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ENGINEERING CHANGE NOTICE

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Gas and Liquid Sampling for Closed
Canisters in K-West Basin

Functional Design Criteria

July 27, 1994

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**AIR AND LIQUID SAMPLING FOR CLOSED
CANISTERS IN K-WEST BASIN**

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1.0 INTRODUCTION

1.1 Document Purpose

The purpose of this document is to provide functions and requirements for the design and fabrication of equipment for sampling closed canisters in the K-West basin. The samples will be used to help determine the state of the fuel elements in closed canisters. The characterization information obtained will support evaluation and development of processes required for safe storage and disposition of Spent Nuclear Fuel (SNF) materials.

1.2 Background

Background information regarding the construction, operation, and present status of the 105-K Basins is provided in the *Environmental Assessment of 105-KE and 105-KW Basin Fuel Encapsulation and Repackaging, 100-K Area, Hanford Site* (DOE/EA-0535).

The 105-K Basins were constructed during the early 1950s, as integral components of the 105-K East and 105-K West reactor buildings. The 105-K Basins were designed to receive fuel elements discharged from the K Reactors and stage them for rail transport to 200 Area fuel reprocessing plants. Similar basins were provided for all Hanford weapons production reactor buildings.

The 105-KW and KE Basins are a 5,000 m³ water pool, 38 meters long, by 20 meters wide, by 6 meters deep. The basin is provided with an asphaltic membrane lined leakage collection sump under most of its foot print. The collection sump does not extend beneath several basin structures, including the construction joint between the basin and the main reactor portion of the building.

Both 105-K reactors began operation in 1955. The 105-KW Reactor was shut down in 1970, and the 105-KE Reactor was shut down in 1971. However, the 105-KE Basin was reactivated several years later to store spent N-Reactor fuel during reprocessing plant outages in the 200 Area.

In 1980, continuing problems in the 200 Area made it necessary to reactivate the 105-KW Basin as well, in order to continue operation of N-Reactor. However, prior to reactivation of the 105-KW Basin, the basin walls and floor were decontaminated and coated with epoxy to prevent extensive recontamination. In addition, all SNF introduced into the 105-KW Basin was packaged in closed, vented containers (as opposed to the open top containers, in which SNF is currently stored at the 105-KE Basin).

The fuel in KW basin is stored in sealed canisters, two barrels joined together by trunnions. Each barrel is 20 centimeters in diameter by 70

centimeters. There are seven fuel elements in each barrel. The barrels were loaded under water. Nitrogen was used to purge the air space and a dilute potassium-nitrite solution was added to the water inside the canisters. Two different types of lids, Mark I and Mark II, were used to seal the fuel inside the canisters. Both types of lids have two valves, one is centered and the other is approximately 6 centimeters from the center.

The 105-KW Basin contains approximately 1000 MTU of spent fuel in more than 3800 sealed canisters.

1.3 Overall Scope

This project is to provide equipment that will draw samples of gas/liquid from the closed canisters in KW Basin to be collected and analyzed to help determine the state of the spent nuclear fuel being stored there. The sampling will be performed with controls to maintain the chemistry of the closed canister. The equipment designed for this sampling task will be used on both the Mark I and Mark II canister lids.

1.4 Project Interfaces

The sampling equipment will be designed to operate in the main basin area. Minimal handling of the canisters is desirable to maintain low dose rates to the workers. The water in the basin is filtered in a closed loop system that is monitored for any increases in radionuclide activity. The sampling equipment and process should not interfere with any of the normal activities of the KW Basin.

Gas and liquid samples will be loaded into shipping containers that are compatible with ~~B Plants~~ Licensed shipping cask. ~~used in Tank Farms~~.

2.0 PROJECT CRITERIA

The general functional, performance, and design requirements for the gas and liquid sampling task are provided in the following subparagraphs.

2.1 Functional Requirements

The functional requirements for the gas and liquid sampling task are to design, build, and install instrumentation and equipment to sample the vapor space gas and liquid in a sealed canister of spent nuclear fuel stored in KW basin.

2.2 Performance Requirements

The sampling equipment will be operated by K-Basins operations personnel. Procedures will be created to perform this task with operations personnel trained on the equipment.

2.3 Design Requirements

The equipment will be designed ~~to move easily within the basin~~ to have very few parts that will require replacement, and minimize contamination to the operators. The equipment will be used in the weasel pit at a sampling station.

3.0 PROCESS CRITERIA

3.1 Instrumentation and Control

The gas and liquid sampling equipment will require one pump used to flush the system after each sample. The equipment must take a minimum of 10 ml of liquid and/or a gas. The equipment will be used to sample both Mark I canisters and Mark II canisters. The sampling equipment will be hand operated ~~6 meters~~ 6.32 meters above the canister lids or approximately ~~5 meters~~ 1 meter above the grating. Sampling will be performed on a number of closed canisters requiring that the equipment be reusable with little or no maintenance between samples extractions.

3.1.1 Functional Requirements

The pump shall be used to transfer deionized water ~~or~~ down a small diameter tube to the needle housing an the bottom of the sample equipment in the basin.

3.1.2 Performance Requirements

The pump shall be portable and operated at the sample site.

3.2 General Mechanical Requirements

The sampling equipment shall be able to sample liquid and gas on both Mark I and Mark II lids.

3.2.1 Functional Requirements

~~The sampling equipment shall be designed to access any canister in the KW Basin.~~ The equipment shall be designed for storage and contamination control. The sampler will be operated and stored in the weasel pit at the KW Basin.

3.2.2 Performance Requirements

The requirements of the gas and liquid sampling equipment are as follows:

- The sampling equipment shall be made of materials that are compatible with the basin water and the gas and liquid in the closed canisters.
- The equipment shall interface with both Mark I and Mark II canister lids.
- The equipment shall return the canister lid valves to their original place, maintaining the integrity of the closed canister.
- Sample sizes, minimum 10 ml liquid and/or a gas.
- The sample containers shall be supplied by the receiving laboratory. K-Basin Engineering Projects, Process System.
- The sample equipment shall have the capability to be flushed after each sample.
- ~~The equipment shall be designed in two parts, one will be attached to a float and stay under the water line. The other part will be attached to the top of the float. This will allow the sample equipment access to all canisters and reduce the chance of surface contamination on the operator handled equipment.~~

4.0 GENERAL REQUIREMENTS

4.1 Safety

The gas and liquid sampling equipment shall be designed to minimize contact with any of the liquid or gas collected from the closed canisters.

4.1.1 Criticality

The canisters will ~~not~~ be moved from the racks, ~~criticality will not be an issue and~~ placed in a rack at the sampling station.

4.1.2 Safety Analysis

The sampling equipment shall be designed to meet all applicable safety boundary that are addressed in the SAR. A Safety Evaluation will be completed before any samples are taken from the closed canisters in KW Basin.

4.1.3 Contamination Control

The sampling equipment shall be designed to insure the samples will be in double containment at all times. The major section of the sampling

equipment will remain in the basin. This will help eliminate contamination of the operator with the basin water.

4.1.4 Shielding

Estimated dose calculations will be used to determine the amount of dose expected from sampling the liquid in the closed canisters.

4.2 Environmental Protection and Compliance

Environmental compliance will be addressed within the Characterization organization.

4.3 Quality Assurance

QA will review and approve all technical documents and work packages generated for this activity.

4.4 Safety

Spent Nuclear Fuel Technical Safety will review and approve final test report and work packages for this activity.

4.4 Operating Personnel and Services

Operations personnel will be trained to operate the equipment. When equipment is ready to be used for training, the current system being used by K-Basins (procedures or JCS) will be used to outline the operating instructions.

4.5 Testing

All equipment will be tested in the 305 building test facility using closed canisters. Test procedures will be prepared and issued for this activity.

6.0 REFERENCES

DOE, 1992, *Environmental Assessment of 105-KE and 105-KW Basin Fuel Encapsulation and Repackaging, 100-K Area, Hanford Site* (DOE/EA-0535), U. Washington, D.C.