9.0 SURVEY DOCUMENTATION AND REPORTS

Documentation for final status surveys should provide a complete and unambiguous record of the radiological status of the site/facility, relative to established guidelines for the license termination. In addition, sufficient information and data should be provided to enable an independent re-creation and evaluation at some future date of both the survey activities and the derived results. Much of the information in the final status report will be available from the decommissioning plan; the written survey plan and/or the survey design document; and the various report requirements inherent in the accountability program of the survey procedures (that is, lab reports, reports of survey findings, QA documentation, chain-of-custody forms, etc.).

To the extent practicable, the final status survey report should stand on its own with minimal information incorporated by reference. This section will assist in determining the basic content of the report by providing a comprehensive, annotated outline. Although site-specific conditions or criteria may require some modification, this basic outline may be used for the report. A sample final status survey report for the hypothetical Reference Uranium Fuel Fabrication Plan is provided in Appendix D. Certain support or related information related to the decommissioning process, such as health physics practices for personnel conducting decontamination and waste volumes generated are provided as part of the decommissioning plan and/or final project report. For convenience, the licensee may also incorporate this information into the final status survey report.

Final Status Survey Report for Decommissioning
[Facility Name]

BACKGROUND

REASON FOR DECOMMISSIONING

[Identify the reason that the facility is to be returned to unrestricted use; for example, age of facility, relocation of process activity, geographic or environmental concerns, planned future uses, etc.]

MANAGEMENT APPROACH

[Provide very broad statements concerning conceptual designs, general considerations, management philosophy, regulatory requirements, reasons for certain approaches, etc. Discuss assigned management responsibilities for QA/QC activities and for health and safety activities during the survey process. List any special training and/or qualifications that the management team may have. (Note: Information concerning cost estimations, funding, or scheduling may be included here.]

SITE DESCRIPTION

[Describe the physical characteristics of the building and provide enough information to distinctly identify which facility or portion of a facility is to be decommissioned. Refer to Manual Section 4.0 for additional details on the types and sources of information to be covered in the site description section.]

TYPE AND LOCATION OF FACILITY

[Discuss the type of facility, such as a research facility, light-water reactor, radiopharmaceutical facility, nuclear laboratory, etc. Include specific activities performed. Identify the location of the facility, including geographic location, state or local vicinity, building-specific information, etc.]

OWNERSHIP

[Identify who owns the facility and how the ownership is structured; that is, state or national government owned, private corporation, parent company, academic institution, etc. If there have been multiple owners, provide a history of the ownership.]

Facility Description

[Include information on buildings, grounds, and any relevant topographical information that may have been a factor in the extent of contamination. Submit available drawings or photos that are relevant to the survey.]

Buildings

[Include information on the size; construction materials; contents; roofs and release points; condition of surfaces after decontamination; and special considerations or problems such as inaccessible areas, expansion joints or floor penetrations, and piping. Include locations and use of any buildings that may have been razed or remodeled or whose use has been changed over the life of the facility.]

Grounds

[Discuss the size, topography, meteorology, demographics, vegetation, access routes, subsurface features, buried waste, water courses, surface water runoff, outfall, etc. that may affect the area to be surveyed or the location or extent of contamination.]

Operating History

[Identify the types and dates of specific operations and/or uses of particular chemical or radiological processes that have evolved over the life of the facility, including uses of the site before licensed operations. Refer to Sections 3.0 and 4.0 for more details on information to be included in the operating history section of the termination survey report.]

Licensing and Operations

[Include the draft number and license number and issuance date for every license the facility has been issued. Indicate the type of work activity at every operating phase and the buildings and/or geographic locations wherein each licensed activity was performed.]

Processes Performed

[Specify every type (chemical and physical form) of radionuclide used and indicate the quantity required for each operation involved over the life of the facility. Be specific about the processes performed, the specific (and relevant) chemicals and/or radionuclides involved, the locations of each process performed over the life of the plant, related activities, etc. Also, discuss the containment practices for all radiation sources.]

Waste-Disposal Practices

[Discuss any disposal practices that may have impacted the contamination status of the facility. Include any incident reports and significant spills.]

Decommissioning Activities

[Discuss any relevant political, philosophical, or environmental considerations that may have influenced the method of decommissioning selected. Identify any agencies whose philosophy or methodologies (and/or procedures) were chosen for modeling and specify why those were selected.]

Objectives

[Broadly discuss what was to have been accomplished and why. Set the parameters (especially the limitations) within which the decommissioning activities were confined.]

Results of Previous Surveys

[Generalize the results of previous surveys in the chronological sequence in which they were performed. Discuss the activities of subsequent surveys as they address findings in earlier surveys. Include results of preliminary surveys, characterization surveys, etc. Refer to Section 2.0 for additional information on the different types of surveys that may have been performed prior to the final status survey.]

Decontamination Procedures

[Discuss the specific procedures used to decontaminate the facility. Identify the organization who performed the decontamination and discuss their credentials and related expertise. Cover information on demolition and dismantling, including shipping, storage, and disposal of materials at a safe storage facility or landfill approved for radioactive waste. Discuss any security precautions and safeguards that may have been taken.]

Final Survey Procedures

[Discuss general approach and list philosophy of (or reasons for selecting) that approach. Refer to any unique conditions that may have been discovered in earlier surveys which relate to the written survey plan.]

SAMPLING PARAMETERS

[Summarize information concerning grid placement, specific areas scanned, accessibility restrictions, sampling criteria, defining parameters, types of samples taken (soil, water, etc.) and any special precautions taken to ensure readings are accurate. Include procedures used for determining sample analysis. Identify the areas that had low, medium, and high potential for contamination. Discuss how samples were taken at effluent systems (air handling systems, drains, sumps, and sewers. See Sections 2.0 - 7.0 for information to include in this portion of the survey report.]

BACKGROUND/BASELINE LEVELS IDENTIFIED

[Discuss the background and baseline levels established for the site. Identify how these levels were determined. (See Sections 2.0 and 6.0)]

MAJOR CONTAMINANTS IDENTIFIED

[Discuss the major contaminants. Include the concentration levels and locations of each radionuclide of interest. Refer to the sources from the plant history if known.]

GUIDELINES ESTABLISHED

[Discuss each agency whose guidelines had to be met before the facility could be released. Identify all procedures and regulations and define the release criteria that had to be met. See Section 3.0 for additional information.]

EQUIPMENT AND PROCEDURES SELECTED

[Discuss the philosophy behind the selection of instruments and procedures. Cite any special conditions that may have required deviating from normal practices. Define which radionuclides were present and explain how instrumentation was selected to best detect their particle-emitting characteristics. Additional information is available in Sections 3.0 - 7.0.]

INSTRUMENTS AND EQUIPMENT

[Specifically identify all equipment and instrumentation used in the survey procedures. If the criteria upon which each instrument was selected was not included in the previous subheading, elaborate on the radionuclides of interest and the associated detecting instrument chosen. Discuss calibration procedures used as well as instrument sensitivities and detection limits.]

Instrument Use Techniques

[Discuss the procedures and techniques used in operating the instruments or equipment used in the survey.]

Procedures Followed

[Discuss the procedures used in the survey process, including statistical methodologies used to determine the number of samples required, QA/QC procedures, field and laboratory techniques, and methods of sampling and disposing of contaminated materials used during the survey. See Sections 4.0 - 7.0, for additional information that should be discussed in this subsection of the final status survey report.]

Surveying Organization

[Identify the surveying organization and include any particular expertise or credentials that establishes their credibility.]

Survey Findings

[Discuss the general condition of the site as determined by the survey. Evaluate reasons for any significant differences found between the final status survey and any previous surveys. Prepare and reference (1) tables of survey data and (2) graphic representations of findings to be included in this section. Reference techniques for reducing and evaluating the data in the following subsections.]

Techniques for Reducing/Evaluating Data

[Describe the computational methods used to convert raw data into conventional units and to evaluate average and/or "hot spot" activity levels. Include formulas and/or examples where appropriate.]

Statistical Evaluation

[Provide an explanation of the statistical methodology used to evaluate the survey findings. That is, show how the statistical method used provides a true representation of the data in relation to the applicable guideline values.]

COMPARISON OF FINDINGS WITH GUIDELINE VALUES AND CONDITIONS

[Provide a table and any supporting text that is needed to compare the findings with the release criteria established by the regulatory agencies. Include criteria from any state, local, or other federal agencies who, in addition to NRC, may have jurisdiction. Reiterate how QA/QC procedures, survey procedures, documentation procedures, etc. comply with guidelines established by the NRC or other regulatory agency. Use procedures listed in this document (Sections 2.0 - 8.0) as a resource.]

SUMMARY

[Provide an overview of the entire program. One or two sentence summaries of each section and/or subsection should provide the information that should be included in the summary. The concluding paragraph should state that according to the findings of the final status survey, the release criteria have been met and the license is applying for license termination.]

10.0 REFERENCES

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R.O. Gilbert and J.C. Simpson, Statistical Methods for Evaluating the Attainment of Cleanup Standards, Volume 3: Background Based Standards for Soils and Solid Media, PNL-XXXX (Draft), Pacific Northwest Laboratory, May 1990.

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A Guide for Radiological Characterization and Measurements for Decommissioning of U.S. Department of Energy Surplus Facilities, DOE/EP-0100, U.S. Department of Energy, August 1983.

Survey Procedures

A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, U.S. Environmental Protection Agency, December 1987.

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12.0 GLOSSARY

Activity: A measure of the rate at which radioactive material is undergoing radioactive decay, usually given in terms of the number of nuclear disintegrations occurring in a given quantity of material over a unit of time. The unit of activity is the curie (Ci) Also, known as **Radioactivity.**

Alpha Particle: A positively charged particle emitted by some radioactive materials undergoing radioactive decay. Alpha particles are the least penetrating of the three common forms of radiation (alpha, beta, gamma); they can be stopped by a sheet of paper and cannot penetrate skin.

Background Radiation: Naturally occurring radiation in the human environment. It includes cosmic rays, radiation from the naturally radioactive elements, and man-made radiation from global fallout.

Beta Particle: An electron emitted from the nucleus during radioactive decay. Beta particles are easily stopped by a thin sheet of metal or plastic.

Byproduct Material: Radioactive materials resulting from the production or processing of nuclear materials.

Characterization Survey: Facility or site sampling, monitoring, and analysis activities to determine the extent and nature of contamination. Characterization provides the basis for acquiring the necessary technical information to develop, analyze, and select appropriate cleanup techniques.

Cleanup: Actions taken to remove a hazardous substance that could affect humans and/or the environment. The term "cleanup" is sometimes used interchangeably with the terms **Remedial Action, Remediation,** and **Decontamination.**

Confirmatory Survey: limited independent (third-party) measurements, sampling, and analyses to verify the findings of a final status survey.

Contamination: The presence of residual radioactivity, in excess of levels which are acceptable for release of a site or facility for unrestricted use.

Criteria (release criteria): Combination of numerical activity guideline levels and conditions for their application. If criteria are satisfied, the site may be released without restrictions.

Curie: A measure of the rate of radioactive decay. One curie (Ci) is equal to 37 billion disintegrations per second (3.7×10^{10} dis/s), which is approximately equal to the decay of one gram of radium-226. Fractions of a curie, e.g. picocurie (pCi) or 10^{-12} Ci and microcurie (μCi) or 10^{-6} Ci, are levels typically encountered in the decommissioning process.

Decay: The spontaneous radioactive transformation of one nuclide into a different nuclide or into a lower energy state of the same nuclide. Also, known as **Radioactive Decay.**

Decommissioning: The process of removing a facility from operation, followed by decontamination, and license termination.

Decontamination: The removal of unwanted radioactive material from facilities, soils, or equipment. Also, known as **Remediation, Remedial Action,** and **Cleanup.**

Derived Guideline: Levels of radioactivity presented in terms of ambient radiation, surface activity levels, and soil activity concentrations; these levels are derived from activity/dose relationships through various exposure pathway scenarios. Also known as Guidelines.

Detection Sensitivity: The ability to identify the presence of radiation or radioactivity. Also see **Minimum Detectable Activity.**

Direct Measurement: Radioactivity measurement obtained by placing the detector against the surface or in the media being surveyed. The resulting radioactivity level is readout directly.

Dose Commitment: The dos that an organ or tissue would receive during a specified period of time (e.g., 50 or 70 years) as a result of intake (as by ingestion or inhalation) of one or more radionuclides from a given release.

Dose Equivalent (Dose): A term used to express the amount of effective radiation when modifying factors have been considered. It is the product of absorbed dose (rads) multiplied by a quality factor and any other modifying factors. It is measured in rem (roentgen equivalent man).

Exposure Rate: The amount of ionization produced per unit time in air by X-rays or gamma rays. The unit of exposure rate is roentgens/hour (R/h); for decommissioning activities the typical units are microroentgens per hour (μR/h), i.e. 10^{-6} R/h.

Final Status Survey: Measurements and sampling to describe the radiological conditions of a site, following completion of decontamination activities (if any) and in preparation for unrestricted release.

Gamma Radiation: Penetrating high-energy, short-wavelength, electromagnetic radiation (similar to X-rays) emitted during radioactive decay. Gamma rays are very penetrating and require dense materials (such as lead or uranium) for shielding.

Grid: System of coordinates established on a site for purposes of referencing survey locations. Also, known as **Reference Grid System.**

Grid Block: Standardized averaging (1 m^2 for building interiors and 100 m^2 for soil areas).

Ground Penetrating Radar (GPR): Electromagnetic radiation, used to identify electrically reflective targets, voids, and differences in moisture content of subsurface soil. GPR is used to identify buried objects and materials for guiding subsoil sampling.

Half-Life: The time it takes for half the atoms of a quantity of a particular radioactive element to decay into another form. Half-lives of different isotopes vary from millionths of a second or less to billions of years.

Hot Spot: Small, isolated location where radiation or radioactivity level is higher than the guideline level but satisfies other conditions (see Sections 2.2 and 8.6.2).

Inventory: Total residual quantity of formerly licensed radioactive material at site.

License: Authorization by NRC to possess, use, transfer, etc. radioactive materials for specified applications and under established conditions.

License Termination: Discontinuation of a license -- the eventual conclusion to decommissioning.

Minimum Detectable Activity (MDA): The minimum level of radiation or radioactivity that can be measured by a specific instrument and technique. The MDA is usually established on the basis of assuring false positive and false negative rates of less than 5%.

Quality Assurance/Quality Control: A system of procedures, checks, audits, and corrective actions to ensure that design, performance, monitoring and sampling, and other technical and reporting activities are of the highest achievable quality.

Radionuclide: An unstable nuclide that undergoes radioactive decay.

Release Criteria: Numerical guidelines for direct radiation levels and levels of radioactivity in soil on surfaces which are considered to be acceptable within a given set of conditions and applications.

REM (Roentgen Equivalent Man): A quantity used in radiation protection to express the effective dose equivalent for all forms of ionizing radiation. It is the product of the absorbed dose in rads and factors related to relative biological effectiveness (see also **Dose Equivalent**).

Remediation: The removal of contamination from a site. Also known as **Remedial Action and decontamination.**

Remediation Control Survey: Monitoring the progress of remedial action by real time measurement of areas being decontaminate to determine whether efforts are being effective and to guide further decontamination activities.

Removable Activity: Surface activity that can be removed and collected for measurement by wiping the surface with moderate pressure.

Restoration: Actions to return a remediated area to a usable state, following decontamination.

Roentgen (R): Unit of exposure. One roentgen is the amount of gamma rays or X-rays required to produce one electrostatic unit (esu) of charge of one sign (either positive or negative) in one cubit centimeter of dry air under standard conditions.

Scanning: An evaluation technique performed by moving a detection device over the surface at some consistent speed and distance above the surface to detect elevated levels of radiation. Scanning provides qualitative or semi-quantitative, rather than quantitative, data.

Scoping Survey: A survey that is conducted to identify which radionuclides are present as contaminants, relative ratios in which they occur, and the general levels and extent of the contaminants.

Soil Activity (Soil Concentration): The level of radioactivity present in soil and expressed in units of activity per soil mass [typically picocuries per gram (pCi/g)].

Surface Activity: Radioactivity found on building or equipment surfaces and expressed in units of activity per surface area [typically disintegrations per minute per 100 cm^2 (dpm/100 cm^2)].

Survey: Evaluation of a representative portion of a population to develop conclusions regarding the population as a whole. In the decommissioning process several different types of surveys are conducted, including **Background, Scoping, Characterization, Remediation Control, Final Status, and Confirmatory.**

Survey Unit: Grouping of contiguous site areas with a similar use history and the same classification of contamination potential. Survey units are established to facilitate the survey process and provide increased data pints for statistical evaluations.

Source Material: Uranium and/or Thorium other than that classified as special nuclear material.

Special Nuclear Material: Plutonium, U-233, and Uranium enriched in U-235. Special nuclear material is generally considered material capable of undergoing a fission reaction.

Unrestricted Use: Use of a former radioactive materials site without requirements for future radiological controls. Also, known as **Unrestricted Release.**