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# Characterization Sampling Activity for Decommissioning of the 105-F and 105-H Fuel Storage Basins on the Hanford Site

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# CHARACTERIZATION SAMPLING ACTIVITY FOR DECOMMISSIONING OF THE 105-F AND 105-H FUEL STORAGE BASINS ON THE HANFORD SITE

## SUMMARY

The U.S. Department of Energy (DOE) owns the eight surplus production reactors at the Hanford Site, north of Richland, Washington. The fuel storage basins at two of these facilities were filled in 1970 to stabilize the residual sediment. Before the reactor facilities are decommissioned, the subject basins need to be investigated. The basins' fill material investigation project stipulates that the fill is to be removed, inspected, and appropriately disposed of in accordance with the material radiological and chemical constituents concentration levels. This initial characterization of the basins' fill material is to facilitate an appropriate material disposal designation on a timely basis in the field during the removal operation.

An environmental impact statement (EIS) has been prepared to examine the environmental impacts associated with several alternatives considered for decommissioning the surplus production reactors at the Hanford Site. Some alternatives would require removal of the fill before the start of final decommissioning. The 105-F and 105-H fuel storage basins are filled with debris and dirt, and may possibly cover hazardous and radioactive waste. The project will prepare the facilities for the decommissioning alternative.

The definitive design was completed in fiscal year 1990. The design included building modifications and material handling equipment necessary to excavate and monitor the fill removal. The fill material will be characterized thoroughly for both radiological and chemical hazardous materials before beginning removal.

The sampling and analysis of the fill (soil and water) serves to characterize the materials and define the material handling and disposal strategy. The fill material will be characterized for radionuclides and chemicals to determine parameters of concern. Special emphasis is placed on analysis for chemicals in material near the basin floor that may have been in contact with residual basin water and sediment, and the material strata residing above this interface.

The analytical results will be used to designate the fill material as noncontaminated, radioactive-contaminated, dangerous waste, or mixed waste. The results also will be used to identify the approximate boundaries of these materials. Based on this analysis, a best-cost disposal strategy will be finalized.

The fuel storage basin was designed to collect, store, and transfer the irradiated fuel elements discharged from the reactor. These storage facilities are concrete basins approximately 24 m (80 ft) wide by 30.5 m (100 ft) long by 6 m (20 ft) deep and contained 6 m (20 ft) of water to act as

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a coolant and shielding for the irradiated fuel. The fuel was stored in stainless steel baskets in rows separated by a 1 m (3 ft) high concrete wall.

Over the years, considerable sediment collected on the bottom of the basins. The sediment contains low levels of transuranics, fission products, and activated coolant materials. Each basin contains an estimated 50,000 kg of sediment.

The fuel storage basins were stabilized in 1970. In preparation for stabilizing the basins, the water level was lowered to approximately 0.6 m (2 ft). Some of the fuel storage baskets were removed from the basins. The grade-level wood deck was dismantled and placed in the basins. The monorail system above each aisle were cut from the ceiling and placed in the basin. Other miscellaneous objects removed from the building were placed in the basin. The basins were then stabilized by filling them with resident soil. Approximately 3,420 $m^3$ (4,500 $yd^3$) of backfill materials was placed in the 105-F basin. The fill came from the local surface and is essentially aeolian sand. Approximately 4,400 $m^3$ (5,800 $yd^3$) of backfill for the 105-H basin was obtained from a nearby barrow pit. The 105-H fill is mainly cobble, with rock up to 15 cm (6 in.) in diameter. The backfill was not compacted in either basin.

Samples were taken of the basins' sediment before they were backfilled. Radioanalytical results for these samples are shown below.

| | nCi/g of Sediment | | | Curies/Basin[a] | | |
|---|---|---|---|---|---|---|
| Basin | $^{239}Pu$ | $^{137}Cs$ | $^{90}Sr$ | $^{239}Pu$ | $^{137}Cs$ | $^{90}Sr$ |
| 105-F | 2.0 | 55 | 68 | 0.10 | 2.7 | 3.4 |
| 105-H | 1.3 | 54 | 9 | 0.065 | 2.7 | 0.45 |

[a]Based on 5 x $10^7$ g/basin.

It is assumed that the top 3 m (10 ft) of backfill is uncontaminated. The next 2.1 m (7 ft) is suspected to be contaminated, and the bottom 0.9 m (3 ft) is contaminated with material, equipment, a sediment layer, and possibly hazardous material, mainly residing close to the basin floor.

The fill material is believed to have a uniform distribution of inorganic and organic chemicals present in insufficient concentrations to be designated as mixed waste based on previous sampling of the 105-F and -H basins and the analogous sampling of residual basin material from 105-B, -C, -D, and DR basins.

A sample plan was prepared and approved in April 1991, and the sample procedure was issued in July 1991. Sampling was completed in October 1991. The sample analysis is being done at Oak Ridge K-25 Laboratory. The laboratory analyses results then will be evaluated and incorporated into a basin-fill characterization report.

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Each basin had ten sites designated for vertical sampling; four are designated for inorganic/organic (I/O) and radionuclide/transuranic (R/T) sampling, and six are designated for near-surface radionuclide sampling. The four sites designated for vertical I/O and R/T sampling have four locations designated for obtaining strata samples from the "surface" [0 m (0 ft)], -3.1 m (-10 ft), -5.2 m (-17 ft), and the "bottom" [-6.1/-9.1 m (-20/-30 ft)] materials.

Five of the six sites designated for vertical near-surface radionuclide sampling have three strata sampling locations [0 m (0 ft), -3.1 m (-10 ft), and -5.2 m (-17 ft)]. The sixth near-surface site has strata sampling locations at 0.305-m (1-ft) intervals from the 0-m (0-ft) to the -5.2-m (-17 ft) depth.

The sample methodology used a stratified three-dimensional random and bias grab sampling strategy (e.g., landfill strategy) based on process knowledge with analytical methods performed to protocols outlined in U.S. Environmental Protection Agency's SW-846 guidance. The sampling plan was developed to provide a statistically representative sample database for characterization of the fill, sediment, and water in the basins.

The basin spaces were surveyed thoroughly for both radiological and nonradiological hazardous materials as the first step in the sampling preparation. Generally, the radiation and contamination levels within the basin facility were low enough to pose no problems to the sampling personnel. The 105-F basin area required ventilation before beginning the sampling operation to assure that radon concentration levels were maintained below detection limits of the continuous air monitors.

Three onsite drill systems are considered capable of obtaining the basin below-grade samples that could operate under the low-overhead 3.1-m (10-ft, 4-in.) basin ceiling and of exerting enough force to penetrate the debris near the floor. The three drill rigs evaluated were the vibratory drill, the auger drill, and the hydraulic core drill. Both the auger and hydraulic drill rigs require a skilled and experienced drill crew. The vibratory and auger drill were available for the scheduled sampling time.

Initially the vibratory drill was considered the prime system because of past experience in driving test well casings in the basins. Later a new vibratory drill was tested using a combination of sampling equipment. The wireline core-barrel sampling (WCBS) components were evaluated with the sonic vibratory drill unit. The drill head assembly is attached to the WCBS inner barrel, which allows the inner barrel to remain stationary while the outer barrel is rotated. This vibratory drill design exerts a soil "liquidfication" energy for driving the bit; rotation was not considered to be necessary for this drill configuration. The WCBS system does not have to remove the outer barrel from the boring each time a sample is taken. If needed, the core barrel can be fitted with a plug bit and the boring advanced without taking subsurface samples.

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The field trial of the vibratory (sonic) drill in both gravel pits and in the basins concluded it would not continue to advance once the sample chamber had minimal material lodged in the chamber throat. Therefore, the vibratory drill was not used for basin sampling.

The auger drill system then was modified to lower the drill mast attachment on the trailer fulcrum. The mast extension and spindle adapter were shortened for low-overhead erection and driving sample string operation. This auger configuration also required that a 0.61-m (2-ft) deep hole be provided under the mast for lower drill clearance at each sample site. The auger drill was used for all the basin subsurface sampling operations. A senior drill engineer and a drill scientist comprised the auger drill crew for this sampling operation.

Depth measurements were based on cumulative measurements of drill rods, length of down hole tools, constant, and the amount of stick-up at the borehole collar. Depth measurements were logged in the field log. Particular attention was given to calculations to ensure that the sample depth of the bit was at the correct location.

The basin liquid removal method used the drill unit to provide the access channel for a stainless-steel bailer or a pump sample tube. Liquid samples could have been obtained from the basins' bottom using a peristaltic or roto-flex pumps.

The laboratory will separate the liquid/solid phases to obtain the material required for the analyses. The four sets of two samples were collected in 40-ml volatile-organic-analysis septum bottles. The septum bottles were filled assuring that no air bubbles were trapped within the bottles upon closure. The I/O and R/T liquid samples were described previously.

Sampling activities included: sample taking preparations, sampling equipment setup, sample collection, sample labeling, sample record keeping (field logbook), sample transfer to the laboratory and/or shipper, sampling equipment cleanup, and transfer of all contaminated material to the shipper for disposal. The lead sampler also obtained prior approval of the sample coordinator and any other organization as the coordinator may have directed regarding any necessary deviations from the sample plan requirements.

Preparation for offsite shipment included placing the samples in their proper shipping container and with a unique Chain-of-Custody form. The samples were screened by the 222-S Laboratory onsite to establish radiological shipping information. The shipper prepared shipping papers for offsite shipment with inputs from the Office of Sample Management (OSM), Health Physics, and the transportation logistics organizations.

The sampling lines and sampling apparatus were replaced with new precleaned components after each location point was sampled to prevent cross-contamination of the samples. The applicable sampling apparatus was swiped/surveyed before reuse and radiologically decontaminated after use. Then the apparatus was sent to the 1706-KE RCRA Decontamination Facility for chemical cleaning.

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The quality control (QC) samples (i.e., trip blank, rinsate, etc.) described in the sample work procedure also were prepared for analyses along with the other samples to determine if the samples were contaminated in any way during sampling, transportation to the laboratory, or analysis by the laboratory. If contamination of a sample is determined from this QC sample, resampling may be required.

The analytical laboratory will submit reports that document the analytical results, methods used, quality assurance QC methods employed, etc., through OSM to the task team data assimilator for technical review and acceptance. The analytical laboratory (ASL) will provide the fill sample analyses evaluation report. The analytical laboratory report will contain a statistical verification on fill sampling accuracy, analyses accuracy, and precision for both the radionuclide and chemical constituents, and identify the boundary(s) at which the material is unconditionally releasable, mixed, etc.

The sampling and analysis will identify and establish boundaries and facilitate disposal of the materials. The fill characterizations will reduce and/or eliminate the need for in-process material analyses, except for specific disposal conditions, and may make the field survey instruments the primary material disposal designating tool.

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