Successful Characterization Strategies for the Active High Risk Y-12 National Security Complex 9201-5 (Alpha-5) Facility, Oak Ridge, TN - 12164

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ABSTRACT

Building 9201-5 (Alpha 5) was completed in May 1944 and served as a production facility for National Nuclear Security Administration (NNSA) Y-12 Weapons Plant. During the Manhattan Project, it functioned as a uranium enrichment facility. The facility was renovated and altered over the years, converting the calutrons to support other missions. Alpha 5 consists of 4 floors and a basement measuring approximately 600,000 square feet. The facility contains various pieces of equipment remaining from legacy operations. A significant amount (approximately 200,000 kgs) of mercury (Hg) has been spilled in the facility over the operational history of the building. To further complicate matters, beryllium (Be) contamination in 9201-5 is found throughout approximately sixty percent of the facility. Concentrations varying from very low (< 0.2 micrograms (µg)/100 cm2) to areas where concentrations are relatively high, approximately 600 µg/100 cm2, in regulated beryllium areas. The primary site related contaminants (SRCs) for the waste in this facility are enriched uranium, depleted uranium, beryllium and mercury. This facility represents the highest environmental risk for DOE-ORO EM and NNSA at Y-12 and must be quickly addressed to minimize impacts to future Y-12 missions, as well as human health and the environment.

As part of the American Recovery and Reinvestment Act (ARRA), approximately 700,000 cubic feet of legacy material was removed in 2010 and 2011. In addition, characterization of the 9201-5 facility was scheduled in the winter and spring of 2011. This activity was initiated in January 2011 and was completed in July 2011. Heavy schedule pressure was further complicated by the fact that this building has active utility, security and process systems. Given these complex variables, a unique, out of the box characterization strategy was forged in an effort to bound radiological and chemical contaminants, as well as providing the appropriate level of quality to ensure that this data could be used to develop waste profiles when deactivation, decontamination and demolition (D&D) activities are authorized at a future date.

The characterization strategy involved a hybrid model of statistically-based and biased sampling events. To achieve the desired results, traditional intrusive sampling and laboratory analysis, as well as a number of field-based characterization methodologies (e.g., X-ray Fluorescence [XRF], Lumex and Non-Destructive Assay [NDA]) were utilized. Results were captured and synthesized into meaningful, useable conclusions in a facility characterization report that will more accurately aid D&D cost estimates for future remedial actions. This massive characterization campaign involved over 1,200 separate sample locations using 4 separate characterization methods and was successfully completed to meet a performance-based milestone within 8 months of initiation.

PURPOSE

This technical paper addresses the characterization planning for the 9201-5 facility located at the Y-12 NNSA Plant in Oak Ridge, Tennessee. This building supported the various operations throughout its lifespan and is considered a high hazard facility due to the presence of large quantities of mercury and beryllium. The facility is also in an active state, meaning utilities and various building systems were active at the time of characterization and have not been purged or disconnected. The facility is expected to deactivated, decontaminated and decommissioned in the next 10 years depending on U.S. DOE budgetary projections.

BACKGROUND

Building 9201-5 is a large four-story, steel and reinforced concrete structure that encloses approximately 191,000 square feet (ft^2) within the protected area of Y-12 (Figure 1). It was constructed in 1944 and has a gross total floor space of 614,000 ft^2.

The upper-level framing of the building consists mainly of structural steel. The building is enclosed with hollow-clay-tile walls that are used primarily for architectural purposes. Several of the hollow-clay-tile walls do, however, provide some resistance to lateral forces (especially wind loading). Additions made to the original structure include Building 9201-5E (to the east) and Building 9201-5W (to the west).

The facility exterior walls are primarily made of red clay bricks, transite, steel and concrete. The interior walls are drywall, block, hollow clay tile, and transite. The floors are concrete ranging from 6 to 18 inches thick and floors are reinforced with rebar.

9201-5 facility's south façade features hooded vents attached directly to the building's face and numerous electrical and piping systems. The building was enlarged with a one-story addition on the west façade in 1967 (Building 9201-5W). The Alpha-5 facility underwent a major rennovation in the 1950s when the facility supported the COLEX process and again in 1970 which altered the interior with new walls, ceilings, floors, mezanine, work platform, office space, and changehouse. Other building modifications have resulted in extensive exterior alterations and additions.

Utilities currently active within the facility include:

- Electrical
- Steam
- Potable Water
- Plant Air
- Methanol Brine
- Fire Suppression Systems
- Compressed Gases

Asbestos containing materials (ACM) in the form of transite panels, roofing, pipe insulation, floor and acoustical ceiling and floor tiles are present. Polychlorinated biphenyls (PCBs) are potentially present in light ballasts, painted surfaces and in heavy equipment, as well as spill areas.

Mercury is expected inside walls, drains, and floors, as well as mercury switches and fluorescent tubes. Lead is expected to be present in painted surfaces, lead bricks, shielding, and some machining equipment.

Structural deteriorations necessitates ongoing characterization and task hazards analysis to ensure effective controls are in place for the safety and health of workers.

The 9201-5 facility has been divided into 82 Capability Units (CUs). These CUs were based on previous uses and Contaminants of Concern (COCs). The four wind tunnels beneath the first floor of 9201-5 are specifically excluded from the scope of this characterization project and will be addressed in future deactivation activities.

Mercury Spill History

Process leaks and spills are known to have occurred within the process areas. Five major mercury spills were noted during the review of historical operating records and documentation (see Table 1). Four of the spill reports indicate that there was “digging” associated with cleaning up the spills, implying that the released mercury had breached the containment of the building. The 1966 spill occurred at the “dump pit” in the south west side of the facility. These pits, located in the east and west crane bays, were sealed with an epoxy resin coating to prevent seepage through the porosity or cracks. Process history and operating records indicate there were also numerous small spills of mercury during COLEX operations. Potential mercury from leaky pipes, condensation, hollow clay tile walls, and cracks in the floors is suspected throughout the facility as well as in the fan rooms and fan room sumps.

Table I. Documented Mercury Spills in the 9201-5 Building

Date	Estimated Losses
1/1/56	70,000 Pounds
7/17/56	40,000 Pounds
Mid 1956	40,000 Pounds
11/15/56	85,000 Pounds
3/28/66	85,000 Pounds

Contamination from Machining

In the late 50's when Y-12 was transitioned into a 'Specialized Machine Shop' role, the plant re-organized to reflect the types of operations to be performed. The primary operating divisions were Metal Prep, Fabrication, QA/QC and Product Certification (included basic Inspection, Dimensional Inspection, Properties Inspection, X-ray, Dye Penetrant), Product Certification (includes the plant laboratory), Assembly, Packaging and Dispatching Maintenance, and Utilities.

Metal processes could include heat treat by furnace and salt bath, pressing (rough and finished and many in between), forming, Arc Melt, alloying, pickling, metal finishing such as plating, electroplating, Electrical Discharge Machining (EDM), Degreasing, special material processing and others. Fabrication was responsible for basic machining and included rough machining, cutting, grinding, machining to shape and size, and finish machining. Maintenance was also a continuous operation usually as tools, machine parts, furnaces, plating baths and salt baths, pumps, elevators, building, ventilation units, electrical and mechanical were always in need of repairs and always being repaired.

Formed uranium metal parts were machined into finished weapon parts and then transferred to Y-12 assembly operations. Numerous buildings were needed to support these diverse operations and the buildings were frequently modified to meet changes in production needs. These operations were primarily done in Buildings 9201-5, 9204-4, 9215, and 9998. Depleted uranium (DU) operations for the production of weapon components have existed at Y-12 since the early 1950's. DU is a form of uranium consisting of over 99.8% 238-Uranium and less than 0.72% 235-Uranium by mass.

The first record of thorium at Y-12 was in January 1947. At that time, the inventory was used in research and development studies primarily by Oak Ridge National Laboratory (ORNL) personnel at Y-12. In 1952 the thorium inventory increased significantly. Shipments and receipts were primarily between Y-12 and ORNL. Processing of thorium at Y-12 began in the early 1960's. The thorium metal in pellet form was pressed into electrodes and two arc meltings were made. The metal from these melts was pressed and/or rolled, formed, and machined. Metal scraps and chips were salvaged and also pressed into electrodes to be used in the arc-melting process. Pellet/scrap preparation, arc melting, crop and trim machining and sawing occurred in 9201-5.

SITE CONCEPTUAL MODEL

Figure 1 represents the Site Conceptual Model (SCM) for the 9201-5 Characterization Project. The SCM describes the categories of material contained within the building and identifies the radioactive and chemical contaminants determined to be COC. The waste within the 9201-5 facility is a heterogeneous population of equipment; items described as accountable material/classified waste; personal protective equipment (PPE) and other incidental waste (e.g., material wrapping); empty containers, tanks, and the facility itself. The facility was divided into seven subpopulations for sampling: piping and ventilation, roof, floors and ceilings, exterior walls, interior walls, structural steel, and remaining equipment.

All of the equipment remaining in the building is from Y-12 facilities; accordingly, potential COC from off-site sources are not present. Some of the remaining equipment originated at other sites such as Pantex and Naval Reactors; however, the equipment was transferred prior to any contamination. Therefore the COCs are native to Y-12.

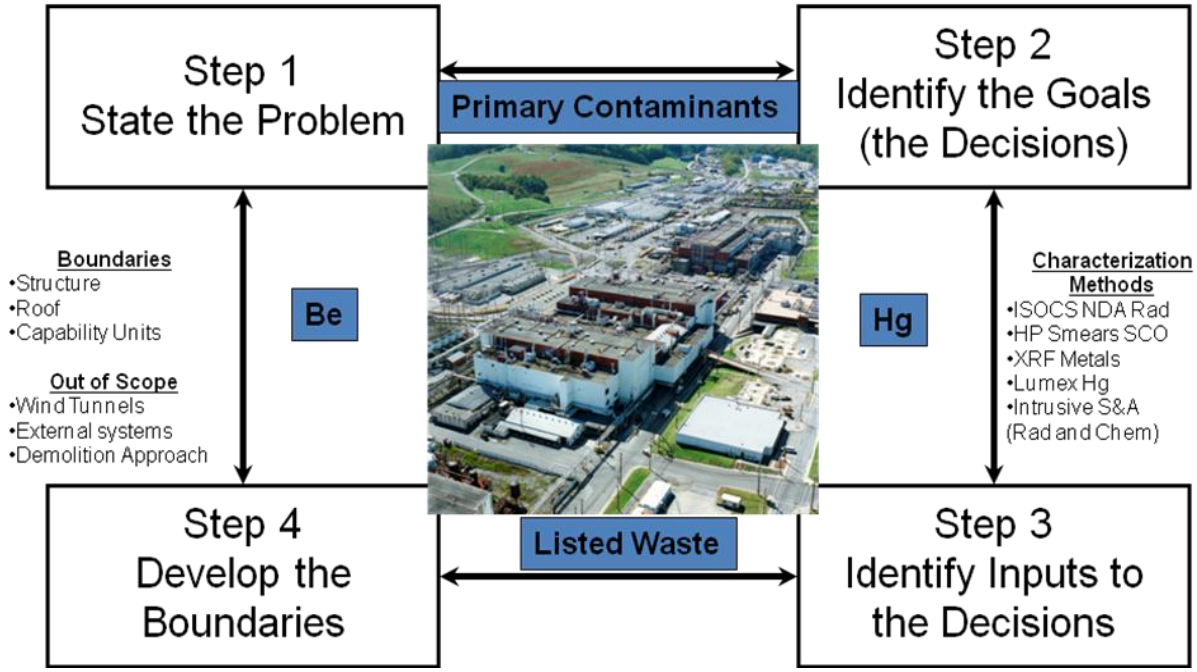

Fig. 1. 9201-5 Site Conceptual Model

Based on the review of Process Knowledge (PK), including historical health physics data, radiological COCs are DU, EU, and the atypical radionuclides thorium, and sources used for x-ray (cobalt 60 and iridium) whose removal will be verified. All of the characterization samples were analyzed for a full radiological suite. This approach quantified the amount of uranium isotopes and thorium and verified the absence of other atypical radioactive contaminants (i.e., cobalt, americium-241, cesium-137, neptunium-237, plutonium isotopes, and technetium-99).

Also based on the PK, chemical COCs have been identified as beryllium, lead, lithium, mercury; phosphoric acid, chromic acid, nitric acid, boron carbide, tetrachloroethene, carbon foam ingredients, toluene di-isocyanate, trichloroethane, chlorofluorocarbons (e.g., Freon), PCBs and asbestos or asbestos-containing material (ACM). Sources of chemical contaminants include equipment and machinery and metal objects such as lead bricks and Resource Conservation and Recovery Act (RCRA) universal waste (e.g., batteries). Organic contaminants such as Volatile Organic Compounds (VOCs), semi-volatile organic compounds (SVOCs), and Polychlorinated Biphenyls (PCBs) may be present on unremovable equipment or in depressions and floor joints due to spills. Pesticides and herbicides (or residues) are not expected.

Characterization efforts to confirm the presence and identity of chemical COC included analysis for Total and Toxicity Characteristic Leaching Procedure (TCLP) VOCs; Total and TCLP SVOCs; Total and TCLP metals; and PCBs, as established in the Sampling and Analysis Plan [2]. Total metal analysis was performed for beryllium and mercury.

CHARACTERIZATION DESIGN

Assessment of historical characterization investigations of the 9201-5 facility indicates that fixed and removable radiological contamination is present. It is important to note that the 9201-5 facility is no longer associated with production support missions; however, it remains an active facility. Due to active utilities and process lines, intrusive sampling was prohibited from certain

parts of the building structure and systems. Areas excluded from sampling will require verification that the waste is bounded by a waste profile when demolition of this facility is authorized. Every effort was made to non-invasively characterize these structural components and systems using field-based techniques such as X-Ray Fluorescence (XRF), Lumex for mercury, and field Non-destructive assay (NDA).

Some areas were excluded from intrusive characterization including a structural wall at column 29 that is shared with Alpha 5 West, various chemical tank systems, ventilation systems, brine systems, active utilities (electrical, water, sewer, steam, etc.,) coolant systems and pressurized gas lines.

Over 1,141 different sampling points were selected on the various inactive building structural media (e.g., floor, concrete, structural steel, walls) and remaining non-legacy material removal (LMR) equipment. The total sample population was further divided into 601 laboratory, 324 NDA, 53 XRF and 163 Lumex sampling points.

Sufficient data was collected to determine representative contaminant averages within the scope of the SAP [2]. The characterization requirements specified in the SAP are designed to meet waste acceptance criteria (WAC) requirements for the on-site Oak Ridge Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Environmental Management Waste Management Facility (EMWMF) (i.e., must meet a 95% upper confidence limit [UCL] with an 80% power). This approach also ensures compliance with WAC requirements of other treatment, storage, disposal and recycle facilities (TSDRF), which typically require waste characterization to achieve a maximum UCL of 95%. Table 3 provides the sample design summary utilized in the characterization planning for the 9201-5 Building.

Table III. Summary of Sample Population Analytical Requirements for the Building 9201-5 Characterization Project

Media	Original Number of Samples [a]	Final Number of Samples [b]	CHEMICAL SAMPLES FOR EACH POPULATION		RADIOLOGICAL SAMPLES FOR EACH POPULATION	
			CHEMICAL ANALYTES	PERCENT OF SAMPLES	RADIOLOGICAL ANALYTES	PERCENT OF SAMPLES
Concrete Floor	99	99	Total VOCs [d] & SVOCs [e]	30%	Uranium-isotopic [c]	100%
Ceilings	99	99				100%
Interior Walls [a]	99	94	TCLP VOCs d & SVOCs [e]	30%	Technicium-99 Americium-241 Neptunium-237 Plutonium-isotopic Thorium-isotopic Cesium-137 Cobalt-60	100% 100% 100% 100% 100%
Exterior Walls	99	87	TCLP [f] Metals	30%		
Roof	59	23				

Piping	Biased	Chemical and radiological analytes will be selected based on process knowledge of the systems and equipment.
Legacy Equipment	Biased	

Key:
[a] Quantity of samples determined by the Project Statistician based on percent coverage and accessibility in original SAP.
[b] Quantity of samples altered under approved concurrence form for deviation from original SAP.
[c] Radiological analysis of uranium isotopes also may be performed by field NDA measurement.
[d] VOCs – volatile organic compounds
[e] SVOCs – semi-volatile organic compounds
[f] TCLP – Toxicity Characteristic Leachate Procedure

Table 4, provides a summary of collected samples and the various characterization methodologies.

Table IV. Summary of Biased Sample Population And Characterization Methods Employed For The Building 9201-5 Characterization Project

Media	Number of Biased Samples [a]	Lumex	Laboratory Cold Vapor Extraction	X-Ray Fluorescence	Non Destructive Analysis
Equipment	54	0	0	30	95
Structural Steel	0	0	0	10	0
Ventilation	0	0	0	0	205
Walls/Ceiling	0	11	280	0	14
Floor	0	124	240	0	3
Piping	0	0	0	0	7
Miscellaneous	0	0	23	0	0
Totals	54	135	543	40	324

Key:
[a] Quantity of samples determined by the Project Waste Management Personnel based on process knowledge, professional judgment and accessibility.

RESOURCE CONSERVATION AND RECOVERY ACT LISTED WASTE DETERMINATION

Due to materials and chemicals processed throughout the operating history of the 9201-5 facility, historical information was collected and evaluated to make an accurate RCRA Listed Waste Determination (LWD). Because a LWD is not based on chemical concentrations but rather the presence of the material and the end use of the chemical, living memory interviews, facility due diligence inspections and process evaluations were conducted. The final determination was that the 9201-5 Building did not contain listed RCRA waste.

RESOURCRE CONSERVATION AND RECOVERY ACT CHARACTERISTIC WASTE DETERMINATION

9201-5 Structural Media

The 9201-5 Building was characterized for mercury using mobile Lumex, laboratory cold vapor extraction, and TCLP. Two hundred fifty nine (259) samples were collected and analyzed using the TCLP protocol. Of the collected samples, 32 samples failed TCLP (i.e., 12.4%).

Twenty Nine (29) of the RCRA failures were in concrete. The concrete failures were all floor locations. Three (3) TCLP failures were exhibited in wall samples. The wall sample media failures were found to be constructed of clay tile.

Using the 20 times rule on the total metal data, by either cold vapor or Lumex, all results that exceeded 4 mg/kg (20 times calculated RCRA limit for mercury) could potentially be considered mathematical failures. Of the 543 total mercury samples, 345 exceed the twenty times rule, mathematically speaking. Theoretically, this would result in a 63.5% simulated TCLP failure; however, only 32 of 259 collected samples (i.e., 12.3%) actually resulted in TCLP data failures. This suggests that the total mercury results are highly variable within the 9201-5 structural media and are extremely difficult to accurately delineate mercury remediation boundaries within the facility. The mercury data was mapped for each floor of the 9201-5 facility to provide a visual indication of the areas within the building that have mercury issues.

One sample of the 133 failed TCLP threshold levels for lead at 31.1 mg/L. Upon investigation, it was confirmed that it was an asbestos ceiling tile with a thin lead-based laminate coating. With this sample result included, the calculated UCL-90 is 11.5 mg/L for lead. The RCRA limit for lead is 5.0 mg/L. This lead sample will be eliminated from the controlled data set because the asbestos will be abated prior to demolition. With this data point removed, the UCL-90 is below the RCRA limit of 5 mg/L.

No RCRA constituents, other than mercury and lead, exceeded the UCL-90 standard during characterization of the 9201-5 building.

9201-5 Remaining Equipment

One RCRA issue was noted regarding the remaining equipment and cadmium. One sample was measured at 6.34 mg/L, well above the RCRA TCLP limit of 1.0 mg/L for cadmium. The second failure was 2.11 mg/L. Upon closer examination, the sample media were gloves from a glove box. The calculated UCL-90 cadmium value for the entire population of glove boxes is 2.34 mg/L above the 1.0 mg/L limit.

POLYCHLORINATED BIPHENYLS

The 9201-5 facility contains both PCB articles and spill areas. PCB articles contain oils with PCB concentrations greater than 500 parts per million (ppm). Furthermore, a number of areas have been encapsulated and are managed as PCB spill areas. PCBs are also found in paints on various 9201-5 structural and equipment surfaces. Two aroclors that possess extremely low concentration levels for disposal at EMWMF, PCB-1221 and -1232, were not present in the 9201-5 LMR equipment or on Y-12 in general.

ASBESTOS CONTAINING MATERIAL

The 9201-5 facility also contains asbestos containing material (ACM) throughout the structure and remaining equipment. The ACM primarily consist of tile, wall and ceiling panels and insulation. Approximately 216,000 square feet and 20,000 linear feet of ACM remain within the building structure and equipment. These estimates were completed using detailed inventories by qualified asbestos personnel.

BERYLLIUM

Beryllium was utilized in various equipment (e.g., glove boxes) remaining in the building. The calculated UCL-95 value for the overall structure is 4.31 mg/kg. Given these results, on-site disposal of the 9201-5 structure can meet the EMWMF Waste Acceptance Criteria (WAC). Conversely, some of the remaining equipment exhibited elevated beryllium resulting in a calculated UCL-95 value for the equipment of 4,366 mg/kg. This may be problematic for the remaining equipment from a nuclear criticality safety and industrial hygiene perspective and will need to be further investigated when deactivation, decontamination and decommissioning activities are authorized.

RADIONUCLIDES

Uranium was the primary radionuclide of concern within the 9201-5 building. Because the facility is still active, not all equipment and systems could be intrusively sampled. A field NDA program was employed using qualified technicians, calibrated equipment and the proper quality assurance protocols to ensure sound radiological data could be collected.

Intrusive Radiological Data on Structure

The 9201-5 facility has low levels of contamination throughout it. The intrusive samples of the floors, wall, ceilings and roofs had a UCL-95 of 2.42 for uranium-235 and 1.5 for thorium-232.

NDA Radiological Data on Remaining Equipment

Table 5 provides a summary of the measured radionuclides that were detected using non-invasive, NDA that was performed on some of the inaccessible 9201-5 systems and the majority of the remaining equipment. Significant radionuclide levels for U-235 and U-238 were calculated, at a UCL-95 value of 8.0E+26 and 2.8E+10 pCi/g, respectively. Thorium-232 was also observed to be 2.7E+9 pCi/g. The NDA results include a sample with high minimum detectable activity (MDA), which biased the results high. The radionuclide levels in this equipment and building systems are considered significant and will need to be addressed during the D&D planning.

Table V. Non Destructive Assay Results for 9201-5 and Remaining Equipment and Inaccessible Systems

Constituent	Frequency of Detection	Units	Upper Confidence Limit-90	Upper Confidence Limit-95
Thorium-232	243 / 244	grams	20,245	24,721
Thorium-232	242 / 244	picocuries	2.2E+09	2.7E+09
Uranium-235	203 / 244	grams	3.0E+20	3.7E+20
Uranium-235	203 / 244	picocuries	6.6E+26	8.0E+26
Uranium-238	214 / 244	grams	68,701	83,893
Uranium-238	214 / 244	picocuries	2.3E+10	2.8E+10

ON-SITE DISPOSAL FACILITY EVALUATION

The Oak Ridge Reservation (ORR) currently maintains an operating CERCLA disposal landfill known as the EMWMF. In an effort to aid future deactivation, decommissioning and decontamination activities, the characterization data detailed in this technical paper was evaluated to determine if the WAC for the EWMMF could be met. The EMWMF WAC is unique in that waste lot profiles are developed using a sum of fractions methodology for both carcinogenic (CA) (radiological) and hazard index (HI) (chemical) constituents. The sample design and extensive data collection for the 9201-5 building structure yielded data to determine a projected waste lot profile for EMWMF. Table 6 provides a statistical analysis of the anticipated sum of fractions for both the HI and CA WAC.

Remaining Equipment Evaluation

An EMWMF SOF evaluation for the remaining equipment within the 9201-5 facility was not performed because of elevated chemical and radiological values observed which are most likely in excess of acceptable EMWMF disposal criteria. It should be noted that these values observed were gross values prior to decontamination and removal efforts. It is highly likely a large majority of the equipment can undergo disassembly and decontamination efforts to greatly reduce residual chemical and radiological contamination in an effort to meet on-site EMWMF disposal requirements.

Because the EMWMF Physical WAC requires void spaces not to exceed 10% of the total volume of a piece of equipment or container, many of the pieces of equipment were evaluated using physical measurements, photographs, engineering drawings, manufacturer specifications and other pertinent documentation. The final product was a void space package (VSP) determination for individual pieces of equipment. VSPs contain physical measurements of the item, as well as the identification of fluid reservoirs, anomalous wastes (e.g., circuit boards, lamps, mercury containing equipment, etc.) and disassembly/cut points on the item to expose internal void spaces for external fill. VSPs will be utilized extensively in future deactivation, decommissioning and decontamination efforts on the 9201-5 facility.

As previously mentioned, a full RCRA LWD was also performed on all remaining equipment as well.

9201-5 Building Structure Media

As positively demonstrated in Table 6, none of the heavy metals or radionuclides for the 9201-5 building structure challenges the EMWMF WAC for the ceiling, walls, floors and roof media together. The RCRA TCLP data is not included in this table. The projected Sum of Fractions (SOF) for HI and CA is 0.07 and 0.382 respectively; well below the administrative target SOF limit of 1.

Table VI. EMWMF Disposal Evaluation Statistics for the 9201-5 Facility Intrusive Sampling

Constituent	Frequency of Detection	Units	UCL 90 a	UCL 95 b	Analytic WAC c		ASA WAC f	E(X) g divided by Analytic WAC c	
					Carc. d	HI e		Carc. d	HI e
Intrusive samples from ceiling, wall, floor, and roof combined									
Metals									
Beryllium	107 / 402	mg/kg h	3.61	4.31	--	--	--	--	--
Mercury	534 / 543	mg/kg h	1604	1958	--	--	--	--	--
Total Uranium	402 / 402	mg/kg h	452	552	--	--	--	--	--
Radionuclides									
Thorium-228	178 / 402	pCi/g i	4.71	5.63	--	--	--	--	--
Thorium-230	275 / 402	pCi/g i	1.53	1.76	--	--	--	--	--
Thorium-232	221 / 402	pCi/g i	1.3	1.5	--	--	--	--	--
Uranium-233	0 / 402	pCi/g i	8.08	8.66	1700	4.5E+07	100,000	NA j	NA j
Uranium-234	6 / 402	pCi/g i	25.9	30.7	1700	2.8E+07	100,000	0.008	4.6E-07
Uranium-235	386 / 402	pCi/g i	1.99	2.42	1500	9500	100,000	6.0E-04	9.5E-05
Uranium-236	19 / 402	pCi/g i	0.792	0.96	1700	280,000	100,000	2.2E-04	1.3E-06
Uranium-238	400 / 402	pCi/g i	152	185	1200	1500	100,000	0.057	0.046
Projected EMWMF SOF k								***0.07***	***0.382***

Key:
a UCL-90 – Upper Confidence Limit – 90
b UCL-95 – Upper Confidence Limit – 95
c WAC – Waste Acceptance Criteria
d Carc – Carcinogenic
e HI – Hazard Index
f ASA WAC – Analytical Safety Analysis Waste Acceptance Criteria
g E(X) – expected value

h mg/kg – milligrams per kilogram
i pCi/g – picocuries per gram
j NA – not applicable
k EMWMF SOF – Environmental Management Waste Management Facility Sum of Fractions

CONCLUSION

Analysis of the 9201-5 building structural media indicates extremely low levels of radionuclide and chemical contamination are present, with the exception of mercury, which has a calculated UCL-90 value above the RCRA TCLP threshold value of 0.2 mg/L for all sampled structural media. Lead also has a calculated UCL-90 value above the RCRA TCLP threshold value of 5.0 mg/L; however, the sample media failure was associated with a ceiling tile that was confirmed to contain a lead-laminated coating and asbestos.
The only remaining equipment RCRA failure involved cadmium and was associated with gloves from a glove box. Beryllium and PCBs are also present, but at levels that will not present an issue for potential on-site EMWMF disposal.

A clear, concise mercury management strategy will be required for those structural areas that demonstrated TCLP failures in an effort lower the calculated UCL-90 RCRA value for the entire structure below 0.2 mg/l. In addition, a beryllium and asbestos management strategy will also need to be developed to ensure compliant waste packaging such that the EMWMF Physical or appropriate TSDF WAC requirements can be met.

The remaining equipment within the 9201-5 facility has a number of radionuclide holdup and beryllium issues. The sampled glove boxes appear to be problematic for disposal at EMWMF given the PK associated with their historical processes and the cadmium TCLP RCRA failures. The glove boxes should not be sent to EMWMF given the limited biased data collected from them, and process knowledge associated with their historical processes. It is possible that after the various active systems within the building have been deactivated, drained and verified to no longer contain radiological and chemical levels in excess of EMWMF WAC, and anomalous waste removed, the remaining equipment and the facility can be combined into a single high volume, low SOF EMWMF waste profile.

It is important to note that these characterization results are a snapshot of the 9201-5 structural media at the time this characterization information has been published. Chemical or radiological changes to the 9201-5 facility in the future could have a serious impact upon the characterization data collected during this campaign. Every effort should be made to minimize facility access and the storage of any wastes, equipment, chemicals, etc. that could have a drastic effect on the projected TSCA, RCRA and radiological of the structure and remaining equipment.

REFERENCES

1. U.S. Department of Energy, *Record of Decision for Phase I Interim Source Control Actions in the Upper East Fork Poplar Creek Characterization Area, Oak Ridge, Tennessee*, 2002
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