 3. Soil Sampling Location at the 105-DR Large Sodium Fire Facility.

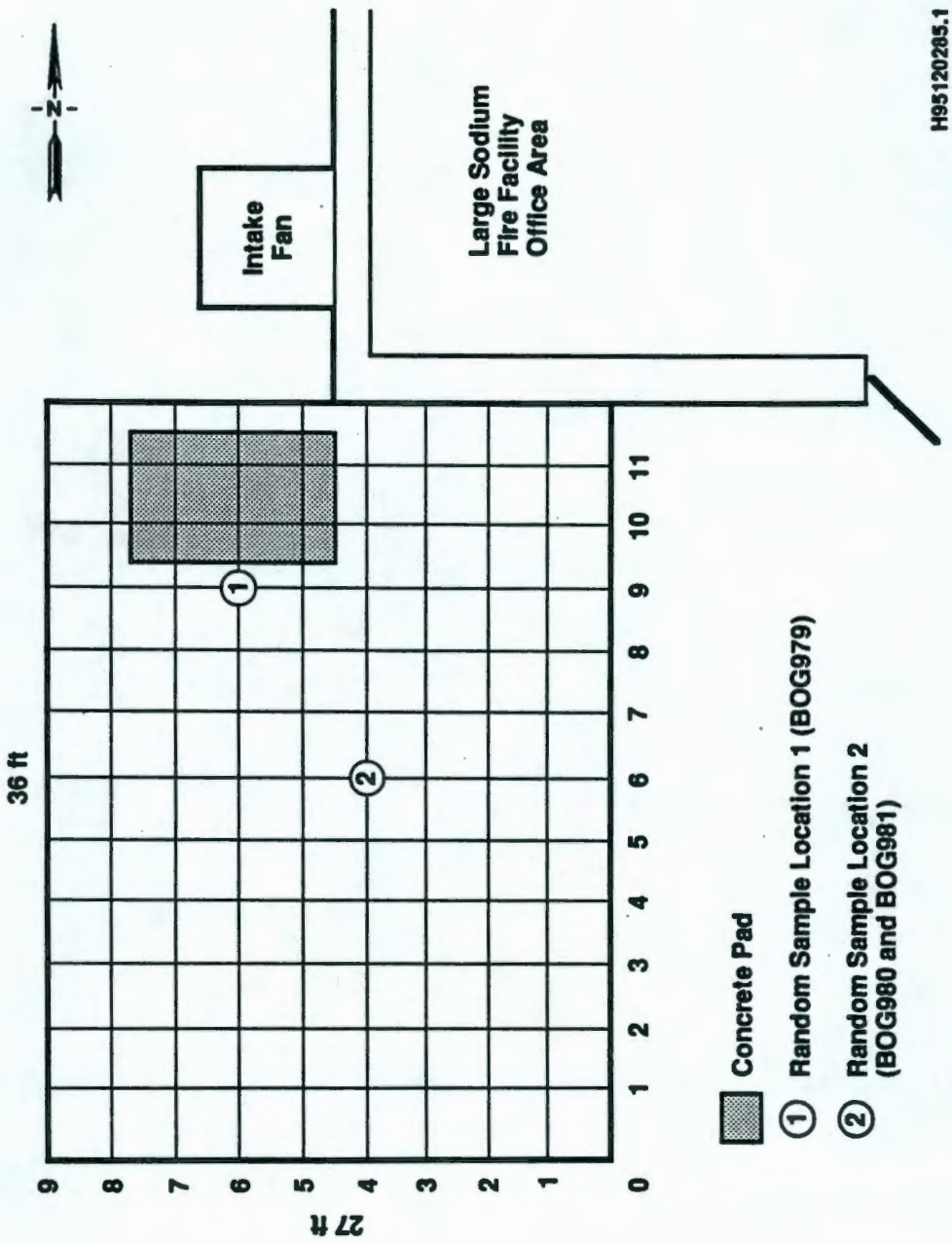

Figure 4. Soil Random Sample Location for Closure Area 7.

Table 1. 105-DR Large Sodium Fire Facility
Closure Area 7 Soil Results, Metals Analysis.

Sample Number	Constituent	
	Lithium mg/kg	Sodium mg/kg
B0G979	6.6 B	273 J
B0G980	6.6 B	154 J
B0G981	6.9 B	175 J
B0G982	9.5 B	183 J
B0G983	10.2 B	182 J
B0G984	23.7	117 J
Hanford Site Background 95/95 Threshold in Soil	37.2	1910
Hanford Site Background Maximum Concentration in Soil	38.2	6060

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