

# Rocky Flats Environmental Technology Site

## MAN-077-DDCP

### DECONTAMINATION AND DECOMMISSIONING CHARACTERIZATION PROTOCOL

#### REVISION 0



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#### 4.2.2 RLC/FSS Report

The characterization process results are documented in the RLC/FSS Report. The report **SHALL** provide an analysis of the characterization/survey results and summarize the hazards and risks associated with them. The report **SHALL** document the process knowledge and/or history and/or characterization survey results that demonstrates the building can be managed as sanitary waste. **An annotated outline for the RLC/FSS Report is presented in the Appendix C.**

Final reports containing survey and analytical results **SHALL** describe the results of QC measurements, applicable audits, and confirmation sample comparisons performed for each sampling and analysis task as defined in the D&D QA Program Plan. Any quality problems associated with the data (including field and confirmatory data), **SHALL** be documented with the corrective actions taken in response to the deficiencies identified. Data review requirements are discussed in Section 7.0.

### 5.0 TYPE 2 AND TYPE 3 FACILITIES

This section defines the three possible sets of DQOs that may be associated with the three characterization phases of Type 2 and Type 3 facilities: RLC, IPC, and FSS, and related documentation requirements. DQOs for each of these characterizations are outlined in Sections 5.1, 5.2, and 5.3. Documentation requirements for Type 2 and Type 3 facilities are presented in Section 5.4.

#### 5.1 DQOs FOR RLC

##### 5.1.1 The Problems

- Is the amount of material, media, equipment, floors, walls, and ceilings, interior/exterior to the building adequately quantified?
- Is the nature and extent of radiological and hazardous substance contamination adequately characterized so that material, media, equipment, floors, walls and ceilings can be categorized as sanitary, LLW, low-level mixed waste (LLMW), transuranic (TRU) waste, TRU mixed Waste, RCRA waste, TSCA waste, or asbestos-containing waste?

##### 5.1.2 The Decisions

- Is there an inventory/estimate of materials, media, equipment, floors, walls and ceilings interior/exterior to the building(s)?
- Are there sufficient data to adequately characterize materials, media, equipment, floors, walls and ceilings as sanitary, LLW, LLMW, TRU waste, TRU mixed waste, RCRA waste, TSCA waste, or asbestos-containing waste and meet transportation requirements?

### 5.1.3 Inputs to the Decision

- Assess magnitude and location of data from scoping characterization.
- Identify applicable action levels, unrestricted release criteria, transportation requirements, waste management regulations, pollution prevention/waste minimization criteria, and the disposal facilities' WAC.

### 5.1.4 Decision Boundaries

- Identify spatial confines of building, including room, sets of rooms or facility in 2 and 3 dimensions. Use engineering drawings for definition where available. (The accuracy of the drawings **SHALL** be verified prior to use).
- Include temporal aspects of the project and applicable regulations.

The characterization boundaries are limited to the spatial confines of the facility itself and materials, equipment, equipment components, and media that make-up or are within the buildings (interior and exterior).

### 5.1.5 Decision Rules

- If there is an inventory/estimate of remaining materials, media, equipment, floors, walls and ceilings within the building, no additional inventory/estimate is necessary; otherwise, inventory/estimates are necessary.
- If materials are found to be non-radioactive, non-hazardous, non-beryllium contaminated, non-TSCA-regulated and non-ACM, then material can be free-released or managed as sanitary waste (refer to criteria listed below).

### Radionuclides

- For materials, media, equipment, floors, walls and ceilings:
  1. If all radiological survey measurements are below the surface contamination thresholds provided in DOE Order 5400.5, the related area or volume of material is considered sanitary waste or may be free-released.
  2. If all radiological sample measurements are below the volume contamination thresholds provided in the No-Rad-Added Verification (NRA) Program, the related volume of material is considered sanitary waste or may be free released.
  3. If any radiological survey measurement exceeds the surface contamination thresholds provided in DOE Order 5400.5, the related area or volume of material is considered LLW.

5. If any radiological sample measurement exceeds the volume contamination threshold provided in the NRA Program, the related volume of material is considered LLW.
6. If any radiological sample measurements exceed 100 nanocuries/gram of plutonium and/or americium for volume contaminated material, the related volume of material is considered transuranic (TRU) waste.

### RCRA Constituents

- If the waste is mixed with or contains a listed hazardous waste, or if the waste exhibits a characteristic of a hazardous waste, then the waste is considered RCRA-regulated hazardous waste in accordance with 6 CCR 1007-3, Part 261; otherwise, the waste is considered non-hazardous.

### Beryllium

- If concentrations of beryllium are equal to or greater than 0.2ug/100 cm<sup>2</sup>, the material is considered beryllium contaminated per the Occupational Safety and Industrial Hygiene Program Manual, Chapter 28, Chronic Beryllium Disease Prevention Program; otherwise the material is considered non-beryllium contaminated.

### PCBs

- If PCB's are only suspected in or on materials that fall within the definition of "PCB Bulk Product Waste," sampling is not required and material can be free-released or managed as sanitary waste.
- If the 95% UCL of the mean value of the sample set exceeds 50 ppm or other applicable RFCA decision document threshold, then the associated material is considered TSCA waste; otherwise the material is considered non-TSCA waste.

### Asbestos

- If any one sample of a sample set representing a homogeneous medium results in a positive detection (i.e., >1% by volume), then material is considered ACM; otherwise the material is considered non-ACM (40 CFR 763 and 5 CCR 1001-10).

#### 4.1.6 Tolerable Limits on Decision Errors

- The maximum value for false positive and false negative errors is 5% when calculating the number of samples required.
- Decision error does not apply to asbestos sample sets per 40 CFR 763. Results are compared with the action levels on a sample-by-sample basis.

#### 4.1.7 Optimization of Plan Design

- If radiological, RCRA, TSCA and asbestos survey/samples are not required per the DQO process, a survey/sampling plan is not required.
- If RCRA, TSCA or asbestos survey/samples are required for materials, media, equipment, floor, wall and ceilings, refer to Section 6.0.
- If radiological survey/samples are required for floors, walls and ceilings, then:
  1. a statistically based radiological survey/sampling program **SHALL** be developed per the requirements in Section 5.0 of the MARSSIM.
  2. the location of radiological survey/sampling points **SHALL** be delineated per the requirements in Section 5.5 of the MARSSIM.
  3. radiological field measurement methods and instrumentation **SHALL** be delineated per the requirements in Section 6 of the MARSSIM.
  4. radiological sampling and preparation for laboratory measurements **SHALL** be delineated per the requirements in Section 7 of the MARSSIM.
- If radiological survey/samples are required for materials, media and equipment, then a radiological survey/sampling plan **SHALL** be developed per the requirement in Health and Safety Plan (HSP) 18.10, Radioactive Material Transfer and Unrestricted Release of Property and Waste.

#### 4.2 DOCUMENTATION REQUIREMENTS

Type 1 facilities require two characterization documents: a RLC/FSS Plan and a RLC/FSS Report.

##### 4.2.1 RLC/FSS Plan

Because anticipated Type 1 facilities are assumed to be free of contamination, these facilities can undergo a combined RLC/FSS to confirm that they are contamination free. The combined RLC/FSS Plan **SHALL** identify building conditions and contamination per the DQOs identified in Section 4.1 and establish the basis for project planning, including facility strip-out, and demolition or re-use.

Characterization **SHALL** be based on process knowledge and/or history or on surveys/samples as required. If process knowledge/history is inadequate for characterization, appropriate characterization survey/samples **SHALL** be collected through selection and implementation of the appropriate combination of direct measurement, sample collection and laboratory analysis, and physical observation. **An annotated outline for the RLC/FSS Plan is presented in the Appendix C.**

4. If any radiological sample measurement exceeds the volume contamination Threshold provided in the NRA Program, the related volume of material is considered LLW.
5. If any radiological sample measurements exceed 100 nanocuries/gram of plutonium and/or americium for volume contaminated material, the related volume of material is considered transuranic (TRU) waste.

### **RCRA Constituents**

- If the waste is mixed with or contains a listed hazardous waste, or if the waste exhibits a characteristic of a hazardous waste, then the waste is considered RCRA-regulated hazardous waste in accordance with 6 CCR 1007-3, Part 261; otherwise, the waste is considered non-hazardous.

### **Beryllium**

- If concentrations of beryllium are equal to or greater than 0.2ug/100 cm<sup>2</sup>, the material is considered beryllium contaminated per the Occupational Safety and Industrial Hygiene Program Manual, Chapter 28, Chronic Beryllium Disease Prevention Program; otherwise the material is considered non-beryllium contaminated.

### **PCBs**

- If PCB's are only suspected in or on materials that fall within the definition of "PCB Bulk Product Waste," sampling is not required and material can be free-released or managed as sanitary waste.
- If the 95% UCL of the mean value of the sample set exceeds 50 ppm or other applicable RFCA decision document threshold, then associated material is considered TSCA waste; otherwise material is considered non-TSCA waste.

### **Asbestos**

- If any one sample of a sample set representing a homogeneous medium results in a positive detection (i.e., >1% by volume), the material is considered ACM; otherwise the material is considered non-ACM (40 CFR 763 and 5 CCR 1001-10).

#### **5.1.6 Tolerable Limits on Decision Errors**

- For radionuclides, no statistically based sample sets are required, thus decision errors do not apply.
- The maximum value for false positive and false negative errors is 5% when calculating the number of samples required for RCRA and TSCA characterization.

- Decision error does not apply to asbestos sample sets per 40 CFR 763 and 5 CCR 1001-10. Results are compared with the action levels on a sample-by-sample basis.

### 5.1.7 Optimization of Plan Design

- A subjective radiological survey/sampling plan will be developed. This plan is developed to initially classify materials, media, equipment, floors, walls and ceilings as sanitary, LLW and TRU waste for decontamination and waste classification purposes.
- Radiological field measurement methods and instrumentation are described in Section 6 of MARSSIM.
- Radiological sampling and preparation for laboratory measurements are described in Section 7 of MARSSIM.
- If RCRA, TSCA or asbestos survey samples are required for materials, media, equipment, floors, walls and ceilings, refer to Section 6.0.

## 5.2 DQOs FOR IPC

### 5.2.1 The Problems

#### During strip-out:

- Is the amount of material, media, equipment, floors, walls and ceilings, interior/exterior to the buildings adequately quantified?
- Is the nature and extent of radiological material and hazardous substance contamination adequately characterized so that material, media, equipment, floors, walls and ceilings can be categorized as sanitary, LLW, LLMW, TRU waste, TRU mixed waste, RCRA waste, TSCA waste, or asbestos-containing waste?

### 5.2.2 The Decisions

#### During strip-out:

- Is there an inventory/estimate of materials, media, equipment, floors, walls and ceilings, interior/exterior to the building(s)?
- Are there sufficient data to adequately characterize all materials, media, equipment, floors, walls, and ceilings as sanitary, LLW, LLMW, TRU waste, TRU mixed waste, RCRA waste, TSCA waste, or asbestos-containing waste?

### 5.2.3 Inputs to the Decision

- Assess magnitude and location of data from preceding characterizations, including data from scoping characterization, and contained in the RLCR, Decommissioning Operations Plan (DOP), and the Interim Measure/Interim Remedial Action (IM/IRA).
- Identify applicable action levels, free-release criteria, transportation requirements, health and safety requirements, waste management regulations, pollution prevention/waste minimization criteria, and the disposal facilities' WAC.

### 5.2.4 Decision Boundaries

- Identify spatial confines of building, including room, sets of rooms or facility in 2 and 3 dimensions. Identify changes to facility/room configuration and content resulting from strip-out and decontamination activities. Identify newly accessible and decontaminated areas.
- Include temporal aspects of the project and applicable regulations.

The characterization boundaries are limited to the spatial confines of the facility itself and materials, equipment, equipment components, and media that make-up or are within the buildings (interior and exterior).

### 5.2.5 Decision Rules

- If there is an inventory/estimate of remaining materials, media, equipment, floors, walls and ceilings within the building, no inventory/estimate is necessary; otherwise, inventory/estimates are necessary.
- If materials are found to be non-radioactive, non-hazardous, non-beryllium contaminated, non-TSCA-regulated and non-ACM, then material can be free-released or managed as sanitary waste (**refer to criteria listed below**).

#### Radionuclides

- For materials, media, equipment, floors, walls and ceilings:
  1. If all radiological survey measurements are below the surface contamination thresholds provided in DOE Order 5400.5, the related area or volume of material is considered sanitary waste or may be free-released.
  2. If all radiological sample measurements are below the volume contamination thresholds provided in the No-Rad-Added Verification (NRA) Program, the related volume of material is considered sanitary waste or may be free released.

3. If any radiological survey measurement exceeds the surface contamination thresholds provided in DOE Order 5400.5, the related area or volume of material is considered LLW.
4. If any radiological sample measurement exceeds the volume contamination threshold provided in the NRA Program, the related volume of material is considered LLW.
5. If any radiological sample measurements exceed 100 nanocuries/gram of plutonium and/or americium for volume contaminated material, the related volume of material is considered transuranic (TRU) waste.

### **RCRA Constituents**

- If the waste is mixed with or contains a listed hazardous waste, or if the waste exhibits a characteristic of a hazardous waste, then the waste is considered RCRA-regulated hazardous waste in accordance with 6 CCR 1007-3, Part 261; otherwise, the waste is considered non-hazardous.
- If material is to be disposed as hazardous waste, the material will have to be disposed of in compliance with LDRs (40 CFR 268) and in conformance with TSDF WAC. For example, some characteristic wastes (i.e., ignitable, corrosive, reactive and organic wastes) will have to be characterized for underlying hazardous constituents.

### **Beryllium**

- If concentrations of beryllium are equal to or greater than 0.2ug/100 cm<sup>2</sup>, the material is considered beryllium contaminated per the Occupational Safety and Industrial Hygiene Program Manual, Chapter 28, Chronic Beryllium Disease Prevention Program; otherwise the material is considered non-beryllium contaminated.

### **PCBs**

- If PCB's are only suspected in or on materials that fall within the definition of "PCB Bulk Product Waste," sampling is not required and material can be free-released or managed as sanitary waste (Federal Register, Vol. 63, No. 124, Section 761.62, June 29, 1998).
- If the 95% UCL of the mean value of the sample set exceeds 50 ppm or other applicable RFCA decision document threshold, then the associated material is considered TSCA waste; otherwise the material is considered non-TSCA waste.

- TSCA-regulated waste **SHALL** be characterized for disposal in accordance with 40 CFR 761. Characterization requirements vary depending on the TSCA waste type (eg., PCB liquids, PCB items, PCB remediation waste, PCB bulk product waste) and the specific disposal options allowable for each waste type under the PCB regulations.

### **Asbestos**

- When friable and potentially friable asbestos is removed, if based on five air samples ( $>1200$  L/sample), there are  $<70$  (asbestos fibers)/  $\text{mm}^2$  as determined by Transmission Electron Microscopy and as described in 40 CFR 763, Subpart F, or 5 CCR 1001-10, Part B, Subsection III.C.6-8), the friable and potentially friable asbestos has been successfully removed; otherwise the building may contain friable asbestos.
- Asbestos waste **SHALL** be managed in accordance with 40 CFR 763, 40 CFR 261-268, CHWA and 5 CCR-1001-10, Part B.

### **5.2.6 Tolerable Limits on Decision Errors**

- For radionuclides, no statistically based sample sets are required, thus, decision errors do not apply.
- The maximum value for false positive and false negative errors is 5% when calculating the number of samples required for RCRA and TSCA characterization.
- Decision error does not apply to asbestos sample sets per 40 CFR 763. Results are compared with the action levels on a sample-by-sample basis.

### **5.2.7 Optimization of Plan Design**

- A discretionary radiological survey/sampling plan will be developed for remaining floors, walls, and ceilings. This plan is developed to classify floors, walls and ceilings as non-radioactive waste for FSS purposes.
- Radiological field measurement methods and instrumentation are described in Section 6 of MARSSIM.
- Radiological sampling and preparation for laboratory measurements are described in Section 7 of MARSSIM.
- For materials, media, equipment, floors, walls, and ceilings being released as low level and/or TRU waste, radiological surveys/samples **SHALL** be taken per Site Procedure 1-PRO-079-WGI-001, Waste Characterization, Generation and Packaging.
- If radiological survey/samples are required for materials, media and equipment for release as non-radioactive waste, then a radiological survey/sampling plan **SHALL**

be developed per the requirement in the RFETS HSP 18.10, Radioactive Material Transfer and Unrestricted Release of Property and Waste.

- If RCRA, TSCA or asbestos survey/samples are required for materials, media, equipment, floors, walls and ceilings, refer to Section 6.0.

### 5.3 DQOs FOR FSS

#### 5.3.1 The Problems

- Is there an adequate estimate of floors, walls and ceilings within the interior/exterior of buildings?
- Is the nature and extent of radiological contamination adequately characterized so that remaining floors, walls and ceiling can be released as sanitary waste?

#### 5.3.2 The Decisions

- Is there an inventory/estimate of floors, walls and ceilings within the interior/exterior of building(s)?
- Are there sufficient radiological surveys/samples to release all remaining floors, walls and ceilings as sanitary waste?

#### 5.3.3 Inputs to the Decision

- Assess magnitude and location of data from preceding characterizations, including data contained in the RLCR, IM/IRA, DOP and IPC.
- Identify applicable action levels, free release criteria, transportation requirements, waste management regulations, pollution prevention/waste minimization criteria, and the disposal facilities' WAC.

#### 5.3.4 Decision Boundaries

- Identify spatial confines of building, including room, sets of rooms or facility in 2 and 3 dimensions.
- Identify temporal aspects of the project.

### 5.3.5 Decision Rules

- For remaining floors, walls and ceilings:
  1. If all radiological survey measurements are below the surface contamination thresholds provided in DOE Order 5400.5, the related area or volume of material is considered sanitary waste or may be free-released.
  2. If all radiological sample measurements are below the volume contamination thresholds provided in the No-Rad-Added Verification (NRA) Program, the related volume of material is considered sanitary waste or may be free released.
  3. If any radiological survey measurement exceeds the surface contamination thresholds provided in DOE Order 5400.5, the related area of material must be dispositioned per Section 5.2 and resurveyed per Section 5.3.
  4. If any radiological sample measurement exceeds the volume contamination threshold provided in the NRA Program, the related volume of material must be dispositioned per Section 5.2 and resurveyed per Section 5.3..

### 5.3.6 Tolerable Limits on Decision Error

- The maximum value for false positive and false negative errors is 5% when calculating the number of samples required.

### 5.3.7 Optimization of Plan Design

- A statistically based radiological survey/sampling plan **SHALL** be developed per the requirements in Section 5.5 of MARSSIM.
- The location of radiological survey/sampling points **SHALL** be delineated per the requirements in Section 5.5 of MARSSIM.
- Radiological field measurement methods and instrumentation **SHALL** be delineated per the requirements in Section 6 of MARSSIM.
- Radiological sampling and preparation for laboratory measurements **SHALL** be delineated per the requirements in Section 7 of MARSSIM.

## 5.4 DOCUMENTATION REQUIREMENTS

Two of the three characterization phases for Type 2 and Type 3 facilities require the following documentation: the RCLP, the RLCR, the FSSP, and the FSSR. No formal plan is required for IPC. Applicable results are documented in the FSSP and the FSSR.

#### 5.4.1 RLCP

A detailed RLCP **SHALL** be prepared that describes the reconnaissance necessary to fully characterize a specific building, including building conditions, type and extent of contamination, and wastes. Such a plan **SHALL** address the DQOs identified in Section 5.1. The Plan **SHALL** also specify quality assurance (QA) requirements or a project-specific QA Plan (QAP) should be prepared. **An annotated outline for the RLCP is presented in the Appendix C.**

Development of the Plan **SHALL** involve reviewing information and data from previous characterizations and identifying data gaps based on the DQO problems and decisions (see Section 5.1.3, Inputs to the Decision). The focus of the RLC is to fill the data gaps. Based on data gaps and building-specific information (e.g., surface areas of floors, walls and ceilings), the Project Manager **SHALL** specify the types, numbers and location of samples and measurements; detection limits; error tolerances; and QA/QC requirements.

The Plan should include table(s) to present input data, such as Contaminants Of Concern, existing data on Contaminants Of Concern, related action levels and free-release criteria (i.e., DQO decision rules), WAC for Contaminants Of Concern -containing material, transportation requirements, number and location of samples, required sampling and analysis methods and references, number of QA/QC samples, detection limits, and location of other hazards.

Characterization should be achieved through selection and implementation of the appropriate combination of direct measurement, sample collection and laboratory analysis, physical observation, prior characterization and process knowledge. The gross presence and location of loose and fixed radiological contamination should be identified. Past chemical spills and existing hazards also should be characterized. In addition, characterization should include identification of radioactive and hazardous materials, including any quantities of residual SNM, beryllium, PCB and ACM, lead- and PCB-based paints, and radioactive and hazardous wastes.

The management and characterization of RCRA units should also be addressed. Units can either be closed as part of deactivation, or rendered RCRA-stable and closed under the D&D program. If a unit is to be closed as part of deactivation, closure activities, including characterization, should be described in a closure description document and approved by CDPHE under CHWA.

Characterization results **SHALL** be used to re-evaluate the facility type and the disposition decision. Results should be used to prepare the CERCLA decision document, including alternatives development and analysis, health and safety analysis, determination of engineering support requirements, and determination of appropriate schedules. Results should provide adequate detail to allow DOE to make a determination if the facility has significant contamination or hazards as described in Section 9 of the RFCA and to confirm the hazard categorization of the facility.

#### 5.4.2 RLCR

The documentation of RLC results is a RFCA-mandated report. This report **SHALL** provide an analysis of the characterization results and summarize the hazards and risks associated with the facility, including the nature and extent of radiological and chemical contamination and the types and volumes of wastes to be managed. Specifics should address the type and extent of strip-out and decontamination necessary, estimates on the types and volumes of waste anticipated, and controls needed for strip-out and decontamination, including personal protection equipment (PPE) and environmental controls. Compliance with data review requirements **SHALL** also be documented, as described in Section 7. The report should provide information in adequate detail to allow DOE to make a determination if the facility has significant contamination or hazards, as described in Attachment 9 of the RFCA. DOE will use the information from the report to confirm its categorization of the facility, and will transmit the report and a notification letter to the Lead Regulatory Agency for concurrence. The notification letter will include DOE's determination as to the facility type. Refer to Section 3.4.4 of the DPP for more detail on the process. **An annotated outline for the RLCR is presented in Appendix C.**

Final reports containing survey/sample results **SHALL** describe the results of QC measurements, audits, and confirmation sample comparisons performed for each sampling and analysis task per the D&D QA Program Plan (QAPP). Quality problems associated with performance of methods, completeness of data, comparability of data including field and confirmatory data, and data storage **SHALL** be documented with the corrective actions that have been taken to correct the deficiencies identified (pursuant to Analytical Services Division QA documentation). Refer to Section 7.0 which discusses the data review requirements.

#### 5.4.3 FSSP

A detailed FSSP **SHALL** be prepared to determine the nature and extent of radiological and chemical contamination after strip-out and decontamination. Survey results **SHALL** be used to re-evaluate final disposition alternatives and to plan for demolition if demolition is the selected disposition alternative. Such a plan **SHALL** address the DQOs, including the problems and decisions, contained in Section 5.3. The Plan should also address quality assurance requirements, or a project specific QA Plan should be prepared. **An annotated outline for the Final Status Survey Plan is presented in Appendix C.**

Development of the Plan **SHALL** involve reviewing information and data from reconnaissance and in-process characterizations and identifying data gaps based on the DQO problems and decisions (see Section 5.3, Inputs to the Decision). Based on data gaps and building-specific information (e.g., surface areas of floors, walls and ceilings), the Plan **SHALL** specify the types, numbers and location of samples and measurements; detection limits; error tolerances; and QA/QC requirements. The Plan should include table(s) to present input data, such as Contaminants of Concern, existing data on Contaminants of Concern, related action levels and free-release criteria (i.e., DQO decision rules), the WAC for Contaminants of Concern-containing material, number and location of samples, required sampling and analysis methods and references, number of QA/QC samples, detection limits, and location of other hazards.

Characterization **SHALL** be achieved through selection and implementation of the appropriate combination of direct measurement and sample collection and laboratory analysis. Any remaining loose and fixed radiological contamination **SHALL** be identified. Areas of past chemical storage, use and spills also **SHALL** be checked for contamination. Results **SHALL** be used to estimate the types and volumes of waste anticipated, and controls needed for demolition.

#### 5.4.4 FSSR

The documentation of FSS results is a RFCA-mandated report. This report **SHALL** provide data on the nature and extent of radiological and chemical contamination after strip-out and decontamination. Compliance with data review requirements **SHALL** be documented, as described in Section 7. This report **SHALL** validate the premise that the building may be free-released as sanitary waste or material for recycle. **An annotated outline for the Final Status Survey Report is presented in Appendix C.**

Final reports containing survey results should describe the results of QC measurements, performance audits, and systems audits, and confirmation sample comparisons performed for each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data including field and confirmatory data, and data storage **SHALL** be documented with the corrective actions that have been taken to correct the deficiencies identified. Refer to Section 7.0, which discusses data review requirements.

## 6.0 SAMPLING AND ANALYSIS

The DQO process will identify sampling and analysis needs. For example, if historical data or process knowledge is not available to make a D&D decision, sampling and analysis **SHALL** be required. This section describes the minimum sampling requirements for the non-radioactive Contaminants Of Concern (i.e., asbestos, PCBs, and RCRA constituents), as well as the methods required to determine chemistry of the samples. These methods **SHALL** be implemented following determination of the project-specific DQOs. This section does not address radiological swipes and sampling, radiological field measurement methods and instrumentation, and radiological sampling and preparation for laboratory measurement (refer to MARISSIM Sections 5.0, 6.0, and 7.0 respectively).

A general note applicable to Contaminants of Concern, radioactive and non-radioactive, is as follows: if process or historical knowledge suggests that a medium is contaminated and the project assumes the associated risk of false positive results, the medium may be categorized as contaminated without further sampling prior to remedial actions. This rationale allows potential cost-savings relative to sampling and analysis, but has the associated risk of excess costs that result with managing hazardous/radioactive waste (when the waste is actually non-hazardous nor non-radioactive). Confidence in such a decision resides in the quality of the process and/or historical knowledge. In addition, the decision must be considered in light of waste minimization requirements contained in 6 CCR 1007-3 and DOE Order 5820.2A.

Samples **SHALL** be collected and submitted for analysis in bulk form pursuant to applicable regulations (i.e., in a form and cumulative composition most representative of the anticipated form of the waste stream). For example, samples of paints from walls constructed with cinder

blocks should contain both the superficial paint layer(s) and a portion of the associated cinder block wall. Also, a minimum of 100 and maximum of 200 grams (g) of bulk sample is required for performance of the Toxicity Characteristic Leaching Procedure (TCLP) procedure.

## 6.1 ASBESTOS

Surface materials and thermal insulation materials, potentially containing asbestos, **SHALL** be sampled for asbestos per 40 CFR 763.86 and 5 CCR 1001-10 by a Certified Asbestos Inspector. A minimum of three samples are required per homogeneous area greater than six linear feet (ft) and <1,000 ft<sup>2</sup> in dimension; one sample is required for areas <six linear ft in dimension. Five samples are required per homogeneous areas between 1,000 ft<sup>2</sup> and 5,000 ft<sup>2</sup>. Where homogeneous areas of >5000 ft<sup>2</sup> are encountered, seven samples are required. Samples are randomly selected from the centers of a square grid proportional to the size of the area. Grid spacing is only required for friable surfacing materials which may include drywall joint compound if suspected by the inspector.

The generic categories of materials to be sampled are listed below:

- Thermal systems (e.g., pipe insulation);
- Surfacing materials (e.g., fireproofing, ceiling texture); and
- Miscellaneous (e.g., floor tiles, ceiling panels, concrete foundations and walls).

The presence of friable asbestos (i.e., >1% by volume) **SHALL** be determined at a laboratory with asbestos accreditation (AIHA and NVLAP). The correct asbestos characterization method is EPA 600/R-93/116. Based on the sampling results and the bulk materials represented by the samples, the quantities of friable and nonverbal ACM **SHALL** be estimated for subsequent abatement and waste management purposes.

## 6.2 POLYCHLORINATED BIPHENYLS (PCBs)

Sampling and analysis to verify PCB spill clean-up **SHALL** comply with 40 CFR 761.123 and 761.125 or 40 CFR 761.130. Compliance with 40 CFR 761.130 **SHALL** be attained through the following criteria:

- A sampling area that is equal to the original spill area plus 20% or an additional one-foot boundary;
- 95% confidence limit (against false positives); and
- A minimum of three samples taken via the Midwest Research Institute (MRI) method (EPA, 1986), which implements a hexagonal grid sampling design.

The analytical method **SHALL** have a practical quantitation limit (PQL) of less than 50% the regulatory threshold of 50 ppm. The SW-846 analytical method, 4020 (portable field kit) or 8082 (off-site analysis in a fixed lab), are recommended.

### 6.3 RCRA CONSTITUENTS

Media potentially contaminated with RCRA constituents **SHALL** be characterized using process knowledge and/or analyzed for compounds and elements in accordance with 6 CCR 1007-3, Part 261, and 40 CFR 268. Analytical methods **SHALL** have PQLs at levels better than 50% of the regulatory thresholds:

The following SW-846 methods or equivalent industry-proven methods **SHALL** be used for analyses or other equivalent methods as specified in the applicable Waste Acceptance Criteria (WAC):

- Metals (incl. Be) 6010B
- Mercury 7470A (liquid)  
7471A (solids)
- Semi-volatiles 8270C
- Volatiles 8260B
  
- Pesticides 8081A
- Herbicides 8151A
- Ignitability 1010 or 1020A (liquids)  
1030 (solids)
- Corrosivity 1110 or 1120
- Reactivity HCN Test Method or H<sub>2</sub>S Test Method

Both total analysis and the TCLP can be used to characterize solid samples. If total analysis is used, results **SHALL** be divided by 20 before comparison with the Table 6-1 regulatory thresholds. If TCLP is used, the SW-1311 preparation method **SHALL** be used. The Paint Filter Test, SW-9095A, **SHALL** be used for sludge for determining whether liquid or solid units shall be reported.

All samples from painted surfaces (non-asbestos samples) acquired for lab analysis **SHALL** be acquired by ASTM Method E 1729-95, Standard Practice for Field Collection of Dried Paint Samples for Lead Determination by Atomic Spectrometry Techniques.

**Table 6-1 Maximum Concentration of Contaminants for the Toxicity Characteristic**

EPA HW No. \ 1\	Contaminant	CAS No. \2\	Regulatory Level (mg/L)
D004	Arsenic	7440-38-2	5.0
D005	Barium	7440-39-3	100.0
D018	Benzene	71-43-2	0.5
D006	Cadmium	7440-43-9	1.0
D019	Carbon Tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100.0
D022	Chloroform	67-66-3	6.0
D007	Chromium	7440-47-3	5.0
D023	o-Cresol	95-48-7	\4\ 200.0
D024	m-Cresol	108-39-4	\4\ 200.0
D025	p-Cresol	106-44-5	\4\ 200.0
D026	Cresol		\4\ 200.0
D016	2,4-D	94-75-7	10.0
D027	1, 4-Dichlorobenzene	106-46-7	7.5
D028	1, 2-Dichloroethane	107-06-2	0.5
D029	1, 1-Dichloroethylene	75-35-4	0.7
D030	2, 4-Dinitrotoluene	121-14-2	\3\ 0.13
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its epoxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	\3\ 0.13
D033	Hexachlorobutadiene	87-68-3	0.5
D034	Hexachloroethane	67-72-1	3.0
D008	Lead	7439-92-1	5.0
D013	Lindane	58-89-9	0.4
D009	Mercury	7439-97-6	0.2
D014	Methoxychlor	72-43-5	10.0
D035	Methyl ethyl ketone	78-93-3	200.0
D036	Nitrobenzene	98-95-3	2.0
D037	Pentachlorophenol	87-86-5	100.0
D038	Pyridine	110-86-1	\3\ 5.0
D010	Selenium	7782-49-2	1.0
D011	Silver	7440-22-4	5.0
D039	Tetrachloroethylene	127-18-4	0.7
D015	Toxaphene	8001-35-2	0.5
D040	Trichloroethylene	79-01-6	0.5
D041	2, 4, 5-Trichlorophenol	95-95-4	400.0
D042	2, 4, 6-Trichlorophenol	88-06-2	2.0
D017	2, 4, 5-TP (Silvex)	93-72-1	1.0
D043	Vinyl chloride	75-01-4	0.2

\1\ Hazardous waste number.

\2\ Chemical Abstracts Service (CAS) number.

\3\ Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.

\4\ If -, m- and p-Cresol concentrations cannot be differentiated, the total cresol (D-026) concentration is used. The regulatory level of total cresol is 200 mg/l.

SOURCE: 6CCR 1007-3, Part 261, and 40 CFR 268

## 7.0 DATA REVIEWS

As stated in Sections 4.2 and 5.2, in order to meet QA requirements of the D&D Program, data collected during characterization **SHALL** be reviewed prior to incorporation into final reports to determine usability and compliance with RFCA and minimum quality requirements. In general, reviews include data verification and validation (V&V); precision, accuracy, representativeness, completeness and comparability (PARCC) evaluations and DQA. Radiological data collected during the reconnaissance level and in-process phase **SHALL** be reviewed according to the Radiological Control Manual and established Radiological Safety Practices Procedures. Radiological data gathered during final status surveys **SHALL** be reviewed according to MARSSIM. The review process is described below.

### 7.1 DATA VERIFICATION AND VALIDATION (V&V)

Verification **SHALL** be performed on sets of data produced by the project on which decisions are based. Validation **SHALL** be performed on minimum percentages of data/data packages as stipulated in project-specific sampling and analysis plans. Analytical data **SHALL** be verified and validated according to RFETS Analytical Services Division guidelines (General Guidelines for Data Verification and Validation, DA-GR01-V1).

Project managers **SHALL** plan for V&V accordingly (i.e., ensure adequate funding, schedule, and personnel to achieve data quality requirements as the project progresses); comprehensive V&V immediately before final reporting is typically too late to allow for data disparity corrective actions. Budgeting is typically based on the estimated number of samples/analyses planned for the project, and is some percentage of the cost per survey of analysis.

Data verification ensures that the requirements stated in characterization plans were implemented as prescribed in project-specific sampling and analysis plans. For example, verification ensures that requirements relative to the data produced by the project are satisfactory with respect to quantity, types, and format of data specified in the applicable planning documents (e.g., electronic data deliverables (EDDs), data packages (hardcopies), reports, data forms, etc.). The attached checklist (Table 7-1) identifies the type of D&D verification that must be performed. Additional line items **SHALL** be incorporated on a project-by-project basis, relative to project-specific data requirements and those requirements identified by the Analytical Services Division. In addition, every D&D report **SHALL** also present, as appendices, attachments, concise reference, etc., the entire data set used for decisions as defined in the DQO section. The attached data become a critical part of the CERCLA Administrative Record, which further verifies the D&D measurements of interest. A section of the report **SHALL** explain the steps and criteria used for data verification and validation including qualified and rejected data, and a summary table of all methods used, real samples, and QC samples. All data (100%) **SHALL** be verified.

In contrast to data verification, data validation is an in-depth technical review of the data (or a representative percentage of the data) that determines whether characterization was performed within quality control requirements and tolerances. Depending on the project and the critical nature of samples, a percentage of the entire data may be validated, so long as the percentage is representative.

For example, validation percentages must include the following:

- each laboratory;
- each subcontractor;
- each medium (matrix or material type); and
- each method (e.g., SW-846 or radiochemical).

A validation rate of greater than/equal to 25% is currently used at the RFETS, based on acceptance (via approved work plans) by EPA Region VIII and CDPHE. A lower rate may become acceptable to the agencies, however, depending on the number of critical samples or surveys for a given project, higher frequencies of validation may be desired for higher confidence. MARSSIM Appendix N also provides guidance for data validation.

**Table 7-1 Data Verification Checklist**

	Caveat?	Compliance?	
		Yes	No
<b>1. DATA PACKAGE &amp; SAMPLE RESULTS</b>			
a) Package(s) is intact and meets project-specific requirements (hard-copy and electronic data deliverable [EDD])			
b) Chain-of-Custody forms were completed and authenticated; all original sample IDs are traceable to final results			
c) Sample turnaround, holding times, & preservation requirements were met			
d) Specified parameters were captured per DQOs			
e) Results reported for each requested analyte/radionuclide			
f) Results with appropriate significant figures			
g) Final results are traceable to locations			
<b>2. QC SAMPLE RESULTS SUMMARY</b>			
a) Sensitivity of methods adequate (i.e., practical quantitation limits $\leq$ 50% action levels)			
b) PARCC parameters achieved relative to project-specific DQOs			

*Respond to each checklist item in the "Caveat?" column with a footnote as applicable and provide the caveat in the Footnotes section below.*

**FOOTNOTES:**

I certify that all responses to this checklist accurately reflect the completeness and quality aspects of this sample data package. Furthermore, I understand that inaccuracies in the completion of this checklist will be considered a nonconformance to Subcontract Requirements as evidenced by the following signature of the laboratory manager or designee.

Print/Typed Name: \_\_\_\_\_ Title: \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

## 7.2 PARCC EVALUATIONS

Following V&V, the data set **SHALL** be evaluated relative to the PARCC parameters (i.e., precision, accuracy, representativeness, completeness and comparability). PARCC parameters **SHALL** be assessed and summarized to ensure compliance with minimum quality requirements (see the D&D QAPP), and communication of compliance (and any exceptions) to the regulators and stakeholders. The basis for assessing each of these elements of data quality is discussed in the following subsections.

### 7.2.1 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Analytical precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. D&D QA **SHALL** use the laboratory control sample duplicate (LCSD) to determine the precision of the analytical method. If the recoveries of analytes in the LCSD are within established control limits, then precision is within limits. Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and matrix duplicate spiked samples **SHALL** be analyzed to assess project and lab analytical precision, respectively, and the precision measurement **SHALL** be determined using the relative percent difference between the sample results.

### 7.2.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random uncertainty (variability due to imprecision) and systemic error. It therefore reflects the total uncertainty associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Analytical accuracy **SHALL** be measured by comparing the percent recovery of analytes spiked into an LCSD to a control limit. For volatile and semivolatile organic compounds, surrogate compound recoveries **SHALL** also be used to assess accuracy and method performance for each sample analyzed. Analysis of performance evaluation (PE) samples shall also be used to provide additional information for assessing the accuracy of the analytical data being produced. Both accuracy and precision **SHALL** be calculated for each D&D QA analytical batch, and the associated sample results **SHALL** be interpreted by considering these specific measurements.

### 7.2.3 Representativeness

Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Representativeness **SHALL** be achieved through use of the standard field, sampling, and analytical procedures. Representativeness **SHALL** also

be determined by appropriate program design, with consideration of elements such as sample locations, matrix and sample type.

#### 7.2.4 Completeness

Completeness **SHALL** be calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness **SHALL** be calculated and reported for each method, matrix and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, **SHALL** determine the completeness of the data set. For completeness requirements, valid results **SHALL** be all results not rejected (due to inadequate quality control). The requirement for completeness **SHALL** be 95 percent for aqueous samples and 90 percent for solid samples. For any instances of samples that could not be analyzed for any reason (e.g., holding time violations in which re-sampling and analysis were not possible, samples spilled or broken, etc.), the numerator of this calculation **SHALL** become the number of valid results minus the number of possible results not reported. The formula for calculation of completeness is presented below:

$$\% \text{ completeness} = \frac{\text{number of valid results}}{\text{number of possible results}} \times 100$$

#### 7.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another data set. One of the objectives of characterization is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability **SHALL** be achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms **SHALL** support the assessment of comparability. Analysis of PE samples and reports from audits **SHALL** also be used to provide additional information for assessing the comparability of analytical data produced among subcontracting laboratories. Historical comparability **SHALL** be achieved through consistent use of methods and documentation procedures throughout the project.

### 7.3 DATA QUALITY ASSESSMENT (DQA)

DQA is a scientific and statistical evaluation that determines if the data are of the right type, quality, and quantity to support their intended use, which is to make decisions regarding D&D. The decisions and the decision-rules are defined within the DQO framework. Although some data assessment may be performed before or in-parallel with data V&V (i.e., confirmation), the DQA **SHALL** not be final until V&V are complete. This restriction is necessary since the data assessment assumes that the individual data constituting statistics and parameters are satisfactory for their intended purpose and based on quality requirements. Data quality is not assumed, but measured.

The DQA process, as defined by EPA QA/G-9 (EPA, 1996) and MARSSIM (NUREG-1575) constitutes the guidance for assessing the quality of data. MARSSIM addresses DQA in Section 8.0 and more specifically in Table 2.3 and Appendices E & I. The assessment **SHALL** include evaluating sample quantities, and sources and magnitudes of uncertainty relative to tolerances allowed in planning documentation, including both systematic and random sources of error. The G-9 process consists of five steps:

1. Review the DQOs;
2. Conduct a preliminary Data Review;
3. Select a Statistical Test;
4. Verify the Assumptions of the Statistical Test; and
5. Draw Conclusions from the Data.

## 8.0 DISPOSITION OF RECORDS

The following documents are quality assurance and CERCLA Administrative Records and **SHALL** be maintained in accordance with 1-V41-RM-001, Records Management Guidance for Records Sources and 1-F78-ER-ARP, CERCLA Administrative Record Program: RLCP, RLCR, FSSP, FSSR, IPC for radionuclides, and the data Verification Checklist.

## 9.0 REFERENCES

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