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December 20, 1994

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7. Abstract

This document is a technical description of the systems associated with the 296-B-10 stack.

8.

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ET

TECHNICAL DESCRIPTION OF STACK 296-B-10

Prepared by: Tina M. Ridge
B Plant Environmental Engineering

December 1994

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1.0 BACKGROUND

1.1 Regulatory Basis

As a result of the Clean Air Act Amendments of 1990, the Environmental Protection Agency (EPA) promulgated new regulations known as National Emission Standards for Hazardous Air Pollutants (NESHAP). Of particular concern to facilities on the Hanford site is Title 40, Code of Federal Regulations, Chapter 40, Part 61, Subpart H (40 CFR 61, Subpart H), "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities". An effort is being made to bring each of the facilities on site into compliance with the applicable portions of 40 CFR 61, Subpart H.

Assessments of facility stacks and potential radionuclide emissions determined whether these stacks would be subject to the sampling and monitoring requirements of 40 CFR 61, Subpart H. The results of these assessments were forwarded to EPA in December 1993. Based on the assessment, Stack 296-B-10 is a minor stack. Therefore, 296-B-10 is not required to be in compliance with the sampling and monitoring requirements of 40 CFR 61, Subpart H. However, the sampling and monitoring system must be in compliance with the Environmental Compliance Manual, WHC-CM-7-5.

WHC-CM-7-5 requirement for sampling and monitoring of a minor registered stack is periodic confirmatory measurements. Currently, 296-B-5 is sampled continuously with a record sampler and continuous air monitor (CAM).

1.2 WESF Description

225-B Waste Encapsulation and Storage Facility (WESF) Building (Figure 1) is located in the 200 East Area of the Department of Energy's Hanford Site. It is connected to B Plant. B Plant (221-B and 271-B) was constructed in 1943, while WESF was put into operation in 1974. WESF is to maintain safe storage of the capsules.

The 225-B Building is a two-story structure 48 meter (m) (157 ft) long, 30 m (97 ft) wide, and 12 m (40 ft) high (outside dimensions). The building has a combined floor area of approximately 1,858 m² (20,000 ft²), including 1,301 m² (14,000 ft²) on the first floor and 557 m² (6000 ft²) on the second floor.

The floor plan is partitioned into the following functional areas: (1) the process hot cell area, (2) the hot cell service areas, (3) the operating areas, (4) the building service areas, and (5) the storage pool area. The partitioned floor plan regulates the flow of personnel and material traffic throughout the building and limits access in areas where potential contamination or radiation exposure is high.

1.3 296-B-10

The 296-B-10 stack exhausts the 225-BB building. The stack is located south of the 225-B Building. The stack is 21.3 meters (70 feet) high and has a

Figure 1. B Plant and Related Areas

diameter of 1.1 meters (42 inches). The sampling and monitoring probes are located 17.4 meters (57 feet) from the bottom of the stack.

2.0 DESCRIPTION OF 296-B-10 STACK FLOW AND MONITORING/SAMPLING SYSTEM

2.1 System Flow Configuration

The ventilation system of WESF is designed to provide airflow patterns so that air movement throughout the building is from areas of lesser radioactivity to areas of greater radioactivity. All potentially contaminated areas are maintained at a negative pressure with respect to the atmosphere so that air flows into the building at all times.

The K-1 Heating, Ventilation, and Air Conditioning (HVAC) system provides ventilation for the high-risk operating and service areas with contaminated air being filtered through the K-1 filter building. The K-3 HVAC system provides ventilation for the highly contaminated process cells and the canyon area. The K-4 HVAC system provides ventilation for the capsule storage pool area, and the air is filtered through the K-1 filter building.

The K-1 system is designed to supply 4,020 liters/s (8,514 cfm) outside air on a once-through basis (no recirculation) to the 225-B Building HVAC room. The supply air is filtered through a 80% National Bureau of Standards (NBS) filter and heated or cooled appropriately and distributed through a duct network to the serviced areas. A similar duct network provides an exhaust flowpath from these areas. Air balance control and optional isolation of the rooms is accomplished by manually-controlled dampers in all supply and exhaust ducts.

The K-3 outside air supply system is designed to provide 3,055 liters/s (6,470 cfm) of air to process cells to maintain air flow from areas of lesser to higher contamination in the canyon and process cells. The system provides ventilation for the contaminated process cells and canyon area and is designed to meet two sets of operating conditions: 1) routine operation, when cell cover blocks are in place; and 2) nonroutine operation, when one or more cover blocks are removed from a cell to provide access to the process cells.

The K-3 supply air from the WESF HVAC room is distributed via ductwork to the canyon area on a once-through basis. A portion of this ventilation air enters each cell via one of two 15.2 cm-dia. (6-in.-dia.) stainless steel ducts that are imbedded in the canyon floor. The air going to the process cells from the canyon is drawn through one stage of High Efficiency Particulate Air (HEPA) filters before it enters the cells.

The K-4 system supplies approximately 3,927 liters/s (8,320 cfm) of ventilation air to the storage pool area on a once-through basis. The air supply equipment, which consists of a bank of 8% and 35% National Bureau of Standards (NBS) filters, a preheat coil, an evaporative cooler, a reheat coil, and a centrifugal fan, are located on the roof of the storage pool area. The supply air enters the storage pool area at 21.1°C (70°F) and is distributed throughout the area. Approximately 113 liters/s (240 cfm) of ventilation air

is distributed under the cover blocks of the pool cells via a 61 cm-dia. (24-in.-dia.) duct to the K-1 filter building.

2.2 Exhaust Filtering System

The exhaust of the K-1 (Figure 2) system to the 296-B-10 Stack sequentially passes through two stages of prefilters and two stages of HEPA filters located in the K-1 filter building. The K-1 exhaust system is designed for 8,113 liters/s (17,190 cfm).

Cell air from each cell is exhausted through one stage of in-cell HEPA filters to a common duct. Cell exhaust dampers are provided in each cell to control the air flow and the pressure within each cell. These dampers are controlled remotely from the operating gallery. The cell ventilation air is exhausted through a 24-in.-dia. exhaust header located under the process cells and connects to the canyon exhaust duct, which terminates at the K-3 filter. The final K-3 filtration (Figure 2) consists of two parallel filter housings. One unit is operating, and the other is on standby. Each of the filter housings contain two banks of six HEPA filters in parallel in each bank. Prefilter and liquid removal from the K-3 filter units is provided through a system of impingement vanes, deentrainer pads with on-line flushing capabilities, heaters, and a built-in sump. This system is capable of handling large particulate loading should some contamination migrate toward the filter housing. The K-3 exhaust system is designed for a maximum flow of 3,060 liters/s (6,480 cfm).

The K-1 and K-3 filter systems are efficiency tested annually and flow tested on a quarterly basis. The filter systems passed the 1994 efficiency test and the flow test in August of 1994 showed the total flow from 296-B-10 to be 9,757 liters/s (20,674 cfm).

2.3 Stack Sampling and Monitoring System

The exhaust discharging through the 296-B-10 Stack is continuously monitored and sampled using a sampling and monitoring probe assembly located approximately 17.4 meters (57 feet) above the base of the stack. The sampling probes are connected by insulated and heat traced transport lines to the 296-B-10 monitoring cabinet which is north of the stack and houses the flow monitoring and radiation analysis equipment. Instrument controls, alarms and indicators are located within this structure, except for the high airborne radiation beacon and system failure bell, which are mounted on the exterior of the cabinet. Remote alarms and indicators are connected to the K-3 panel and the control panel in 225 B.

The stack sampling and monitoring probe assembly consists of 5 nozzles for the sampling probe and 2 nozzles to monitor the flow. The flowrate output is recorded at the G-2 panel in WESF. The sampling and monitoring probes were designed for multinozzle isokinetic sampling. Drawings H-2-91142 and H-2-92507 show the probe assembly as it was installed in 1983.

Figure 2. Stack 296-B-10 Exhaust System

NOTE: K-3 Filter - West and East Filter Banks
Do not operate simultaneously

The record sampling system operates continuously while air is being exhausted from the stack. The system has a switched receptacle linked to exhaust fan operation. A flow switch disrupts power to the receptacle when stack air flow drops and restores power upon detection of resumed flow. The record sampler extracts its air sample at a rate of 0.94 liter/s (2 cfm). This rate can be manually adjusted by the flow control valve for the record sampling system. Air flow rates through the record filter are sensed, regulated, indicated and totalized in the monitoring cabinet. A low sample air flow rate activates an alarm switch that initiates local and remote alarm indicators. Details on the record sampler components are shown in Table 1.

The sample flow rate through the continuous air monitor (CAM) is 0.94 liter/s (2 cfm). The CAM flow rate can be manually adjusted at its flow control valve. The air flow through CAM is regulated and equipped with a flow rate indicator. Local alarms are provided by the sample system for low sample flow rate. Alarms resulting from radiation analyzer malfunction or low sample flow rate are combined into one general alarm at the K-3 panel and the control panel in 225 B. The sample system has local alarms for high airborne radiation and system failure and a high temperature alarm for CAM circuit protection. Details on components of the beta/gamma radiation monitor are shown in Table 2. Photographs of the system are provided in Appendix B.

Table 1. 296-B-10 Record Sampler Instrumentation

Component	Manufacturer/Model	Specifications/Operations
Record Filter Paper Holder	BGI Incorporated	47 mm filter paper (Gelman Sciences);
Flow Totalizer	Rockwell/MR-9	8.92 cm/hr at 34.5 kPa (5 psi); temperature compensated at 15.6 °C (60 °F).
Flowmeter	Dwyer ⁽¹⁾ /RMC	Pressure rating: 241 kPa (35 psi); temperature rating: to 54.4 °C (130 °F); accuracy: 2% of full scale; maintained at .63 liter/s (2 cfm).
Flow Switch	Chem-Tec ⁽²⁾ /500-316-BP	Maximum pressure : 9.44E-2 liter/s (.2 cfm) to 16.5 liters/s (35 cfm) at 103 kPa (15 psi), 21.2 liters/s (45 cfm) at 414 kPa (60 psi);
Flow Control Valve	Eberline/10552-CO2-RAP-1R	none provided on vendor information
Vacuum Pump	Gast ⁽³⁾ /0822 or 0823	Oilless, 373 Watt rating; capacity: 3.4 liters/s (7.2 cfm) at 0 kPa (0 " Hg) and 1725 rpm

Table 2. 296-B-10 Beta/Gamma Radiation Monitor Instrumentation

Component	Manufacture/Model	Specifications/Operating Ranges
Continuous Air Monitor (CAM)	Eberline/AMS-3 Beta-Gamma	Detector: a pancake G-M tube that is 4.4 centimeter (1.74 inches) diameter with a 1.4-2 mg/cm ² mica window; scale: logarithmic; range: 10-100 cpm; air flowmeter: 4.7-47.2 liters/s (10-100 cfm) maintained at 38 liters/m; temperature range: -7 to 49 °C (19.4 to 120 °F).
Flow Switch	Chem-Tec/5000-316-BP	Maximum pressure : 9.44E-2 liter/s (.2 cfm) to 16.5 (35 cfm) liters/s at 103 kPa (15 psi) , 21.2 liters/s (60 cfm) at 414 kPa (60 psi).
Flow Control Valve	Eberline/10552-CO2-RAP-1R	none provided on vendor information
Vacuum Pump	Gast/0822 or 0823	Oilless; 373 Watt rating; capacity: 3.4 liters/s (7.2 cfm) at 0 kPa (0 " Hg) and 1725 rpm

- (1) Dwyer is a registered trademark of Dwyer, Inc.
 (2) Chem-Tech is a registered trademark of Chem-Tech Equipment, Inc.
 (3) GAST is a registered trademark of GAST Manufacturing Corp.

2.4 Calibration and Surveillance of Stack Sampling and Monitoring Instrumentation

The calibration and functional tests of the 296-B-10 stack sampling and monitoring instrumentation are tracked using the Component Based Recall System (CBRS) in place at B Plant. Stack monitoring instrumentation is on a six month calibration cycle. The calibration procedures being used are shown in Table 3. The calibrations are performed by B Plant Instrument Maintenance.

Table 3. Calibration Procedures for 296-B-10 Monitoring Instrumentation

Instrument	CBRS Procedure	Issue Date	Calibration Frequency
Continuous Air Monitor	PSCP-3-002	03/01/91	6 month
Sample Flow Indicator	PSCP-7-001	08/18/89	6 month
Flow Totalizer	PSCP-4-007	09/29/89	6 month
Pressure Indicator	PSCP-4-091	06/09/92	6 month

Flow Alarm Switch	PSCP-6-029	12/13/90	6 month
Flow Control Valve	Uses Functional Test	N/A	6 month
Timer	None	N/A	replaced annually
Flow Transmitter	PSCP-6-085	12/17/90	6 month

The air sample filter papers from the record sampler and the CAM are changed on a weekly basis and analyzed for gross alpha and gross beta. Surveillance of the monitoring system are performed by the Health Physics organization at B Plant according to their established procedures. A summary of all surveillance routinely performed on the 296-B-10 system is shown in Table 4.

Table 4. Routine Surveillance of 296-B-10 System

Surveillance	Frequency	Responsibility
Check of local CAM ratemeter	Each shift	Health Physics
Change and analysis of CAM filter	Weekly	Health Physics
Change and analysis of record sample filter	Weekly	Health Physics/ 222-S Laboratory
Stack flow measurement	Quarterly	Vent and Balance
Efficiency test of HEPA Filter System	Annually	Vent and Balance

Additional information and details can be found in the drawings. Appendix A of this report contains a list of drawings and photographs can be found in Appendix B.

3.0 REFERENCES

American National Standards Institute, Inc., *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, ANSI N13.1, 1969, New York, New York.

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

Environmental Protection Agency, *National Emissions Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities*, Title 40 Code of Federal Regulations, Chapter 61, Subpart H, 1989, Washington, D.C.

Lesser, J. E., *Facility Effluent Monitoring Plan for the B Plant*, WHC-EP-0467, September 1994, Westinghouse Hanford Company, Richland, Washington.

Sewell, R. G., *B Plant Safety Analysis Report*, SD-WM-SAR-013, July 1985, Rockwell Hanford Operations, Richland, Washington.

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APPENDIX A. SYSTEM DRAWINGS FOR STACK 296-B-10

DRAWINGS* FOR STACK 296-B-10

DRAWING NUMBER	TITLE	TYPE
H-2-66531	HVAC Air Flow Diagram	Essential
H-2-66681	Instrument Engineering Diagram Building Exhaust System K1	Essential
H-2-66682	Instrument Engineering Cell Exhaust System K3	Essential
H-2-37411	K3 Emergency Ejector System Piping and Details	Support
H-2-92501	Generic Stack Beta Record Cabinet Assembly	General
H-2-92507	Stack Monitor Installation 296-B-10	Support
H-2-91142	Probe Assembly 296-B-10 Stack Monitor	Support
H-2-96552	IEFD B Plant Area Stack Monitor 296-B-10	Essential

* This list is not intended to be inclusive.

APPENDIX B. PHOTOGRAPHS OF 296-B-10

1. Stack 296-B-10 Cabinet
2. Stack 296-B-10 Monitoring System