Piqua, Ohio, Decommissioned Reactor Site Characterization Survey Plan Addendum

Introduction

During the summer of 2020, NV5 (a subcontractor to a subcontractor to the U.S. Army Corps of Engineers) performed a radiological Characterization Survey (CS) of the Piqua, Ohio, Decommissioned Reactor Site in accordance with the reviewed and approved *Characterization Survey Plan Piqua Nuclear Power Facility*, DMA-TR-107 (CSP). The CSP was developed and written to provide appropriate and confident radiological survey data from which to establish the radiological status of the Piqua site and be able to make confident radiological release decisions.

At the completion of the CS, a Characterization Survey Report (CSR) was written, reviewed, approved, and then used to make important project decisions. The CSR concluded that if the facility structures were left as is, then the CS data would be sufficient and appropriate to support an unrestricted release decision of the facilities or an unrestricted release decision of demolished materials from the facilities (if demolished). The unrestricted release decision was made because of (1) the CS data being collected using *Multi-Agency Radiological Survey and Site Investigation Manual* (MARSSIM) survey and sampling methodology and guidance and final status survey-level data quality objectives (DQOs) and (2) the actual CS results and analysis supporting a confident unrestricted release decision. The CSR also identified an exception to the unrestricted release decision, specifically for the current Piqua site entombments in the bottom of the reactor building, the inside of Room B-7 of the Auxiliary Building, and the tank in Room B-7.

Room B-7, identified in the CSP on the "Plan – 79 Foot Level" map (Figure 1), was discovered to be a fully enclosed concrete room with a room-sized metal tank in the center of the room. The only entry into the room was from an elevated platform accessed from Room B-8; this access consisted of a metal ladder up to a metal grate platform approximately 10 feet above the concrete floor. Although Room B-7 and its tank could not be fully accessed during the CS, a partial radiological survey of a section of the room was performed. A radiological control technician (RCT) lowered a sodium iodide (NaI) detector, attached to a radiological survey instrument, into the room to the top of the tank to obtain survey measurements. During the partial survey of the room, no elevated gamma radiation readings were identified. Further required surveys of Room B-7 were not attempted due to the uncertainty of the tank's contents and the safety concerns raised by the RCT entering the room.

This Characterization Survey Plan Addendum (CSPA), an addendum to the original CSP, provides radiological survey guidance and direction necessary to complete the CS of Room B-7 and the tank in Room B-7. Survey guidance and direction in this CSPA comes directly from the original CSP. On completion of the Addendum Characteristic Survey (ACS) of Room B-7 and the tank in the room, the original CS for the Piqua site will be fully completed. Using survey data from the ACS, a release decision for Room B-7 and its tank can be made by project leadership and the project health physicist.

ACSs shall be performed in accordance with the original CSP and the guidance and direction identified below. If a conflict exists between the original CSP and this CSPA, then the Legacy Management Support (LMS) radiological control manager (RCM) shall be made aware of any differences, and a decision shall be made as to which plan requirements to follow.

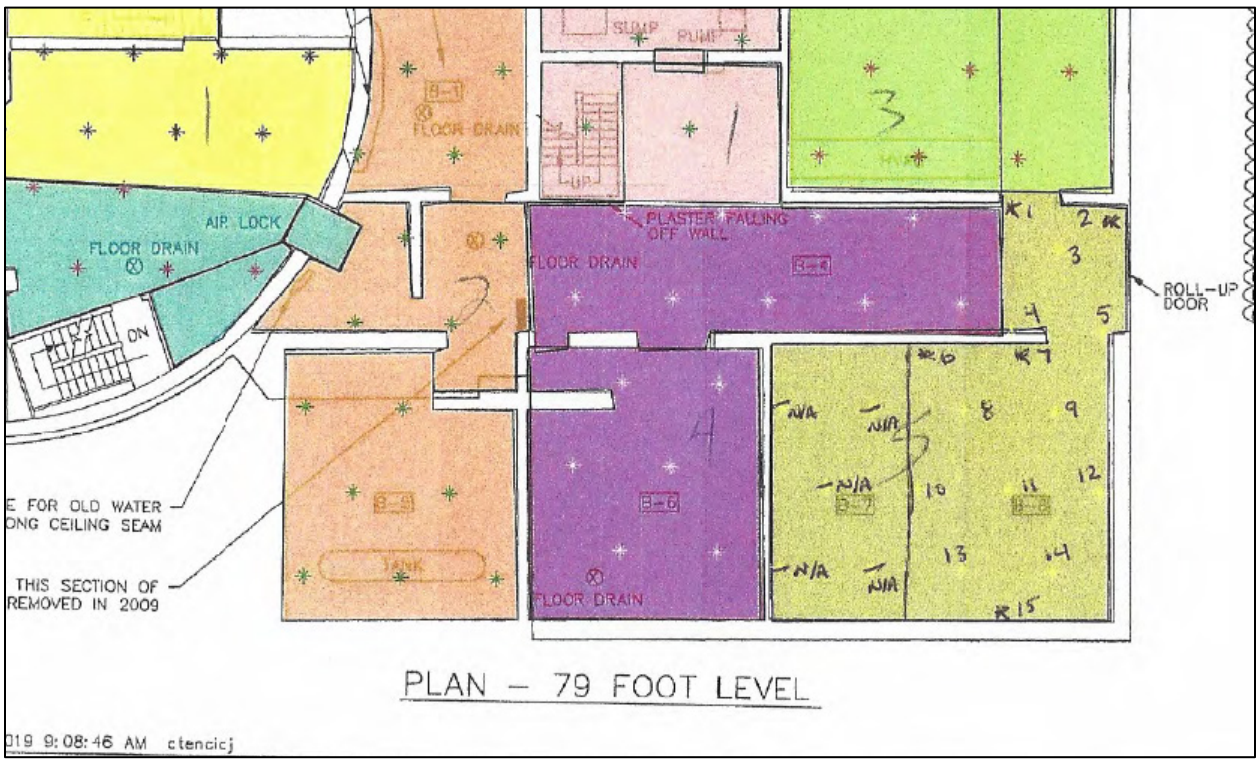

Figure 1. Room B-7 Original Floor Survey Measurement Locations

Instrument Minimum Detectable Activity (MDA) Determination

LMS Radiological Control (RadCon) organization instruments used to perform ACSs shall meet the MDA limits described in the CSP. In many instances, similar, if not identical, radiological survey instruments used by the NV5 survey team will be used by the LMS RCT performing this ACS. As such, LMS radiological instruments that are similar or identical to those used by NV5 are already considered acceptable and meet the various MDA and functional requirements. When a similar or identical instrument is not used by the LMS RCT, then the instrument's MDA shall be determined in accordance with Section 2.1 of the original CSP. The original CSP identified and used the same surface contamination limits as those currently identified in the *Radiation Protection Program Plan* (LMS/POL/S04373) and the *Radiological Control Manual* (LMS/POL/S04322), ensuring that LMS radiological instrumentation used during ACSs meets the original CSP minimum requirements for those instruments.

Building and Material-Specific Radiological Background Determination

Building and material-specific background information shall be collected or obtained for LMS radiological instrumentation as described in Section 2.2 of the CSP. The *Radiation Protection Program Plan, Radiological Control Manual*, and RadCon implementing procedures also require that background and material-specific background determinations are made when similar radiological surveys are performed.

Radionuclides of Concern

The radionuclides of concern for the ACS remain unchanged from the original CSP radionuclides of concern, identified in Section 2.3.

Action Levels

Action levels remain unchanged from the original CSP action levels, identified in Section 2.4.

Deviations from the Sample Design

Deviations from this CSPA remain unchanged from the original CSP instructions, identified in Section 2.5. Deviations from the CSP for this ACS shall be managed and documented as identified in Section 2.5 of the CSP.

Number of Measurements and Survey Locations for Room B-7

In the original CSP, Rooms B-7 and B-8 were identified as a single MARSSIM survey unit. As such, the required number of survey measurement locations for the survey unit were appropriately split between the two rooms based on the random start location of the symmetrical grid placement that the Virtual Sample Plan (VSP) software created (a software program specifically written and used for radiological release surveys like the CSP [Figures 1 and 2]). On the original survey location map of the two rooms, 15 survey measurement locations are identified on the walls (up to 6 feet above the floor) and on the floor. This is consistent with the requirements identified in the CSP for a Class 1 survey unit, including Rooms B-7 and B-8 (as a single survey unit). Room B-7 contained 5 of the 15 floor survey measurement locations and 6 of the 9 total wall measurement locations (between the shared north and south walls and the sole west wall of B-7). However, an east wall was identified for Room B-7 that was not identified on the survey plan drawings and not populated with survey measurement locations. Given the survey unit separation of the two rooms, there should be as many survey locations on the east wall of Room B-7 as there were on the west wall. That said, three additional survey measurement locations need to be added to the east wall of Room B-7. In total, nine wall survey measurement locations and five floor measurement locations are required to complete the ACS of Room B-7, to be in line with the original CSP MARSSIM requirements. For Room B-7, an east wall survey measurement location figure has been added, and the original north and south wall figures have been split between the two rooms to represent the survey measurement locations for Room B-7 (Figure 3).

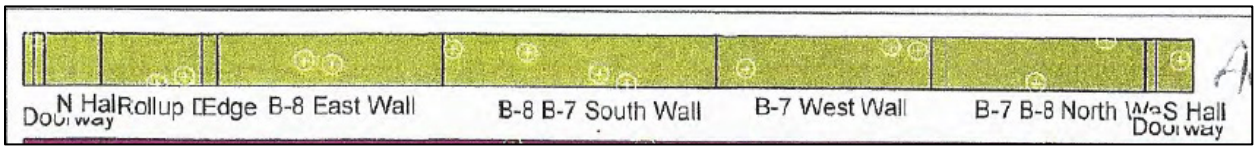

Figure 2. Room B-7 Original Wall Survey Measurement Locations

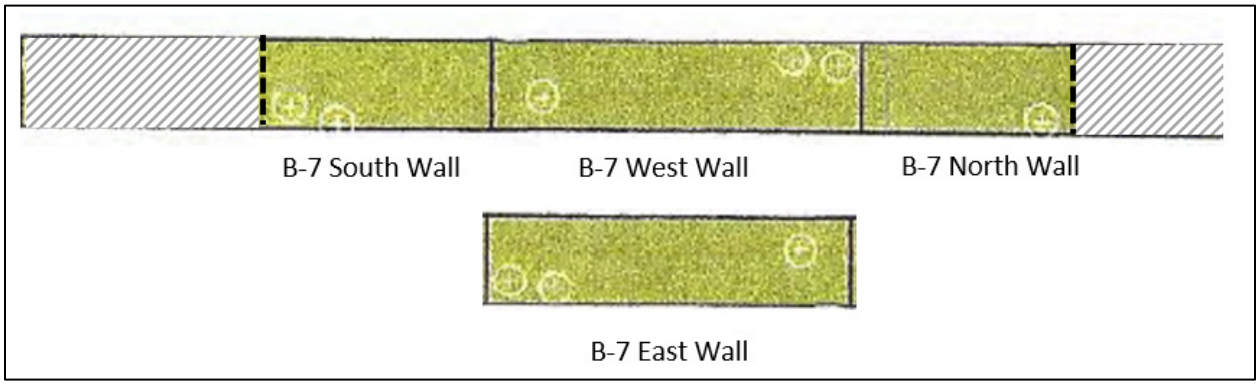

Figure 3. Room B-7 ACS Wall Survey Measurement Locations

As permitted in MARSSIM and the original CSP, random start systematic grid survey locations can be moved or adjusted based on physical interferences or for survey or safety concerns. This allowance holds true for Room B-7. Because a large tank exists in the room, survey measurement locations can be moved or adjusted to the closest location that can be accessed safely. If a planned survey measurement location is moved, then the new survey measurement location shall be identified and recorded in ACS results documentation.

If Room B-7 presents surveyors with physical access limitations (with regard to an RCT being able to enter the room to perform the ACS), then sections or portions of the room (e.g., walls, removable facility supports or structures, the tank) can be mechanically deconstructed as necessary using appropriate construction equipment and techniques (as permitted by approved project demolition plans) before performing the ACS. Deconstructed room material shall be made available to the RCT to survey immediately after deconstruction. Deconstructed room material shall remain in close proximity to Room B-7 if physically possible. If not physically possible, then the RCT shall perform the ACS of the relocated deconstructed material once the material is placed in a safe and appropriate survey area. If ACS results of the relocated deconstructed material indicate that radioactive contamination is present, then the RCT shall implement appropriate LMS radiological controls to identify and mitigate potential surface contamination in areas that the deconstructed material moved through, in addition to its initial and final locations.

The RCT shall scan available deconstructed room material surfaces and make a real-time determination of the survey measurement locations (for direct and smear surveys) for a given section or portion of the deconstructed room material surface. The RCT shall collect no less than nine wall survey measurements and five floor survey measurements (regardless of whether they are deconstructed or still in place) to complete the ACS of Room B-7. If more than nine wall survey measurements or five floor survey measurements are collected during the ACS, then those additional survey data shall be included in the evaluation of the ACS results.

If thermal insulation is present on surfaces of the room or tank, then the surfaces of the insulation shall be surveyed before removal in accordance with this CSPA (if possible). Once thermal insulation is removed from Room B-7 surfaces, then those newly exposed surfaces shall be surveyed in accordance with this CSPA. If surface contamination (above the established limit) is

detected on the surface of the thermal insulation (if present), then the thermal insulation material shall be identified and treated as volumetrically contaminated material.

Survey Instrumentation

Excluding the Ludlum Model 239-1F floor monitor, identical or similar radiological instruments or detectors shall be used to perform this ACS. Similar or identical instruments include the:

- Ludlum Model 43-93, dual phosphor scintillation detector and appropriate Ludlum instrument, used for direct (i.e., fixed-surface contamination) and scan measurements for alpha and beta residual radioactivity. Note: This instrument replaces the Ludlum Model 239-1F, a gas proportional floor monitor, for floor scans or measurements identified in the original CSP and floor scans during the CS.
- Ludlum Model 2929 or 3030 instrument and 43-10-1, a dual phosphor scintillation detector (either internal or external to the instrument), used to analyze wipe samples for alpha and beta removable residual radioactivity.
- Ludlum Model 44-10 NaI detector and appropriate Ludlum instrument used to perform gamma scanning surveys.

These radiological instruments or detectors are currently available in the LMS RadCon instrument inventory and are commonly used by LMS RCTs. If an LMS radiological instrument is not available for use during the ACS, then similar or identical radiological instruments can be rented or obtained from an outside vendor or instrument provider before the start of the ACS.

If different radiological survey instruments are used in the performance of this ACS, then the instrument performance requirements identified in Section 2.7 of the CSP shall apply.

Survey Instrument Operational Checks

Radiological survey prerequisites nominally include the verification of survey instrument performance. LMS radiological instrument performance prerequisites (operational checks) include those identified in LMS RadCon implementing procedures and as generally outlined below:

1. Verify the instrument is within the calibration due date
2. Visually verify that the instrument is not damaged and if battery operated, the battery has an acceptable charge or level
3. Verify the high voltage is set correctly for the instrument, if available and required for the instrument
4. Perform a source check on the instrument using the correct radiation check source
5. Perform a background level determination for the instrument, if necessary
6. Operate radiological instruments in accordance with LMS RadCon implementing procedures
7. Record instrument prerequisite and operational check results on the appropriate LMS radiological results form and on the *Radiological Survey Map* form (LMS 1553)

Instrument verification and operational checks shall be recorded on the appropriate LMS RadCon instrument forms.

Radiological instruments that fail required performance or operational checks shall *not* be used and shall be either tagged out of service (as nonoperational) or failure corrected, when allowed (e.g., replacing the instrument's batteries), and rechecked for proper performance.

Specific ACS Requirements

For identified surfaces and the exterior surface of the tank in Room B-7, perform the following surveys:

Alpha and Beta Scan Surveys

Using the Ludlum Model 43-93 detector and appropriate Ludlum instrument (or similar):

- Scan the required surface area at 4 inches per second with the detector held at a distance from the surface of 1/4 inch for beta and gamma and 1/8 inch for alpha.
- Check for elevated readings. If elevated readings (approximately twice background) are identified during the survey, then stop the survey and mark the elevated area for additional static measurements, as directed in Section 3.4 of the original CSP.
- Note the scan reading results, elevated reading locations, and any alternative survey actions taken on the *Radiological Survey Map* form.

Gamma Scan Surveys

Using the Ludlum Model 44-10 NaI detector and appropriate Ludlum instrument (or similar):

- Perform gamma scan surveys at each survey point. Each survey point will be surveyed over an area of approximately 1 square meter (1 meter on each side).
- Hold the detector approximately 6 inches from the surface being surveyed (e.g., the floor or wall surface).
- Use a serpentine pattern to survey the 1 square meter area.
- Investigate instrument readings greater than two times background.
- Note the scan reading results, elevated reading locations, and any alternative survey actions taken on the *Radiological Survey Map* form.

Direct Surveys

Using the Ludlum Model 43-93 detector and appropriate Ludlum instrument (or similar):

- Perform direct surveys for gross alpha and gross beta at each identified survey location.
- Perform direct surveys for gross alpha and gross beta at each elevated location identified during the alpha and beta scan surveys and gamma scan surveys.
- Collect a measurement (perform a survey) at each survey location for no less than 1 minute.

- If any measurement result exceeds the action level, then repeat the measurement. If the second measurement result is still greater than the action level, then flag or mark the survey location and notify the RCM.
- Note the direct measurement results and any alternative survey actions taken on the *Radiological Survey Map* form.

Wipe Surveys

Using the Ludlum Model 3030 or 2929 and 43-10-1 dual phosphor scintillation detector (or similar):

- Collect a wipe (smear) sample at the survey location by wiping a dry smear over an area of 100 square centimeters.
- Label or identify the wipe with a distinguishable name or identifier.
- Count the wipe on the Ludlum 2929 or 3030 instrument.
- Note the swipe result and any alternative survey actions taken on the *Radiological Survey Map* form.
- If any wipe sample exceeds the action level, then obtain a second wipe sample directly adjacent to the first wipe sample. If the second wipe sample exceeds the action level, then flag or mark the survey location and notify the RCM.

Discretionary Wall Surveys

Given the physical size (surface area) of Room B-7 and the movement restrictions in the room (due to the large tank), discretionary wall surveys are not required for this ACS.

Room B-7 Internal Tank Survey

Without bodily entering the tank and only if the tank openings or access ports are present and hatches are open (**CAUTION:** Do not open the tank opening or access port hatches), perform the following ACSs on the interior surface of the tank using the above survey-type instructions:

- Alpha and beta scan surveys: Scan accessible internal tank openings or access port surfaces, or both.
- Gamma scan surveys: Scan accessible internal tank openings or access port surfaces, or both. If the instrument's detector cable is sufficiently long enough and reinforced, and a tank opening or access port is available on the top of the tank, then lower the Ludlum Model 44-10 detector into the tank and perform gamma scan measurements at various elevations within the tank.
- Direct surveys: Perform direct surveys on accessible internal tank openings or access port surfaces, or both.
- Wipe surveys: Collect wipes on accessible internal tank openings or access port surfaces.

Survey Documentation

ACSs shall be documented on a *Radiological Survey Map* form as soon as possible. Survey documentation shall be performed in accordance with *Documenting Radiological Surveys* (LMS/PRO/S20073).

Survey Results Report

At the completion of the ACS, the project health physicist shall gather the completed and reviewed survey results and evaluate them, ensuring that required surveys were collected and performed in accordance with this CSPA and the original CSP (e.g., ensuring that correct and appropriate instrumentation was used, established DQOs were met, identified survey locations or their alternative locations were surveyed). Once the surveys are found acceptable, the project health physicist shall document the results of the ACS in an Addendum Characterization Survey Results Report (draft) and have the report reviewed by the project manager and LMS site lead. The draft report shall be peer reviewed by the LMS senior health physicist and, if found acceptable, the draft report shall then be sent to LMS Document Management for technical editing and formatting. Once technical editing and formatting are complete, the draft report shall be made final and presented to the project manager and LMS site lead as the official Addendum Characterization Survey Results Report.