

FACILITY WASTE CHARACTERIZATION FOR D&D – HEU, MIXED AND LLRW – FOR CERCLA, RCRA, DOE AND NRC COMPLIANCE

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ABSTRACT

This paper summarizes the scope of the characterization requirements for a DOE D&D Project facility, and describes how DRS developed and implemented the plan to meet all regulatory requirements focused on worker safety and waste minimization and disposal. The D&D Project is at the K-1420 facility at the ETTP. It is a 80,000 S.F. facility used as a gaseous diffusion plant converter maintenance facility incorporating acid decon, nickel plating, uranium recovery and conversion and mechanical maintenance on plant components. The facility has significant quantities of HEU, mercury, lead, acids, metals and mixed wastes. Decon and Recovery Services, LLC, (DRS), a partnership between O'Brien & Gere and NSC Energy Services, Inc was awarded a prime DOE contract for D&D and re-industrialization in late 1997. Waste Characterization activities were completed in January 1999.

CHARACTERIZATION REQUIREMENTS

The plans and results of the Characterization task and the development of the characterization, sampling and analysis plan was based on the requirements of the myriad of regulatory requirements for facility D&D.

Requirements for characterization originate in the following two fundamental areas:

1. Worker Safety
2. Waste disposal

From these, a number of federal regulations prescribe the sampling methods and analytical requirements. Figure 1, Control Point, shows the protective clothing and respiratory protection required for access to the area. One of the main purposes of the



Figure 1 - Worker Protection is a key objective of Characterization.

characterization effort is to optimize these protective requirements for workers.

Worker Safety

These regulations are described in the Occupational Safety and Health Administration (OSHA) regulation in 29 CFR 1910 which requires that all workers are properly informed, trained and outfitted for the hazards in the job. Environmental Protection Agency (EPA) regulations in 40 CFR 302 list the reportable quantities of hazardous materials. Characterization should provide an estimate of the total quantity in the facility for reporting purposes. Table I - Typical Worker Hazards and Characterization Techniques, lists a few of the worker safety and monitoring concerns found in a complex DOE facility D&D project.

Table I - Typical Worker Hazards and Characterization Techniques

Safety Issue	Hazard	Sampling	Analysis
Criticality	Direct radiation Exposure	Residues, NDA Measurement	U-235, SNM, Gamma Spectroscopy
Airborne Metals, Organics and Radioactivity	Inhalation, Ingestion	Surface contamination, air samples	ICP, GCMS

Waste Disposal

40 CFR 261 describes the requirements of the identification and listing of hazardous wastes. Under this requirement, materials in excess of regulatory limits must receive special management for characterization, treatment, (see below) transportation and disposal. Subpart C to Part 261 further clarifies the specific characteristics for waste classification. Table II – Waste Disposition Characterization Summary, lists the four primary waste categories for the K-1420 D&D project.

EPA regulations in 40 CFR 268.40 describe the treatment standards for the disposal of hazardous wastes in landfills. Materials for disposal must be tested to meet these limits for disposal. Disposal facility waste acceptance criteria (WAC) prescribe requirements for identification and reporting of waste constituents. Each waste class must be tested for key constituents to properly classify these wastes for disposal i.e.; low-level, low-level mixed, etc. The wastes from the 1420 D&D project are to be turned over to the USDOE's prime contractor, Bechtel-Jacobs for disposition. Low-level wastes are to be disposed at the Envirocare of Utah Facility. Mixed Wastes are to be treated for storage or disposal under the existing or planned contracts for mixed waste. HEU residues are to be stored in a critically safe geometry pending identification of a disposition method.

Table II – Waste Disposition Characterization Summary

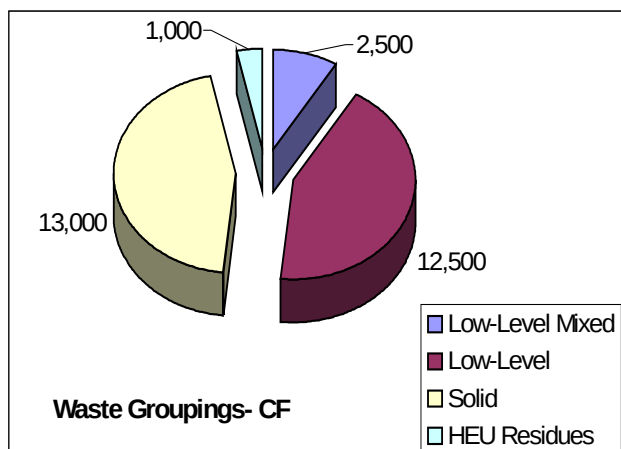
<i>Type</i>	<i>Requirement</i>
Solid Industrial	TCLP, Paint Filter, Radionuclides, PCB's
Hazardous	GCMS, ICP, TCLP, Paint Filter, Radionuclides, PCB's
Low-Level	TCLP, Paint Filter, Radionuclides
Low-Level Mixed	TCLP, Paint Filter, Radionuclides, GCMS, ICP, PCB's

These options for disposition create a complex array of analytical requirements for each waste group. These requirements are discussed below.

METHODS

The characterization of the K-1420 facility was planned in two stages – first, prior to project operations on-site, a preliminary plan was developed from the available data. This data included a Safety Analysis Report from 1985, a number of post-RCRA reports from the period 1994 through 1997 including NDA assessments, hazard analyses, Engineering Evaluation/Cost Analyses and Contamination Control Plans. This database was collected and summed up to produce a characterization baseline. Comparing this

baseline to the desired final data, gaps and missing information was identified.

**Figure 2 - Baseline Waste Grouping**

The existing baseline data set identified the principal hazards and constituents that require notification, engineering controls and personal protective equipment. From a worker safety perspective, no additional samples were required to begin work. The baseline condition of the facility are summarized for a portion of the facility in Table III – Baseline condition or description of Buildings K-1420, K-1421, and K-1422

The past sampling and analytical data were aimed at developing data to support issues other than decommissioning and the attendant waste disposal requirements. From the

perspective of the D&D manager, the past data was not complete and did not support any detailed waste classification.

The number of samples and analysis was developed to support the control, minimization and treatment/disposal of waste from the project.

Figure 2 – baseline Waste Grouping, shows the projected total waste volume was over 29,000 cubic feet with 2,500 of low-level mixed waste, 12,500 of low-level waste, 13,000 of solid wastes and 1,000 CF of residues containing highly enriched uranium. Each waste source was broken down into a group for characterization. Forty (40) groups were created based on process knowledge. This grouping simplified the development of sampling and analytical requirements.



Figure 3 - Sampling Required Access to Internal Surfaces

Based on the prior studies of the facility, each area or waste group was screened for the presence of key constituents that would affect waste class. These are summarized in Table III – Baseline condition or description of Buildings K-1420, K-1421, and K-1422

The methods for sampling areas were taken from SW-846 and consisted of relatively simple collection methods, such as scraping and spooning of sample material into collection containers.

An In-Situ gamma spectroscopy system was used for non-destructive assay of radonuclides in pipes, ventilation ducts and areas. This method employed a high-purity germanium detection system coupled to a multi-channel analyzer calibrated to determine radionuclide concentrations in the field of view. Use of this system reduced radiation exposures from sample collection, and wastes from sample analysis. The in-situ gamma spectroscopy system was particularly useful for assessment of the contamination from the HEU residues in pipes, ducts and small tanks.

Heterogeneous materials were segregated in a manner that was based on the waste packaging plan. The lead based paints were segregated from the building materials for analysis.

The planned sample analyses are listed in Table IV - Planned Samples And Analyses. The selection of the sampling locations and analytical procedures were based on a subjective judgement of the prior data quality as well as a requirement for analyses for disposal.

The analyses were conducted using EPA certified laboratories. The samples were classified into analytical groups for the purpose of optimizing analytical data. The classification was based on process knowledge, and the results of prior analyses. Table V – Sample Analytical Plan, shows how various samples were analyzed.



Figure 4 - Chain of Custody and Split Samples Ensured Data Quality

Table III – Baseline condition or description of Buildings K-1420, K-1421, and K-1422

Component	Current condition or description	Radiological	PCB	Asbestos	Chemical
G/H-2/7 maintenance area	Maintenance equipment still present. Pipe threader, drill press, grinder, welders, saws,	Contaminated	Cutting oils	Table tops	Not suspect.
J-4/5 vapor/vacu blasters	System shutdown and drained. Equipment still present. Grit material in each blaster.	Fan motors and cooling oil may be contaminated	Cutting and cooling oils	Vapor blaster	Potential from degreasing and blasting operations
H-8 Stripping Tanks	System shutdown and drained. Equipment still present.	Contaminated	Not suspect	Not suspect	Acids and freon.
J-9 Heat Treat Furnace	Shutdown	Contaminated	Not suspect	In furnace	Potential
G/H-9/10 megatherm room	HEPA system is disconnected. Control panel and Hood remains.	HCA*	Potential	Control panel	Lead/silver solder
G/H-9/14 nickel plating – electrolytic	Piping, ductwork, pumps, and wooden platform are significantly corroded. Tanks were drained, not cleaned.	Contaminated	Not suspect	Control panels and pipes	Nickel contamination and residuals.
G/J-15/18 small parts maintenance	Bead blasters, hand tables, heaters remain in a diked area (diking is in poor shape). Degreaser. Drained to A-pan.	Contaminated	Potentially in monorail or jib crane greases	Heaters, piping	Acids, solvents, perchloro ethylene
H-14 A-Pan	Brick-lined pan with hood; sparging took place; drain to Western Effluent Treatment System	HCA*, U deposits	Not suspect	Process steam lines	Acids
G/H-20/22 nickel plating- (electrolytic)	Control panels. Tanks were drained. Floor under plating facility significantly corroded. Diked area held water pumped from tunnels.	Contaminated	Potentially in electrical equipment	Yes	Nickel sulfate, Sodium hypophosphate, sodium hydroxide, Nickel residuals

Table IV – Planned Sample Analysis

<i>Universal Treatment Standard - Metals</i>	<i>Analytical Method</i>
TCLP Metals	SW846 1311
TCLP Volatile Organic Compounds	SW846 8260A
TCLP Semi-Volatile Organic Compounds	SW846 8270A
U234/235/236/238	Alpha Spectroscopy
Total U and %U235	Thermal Ionization MS
Tc99	Liquid Scintillation
Gross Alpha/Beta	Gas Proportional Counting
Am241, Np237, Pu238/239	Alpha Spectroscopy
Gamma Spec	Gamma Spectroscopy
Asbestos Containing Materials	Microscopy
Pesticides/PCB	SW-846 8080

CHARACTERIZATION – RESULTS

The results of the characterization effort were twofold:

1. Baseline estimates of hazardous and nuclear materials were confirmed. The planned worker protection plans were adequate without significant revision. Levels and distribution of uranium, PCB's and metals were confirmed in areas thought to have these residues.

2. The quantity and extent of the chemical contamination was larger than expected. The increase in the apparent distribution of mixed wastes has a major impact on the plans for waste minimization and disposal. Total project volume was not impacted.

TRU Levels - Downposting

The facility was posted as TRU prior to characterization. The TRU classification was based on NDA characterization data and scaling factors from relatively insensitive analyses.

The new characterization data is based on a more sensitive analytical result which improves the lower limit of detection. The characterization data now supports down-posting to general rad areas at considerable savings to the project – and a significant reduction in worker protection requirements. TRU nuclides are still present, but not in levels that result in TRU postings.

PCB Residues

PCB contaminated materials were found in areas and materials not anticipated. The characterization identified PCB's above 50 PPM in paints, process system debris, sediments and waste materials throughout the plant.

The concentration and distribution of PCB's in the building media ranged from less than 50ppm to over 20,000ppm. Lubricating oils, which had leaked from machinery during operations, were spread in areas that were not expected to have PCB contamination, such as waste collection tanks, sumps and flooring materials.

Table V - Sample Analytical Plan

[illegible]

The acceptance criteria for PCB contaminated materials has recently been made less restrictive – but the selected disposal site does not have the regulatory approval to accept these materials.

Sampling Process Implementation

DRS used the expertise of the DOE Sample Management Office (SMO) on-site at ETTP to get a fast track start to development and implementation of the characterization effort. The SMO provided sampling infrastructure and access to sampling plans, quality procedures, data management procedures and approved laboratories. Savings in development of the most effective plan were significant .

Hold-up Materials Determination

Prior efforts at determination of SNM/Fissile material hold-up were based on non-invasive Non-destructive assay (NDA) methods – using procedures developed many years ago.

DRS relied on intrusive inspections and visual inspection/sampling to develop more accurate SNM and fissile materials inventories. High Background and self-shielding limit the LLD for NDA results.

CONCLUSIONS

Develop as much of the characterization plan as practical based on process knowledge, prior sampling and analysis and worker information.

Plan to assess areas of the facility that have not seen access during normal operations. These areas include low points in ducting, sumps and insides of tanks and areas thought to be inaccessible.

Study the analytical capabilities of the laboratories carefully. Multiple labs may be required to meet the complete spectrum of analyses.

Plan to revise the remediation plan after characterization. Waste volumes are susceptible to the focused characterization data. Worker protection requirements can be changed based on the sample analysis effort.