

D&D Procedure Cover Page

CHARACTERIZATION/LICENSE TERMINATION PROCEDURE

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| <p>UNCONDITIONAL RELEASE OF MATERIAL, EQUIPMENT AND SECONDARY STRUCTURES</p> <p>Procedure No. ZS-LT-400-001-001</p> <p>Revision No. 3</p> |
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Initiated By: (Print name / sign): Ron Shippee, Ronald Shippee Date: 4/15/2015

| Regulatory Required Reviews (per AD-11, "Regulatory Reviews") | | |
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| Part 72 ISFSI Impact License: 10 CFR 72.48 | <input type="checkbox"/> YES | <input checked="" type="checkbox"/> NO |
| Part 50 License: 10 CFR 50.59 and 50.90 | <input type="checkbox"/> YES | <input checked="" type="checkbox"/> NO |
| Fire Protection: 10 CFR 50.48(f) | <input type="checkbox"/> YES | <input checked="" type="checkbox"/> NO |
| Conditions of License: E-Plan: 10 CFR 50.54(q) | <input type="checkbox"/> YES | <input checked="" type="checkbox"/> NO |
| Technical Review Required? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO | | |
| Secondary Reviewer: <u>Charles M. F. [Signature]</u> | | DATE: <u>4/15/2015</u> |
| Print Name / Signature | | |

| Approval Section | |
|---|----------------------|
| DEPARTMENT MANAGER: <u>R. YETTER [Signature]</u> | DATE: <u>4/15/15</u> |
| Print Name / Signature | |
| DECOMMISSIONING PLANT MANAGER: <u>James A. St. Pierre [Signature]</u> | DATE: <u>4/20/15</u> |
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Summary of Changes in this Revision:

- Rev. 3 – Rewrite.

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1. **PURPOSE AND SCOPE**

1.1. **PURPOSE**

This procedure provides guidance for performing Unconditional Release Surveys (URS) on secondary side structures, systems, and miscellaneous Materials and Equipment (M&E) within non-Radiologically Controlled Areas (RCAs) at the Zion Site prior to and/or after demolition activities, and documents that the secondary side structures, systems and miscellaneous M&E are suitable for subsequent unconditional release from the Zion Site, or for reuse on the Zion Site.

The conduct of this procedure is intended to prevent the inadvertent release of radioactive material offsite to the general public, through waste disposal, recycling, or asset recovery (i.e., sale or reuse of materials and equipment), by providing a controlled process for performance of biased radiological assessment surveys and implementation of material control on secondary side structures, systems, and miscellaneous M&E at the Zion Site.

1.2. **SCOPE**

This procedure describes the protocols to be used to design, perform, control, evaluate and document radiological surveys performed on secondary side structures, systems and miscellaneous M&E to support unconditional release from the Zion Site, or for reuse on the Zion Site. These protocols are established using guidance from NUREG-1575, Supplement 1, Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual (MARSAME).

2. **RESPONSIBILITIES**

2.1. **Vice-President D&D/Construction – is responsible for:**

- Directing D&D/Construction group to identify and prepare secondary side structures, systems, and miscellaneous M&E for radiological surveys.
- Reviewing scope of demolition work packages for secondary side structures, systems, and miscellaneous M&E and initiating turnover to the Characterization/License Termination (C/LT) Group for performance of surveys.

2.2. **Characterization/License Termination (C/LT) Manager – is responsible for:**

- Establishing programs and procedures to ensure secondary side structures, systems, and miscellaneous M&E are surveyed, as necessary, to minimize the inadvertent release of radioactive material from the Zion Site, or reuse on the Zion Site.
- Establishing and maintaining control of structures, systems, and miscellaneous M&E once surveyed to prevent inadvertent contamination.

2.3. **Director, Radiological Protection (DRP) – is responsible for:**

- Reviewing survey results and providing permission, through signature, that secondary side structures, systems, and miscellaneous M&E are suitable for demolition and/or unrestricted release from the Zion site, or for reuse on the Zion Site.

2.4. MARSAME Manager – is responsible for:

- Implementing programs and procedures to ensure secondary side structures, systems, and miscellaneous M&E within non-radiologically controlled areas of the site are surveyed as necessary prior to leaving site, or reuse on the Zion Site.
- Providing oversight to ensure that proper surveys are performed, survey results are evaluated correctly, and properly documented.
- Maintaining control of structures, systems, and miscellaneous M&E once surveyed to prevent inadvertent contamination.

2.5. Manager, Industrial Safety and Hygiene – is responsible for:

- Providing assistance and input for Job Safety/Task Hazard Analysis Evaluations.
- Providing guidance for safely accessing structure and M&E to be surveyed to ensure the safety of personnel. Examples include; blocking and bracing, elevated work activities, asbestos controls, and confined spaces.

2.6. Cold and Dark Manager – is responsible for:

- Initiating turnover of structures, systems, and miscellaneous M&E to the C/LT Group.

2.7. Radiological Engineer (RE) / Field Supervisors (FS) - are responsible for:

- Preparing and reviewing survey packages to facilitate the surveys of secondary side structures, systems, and miscellaneous M&E being considered for release.
- Ensuring only approved instrumentation is used to perform release surveys and that the instrumentation is capable of meeting the required Minimum Detectable Concentrations (MDCs).
- Providing direction to the C/Final Radiation Survey (FRS) Technicians performing surveys in accordance with this procedure.
- Providing daily supervision and guidance to field survey and sampling crews and performing quality checks of field activities.
- Evaluating and providing direction when surveys are required of secondary side structures, systems, and miscellaneous M&E with the potential for internal or inaccessible contamination, volumetric contamination, or that may contain other nuclides (e.g., Natural Occurring Radioactive Material, NORM) versus plant-derived or plant-related activity.
- Reviewing, maintaining, and controlling survey packages and completed survey documentation appropriately.
- Maintaining control of structures, systems, and miscellaneous M&E once surveyed to prevent inadvertent contamination.

2.8. Data Base and LTP Support Engineer is responsible for:

- Maintaining MARSAME survey plan index and filing locations.
- Tracking the status of the MARSAME Survey Plans and supporting documents.

2.9. Project Leads and Job Supervisors – are responsible for:

- Notifying the MARSAME Manager of plans to remove M&E from the site.
- As necessary, assist in providing access to M&E to be surveyed including staging, disassembly, cutting access ports, and providing man lifts and scaffolding, etc.

2.10. Waste Operations Manager – is responsible for:

- Approving Container/Shipment Traveler Form, Attachment 1 of ZS-WM-135 for M&E free released from RCAs and RRAs prior to the material and/or equipment being shipped off-site.

2.11. C/Final Radiological Survey (FRS) Radiological Protection Technicians (RPT)– are responsible for:

- Performing required radiological surveys in accordance with ZS-RP-105-001-001, “Radiological Surveys,” and related survey plans, packages, or instructions, and documenting the results.
- Preparing the Container/Shipment Traveler Form, Attachment 1 of ZS-WM-135, “Onsite Radioactive and Non-Radioactive Container Tracking and Traveler.”

3. DEFINITIONS

- 3.1. Action Level**- The numerical value that causes a decision-maker to choose one of the alternative actions. In the context of MARSAME, the numerical value is the radionuclide concentration or level of radioactivity corresponding to the disposition criterion, and the alternative actions are determined by the selection of a disposition option.
- 3.2. Aggregate Survey** – A gamma dose rate survey performed on waste conveyance leaving an RCA or Radiologically Restricted Area (RRA) with material for Unconditional Release in accordance with the requirements of ZS-WM-135.
- 3.3. Disposition Survey** – A radiological survey designed to collect information to support a disposition decision.
- 3.4. Historical Site Assessment** – The identification of potential, likely, or known sources of radioactive material and radioactive contamination based on existing or derived information for the purpose of classifying a facility or site, or parts thereof, as impacted or non-impacted.
- 3.5. Impacted Area** - Areas which could have been radiologically impacted by site operations. Impacted areas are classified by their potential for residual radioactivity in excess of natural background or fallout levels.

- 3.6. **Materials and Equipment (M&E)** – Items considered for disposition including metals, concrete, dispersible bulk materials, tools, equipment, piping, conduit, furniture, solids, liquids, and gases in containers, etc. M&E are considered non-real property distinguishable from buildings/structures and land, which are considered real property.
- 3.7. **Measurement** – 1) The act of using a detector to determine the level or quantity of radioactivity on a surface or in a sample of material removed from a media being evaluated, or 2) The quantity obtained by the act of measuring.
- 3.8. **Measurement Quality Objective (MQO)** – A statement of performance objective or a requirement for a particular method performance characteristic.
- 3.9. **Minimum Detectable Concentration (MDC)** – The minimum detectable concentration is the *apriori* activity level that a specific instrument and technique can be expected to detect 95% of the time. When stating the detection capability of an instrument, this value should be used. The MDC is the Detection Limit, L_D , multiplied by an appropriate conversion factor to give units of activity concentration.
- 3.10. **Non-impacted Area** – Areas not impacted by site operations and have no reasonable potential for residual radioactivity in excess of natural background or fallout levels.
- 3.11. **Preliminary Survey** – Any survey performed prior to the disposition survey in MARSAME, and is generally performed to provide information required to support the design of the disposition survey.
- 3.12. **Qualified Individual** – A person meeting the radiation protection technician qualifications of Regulatory Guide 1.8, Rev.1, which endorses ANSI N18.1 and is trained to Zion instruction guide listed in ZS-TQ-100-F010 SRPT 6.
- 3.13. **Sentinel Measurement** – A biased measurement performed at a key location to provide information specific to the objectives of the initial assessment.
- 3.14. **Total Efficiency** - Instrument efficiencies (ϵ_i) are derived from the surface emission rate of the radioactive source(s) used during the instrument calibration. Total Efficiency (ϵ_t) is calculated by multiplying the instrument efficiency (ϵ_i) by the surface efficiency (ϵ_s) commensurate with the radionuclide's alpha or beta energy using the guidance provided in ISO 7503-1.
- 3.15. **Unconditional or Unrestricted Release** – The removal of radiological regulatory controls from structures, materials and equipment.
- 3.16. **Unconditional Release Survey (URS) Areas** – Secondary side structures, systems and miscellaneous M&E within non-radiologically controlled areas of the site that are controlled for the purposes of being surveyed or have been surveyed for unconditional release.

4. PRECAUTIONS, LIMITATIONS, AND PREREQUISITES

4.1. Precautions

- 4.1.1 Only instrumentation specifically approved by the MARSAME Manager for surveying structures, systems, and M&E for unconditional release shall be used when performing surveys in accordance with this procedure.
- 4.1.2 Only instrumentation capable of meeting the required MDCs shall be used to survey structures, systems, and miscellaneous M&E for unrestricted release.
- 4.1.3 Only qualified individuals may perform a URS of structures, systems, and miscellaneous M&E.
- 4.1.4 Structures, systems, and miscellaneous M&E designated for surveys and within the scope of this procedure shall be assessed for the possibility of internal contamination. This may involve disassembling or cutting access ports to gain access to internal surfaces/components. Prior to disassembling or cutting access ports, communications must be established with the appropriate Project Lead, Job Supervisor, and Zion Safety Department to ensure proper procedures are followed and the necessary support is available.
- 4.1.5 Prior to any elevated work or confined space entries, discussions must be held with the appropriate Project Lead, Job Supervisor, and Zion Safety Department to ensure proper procedures are followed and the necessary support and permits are available.
- 4.1.6 Structures, systems, and miscellaneous M&E being surveyed that do not pass the release criteria may be (1) dismantled to isolate radioactive material and then resurveyed or (2) decontaminated and then resurveyed in an attempt to unconditionally release the structures, systems, and miscellaneous M&E. The scope of these actions will be determined by the survey planning team and added to the survey plan.
- 4.1.7 Survey data that exceeds the criteria or action levels used to determine that structures, systems, or M&E are suitable for release from radiological controls shall be reported to the RP-OPS Supervisor to ensure proper radiological controls, postings, and labels are implemented and maintained.
- 4.1.8 When surveying structures, systems, or M&E for unconditional release, the ambient background as measured by the instrumentation used must be known and/or controlled to ensure that the required MDCs are met. If necessary, consider relocating M&E to a lower background area or determine a local background by performing a shielded vs. unshielded background assessment. Increase the count times, and/or using alternative instrumentation as approved by the MARSAME Manager.
- 4.1.9 All radiological markings (placards, labels, markings, rad tape, rad rope, etc.) shall be removed or permanently defaced on all material and equipment to be released from radiological controls.

- 4.1.10 Prior to shipments of bulk material (i.e. demolition debris) leaving site, an aggregate check of the shipment using a “micro-R” or “micro-Rem” survey instrument must be performed and an evaluation of the load using the truck monitor at the exit should be performed.

4.2. Limitations

- 4.2.1 Structures, systems, and miscellaneous M&E shall not be released from radiological controls at Zion Station if they contain or are contaminated with plant-related radioactive materials that are distinguishable from background.
- 4.2.2 In most cases, structures, systems, and miscellaneous M&E shall be deemed to contain, or be contaminated, with plant-related radioactivity if radiological surveys and/or sample analyses identified plant-related radioactivity in excess of the critical level. This critical level is associated with the appropriate minimum detectable concentrations (MDCs), after correcting for applicable background interferences, as necessary. If alternative criteria are used to determine if structures, systems, and miscellaneous M&E contain, or are contaminated with plant-related radioactivity, the criteria used shall be clearly documented as part of the survey plan/package documentation, and approved prior to initiating any related surveys, by the MARSAME Manager, or designee.
- 4.2.3 The associated MDCs for scan measurements and smears shall be no greater than the corresponding limits in NRC I.E. Circular No. 81-07.
- Scan alpha measurements 100 dpm/100 cm²
 - Scan beta measurements 5,000 dpm/100 cm²
 - Removable alpha contamination 20 dpm/100 cm²
 - Removable beta contamination 1000 dpm/100 cm²

NOTE

The C/LT Manager must be notified, and grant approval, prior to obtaining samples for isotopic analysis not initially required in the sample plan.

- 4.2.4 For the analysis of volumetric activity in solids/sludge using gamma spectroscopy analyses, the analysis MDCs shall be no greater than the MDCs derived from ODCM Chapter 12, Table 12.5-3 for sediments listed in the following table.

| Radionuclide | MDC (pCi/g) |
|--------------|-------------|
| Cs-137 | 0.18 |

- 4.2.5 For the analysis of volumetric activity in liquids using gamma spectroscopy analyses, the analysis MDCs shall be no greater than the MDCs derived from ODCM Chapter 12, Table 12.5-3 for water listed in the following table.

| Radionuclide | MDC (pCi/ml) |
|--------------|--------------|
| Co-60 | 0.015 |
| Cs-137 | 0.018 |

- 4.2.6 When using gamma spectroscopy equipment in an attempt to quantify activity or demonstrate achievement of specified MDCs, approved ISOCS/LABSOCS geometries must be used to obtain quantitative results.
- 4.2.7 Gamma spectroscopy equipment may only be used for qualitative analyses if counting geometries are not available.

4.3. Prerequisites

- 4.3.1 All survey or counting instruments used to obtain survey data shall be within current calibration requirements and verified to be operational.
- 4.3.2 Documents and databases containing survey data and survey records are Quality Assurance (QA) records when complete. Positive control of these records shall be maintained until they are forwarded to Records Management.
- 4.3.3 When documenting survey information, all personnel shall ensure that all QA records are of good quality and legible. Legibility is determined to be readable and reproducible.
- 4.3.4 Decommissioning activities having the potential to contaminate a specific area or structure must be completed prior to implementing the URS in that area.
- 4.3.5 Loose non-system specific miscellaneous M&E found in the survey unit shall be identified and listed.
- 4.3.6 The list of miscellaneous M&E found in the survey unit should be distributed to interested parties in order to finalize disposition. Disposition options include:
- Relocated for continued use by D&D.
 - Designated for asset recovery. (Segregate/relocate M&E out of survey unit prior to survey).
 - Disposition by demolition contractor (M&E remains in area for survey).
- 4.3.7 Housekeeping and cleanup of the area must be completed prior to implementing the URS.

5. **MAIN BODY**

5.1. **General Requirements**

- 5.1.1 All structures, systems and associated M&E outside of radiologically controlled areas that are designated for demolition and subsequent removal from the site as clean material shall be surveyed for unconditional release in accordance with this procedure.
- 5.1.2 The Cold and Dark Manager, or designated alternate, shall notify the C/LT Group prior to any structure demolition and associated systems and miscellaneous M&E. The cognizant engineer responsible for the demolition of an area/structure shall coordinate with the Vice-President D&D/Construction, or designated alternate, to schedule a survey of the structure, system and associated M&E.
- 5.1.3 The MARSAME Manager shall initiate and maintain access controls, as necessary, to prevent the cross contamination of previously surveyed areas and to ensure the final configuration of the areas is maintained. Access controls will remain in place until the time of demolition.

5.2. **Turnover of Areas/Structures to the Final Status Survey Group**

- 5.2.1 The Cold and Dark Manager, or designated alternate, shall initiate Attachment 1, “Secondary Side Area/Structure Release for Demolition” as follows:
 - 1.) Complete the D&D/Construction Group Request for Survey Section of the form by identifying the area/structure to be demolished and associated M&E, the demolition date, the intended waste disposition, and inherent value of M&E, as appropriate.
 - 2.) Forward the form to the MARSAME Manager.
- 5.2.2 The Vice President D&D/Construction, or designated alternate will verify the area or structure is acceptable for the implementation of a pre-demolition release survey as follows:
 - 1.) Initiate Attachment 2 “Secondary Side Area/Structure Turnover and Control.”
 - 2.) Ensure the completion of housekeeping and the removal of any tools or equipment not required to support survey activities and verify any additional measures or engineering controls necessary to limit the spread of contamination from adjacent areas (i.e., plug vent louvers, cover floor gratings, etc.) have been implemented.
 - 3.) Sign the appropriate section of Attachment 2.
 - 4.) Forward the signed Attachment 2 to the MARSAME Manager.
- 5.2.3 The MARSAME Manager shall sign the appropriate section of Attachment 2 to signify acceptance of the area or structure and associated M&E as being suitable for performing a URS and file the signed forms in the survey package.

5.3. URS Area Access Control Measures

5.3.1 The MARSAME Manager shall control entry to areas for which URS have been or are being performed and ensure proper controls are maintained as follows:

- 1.) Place postings, such as Attachment 3 or 4, at the entrances to these areas, as appropriate.
 - A. Use Attachment 3 for areas where access must be authorized.
 - B. Use Attachment 4 for areas where access control of personnel is not required (e.g., occupied office spaces).
- 2.) Use additional controls such as rope, barricades, tamper proof seals and locks as necessary.
- 3.) Perform periodic surveys on structures up to the actual start of demolition for the purposes of:
 - A. Monitoring for indications of cross contamination.
 - B. Verifying postings and access control measures.

5.3.2 Review and approval by MARSAME Manager is required for any work activities to be performed following completion of URS in a specific area.

5.4. Creating a Survey Package

NOTE

Electronically generated forms that contain equivalent content DO NOT have to have the identical formatting as stated in this procedure.

5.4.1 The MARSAME Manager, or designee shall assign a Radiological Engineer (RE) to develop a survey plan for the following scenarios as appropriate:

- 1.) Structure Survey Areas
 - A. Floors
 - B. Walls below 2 meters
 - C. Walls above 2 meters
 - D. Ceiling
 - E. System external surface below 2 meters
 - F. System external surfaces above 2 meters
 - G. Miscellaneous M&E remaining in the survey area after turnover (Use Generic Plan G001)
- 2.) Systems Survey Plans
 - A. System and component internal surfaces
- 3.) M&E Unconditional Release Survey (URS) Plan

- A. Generic M&E URS (G001)
- B. Specific M&E for URS.

5.4.2 The RE shall develop a survey plan (Attachment 5) per the following:

- 1.) Generate a MARSAME Survey Plan number based on Survey Area Numbers or Survey Unit ID Numbers per ZS-LT-02, “Characterization Survey Plan” as appropriate.
 - A. For structures, use the Survey Unit ID number followed by the appropriate alphanumeric sequence.
 - B. For systems and system components (internal surfaces) that cross multiple survey units, use the Survey Area Number followed by the appropriate alphanumeric sequence.
 - C. For loose M&E, use survey plan G001.
 - D. For specific miscellaneous M&E plans, number survey plans sequentially beginning with G002.

5.4.3 Document the MARSAME Plan number and complete Section 1 of Attachment 5, “Cover Page and Approvals.

5.4.4 Complete Section 2, Initial Assessment.

- 1.) Review historical information and process knowledge available for the area, system, or miscellaneous M&E to assess its potential for containing contamination or being contaminated as follows:
 - A. Perform a walk down of the area and take pictures that adequately show what surfaces need to be surveyed, whenever possible.
 - B. Identify the type and number of miscellaneous M&E items remaining in the survey area.
 - C. Identify potential radionuclides of concern and their relative fractions if different from the assumptions in TSD 11-002.
 - D. Determine the potential for volumetric contamination.
 - E. Establish the history of prior use.
 - F. Determine the need to perform sentinel and/or preliminary measurements. If these surveys have already been performed, then enter the record identifier and location.

5.4.5 Complete Section 3, Task Hazard Analysis.

- 1.) Based on the walk down performed in Section 5.4.4.1.A, identify possible safety hazards.
- 2.) Initiate a Task Hazard Analysis in conjunction with the *ZionSolutions* Safety Department.

5.4.6 Complete Section 4, Physical Attributes.

- 1.) Describe surface/material to be surveyed:
 - A. Dimensions/area in m²
 - B. Volumes in m³
 - C. Mass in kilo grams
- 2.) Determine the complexity including the need for segregation or disassembly.
- 3.) Evaluate the accessibility of the material and/or equipment including surface conditions that may affect the surface efficiency.
- 4.) Ascertain any inherent value, if applicable. Refer to Section 5.2.1.1.
- 5.) Note any other issues that may complicate subsequent surveys.

5.4.7 Complete Section 5, Radiological Attributes.

- 1.) See TSD 11-002, Section 4.1.3.2.2 table titled M&E Attributes.
- 2.) Provide other information, if pertinent.

5.4.8 Complete Section 6, Disposition Survey Design.

- 1.) Define the boundaries of the survey plan and total surface area of structures or system internals.
 - A. Identify whether the survey plan will be incomplete prior to initiation of demolition activities and require additional surveys be performed during demolition or after demolition is complete.
- 2.) Identify the location, type, and number of miscellaneous M&E items to be surveyed, as appropriate.
- 3.) Attach photos and or drawings used for package development, as appropriate.
- 4.) Check the appropriate box indicating the classification of the structure, system, or miscellaneous M&E for survey.
- 5.) Summarize the information that justifies the classification of the structure system or miscellaneous M&E and provide reference documents, as appropriate.
- 6.) Identify the intended disposition of the M&E (refer to Attachment 1, Secondary Side Area/Structure Release for Demolition).

5.4.9 Complete Section 7, Survey Plan Development

- 1.) Survey Requirements.
 - A. Based on classification, previous and current use and/or engineering judgment, identify and document the percentage of structure, system, or miscellaneous M&E items to be surveyed per Attachment 6.

- B. Identify and document the number of measurements required for each Type of Measurement using Attachment 6.
 - C. Document the Instrument/Probe Model Numbers to be used provided on Attachment 7.
 - D. List Discrimination Limit (MDC) provided on Attachment 6.
 - E. Enter the Action Level associated with the Type of Measurement provided on Attachment 7.
- 2.) Quality Control (QC) consists of a repeat of five percent (5%) or a minimum of one (1) of both scan and direct measurements, and smear samples as required in the survey plan. Address QC requirements as follows:
- A. Identify the Type of Measurement.
 - B. Identify and document the amount of QC measurements.
 - C. If QC measurements are to be performed on specific items or locations, then list the items or locations.
 - D. Perform QC measurements by a C/FRS RPT other than the individual who originally performed the survey and use a different survey instrument other than the instrument used in the original survey.
- 3.) Survey Plan Instructions.
- A. Develop survey plan instructions to implement the survey requirements as identified in section 5.4.9.1 to include:
 - i. Determination of background.
 - ii. Determination of scan and static alarm set points.
 - iii. Number and location of survey measurements.
 - iv. Number and location of QC measurements.
 - B. Assign survey identifiers for scan and static measurement locations in accordance with Attachment 8.
 - C. Assign survey identifiers for media sample locations in accordance with Attachment 9.
 - D. Initiate Attachment 12 as follows:
 - i. Identify Survey Area and Plan # or N/A for loose M&E URS.
 - ii. Identify area/material classification and intended % of survey.
 - iii. List total number of items and number of items to be surveyed by type i.e. tables, chairs, lockers, etc.
 - iv. Indicate items for QA/QC assessment.

5.5. Survey Plan Review and Approval

- 5.5.1 Submit the draft survey plan, including photos drawings and survey map, as appropriate, to the MARSAME Manager for review and approval.
- 5.5.2 The MARSAME Manager will forward the approved plan to the C/LT Manager for review and approval.
- 5.5.3 If additional surveys are required during or after demolition, then the C/LT Manager shall complete page 2 of Attachment 1 to communicate the conditions to the VP of D&D.
- 5.5.4 When the survey plan is approved by the C/LT Manager, forward the approved survey plan to Data Base and LTP Support Engineer for entry into the MARSAME Index.
- 5.5.5 File the survey plan in the designated storage location.

5.6. Survey Plan Implementation

- 5.6.1 Initiate implementation the survey plan as follows.
 - 1.) Review the approved survey plan and resolve any questions with the RE and/or MARSAME Manager. (FS)
 - 2.) Conduct a pre-job brief with the C/FRS RPTs and support labor and assign survey duties, as appropriate. (FS)
 - 3.) Sign and date the survey plan prior to initiating survey activities. (C/FRS RPTs)
- 5.6.2 Provide direction to personnel regarding layout and identification of structure/system survey locations or identification of M&E items for survey, as appropriate. (FS and/or RE)
- 5.6.3 C/FSS RPTs perform the following:
 - A. Obtain survey instruments and smears, as appropriate, and proceed to the survey location.
 - B. Identify the ambient background count rate in the area for each survey instrument and collect and record five (5), one (1) minute background measurements.
 - C. Calculate and record the mean of the 5 background measurements in Attachment 10, Field Log.
 - D. Calculate Scan and Direct Measurement MDCs using equations found in Attachment 11 Measurement Quality Objectives in Survey Plans and document in Attachment 10.
 - E. Perform survey activities per the survey instructions.

NOTE

Beta Direct measurements are performed at the highest scan indication identified per scan area. Collect a smear sample at the same location. Use the same location identifier for the beta scan, beta direct and smear.

- F. If the survey instructions cannot be implemented as written, then document in Section 10 of Attachment 5 and contact the FS and/or the MARSAME Manager for guidance.
 - G. Document performance of the survey activities on Attachment 10, survey maps, instrument data logging/downloads, smear analysis reports and/or M&E URS form (Attachment 12), as appropriate.
 - H. If the survey results exceed the action levels, then notify the FS and/or the MARSAME Manager for guidance.
 - I. Request a peer review prior to submitting the completed survey package to the FS.
- 5.6.4 The MARSAME Manager may provide written supplementary survey instructions as appropriate to address survey indications in excess of an action level. If supplementary survey instructions and survey results are provided, then document in Attachment 5, Section 9.

5.7. Completed Survey Plan Review and Closeout

- 5.7.1 Review survey data collected and documentation for completeness and forward the completed survey package Attachment 5, to the MARSAME Manager. (FS)
- 5.7.2 The MARSAME Manager shall complete Section 10 of Attachment 5 and review the measurement and/or sample analysis results at the completion of the survey to ensure the following:
 - 1.) The required numbers of measurements and/or samples were collected.
 - 2.) The required measurement and/or sample MDCs were met.
 - 3.) The measurement and/or sample analysis results:
 - i. Satisfy the MQOs and Type I, Type II Decision Error of 5%.
 - ii. Meet the criteria or action level used in determining M&E is suitable for release from radiological.
- 5.7.3 Complete the survey package cover page documenting the suitability for release. (MARSAME Manager)
- 5.7.4 Notify the DRP and obtain DRP signature for close out of package.

NOTE

Materials and/or equipment addressed by this procedure may be released from RP controls when any one of the following apply:

- Attachment 12 of this procedure is approved.
- Partial release of M&E covered by a survey plan is approved via ZS-WM-135 Attachment 1.
- The survey package control sheet Review and Closeout is approved on page 1 of attachment 5.

- 5.7.5 If the reviews in Step 5.7.2 indicate the materials and/or equipment are not suitable for release, then the MARSAME Manager, or designee, shall complete the survey package cover page documenting the non-suitability for release and inform operational RP organization to initiate necessary controls.
- 5.7.6 The MARSAME Manager shall provide any Lessons Learned, as appropriate.
- 5.7.7 Notify the Data Base and LTP Support Engineer that the package is complete and file the approved survey package and all associated measurement and/or sample analysis results in the designated storage location.

6. REFERENCES

- 6.1. NUREG-1575, Supplement 1, Multi-Agency Radiation Survey and Assessment of M&E Manual (MARSAME) January 2009.
- 6.2. NRC HPPOS-071, Control of Radioactively Contaminated Material.
- 6.3. NRC HPPOS-072, Guide on "How Hard You Have to Look" as Part of Radioactive Contamination Control Program.
- 6.4. NRC HPPOS-073, Surveys of Wastes from Nuclear Reactor Facilities before Disposal.
- 6.5. NRC Information Notice No. 85-92, Surveys of Wastes before Disposal from Nuclear Reactor Facilities, December 1985.
- 6.6. NRC I.E Circular No. 81-07, Control of Radioactively Contaminated Materials, May 1981.
- 6.7. TSD 11-002, Radiation Clearance Plan for Radiological Survey and Release of Materials and Equipment (M&E) Using Guidance from MARSAME at ZionSolutions, April 2012.
- 6.8. ZS-WM-135, Onsite Radioactive and Non-Radioactive Container Tracking and Traveler
- 6.9. ISO 7503-1, "Evaluation of surface contamination - Part 1: Beta-emitters (maximum beta energy greater than 0.15 MeV) and alpha-emitters", 1988.
- 6.10. ZS-LT-02, Characterization Survey Plan
- 6.11. ZS-RP-105-001-001, Radiological Survey

7. RECORDS

- 7.1. Attachment 1 – Secondary Side Area/Structure Release for Demolition
- 7.2. Attachment 2 – Secondary Side Area/Structure Turnover and Control
- 7.3. Attachment 5 – Survey Plan
- 7.4. Attachment 10 – Field Log
- 7.5. Attachment 12 - Miscellaneous M&E Survey Sheet

8. ATTACHMENTS

- 8.1. Attachment 1 – Secondary Side Area/Structure Release for Demolition
- 8.2. Attachment 2 – Secondary Side Area/Structure Turnover and Control
- 8.3. Attachment 3 - Example Posting for Unconditional Release Survey
- 8.4. Attachment 4 - Example Posting for Unconditional Release Survey
- 8.5. Attachment 5 – Survey Plan
- 8.6. Attachment 6 – Recommended Level of Survey for URS Plans
- 8.7. Attachment 7 - Guidelines for Measurements in URS Plans
- 8.8. Attachment 8 - MARSAME Location Codes for Datalogger
- 8.9. Attachment 9 – MARSAME Location Codes for Samples
- 8.10. Attachment 10 – Field Log
- 8.11. Attachment 11 - Measurement Quality Objectives for Survey Plans
- 8.12. Attachment 12 - Miscellaneous M&E Survey Sheet

| D&D/Construction Group Request for Survey | | |
|---|----------------------|-----------------|
| Demolition Work Package #: _____ Scheduled Demolition Date: _____ | | |
| Area/Structure to be Demolished: _____ _____ | | |
| Waste Disposition: _____ _____ | | |
| Waste Disposition: _____ _____ | | |
| _____ | | |
| Cold and Dark Manager | Date | |
| Site Characterization/License Termination Group Actions | | |
| Indicate the appropriate response below | | |
| Area/Structure survey completed on: _____ | _____ (signature) | _____ (date) |
| Data reviewed by Radiological Engineer/Field Supervisor: | _____ (signature) | _____ (date) |
| Data reviewed by MARSAME Manager: | _____ (signature) | _____ (date) |

| Site Characterization/License Termination Group Response |
|--|
| <p><input type="checkbox"/> The area(s)/structure(s) listed above do not meet the criteria to be released for demolition because:</p> <p><input type="checkbox"/> The area(s)/structure(s) listed above are released for demolition with the following restrictions:</p> <ul style="list-style-type: none"> <input type="checkbox"/> RP job coverage required <input type="checkbox"/> RWP required <input type="checkbox"/> Further surveys required during intermediate steps of demolition (attach requirements to this form) <input type="checkbox"/> No radioactive materials are to be stored in this area. <input type="checkbox"/> Special waste disposal or segregation methods required (attach requirements to this form) <input type="checkbox"/> Aggregate material generated during the demolition SHALL BE monitored (micro-R, truck monitor, etc.) prior to removal from the Zion Site. <input type="checkbox"/> Other: <p><input type="checkbox"/> The area(s)/structure(s) listed above are released for demolition with no restrictions.</p> |

 Site Characterization/License Termination Manager

 Signature/Date

 Director Radiation Protection

 Signature/Date

NOTICE

**AN UNCONDITONAL RELEASE SURVEY IS IN
PROGRESS OR HAS BEEN COMPLETED IN THIS
AREA**

**NO DECOMMISSIONING/DEMOLITION
ACTIVITES ARE TO BE PERFORMED IN THIS
AREA**

**THE USE, MOVEMENT OR STORAGE OF
RADIOACTIVE MATERIAL IS PROHIBITED IN
THIS AREA**

**ENTRY OF PERSONNEL IN THIS AREA IS
PROHIBITED WITHOUT THE AUTHORIZATION
OF Site Characterization/License Termination
SUPERVISION**

CONTACT: _____

EXTENSION: _____

| | | |
|--|--|--|
| | <p style="text-align: center;">Attachment 4 Example Posting for Unconditional Release Survey</p> | <p style="text-align: right;">ZS-LT-400-001-001 Revision 3 Information Use</p> |
|--|--|--|

NOTICE

**AN UNCONDITIONAL RELEASE SURVEY IS IN
PROGRESS OR HAS BEEN COMPLETED IN THIS
AREA**

**NO DECOMMISSIONING/DEMOLITION
ACTIVITIES ARE TO BE PERFORMED IN THIS
AREA**

**THE USE, MOVEMENT OR STORAGE OF
RADIOACTIVE MATERIAL IS PROHIBITED IN
THIS AREA**

| | | |
|----------------|--|--|
| MARSAME Plan # | Attachment 5 Survey Plan Page 1 of 10 | ZS-LT-400-001-001 Revision 3 Information Use |
|----------------|--|--|

Section 1: Cover Page and Approvals

| | |
|---|--|
| Description of Survey Plan: (Structure) | |
| Description of Survey Plan: (M&E) | |

Categorization: Impacted Non-Impacted (see section 6 for justification)

Survey Package Preparation

Prepared by: _____ Date: _____
Package Writer

Reviewed by: _____ Date: _____
MARSAME Manager

Approved by: _____ Date: _____
SC/LT Manager

Disposition Surveys

Individuals performing survey have read and understood this plan.

Performed by: _____ Date: _____

Performed by: _____ Date: _____

Performed by: _____ Date: _____

Reviewed by: _____ Date: _____
Field Supervisor

Review and Closeout

- Surveys for unconditional release demonstrate that there is no plant added radioactivity distinguishable from background.
- DOES NOT meet requirements for unconditional release. Area/Item has been removed, segregated, and controlled.

Approved by: _____ Date: _____
MARSAME Manager

Approved by: _____ Date: _____
RPM

| Section 2 - Initial Assessment (IA): | | |
|---|-------------------------------|---|
| | Historical Info | |
| | HSA Classification | <input type="checkbox"/> Non-impacted <input type="checkbox"/> Class 1 <input type="checkbox"/> Class 2 <input type="checkbox"/> Class 3 |
| | Process Knowledge | |
| | Visual Inspection | |
| | | |
| | Sentinel Measurements: | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| | Record Number / Identifier | |
| | Record Location | |
| | Preliminary Surveys: | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| | Record Number / Identifier | |
| | Record Location | |

Section 3 - Task Hazard Analysis:

| Observed or Potential Hazards | | |
|---|--|--|
| <input type="checkbox"/> - Heat Stress or stroke <input type="checkbox"/> - Cold work environment <input type="checkbox"/> - Stinging Insects <input type="checkbox"/> - Hazardous Plants/Animals <input type="checkbox"/> - Tripping Hazards <input type="checkbox"/> - Standing Water > 1 ft. deep <input type="checkbox"/> - Work @ height > 6 ft. <input type="checkbox"/> - Open excavations <input type="checkbox"/> - Fall hazards <input type="checkbox"/> - Other _____ | <input type="checkbox"/> - Confined space <input type="checkbox"/> - Hazardous atmosphere <input type="checkbox"/> - Load bearing stresses <input type="checkbox"/> - Lack of structural integrity <input type="checkbox"/> - Release of stored energy (hydraulic, steam, etc.,) <input type="checkbox"/> - Buried utilities <input type="checkbox"/> - Overhead power lines <input type="checkbox"/> - Other _____ | <input type="checkbox"/> - Kinetic energy sources (moving equipment) <input type="checkbox"/> - Vehicle traffic <input type="checkbox"/> - Overhead piping or components <input type="checkbox"/> - Exposed electric <input type="checkbox"/> - Sharp objects/surfaces <input type="checkbox"/> - Falling objects <input type="checkbox"/> - Other _____ <input type="checkbox"/> - Other _____ |
| Walk-Down: | <input type="checkbox"/> Performed <input type="checkbox"/> Not-Performed | <hr style="width: 100%;"/> (Name) <hr style="width: 100%;"/> (Date) |
| Notes/drawings from Walk-down | | |

| Section 4 - Physical Attributes: | | | |
|---|--|--|----------------------------|
| | | Example Information | M&E Information |
| Dimensions: | | Size (total mass) | |
| | | Shape (total surface area) | |
| | <input type="checkbox"/> Yes <input type="checkbox"/> No | Are there issues with size or shape that affect how the M&E should be handled? | |
| | | | |
| Complexity: | <input type="checkbox"/> Yes <input type="checkbox"/> No | Is additional segregation required? | |
| | <input type="checkbox"/> Yes <input type="checkbox"/> No | Is disassembly required? | |
| | <input type="checkbox"/> Yes <input type="checkbox"/> No | Are engineering controls needed to prevent release of materials? | |
| | <input type="checkbox"/> Yes <input type="checkbox"/> No | Are there multiple component materials in the M&E? | |
| | <input type="checkbox"/> Yes <input type="checkbox"/> No | Are material specific background measurements required? | |
| | | | |
| Accessibility: | <input type="checkbox"/> Yes <input type="checkbox"/> No | Are there issues with size or shape that limit accessibility? | |
| | <input type="checkbox"/> Yes <input type="checkbox"/> No | Are there porous surfaces? | |
| | <input type="checkbox"/> Yes <input type="checkbox"/> No | Are there seams, ruptures, or corroded areas where radioactivity could penetrate to difficult-to-measure areas? | |
| | <input type="checkbox"/> Yes <input type="checkbox"/> No | Are there painted surfaces that could have activity below the paint? | |
| | <input type="checkbox"/> Yes <input type="checkbox"/> No | Other surface conditions that could affect the measurements (smooth, pitted, corroded and or pitted, porous wood, etc.)? | |
| | | | |
| Inherent Value: | <input type="checkbox"/> Yes <input type="checkbox"/> No | Can the M&E be reused or recycled? | |
| | <input type="checkbox"/> Yes <input type="checkbox"/> No | What are recycling and disposal costs? | |

| | | |
|--|--|---|
| Section 5 - Radiological Attributes: | | |
| | See TSD 11-002, Section 4.1.3.2.2 | |
| | Other | |
| Section 6 - Disposition Survey Design | | |
| | Survey Unit Boundaries | |
| Final Segregation Location: | | |
| | Final Classification: | <input type="checkbox"/> Non-impacted <input type="checkbox"/> Class 1 <input type="checkbox"/> Class 2 <input type="checkbox"/> Class 3 |
| M&E Classification Justification: | | |
| | Disposition Option | Alternative Actions |
| <input type="checkbox"/> | Unrestricted release for disposal (M&E free release and disposal as municipal waste) | <input type="checkbox"/> |
| | | <input type="checkbox"/> |
| | | <input type="checkbox"/> |
| <input type="checkbox"/> | Release for Recycle (Recycle without radiological controls) | <input type="checkbox"/> |
| | | <input type="checkbox"/> |
| | | <input type="checkbox"/> |
| <input type="checkbox"/> | Release for Reuse (Reuse without radiological controls) | <input type="checkbox"/> |
| | | <input type="checkbox"/> |

Section 7 - Survey Plan Development
Survey Requirements

| % Scan Coverage / # survey locations. | Number and Type of Measurement | Instrument / Probe Model Number | Discrimination Limit (MDC) | Maximum BKGD | Action Level |
|--|---|--|---------------------------------------|-------------------------|-------------------------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Quality Control

| Type of Measurement | Number or percent of QC measurements | Specific Items or Locations (If Required) |
|---------------------|--------------------------------------|---|
| Beta scan* | | |
| Beta direct* | | |
| Beta disc smear* | | |

***QC measurements should be independent from the original technician that performed the survey and use a different instrument.**

Measurement Quality Objectives (MQOs) Implemented

| | Type of Measurement | Instrument/probe model # & serial # | Type I (alpha) | Type II (beta) | Count Time [min] / Scan Rate [in/sec] | Background | MDC |
|--|---------------------|-------------------------------------|----------------|----------------|---------------------------------------|------------|-----|
| | Beta scan | / | *5% | *5% | | | |
| | Alpha scan | / | *5% | *5% | | | |
| | Beta direct | / | *5% | *5% | (expected 1 min) | | |
| | Alpha direct | / | *5% | *5% | (expected 1 min) | | |
| | Beta disc smear | | | | (expected 1 min) | | |
| | Alpha disc smear | | | | (expected 1 min) | | |

*Unless otherwise noted

| | | |
|----------------|---|--|
| MARSAME Plan # | Attachment 5 Survey Plan Page 9 of 10 | ZS-LT-400-001-001 Revision 3 Information Use |
|----------------|---|--|

Survey Plan Instructions:

Background Determination, Scan and Static Alarm Set Points

Item/Location Survey Instruction

QC Instructions

Section 8 - Survey Results

Survey Results Attached

Section 9 - Comments (See Survey Results)

Section 10 - Data Assessment:

- Data review performed and documented on survey results Yes No
- Review and approve Attachment 12 Yes No
- Approve partial release of M&E via ZS-WM-135 Attachment 1 Yes No
- Analysis of difference between planned % and actual Yes No
- Determination of locations with potential plant-derived activity distinguishable from background Yes No
- Results of direct surveys to confirm presence of fixed contamination Yes No
- Elevated Radioactivity Identified? Yes No
- Remediation Performed? Yes No
- Deviation from Survey Plan? Yes No
- Special Comments Required? Yes No

Lessons learned: what went right, what needs to be changed

| Surface | Minimum Scan Coverage ⁽¹⁾ | | | Beta Direct Measurements and Smear Surveys Beta/Gamma and Alpha ⁽²⁾ | | |
|---|--------------------------------------|---------|---------|---|---|--|
| | Class 3 | Class 2 | Class 1 | Class 3 | Class 2 | Class 1 |
| Structure | | | | | | |
| Floor | 10% | 25% | 100% | Beta Direct measurements are performed at the highest scan indication identified per scan area. Collect a smear samples at the same location. Smear samples are collected a frequency of 1 smear per 1m ² up to 50 m ² of area surveyed as appropriate (collect a minimum of 30 smears where practical) | Beta Direct measurements are performed at the highest scan indication identified per scan area. Collect a smear samples at the same location. Smear samples are collected a frequency of 1 smear per 1m ² up to 25 m ² of area surveyed as appropriate (collect a minimum of 30 smears where practical) | Beta Direct measurements are performed at the highest scan indication identified per scan area. Collect a smear samples at the same location. Smear samples are collected a frequency of 1 smear per 1m ² up to 4 m ² of area surveyed as appropriate (collect a minimum of 30 smears where practical) |
| Walls below 2 meters | 10% | 25% | 100% | | | |
| Walls above 2 meters | <5% | 10% | 50% | | | |
| Ceilings | <5% | 10% | 50% | | | |
| Exterior walls below 2 meters | 5% | 10% | 50% | | | |
| Exterior walls above 2 meters | <5% | 5% | 10% | | | |
| Roof | 10% | 25% | 100% | | | |
| Systems and Components | | | | | | |
| Exteriors (include as structural elements within the 3D space of a survey unit) | 10% | 25% | 100% | Beta Direct measurements are performed at the highest scan indication identified per scan area. Collect a smear sample at a frequency of 1 smear per 1m ² up to 50 m ² of area surveyed as appropriate (collect a minimum of 30 smears where practical) | Beta Direct measurements are performed at the highest scan indication identified per scan area. Collect a smear sample at a frequency of 1 smear per 1m ² up to 25m ² of area surveyed as appropriate (collect a minimum of 30 smears where practical) | Beta Direct measurements are performed at the highest scan indication identified per scan area. Collect a smear sample at a frequency of 1 smear per 1m ² up to 4 m ² of area surveyed as appropriate (collect a minimum of 30 smears where practical) |
| Interiors | 10% | 25% | 100% | | | |
| Miscellaneous M&E | 10% | 25% | 100% | | | |

(1)- The intensity of the Unconditional Release Survey for structure, system or miscellaneous M&E will vary dependent on the following:

- History of radioactivity present (See Historical Site Assessment Classification)
- Previous or current use
- Process knowledge
- Results of preliminary or sentinel surveys
- Engineering Judgment

(2) –Scan coverage recommendations for β/γ contamination. Scans for α contamination will be performed if the area has a history of α contamination or if α contamination is suspected.

Attachment 7
Guidelines for Measurements in URS Plans

ZS-LT-400-001-001
Revision 3
Information Use

| Survey Method | Instrument Probe Model Number | Discrimination Limit (MDC) | Bkgd | Survey Guidance | Action Level |
|----------------------|--------------------------------------|---|--|---|---------------------|
| Beta scan | Ludlum 2350 with 43-68 | MDC < 5,000 dpm / 100 cm ² Scan indication alarm set point based on mean background | Background determined as the mean of 5 representative measurements within the area or material specific. | Maintain a ¼ “ distance detector to surface of interest Scan speed should be 1 detector width per second. Slow down scan speed over uneven surfaces Listen for increases in audio response of the meter and slowdown in order to identify the location of the highest indication. Mark the location of and record the highest scan indication identified. | 1 |
| Beta scan | Ludlum 2350 with 43-37 | MDC < 5,000 dpm / 100 cm ² Scan indication alarm set point based on mean background | Background determined as the mean of 5 representative measurements within the area or material specific. | Maintain a ¼ “ distance detector to surface of interest Scan speed should be 1 detector width per second. Slow down scan speed over uneven surfaces Listen for increases in audio response of the meter and slowdown in order to identify the location of the highest indication. Mark the location of and record the highest scan indication identified. | 1 |
| Beta scan | Ludlum 2360 with 43-93 | MDC < 5,000 dpm / 100 cm ² Scan indication alarm set point based on mean background | Background determined as the mean of 5 representative measurements within the area or material specific. | Maintain a ¼ “ distance detector to surface of interest Scan speed should be 1 detector width per second. Slow down scan speed over uneven surfaces Listen for increases in audio response of the meter and slowdown in order to identify the location of the highest indication. Mark the location of and record the highest scan indication identified per defined grid | 1 |
| Beta Direct Static | Ludlum 2350 with 43-68 | < 5,000 dpm / 100 cm ² | Background determined as the mean of 5 representative measurements within the area or material specific | Collect a 1 minute direct beta static measurement at the marked location of the highest scan indication or prescribed location by placing the detector at ¼ “ of the surface of interest and record the result. | 1 |

| | | | | | |
|-----------------------|-------------------------------|---|---|---|---|
| Beta Direct Static | Ludlum 2360 with 43-93 | < 5,000 dpm / 100 cm ² | Background determined as the mean of 5 representative measurements within the area or material specific | Collect a 1 minute direct beta static measurement at the marked location of the highest scan indication or prescribed location by placing the detector at ¼ “ of the surface of interest and record the result. | 1 |
| Beta scan | Ludlum Model -3 with GM probe | Indications >bkgd | As read not to exceed 300 cpm | Maintain a ¼ “ distance detector to surface of interest Scan speed should be 1 detector width per second. Slow down scan speed over uneven surfaces | 3 |
| Smear Sample | Tennelec 3030P | Determined by instrument/background < L _d in dpm / 100 cm ² | | 1 per beta direct static measurement location additional smear samples may be collected independent of direct static locations as appropriate | 2 |
| Smear Sample | Tennelec 3030P | Determined by instrument/background < L _d in dpm / 100 cm ² | | Concurrent with beta | 2 |
| HPGe, LaBr, or NaI | ISOCS, LabSOCS or Inspector | No ROC identified | 0.1 mR/hr | In-situ per location or item or laboratory analysis of sample | 4 |
| Plastic Scintillat or | Ludlum Model 54 | <4600 dpm alarm set point per instrument cal. | Self-Regulating | Per item Scan and smear survey prerequisite | 5 |

Action Level

1. Indication > alarm set point
2. Smear analysis result > $L_d = 3 + (4.65 \sqrt{bkrd})$
3. Indication > BKDG
4. ROC identified as present
5. Response > alarm set point

Supplementary Survey Techniques implemented to resolve positive indications identified by scan and/or direct measurement or smear survey techniques include:

- In-situ gamma spectroscopy via ISOCS or Inspector.
- Bulk media sampling and laboratory analysis

| | | | | | |
|---------------|----|----|---|---|----|
| LINE 1 | 1 | 2 | 3 | 4 | 5 |
| LINE 2 | 6 | 7 | 8 | 9 | 10 |
| LINE 3 | 11 | 12 | | | |

| | | | | |
|---|---|---|---|---|
| 9 | 5 | 0 | 1 | A |
| P | G | 0 | 0 | 1 |
| B | D | | | |

| Indicates SUID 1 st – 5 th (L1) | 6 th Digit Identifies type of survey. (L2) | | 7 th -10 th Identifies the item surveyed followed by the number(L2) | 11 th & 12 th Type of measurement surveyed (L3) |
|--|--|------------------------------|---|--|
| 1-4 digits indicate the Survey Unit Identification Number. This will be the last 4 digits of the Survey Unit ID 5 th digit will identify package alphanumeric sequence. Example: 9501A, 9501B, 9501C etc... | B = Background S = Sentinel I = Investigational V = Verification R = Release *FLDBK = Field Background (Digits 6-10 for field backgrounds) | Q = QA/QC P = Preliminary | Example: Grid: G001, G002, G003 etc... Structure: S001, S002, S003 Type Misc. M&E Id # 7+8 Individual Item Id # 9+10 (Example: type M1 item 01, = M101, M102, M03, etc... M201, M02, M03 etc...) | AD = Alpha Direct BD = Beta Direct BS = Beta Scan GD = Gamma Direct GS = Gamma Scan ID = Investigational Direct IS = Investigational Scan JD= Juncture Direct JS = Junction Scan M = Metal PD = Penetration Direct P= Penetration |

*** NOTE: When collecting Field backgrounds, in Line 2, the location code will be FLDBK.**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|----|
| 9 | 5 | 0 | 1 | A | P | S | 1 | C | V | 0 | 1 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

| MARSAME Survey Plan ID 5 digits | 6 th Identifies what type of survey it is. | 7 th & 8 th Identifies the item surveyed followed by the number | 9 th & 10 th Type of sample collected | | 11 th & 12 th identifies the sample number. Sequentially numbering |
|---|---|---|--|---|--|
| <p>This will be the last 4 digits of the Survey Unit ID 5th digit will identify package alphanumeric sequence. Example: 9501A, 9501B, 9501C etc...</p> | <p>P = Preliminary S = Sentinel I = Investigational V = Verification R = Release J = Judgmental</p> | <p>Gr = Grid St = Structure Eq = Equipment Ot = Other</p> | <p>CV = Volumetric Concrete Sample LQ = Other Liquids besides water MS = Metal Sample VS = Volumetric Sample</p> <p>Volumetric Samples ➤ Or = 100gm</p> <p>MT = Metal Sample</p> | <p>SM = Smear Sample OL = Oil Sample PT = Paint</p> | <p>Example: 01, 02, 03, 04, etc.....</p> |

| | | |
|--|--|--|
| | Attachment 11 Measurement Quality Objectives for Survey Plans | ZS-LT-400-001-001 Revision 3 Information Use |
|--|--|--|

Measurement Quality Objectives (MQOs)

The following MQOs are established in order to ensure that the survey instrumentation used and survey and sampling methods performed will adequately and accurately characterize material surveyed for Unconditional Release based on a release limit of “no detectable”. The survey and sample analysis instrumentation selected for performing unconditional release of material, equipment and secondary structures from the ZSRP are consistent with the guidance found in NUREG-1575. The range, ruggedness, sensitivity, detection capability and quantification capability were confirmed through instrumentation calibration. Implementation of instrument special training, operating procedures and survey plan instructions ensure that measurement method uncertainty remains consistent.

Selected Instrumentation

Ludlum Model 2350 Data Logger coupled with detectors; 43-68 and 43-37 proportional detectors, 44-10 NaI.

Ludlum Model 2360 with 43-93 scintillator detectors.

Ludlum Model 3 with a 44-09 GM detector

Ludlum Model 54 article monitor

Ludlum 3030P Alpha-Beta smear counter

Tennelec S5 XLB proportional smear counter

Canberra Lab SOCS/ISOCS Genie-2000 Gamma Spectroscopy System

Canberra Inspector 1000 for qualification of indications of concern

Background Determination

Typically field background is determined as the mean of 5 background measurements collected as ambient area or as material specific background.

The equations below are listed in NUREG 1575, Rev. 1 page 6-34 as (6-6).

The background mean and its associated standard deviation for the area where surveys will take place. Calculation of L_c and L_d can be performed after arithmetic mean of background is obtained.

$$L_c = 2.33 \sqrt{bkrd}$$

$$L_d = 3 + (4.65 \sqrt{bkrd})$$

Material specific background as above for material that has NORM.

The required MDCs associated with the measurements and sample analyses.

NOTE

Scan and Fixed Minimum Detectable Concentrations will be calculated using a d' of 1.38; however, the radiological engineer may use a lower false positive value and a higher d' during development of the survey package. See Table 2 for calculated false positive proportion values calculated using various d' values.

Table 1, False Positive Proportion Values*

| False Positive Proportion | d' |
|---------------------------|-------------|
| 0.05 | 3.28 |
| 0.10 | 2.92 |
| 0.15 | 2.68 |
| 0.20 | 2.48 |
| 0.25 | 2.32 |
| 0.30 | 2.16 |
| 0.35 | 2.02 |
| 0.40 | 1.9 |
| 0.45 | 1.77 |
| 0.50 | 1.64 |
| 0.55 | 1.51 |
| 0.60 | 1.38 |

*Reference NUREG-1575, MARSSIM, Rev. 1, page 6-40.

The type I and type II error rates for each type of measurement will be 5% unless otherwise noted.

| | | |
|--|--|--|
| | Attachment 11 Measurement Quality Objectives for Survey Plans | ZS-LT-400-001-001 Revision 3 Information Use |
|--|--|--|

Beta Scan Measurement MDC:

The formula used to determine the scanning MDC at the 95% confidence level is:

$$MDC_{scan} = \frac{d'(\sqrt{b_i} * \frac{60}{i})}{(\epsilon_t)\sqrt{p}(\frac{A}{100})}$$

- Where, MDC_{scan} = Minimum Detectable Concentration in dpm/100 cm²
- d' = index of sensitivity (1.38)
 - i = observation interval (seconds)
 - b_i = background counts per observation interval
 - ϵ_t = total efficiency
 - p = surveyor efficiency (0.5)
 - A = detector area in cm² (not to exceed 126 cm²)

The observation interval (i) is considered to be the amount of time required for the detector field of view to pass over the area of concern. This time depends upon the scan speed, the size of the source, and the fraction of the detector's sensitive area that passes over the source.

The scan speed is based on one detector window width per second, however; other scan speeds may be used. For the Ludlum Model 43-68 gas flow proportional detector, the window width is 8.8 cm resulting in a scan speed of ~3.5 inches per second. The floor monitor detector is the Ludlum Model 43-37 with a window width of 13.35 cm which results in a scan speed of 5.25 inches per second.

Beta Static Measurement MDC (direct/static) measurements utilize the following formula:

$$MDC_{static} = \frac{\frac{2.71}{t_s} + 3.29 \sqrt{\frac{R_b}{t_s} + \frac{R_b}{t_b}}}{\varepsilon_t \frac{A}{100 \text{ cm}^2}}$$

Where, MDC_{static} = Minimum Detectable Concentration in dpm/100 cm²

t_s = sample count time

t_b = background count time

R_b = background count rate (cpm)

ε_t = total efficiency

A = detector window area (cm²)

An instrument alarm set point will be included for the floor monitor. The set point is based on the detector background plus the MDCR and is determined in the same fashion as other characterization surveys. Table 2 below depicts alarm set points for a detectability value (d') of 1.38 based on a 95% correct detection rate and a false positive rate of 60%. Table 3 presents several alarm set points based on different background values the scan speed will be 5.25 inches per second (13.34cm/s). The alarm set point values noted utilize the formula provided in the August 27, 2012 memo, "ZSRP Characterization Survey Package Attachment minimum Detectable Activity (MDA Calculations) and Alarm Set Points".

| Table 2 | | | |
|---|-------------------------------|-------------------------|-------------------------------|
| Ludlum Model 43-37 Detector Alarm Set Point For Scan Survey (Example Only) | | | |
| Background (cpm) | Alarm Set Point (cpm)* | Background (cpm) | Alarm Set Point (cpm)* |
| 600 | 970 | 1200 | 1720 |
| 800 | 1225 | 1400 | 1960 |
| 1000 | 1475 | 1600 | 2200 |
| *Values have been rounded | | | |

An instrument alarm set point will be included for the Ludlum Model 43-68 detector. The set point is based on the detector background plus the MDCR and is determined in the same fashion as other characterization surveys. Table 3 below depicts alarm set points for a detectability value (d') of 1.38 based on a 95% correct detection rate and a false positive rate of 60%. Table 4 presents several alarm set points based on different background values and scan rate (5.0cm/s). The alarm set point values noted utilize the formula provided in the August 27, 2012 memo, "ZSRP Characterization Survey Package Attachment minimum Detectable Activity (MDA Calculations) and Alarm Set Points".

| Table 3 Ludlum Model 43-68 Detector Alarm Set Points (Example Only) | | | |
|--|-------------------------------|-------------------------|-------------------------------|
| Background (cpm) | Alarm Set Point (cpm)* | Background (cpm) | Alarm Set Point (cpm)* |
| 200 | 414 | 500 | 838 |
| 300 | 562 | 600 | 970 |
| 400 | 702 | 700 | 1100 |
| *Values have been rounded | | | |

An instrument alarm set point will be included for the Ludlum Model 43-93 detector. The set point is based on the detector background plus the MDCR and is determined in the same fashion as other characterization surveys. Table 4 below depicts alarm set points for a detectability value (d') of 1.38 based on a 95% correct detection rate and a false positive rate of 60%. Table 4A presents several alarm set points based on different background values and scan rate (5.0cm/s). The alarm set point values noted utilize the formula provided in the August 27, 2012 memo, "ZSRP Characterization Survey Package Attachment minimum Detectable Activity (MDA Calculations) and Alarm Set Points".

| Table 4 Ludlum Model 43-93 Detector Alarm Set Points (Example Only) | | | |
|--|-------------------------------|-------------------------|-------------------------------|
| Background (cpm) | Alarm Set Point (cpm)* | Background (cpm) | Alarm Set Point (cpm)* |
| 200 | 414 | 500 | 838 |
| 300 | 562 | 600 | 970 |
| 400 | 702 | 700 | 1100 |
| *Values have been rounded | | | |

Table 5 Provides information on the GM detector for inaccessible scan areas that cannot be surveyed using the Ludlum Model 43-68 detector or equivalent

| Table 5 | |
|---|--|
| Ludlum Model 3 with Detector 44-9 ⁽¹⁾ | |
| Background (cpm) | Scan MDC |
| 300 | 45,148 dpm/100cm ² ⁽²⁾ |

Ludlum Model 3 with a 44-9 detector (pancake) the scan MDC is based on $i = 0.88$, $p=0.5$, $d' = 1.38$, $\epsilon_i = 0.16$, $\epsilon_s = 0.25$ and $R_b = 300\text{cpm}$.

The GM detector Shall NOT be used to unconditionally release structures, system or miscellaneous M&E from the Zion Decommissioning Site. The GM shall be used only as an indicator for scanning inaccessible areas to determine if plant derived nuclides exists (based on its MDC value.).

