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Rev. 0

Contamination Control Plan for Building Deconstruction at the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project

U.S. Army Corps of Engineers
Buffalo District, Buffalo, New York

Applicability: Luckey FUSRAP Building Deconstruction	Effective Date: 12/16/2020	[redacted]

Completion of Independent Technical Review

This document has been produced within the framework of the North Wind Site Services quality management system. As such, an independent technical review (ITR), appropriate to the level of risk and complexity inherent in the project, has been conducted. This included review of assumptions (methods, procedures, and material used in analyses), alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the project objectives. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

ITR performed by: [redacted]	
Signature: [redacted]	Date: 12/15/2020

History of Revisions

Revision	Issue Date	Action	Description
0	12/16/2020	New document.	Initial issue.

SIGNATURE PAGE

Project: Building Deconstruction at the Luckey Formerly Utilized Sites Remedial Action Program (FUSRAP) Remediation Project

Location: 21200 Luckey Road, Troy Township, Wood County, Ohio

North Wind Site Services, LLC, has developed this contamination control plan for the above-referenced project. This document has been developed for the United States Army Corps of Engineers (USACE), Buffalo District.

The following North Wind Site Services personnel have prepared and approved this plan for implementation of the above-referenced work. Changes, revisions, and updates to this plan are to be reviewed and approved by North Wind Site Services and submitted to the USACE for review and acceptance.

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Table of Contents

Figures

Tables

ACRONYMS AND ABREVIATIONS

µg	microgram
AHA	activity hazard analysis
APP	Accident Prevention Plan
Be	beryllium
Bq	becquerel
CBDPP	Chronic Beryllium Disease Prevention Program
CCP	Contamination Control Plan
cm	centimeter
COC	constituent of concern
COR	contracting officer's representative
CRZ	contamination reduction zone
DAC	derived air concentration
dpm	disintegrations per minute
DZ	deconstruction zone
EZ	exclusion zone
ES&H	Environmental, Safety, and Health
FUSRAP	Formerly Utilized Sites Remedial Action Program
g	gram
H&S	health and safety
HEPA	high-efficiency particulate air
IH	industrial hygiene
ITR	independent technical review
LAW	large area wipe
mL	milliliter
NEA	negative exposure assessment
PAPR	powered air-purifying respirator

Pb	lead
PBZ	personal breathing zone
pCi	picocurie
PM	project manager
PPE	personal protective equipment
PWS	performance work statement
QAPP	Quality Assurance Project Plan
Ra	radium
RCT	radiological control technician
RPP	Radiation Protection Plan
RSO	radiation safety officer
SAP	Sampling and Analysis Plan
SHM	safety and health manager
SSHO	site safety and health officer
SSHP	Site Safety and Health Plan
SZ	support zone
Th	thorium
TSP	total suspended particulate
U	uranium
USACE	United States Army Corps of Engineers

1. INTRODUCTION

This section provides summary information about the Luckey site. It includes a discussion on the purpose and scope of this contamination control plan (CCP). The plan describes the processes and methods used to control the spread of contamination (i.e., beryllium, lead, and radioactive material) at the project site.

1.1 Project and Site Information

The United States Army Corps of Engineers (USACE), Buffalo District, has contracted North Wind Site Services, LLC, under Contract Number W912P420C0013 to perform deconstruction and removal of buildings at the Luckey site. The site is being remediated under the USACE's Formerly Utilized Sites Remedial Action Program (FUSRAP).

The site was used for beryllium processing in support of the national defense program. Atomic Energy Commission (AEC)-related production activities and operations occurred at the site from 1949 to 1961. Beryl ore (beryllium aluminum silicate), scrap metal, and radioactive contaminated scrap metal were brought to the site during this period. The site has been identified as having materials contaminated with FUSRAP-related constituents of concern, which include beryllium, lead, radium-226, thorium-230, uranium-234, and uranium-238. The buildings to be deconstructed and removed under Contract Number W912P420C0013 likely have asbestos-containing materials and lead-based paint.

The site is located at 21200 Luckey Road, northwest of the Village of Luckey in Wood County, Ohio. The Village of Luckey is 22 miles southwest of Toledo, Ohio. The site encompasses approximately 40 acres and contains the production building and warehouse, two abandoned railroad spurs, and several smaller process and support buildings. The site is bordered by Luckey Road to the west, Gilbert Road to the south, abandoned railroad tracks to the east, and private farmland to the north. The surrounding area west, north, and east of the site is primarily farmland with several residential properties and a former quarry to the south.

The primary objective of this project is the timely and effective building deconstruction and removal at the site in accordance with *Performance Work Statement, Luckey Building Deconstruction, Luckey FUSRAP Site, Luckey, Ohio* (PWS; USACE 2020a). The selected approach is deconstruction of above-ground buildings and debris. All materials will be considered as requiring shipment off-site for disposal at a licensed/permitted disposal facility. This approach satisfies the requirements while protecting human health and the environment and will comply with applicable or relevant and appropriate requirements. Deconstruction and removal activities will be conducted in such a manner to provide to the public and deconstruction workers a high level of protection that is consistent with applicable exposure limits and with the

objective of maintaining chemical and radiological exposure as low as reasonably achievable (ALARA).

Positive control of site contaminants will be identified, implemented, maintained, and assessed to prevent the cross contamination of on-site work zones and off-site areas. This CCP describes the approaches used by North Wind Site Services to reduce and minimize the inadvertent spread of contamination at the site. This plan has been prepared to satisfy the requirements specified in the scope of work and will be updated periodically to reflect changes in site conditions, means and methods, or unplanned and unexpected contaminants.

1.2 Purpose and Approach

North Wind Site Services is responsible for performing work in a manner which positively controls site hazards and protects the workers, public, and environment. Based on site conditions, North Wind Site Services will execute deconstruction activities using primarily mechanical means and methods while implementing dust control measures (as needed). Contamination control measures will be achieved using administrative and engineering controls, supplemented with adequate personal protective equipment (PPE). This CCP provides the Luckey FUSRAP remediation team with guidance for controlling the potential spread of beryllium, lead, asbestos, and radiological contamination.

Throughout this document, the term *materials* is used to describe steel, concrete, Transite, and other deconstruction materials, along with concrete dust, soil or other materials. While some of these materials may require special handling, they are all considered asbestos and radioactively contaminated materials within the context of this program.

The project work areas are delineated into Hazardous Waste Operations control zones. The purpose of utilizing control zones is to clearly delineate and control site areas where the contaminant cleanup goals are exceeded and to prevent contamination from migrating to uncontaminated areas. The exclusion zone (EZ) has constituents of concern (COCs) that exceed their cleanup goals. Within the EZ is the deconstruction zone (DZ), a 75-foot radius around a structure being deconstructed. The DZ is restricted to essential equipment and personnel for the operation. The DZ will be considered part of the EZ.

The contamination reduction zone (CRZ) is where personnel egress from the EZ, survey for radiological contamination, shower, and change clothes and enter into the support zone (SZ). The CRZ is a buffer between the EZ and areas of the site that do not have contamination concentrations that exceed the cleanup goals. The SZ is not contaminated and includes a trailer area for administrative personnel, a parking area, access roads, and areas for support equipment/activities (water treatment, storage, truck scale).

This CCP delineates the following methods used for controlling contamination on the site and preventing contaminant spread to the SZ or outside the site boundaries:

- Work flow and contamination control for equipment and personnel.
- Engineering controls to prevent contaminant spread.
- Administrative controls, including procedures, site control, access/egress control to work zones, and personnel and equipment decontamination processes.
- Housekeeping of on-site temporary facilities.
- Surface sampling performed for surface contamination on materials and equipment, including decontamination as needed.
- Airborne contamination monitoring.
- Specifying surface contamination control limits and perimeter and work zone airborne contamination limits.

2. ORGANIZATIONAL STRUCTURE

2.1 USACE Responsibilities

The USACE, Buffalo District, is responsible for oversight of all aspects of the Luckey project, including but not limited to project management, project engineering, health and safety, cost, and schedule.

2.2 North Wind Site Services Responsibilities and Personnel

Key positions for contamination control are project manager (PM), safety and health manager (SHM), site safety and health officer (SSHO), radiation safety officer (RSO), and site superintendent. The *Uniform Federal Policy Quality Assurance Project Plan for Building Deconstruction at the Luckey Formerly Utilized Sites Remedial Action Program Site Remediation, Luckey, Ohio, Sampling and Analysis Plan*, PLN-60066-005 (USACE 2020b); and the *Accident Prevention Plan/Site Safety and Health Plan for Building Deconstruction at the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project* (APP/SSHP), PLN-60066-003 (USACE 2020c) provide a full list of responsibilities relative to the overall project activities. Specific North Wind Site Services responsibilities for this CCP are provided below.

2.2.1 Project Manager

The PM is responsible for providing logistical and policy support to ensure the requirements within the CCP are properly implemented.

2.2.2 Safety and Health Manager

The SHM is responsible for development and implementation of a comprehensive Safety Program for the Luckey project (represented by the APP/SSHP and *Chronic Beryllium Disease Prevention Program for Building Deconstruction at the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project* [CBDPP], PLN-60066-013 [USACE 2020d]). The SHM is responsible for ensuring that safety and the industrial hygiene (IH) procedures are complete, technical and field health and safety (H&S) personnel necessary to execute project tasks are trained and qualified commensurate with assigned responsibilities, all project personnel are trained on safety-related topics commensurate with assigned duties and responsibilities, and H&S hazards and hazard controls are properly addressed in the design of new facilities or processes or modification of same (with emphasis on hazard elimination). The SHM is also responsible for ensuring that H&S hazards and hazard controls are identified during work planning; integrated hazard analyses/controls are developed for each task; and safety and IH equipment, tools, and materials necessary for task execution are available, calibrated, and tested, as necessary.

North Wind Site Services' SHM, and approved alternates, report to the North Wind corporate Environment, Safety, and Health (ES&H) director for functional support, and to the PM on a day-to-day basis. The SHM must also be pre-approved by the USACE prior to assuming the position.

The SHM has the following authorities:

- Approve the person assigned as the SSHO or an acting SSHO prior to USACE submittal for project approval.
- Stop work for unsafe or quality-impacting conditions.
- Approve and enforce the APP/SSHP.
- Approve field changes to active activity hazard analyses (AHAs).
- Direct the SSHO and assign site safety personnel.

2.2.3 Site Safety and Health Officer

The SSHO reports to the PM, or designee, for project responsibilities and has a direct functional reporting relationship to the North Wind corporate ES&H director. The SSHO is responsible for the overall conduct of a comprehensive safety program for the Luckey project (represented by the APP/SSHP and CBDPP). The SSHO ensures that an independent review of work practices, engineering controls, and monitoring results is performed during work activities at the project site. The SSHO works with the RSO to identify engineering controls and work practices that improve the effectiveness of the CCP. The SSHO implements non-radiological contamination controls.

The SSHO is responsible for ensuring that work area inspections are performed before the start of work and periodically throughout task execution; exposure monitoring is conducted and personnel are informed of results; H&S records are generated and retained as required by the APP/SSHP; and program or performance issues are identified, corrected, and communicated.

2.2.4 Radiation Safety Officer

The RSO reports to the PM, or designee, and is responsible for implementing the *Radiation Protection Plan for Building Deconstruction at the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project* (RPP), PLN-60066-014 (USACE 2020e), at the Luckey project. The RSO is responsible for ensuring that the radioactive contamination control and measurement requirements of the CCP are performed at the designated frequency. The RSO ensures that a periodic review of engineering controls, work practices, and monitoring results is performed to assess program effectiveness for radiological contamination control.

2.2.5 Site Superintendent

The site superintendent works with project team to ensure that engineering controls are put in place and are being maintained by site personnel and subcontractors.

2.2.6 Subcontractor Management

Subcontractor management, as part of compliance with the APP/SSHP, is responsible for incorporating the applicable provisions of this CCP into their health and safety programs and ensuring the implementation of the plan with their staff. North Wind Site Services is responsible to ensure subcontractor safety compliance.

3. CONTAMINATION CONTROL PROGRAM

The primary sources and routes for the migration of contamination is through the movement of people, equipment, materials, or airborne emissions during remedial activities. The purpose of the CCP is to identify the areas/materials with contamination, controlling access to these areas/materials, and preventing the spread of contamination outside of the EZ. The contamination control zones and their locations are shown in Figure 3-1.

Contamination control is achieved through work flow and monitoring points, administrative controls, housekeeping, engineering controls, and PPE, as described in the following sections.

3.1 Work Flow and Monitoring Points

The project will have contamination control zones established: the SZ, CRZ, and EZ (see Figure 3-1). The SZ will contain offices and laboratory trailers, equipment parking, and an equipment storage yard. The main entrance and exit to and from the EZ/CRZ into the SZ will be through the Access Control Conex. However, project conditions and status may determine the need for additional transition points from the EZ/CRZ to the SZ. The location and the process for contamination controls will be established and documented in the work instructions for each evolution of work. The AHA will be amended to reflect the change in conditions. The crews involved with the change will be briefed on the new procedures. Sampling will be performed routinely at the new locations to verify that the contamination controls put in place are effective.

Other situations will arise that will require modifications to the existing contamination control procedures. Each situation will be individually evaluated, and an appropriate approach will be developed. The number one goal is to prevent contamination from leaving the EZ in an uncontrolled manner. Every change in procedure will be monitored and sampled to verify that the controls put in place are effective.

3.1.1 Equipment Flow and Monitoring

During deconstruction of the buildings, the debris will be segregated, size reduced, and handled as necessary principally with heavy equipment. As much as possible, this debris manipulation will be executed on the building slab(s) to minimize the spread of contamination. Working on the slab will also allow centralization of water used for airborne control, and water run-off collection systems.

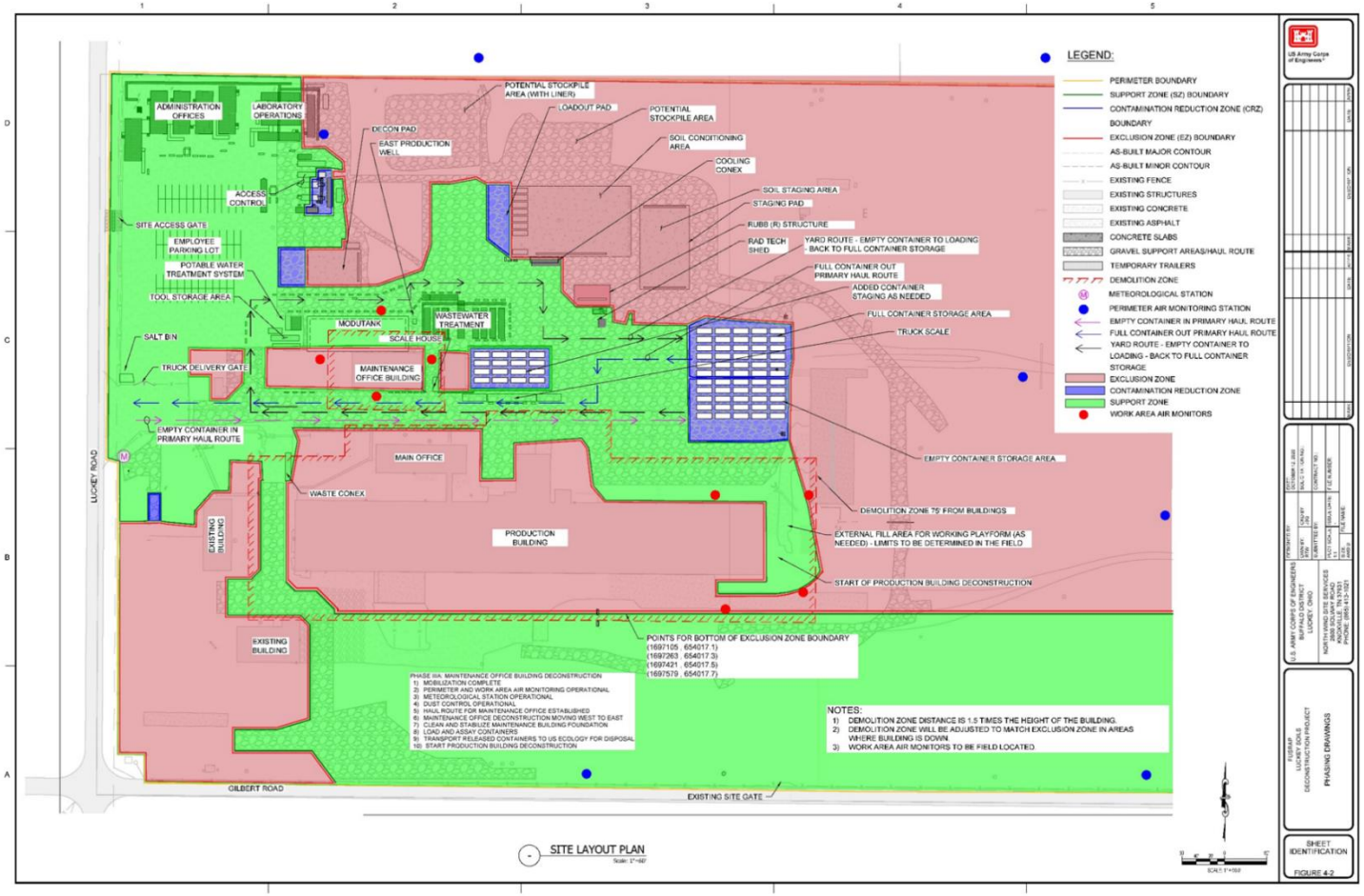

Figure 3-1. Contamination Control Zones and Fixed Monitoring Stations

Contaminated materials (e.g., debris, dust, soils) in the CRZ and/or EZ are removed primarily using heavy equipment (e.g., excavators, dump trucks). These materials will be handled on the slabs as much as possible, but some material may be stockpiled and handled multiples times, and some may be added to containers directly. An excavator is used to load the contaminated material into IP-1 lined roll-off containers for shipping and disposal at an off-site facility. Every effort is made to have all material inside the lining, and any material spilled on the outside of the container is removed. Once the containers are loaded, the IP-1 liners are closed, secured, and the attached tarp unfurled to cover the top of the loaded containers. The container will be marked with appropriate signs and labels immediately to allow appropriate handling.

A radiological control technician (RCT), working in the SZ side of the Material Load Out Area, performs a large area wipe (LAW) survey on the exterior of the roll-off container to identify any radioactive contamination with a direct-read alpha/beta rate counting field instrument, and the results of the LAW survey are documented.

The loaded containers are transferred to the Container Staging Area using a roll-off transport truck. Representative surface swipe (approximately 100 square centimeters [cm^2] each) are collected from the outside of the roll-off container to quantify removable radiological contamination. The surface swipes are considered "contaminated" when the results are greater than the limits, specified in Section 5, of 60 disintegrations per minute per 100 cm^2 (dpm/100 cm^2) alpha OR 600 dpm/100 cm^2 beta. If radiological surface contamination is identified, the roll-off container is placed back into the EZ side of the Material Loadout Area for decontamination and surveyed again for radioactive contamination. Roll-off containers that do not have identified radioactive contamination are stored in the Container Staging Area CRZ.

An industrial hygiene technician collects representative beryllium surface samples (100 cm^2 each) from each of the roll-off containers in the Container Staging Area and the samples are analyzed at the on-site laboratory. Roll-off containers that have beryllium results less than the free-release criterion of 0.2 micrograms per 100 cm^2 (µg/100 cm^2) are documented and reported as approved to be shipped for disposal. If contamination levels above the free-release criteria are identified in sample results, the roll-off container is placed back into the EZ and decontaminated and retested until it passes free-release criteria for off-site use.

The lead contamination limit given for lead in the *Uniform Federal Policy Quality Assurance Project Plan for Building Deconstruction at the Luckey Formerly Utilized Sites Remedial Action Program Site Remediation, Luckey, Ohio, Sampling and Analysis Plan* (QAPP/SAP; USACE 2020b), Worksheet #11, is 50 µg/100 cm^2. This is 10% of the toxic dose of lead on a contaminated surface (500 µg/100 cm^2) that a worker could contact. Lead will not be sampled for on waste roll-offs for free release. The decontamination required for the beryllium free release level would exceed lead free release levels for surface contamination.

3.1.2 Personnel Flow and Monitoring

Personnel leave the EZ through the access control trailer located in a CRZ. This location is the main transitioning area from the SZ to the CRZ/EZ. Due to the majority of traffic utilizing this location, a description of the personnel flow here is described in this section. Additional locations that are added during the evolution of the project will be described in the work instruction and the AHA for that particular task.

The CRZ is part of a trailer complex for doffing PPE, self-monitoring for radioactive contamination (frisk), showering, and changing clothes. Respirators are removed in the CRZ side of the IH Conex. The respirators are decontaminated using wet methods and are placed on the pass-over counter in the IH Conex for inspection. The respirator is visually inspected to ensure it meets visibly clean criteria. An RCT collects an LAW from the respirator for radiological contamination. The LAW is field counted using a survey meter prior to removing the respirator from the CRZ. Once released by the RCT, the IH technician collects a surface sample for beryllium from the respirator and places the respirator in a personal storage container. Individuals then exit the IH Conex into the Access Control Conex where they doff the remainder of their PPE and frisk for radioactive contamination. Once determined that the individual does not have any radiological contamination concerns, he or she may then proceed to the decontamination showers and dress into street clothing in the SZ. If not exiting for the end of the shift, or if the personnel was performing non-intrusive work while in the EZ, the personnel will not have to shower.

In the event of an emergency, loss of shower capabilities, or change in procedure that does not allow for personnel to shower after leaving the EZ/CRZ, the project team will develop alternative means for the decontamination of personnel. Those means will be developed with the availability of resources at the time of the event. (For example, during COVID-19 pandemic, disinfecting wipes have been severely limited in availability.) Sampling of personnel skin can be performed to verify effectiveness of the change in controls.

Radiological contamination surveys and surface wipe samples for beryllium are performed at the boundary of the EZ and the CRZ. This monitoring is performed to detect contamination to help assure that it is not transported to the SZ. The effectiveness of the contamination control program is assessed by monitoring in the CRZ and the SZ. Some contamination is expected to be found in the CRZ. Removable contamination discovered in the SZ may be an indication of cross-contamination and/or migration from the CRZ/EZ of contaminants; however, based on the low levels of beryllium for free-release, it is not unlikely to see occasional exceedances. North Wind Site Services has taken extraordinary housekeeping measures to mitigate activities that have proven to produce exceedances in results (e.g., road grime and salt removal from containers and vehicles, road base and imported material residue on vehicles and trailer surfaces). Exceedances

are investigated and analyzed to evaluate the cause, extent-of-conditions, potential impacts, and potential corrective actions.

Based on the PWS and historical use of the site, lead has been identified as a COC and exposures to lead are possible during execution of the PWS. However, based on the stringent engineering and administrative controls required to maintain worker beryllium exposures below established occupational exposure limits, it is not anticipated that worker exposure to airborne lead will reach levels requiring the collection of surface samples. This will be confirmed by conducting initial and periodic work area/personal breathing zone (PBZ) air sampling for lead and evaluation of the laboratory data by an IH. Lead surface samples will be collected if area/PBZ air sampling data indicates that the results are greater than or equal to the action limit of 30 µg/m³. Routine lead surface samples will be taken only in the laboratory.

3.2 Administrative Controls

As part of the health and safety hierarchy of controls, administrative controls consist of:

- Training and qualifying personnel commensurate with their duties and the hazards they are likely to encounter. Work in the EZ requires Radiological Worker Training and Beryllium Worker Training.
- Signs and postings to warn personnel of entry into contaminated areas.
- Radiation work permits (RWPs), beryllium work permits (BWPs), and AHAs that describe the safety controls to be employed for specific tasks.
- Work practices to minimize contact with contaminants; such work practices include avoiding kneeling or sitting in contaminated areas and limiting stay times.
- Limiting the number of personnel in a work area to the minimum needed to complete the task safely.

Movement of contaminated equipment and waste from one zone to another (e.g., from the EZ to CRZ, and CRZ to SZ) must be coordinated with project management team. For personnel, the transition from the CRZ to SZ is through an access control point.

3.3 Housekeeping

Perhaps the most important element involved in contamination control is effective housekeeping. Housekeeping efforts are maintained site-wide, while the primary emphasis is the SZ and transitional areas of the CRZ. The goals and objectives of housekeeping are clear. They entail performing routine surface cleaning of all surfaces for successfully controlling both surface level contamination controls for contaminants including, but not limited to, beryllium, radiological

material, and biological pathogens such as the COVID-19 virus. Surface housekeeping is performed routinely in the SZ and transition (step-off pads) at the CRZ. In support of routine cleaning and decontamination, surface areas are sampled and monitored consistent with monitoring requirements (Section 4) to ensure that established criteria are maintained. If sampling and monitoring results exceed the established action levels (Section 5), additional housekeeping and decontamination efforts are taken to reduce these surface levels to meet surface level requirements.

Equipment and material used in the EZ and CRZ (e.g., heavy equipment, trailers, utility vehicles) are decontaminated using a variety of methods, including wet methods, high-efficiency particulate air (HEPA) vacuum, and tacky cloth. Waste from the EZ and CRZ will be minimized and managed as contaminated waste. Inspection and assessment for surface contamination following decontamination is performed following the decontamination and inspection process. Surface smears are taken prior to releasing items from the EZ or CRZ and mobilizing them into the SZ.

General housekeeping equipment and materials used in the SZ include HEPA-filtered vacuums, mops, wet wipes, disinfecting wipes, and floor buffers. Waste materials generated in the SZ trailers will be disposed of as general trash.

3.4 Engineering Controls

Engineering controls are designed into work activities whenever appropriate to minimize exposure to contaminants. “Wet methods” and applying water through the use of fog cannon, water truck, and other acceptable means are used routinely for managing fugitive dust emissions and dust control. Engineering controls also include routine use of stabilizing agents such as Gorilla Snot on exposed surfaces where additional control is required (e.g., on-site routes, parking areas, and other high-traffic areas; and material piles, which may be undisturbed for extended weekends or anticipated adverse weather conditions).

Areas may also be enhanced utilizing geofabric, which is then covered with clean stone. On-site haul trucks also use a tarping system, which prevents dust and fine particles from inadvertently being ejected from the truck. Decontamination activities are also performed for equipment and materials that are planned to be moved between zones. North Wind Site Services also utilizes total suspended particulate (TSP) monitors around the project site, which measure the amount of suspended solids in the air at any given time and run 24 hours a day, 7 days per week. Additional engineering controls include but are not limited to:

- Airborne TSP monitors
- Decontamination of surfaces before disturbance

- Wetting agents during activities that may produce dust
- Encapsulating agents to bind dust to prevent it from becoming airborne (e.g., Gorilla Snot)
- Tarping system on dump trucks
- Laboratory hood vents
- Decontamination pads
- HEPA-filtered vacuums
- Geofabric
- Clean stone for cover.

Dust control within deconstruction areas may be supported by using water suppression when conditions warrant this practice. In general, the debris materials may become dry and may produce dust unless they are specifically made moist. (This is very different than soil, which retains moisture readily.)

3.5 Personal Protective Equipment

PPE is the final level on the hierarchy of controls. PPE is to be utilized only when engineering controls and administrative controls are incapable to adequately protect the worker. Specific PPE requirements for work on the Luckey FUSRAP Project are identified in the PWS and AHA(s) for that particular work.

Beryllium-contaminated or radiologically contaminated PPE and clothing must be handled in a manner to prevent the contamination from becoming airborne; it must not be shaken, air-cleaned, or otherwise disturbed. Workers are trained on proper PPE donning, doffing, decontamination, and disposal processes for safely performing these tasks.

Disposable PPE is placed into lined waste containers. Full bags within containers are promptly closed, j-sealed (goose-necked), and removed. Workers are trained to never push doffed PPE into disposal bags to prevent forcing contaminated air outward into their breathing zones.

PPE items that are reused (e.g., hard hats, gloves, muck boots) are cleaned and stored in the CRZ for future use. These PPE materials are placed in containers for safe storage and segregation from other items pending reuse. These containers (plastic totes, poly bags, etc.) are properly labeled with a beryllium warning label and radiological tag.

4. MONITORING

This section discusses means and methods utilized at the site for monitoring and controlling contamination. Surface monitoring is performed for beryllium and radioactivity. Air monitoring at the potential point of generation (workplace monitoring) and at the site perimeter is performed for beryllium, lead, particulates, gross alpha radiation, and gross beta radiation by using a combination of PBZ and TSP monitors. Monitoring, also known as surveying, is described in more detail in Attachment 1, Survey Plan for Luckey Building Deconstruction.

4.1 Surface Contamination Monitoring

Surface contamination control measurements for radioactivity and beryllium are performed at the site to ensure the safety of personnel. Surface sampling is performed on routine basis and as needed for spot-checks or release of equipment and materials. Surface contamination monitoring includes but is not limited to:

- Trucks when they leave the EZ and the CRZ.
- SZ trailers (routine surveys).
- Materials and equipment leaving the EZ and the CRZ.
- Waste containers exiting the EZ, CRZ, and SZ.
- Individuals exiting the EZ.
- EZ and CRZ egress locations, including shower trailer, industrial hygiene (IH) trailer, and access control point (routine surveys).
- Roadways (routine surveys).
- On-site laboratory trailers (routine surveys).
- Incoming equipment.

4.1.1 Personnel Radioactive Contamination Monitoring

Personnel decontamination procedures are provided in the APP/SSHP, identified in training, and discussed with workers and in Work Instructions. Workers exit the EZ through the CRZ. Showers are provided, and personnel who have performed intrusive work (e.g., active deconstruction) in the EZ are required to shower before they exit the EZ/CRZ for the day. However, as stated prior in this document, certain events may alter this procedure.

Personnel exiting the EZ self-perform a radiological controls “frisk” of their hands, feet, and face for gross alpha and beta radioactivity in the CRZ and step into the SZ if uncontaminated. A

"whole-body" frisk may be directed if contamination conditions indicate that it is necessary. North Wind Site Services has collected industrial hygiene data for beryllium, lead, and radiation from start of the project through all work performed to date. At the conclusion of 2019, an evaluation was performed on the mature data that was collected on the radiological studies that were performed at the site during remediation. The NWP CHP and RSO concluded that a whole body frisk for radioactivity was no longer necessary and was not required.

Based on the potential for changing site conditions, this will be monitored and, if required, will be reinstituted. A Geiger-Muller pancake detector is used for personnel frisking and the detector has an analog display and an audible signal alarm. The detectors are held ¼ to ½ inch from the body and moved at a speed of 1 to 2 inches per second. Individuals pause the frisk if there is an audible response that may exceed the natural background detector count rate. The pause is long enough to determine if contamination is present or if there is just a normal fluctuation in natural background. Uncontaminated workers sign out on the access control register to document that they are uncontaminated and have left the zone. Workers who suspect they may be contaminated notify the RCT on duty for direction and supported monitoring.

4.1.2 Contamination Monitoring on Equipment and Materials

Vehicles and large equipment used in the EZ are decontaminated on the decontamination pad prior to being moved from zone to zone. The designated decontamination pad is a concrete pad with drainage systems to the site waste water treatment plant. Other decontamination areas may be established in the field based on need and existing site conditions. For instance, washing off dirt and debris from a an excavator in the EZ prior to moving to the decontamination pad is a best management practice and reduces the potential for tracking and spreading contaminants across the site.

Tools and small equipment may be decontaminated in designated locations or the decontamination pad prior to transfer to the CRZ. Surveys are performed on tools and equipment prior to transfer from the EZ or CRZ into the SZ to ensure that free-release limits have been met.

Materials and equipment used in the EZ are checked for total radioactive contamination, removable radioactive contamination, and removable beryllium before release from the EZ. Surfaces that have the highest rate of personnel exposure to contaminants are preferentially checked.

Total radioactive contamination measurements are made with dual alpha/beta scintillators. Scans are performed as discussed above for personnel monitoring. Results are converted to disintegrations per minute per 100 cm^2.

Measurements for removable beryllium are made using a pre-moistened surface sample medium wiped with moderate pressure in an "S" pattern, over a surface area of 100 cm^2. (Area reference as the size of a dollar bill or by using a dust template guide.) The surface samples are analyzed via optical fluorescence with a BeFinder® detector or inductively coupled plasma mass spectrometer.

Results of both total and removable contamination measurements are compared to the Radiological Levels for Clearance found in the RPP (PLN-60066-014; USACE 2020e) and shown in Section 5. Results of removable beryllium measurements are compared to a limit of 0.2 µg/100 cm^2. Materials and equipment that exceed these values are not removed from the EZ until decontaminated, resurveyed, and demonstrated to meet the release criteria.

4.1.3 Routine Contamination Monitoring in the CRZ and SZ

The potential transfer of radioactivity and beryllium into the CRZ and SZ is monitored routinely in accordance with the CBDPP (PLN-60066-013; USACE 2020d) and RPP (PLN-60066-014; USACE 2020e). Measurements for removable radioactivity and beryllium are taken to evaluate whether contamination is being tracked out of the EZ. Emphasis is placed on high-traffic areas and horizontal surface locations where equipment is stored.

Monitoring is performed in the CRZ side of access control and the IH Conex. Inspections generally include surfaces such as but not limited to: floors, tabletops, shelves, and fixed equipment or materials in the area. If contamination above the beryllium housekeeping limit of 3 µg/100 cm^2 is detected, additional housekeeping efforts are taken and the area is decontaminated and reported for trending. If radioactive contamination is found in excess of 60 dpm/100 cm^2 it is likewise decontaminated (see Section 5 for the contamination limits).

Monitoring is also performed in multiple areas of the SZ. When routinely assessing available surface spaces in the administrative trailers, the following surfaces are smeared and checked for removable contamination: floors, desks, tables, shelves, fixed equipment, and window ledges. Contamination is not expected to be found in the SZ, and if found, this indicates a potential breakdown in site contamination control practices. These findings are shared with the project management team and employees for awareness and enhancing work practices as necessary. Additionally, USACE is also notified if contamination is found in the SZ.

Travel paths in the SZ for roll-off traffic and west of the loadout area are checked monthly for radioactivity. This is done using the same sensitive gamma radiation detectors as used during gamma walkover surveys (e.g., Ludlum Model 2221 and Model 44-20 Detectors) in the EZ.

4.2 Air Monitoring

Air monitoring is performed to assess airborne contamination, as summarized in Table 4-1 and Figure 4-1. The air monitoring requirements are designed to provide early detection of potential contaminant emissions.

Dust, radionuclides, lead, beryllium, and meteorological data have been used to assess and establish baseline conditions (background) and are used to interpret/verify conditions during remedial activities. If there is an exceedance of TSP in a monitor upwind of operations, the exceedance and the wind direction are logged, and work continues. If there is an exceedance in both the upwind and downwind samplers with similar concentrations, it is noted, and work continues. If there is a significant exceedance at a downwind location but not in the upwind location, and emission-generating activities are scheduled to continue, additional controls are implemented. As noted during historical work and monitoring, the TSPs are very sensitive and have been impacted by exterior influences such as fog, smoke, and adjacent farming activities.

Table 4-1. Air Monitoring Program Summary

Requirement/*Objective*	Basis	Locations and Contaminants	Frequency
Air monitoring during deconstruction and remediation, which includes on-site perimeter plus work area monitoring – gross alpha/beta, individual radionuclides, Be, lead (Pb), and TSP. *Provide early detection and notification of potential for exceedance of response and action levels.*	PWS, Section 5.2.1.2 *Monitoring, Sampling, Testing, and Analysis*, Appendix B, *USACE Buffalo District Technical Requirements and Unified Facilities Guide Specifications*	Eight perimeter air monitoring locations. Three mobile air monitor stations each with a pole-mounted TSP monitor for designated deconstruction zones. Four mobile air monitor stations each with a pole-mounted TSP monitor around material processing areas. Both fixed perimeter and mobile work area air monitoring locations and quantities may be adjusted to support project needs.	Weekly perimeter air monitor samples. Daily mobile air monitor samples. Continuous TSP with 15-minute averages.
Exposure monitoring and air sampling program – gross alpha/beta, radionuclides, Be, Pb, Asbestos and TSP. *Protect worker health and safety.*	PWS, Section 5.2.1.2 *Monitoring, Sampling, Testing, and Analysis*, Appendix B, *USACE Buffalo District Technical Requirements and Unified Facilities Guide Specifications*	General work area and worker breathing zone air monitoring (of similar exposure groups for representative sampling) are conducted in the EZ, CRZ, and SZ. Exposure assessments are conducted, as needed.	Daily, shift, and/or activity as needed for gross alpha/beta, Be, Pb, and respirable silica.

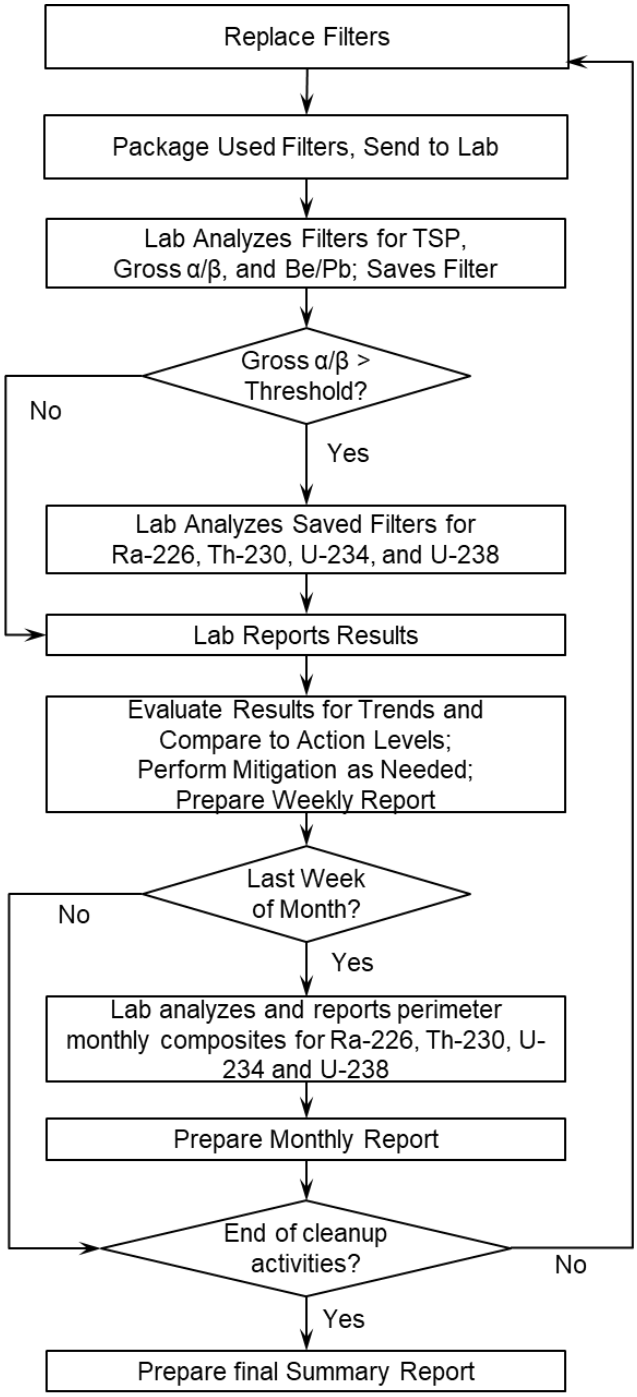

Figure 4-1. Air Filter Flowchart

4.3 Perimeter Air Monitoring Plan

Perimeter air sampling is performed around work areas and at the site perimeter to measure airborne particulate concentrations. The purpose of this air monitoring is to track on-site migrations of air particles during intrusive activities, including deconstruction, excavations, material handling, sorting and sizing, transportation, container movement, and decontamination efforts.

The air monitoring program consists of:

- Real-time meteorological parameters and TSP.
- Radionuclides (gross alpha/beta), Be, and Pb.
- Monthly samples for individual radionuclides (Ra-226, Th-230, U-234, and U-238).
- Asbestos.
- Silica.

4.3.1 Fixed Perimeter Air Monitoring

Eight fixed perimeter air monitoring stations are installed on stands and placed at breathing zone height (approximately 5 ft above the ground surface) at the locations illustrated in Figure 3-1. These locations were selected based on the proximity of intrusive work activities to the site perimeter and wind direction frequency, which is based on measurements collected at the National Weather Service site at the Toledo Express Airport.

Air monitoring locations are equipped with a pair of low-volume particulate matter air sampling systems — one for radionuclides, the other for beryllium and lead. All perimeter locations are equipped with real-time particulate matter air sampling systems. This real-time monitoring allows timely evaluation of potential for site releases that could impact public health.

4.3.1.1 Low-Volume Sampling Systems

The low-volume particulate matter air sampling systems collect samples for radionuclides (gross alpha/beta), beryllium, and lead (see Figure 3-1). The fixed perimeter monitoring stations consist of the following equipment:

- F&J Specialty Products, Inc., LV-22 Environmental Low-Volume Air Sampler, or equivalent.
- Met One ES-642 TSP monitoring system, or equivalent.

These samplers are operated continuously and collected weekly during site deconstruction work activities. The sampling period may be adjusted as needed in consideration of holidays or adverse weather conditions that prevent sampling change-out. The filters are analyzed each week for gross alpha/beta radiation. Each month the weekly filters are composited into one sample for each sampling location. The monthly filter composites are then radio-chemically analyzed for the individual radionuclide contaminants of concern: Ra-226, Th-230, U-234, and U-238.

The low-volume fixed perimeter TSP monitors operate continuously, except during routine maintenance, calibrations, and power outages. Routine maintenance, including sample media exchange, takes significantly less than the downtime of 20 percent as permitted by Section 2.2 of Appendix A to the Environmental Protection Agency's "Guidance on Implementing the Radionuclide NESHAPs" (EPA 1991). Backup monitors/systems are readily available for use, should it be determined that the down-time could exceed the 20 percent for maintenance on a specific monitor.

If a power outage occurs, intrusive/dust-producing activities are stopped until power is restored and the monitors are operational. These air monitors have been outfitted with a red strobe light that is left on during its operation and provides a visual aid to personnel working in and around the area. If the strobe light is off, work is paused to investigate why the light is off. Additionally, TSP alerts are sent via e-mail notification to select personnel, which further enhances timely notification and responses by site personnel.

4.3.1.2 Real-Time Sampling Systems

Eight real-time dust monitors (MetOne ES-642, or equivalent) are used to determine TSP concentrations. The monitors run continuously, and the maximum 15-minute average concentrations are recorded. This data automatically relayed to a site computer that can readily be evaluated.

4.3.2 Portable On-Site Air Monitoring

On-site monitoring is performed during work activities involving contaminated materials. The portable monitoring stations consist of the following equipment:

- F&J Specialty Products, Inc., LV-22 Environmental Low-Volume Air Sampler, or equivalent.
- Met One ES-642 TSP monitoring system, or equivalent.

Four portable monitoring stations (i.e., upwind, downwind, and crosswind) consisting of a pair of low-volume air samplers and one real-time TSP monitor are used at each deconstruction area to

account for daily wind shifts during deconstruction activities. Four portable monitoring stations are used around material processing areas during material processing and/or handling activities.

The air filters from each low-volume air monitor pair are changed daily. The filters from one of the sampler pairs are analyzed for gross alpha/beta radioactivity. These filters are saved for potential analysis of individual radionuclides, depending on the results of the gross alpha/beta analysis (i.e., any that are significantly elevated). The filter from the second of the monitor pairs are analyzed each day for beryllium and lead.

The real-time TSP monitors are equipped with data loggers to measure the maximum 15-minute air concentrations of TSP.

Portable real-time instruments (e.g., TSI AM520) are also used to measure TSP wherever needed (e.g., by walking the site or excavation perimeter).

The locations of the portable monitors are selected by the SSHO/designee when needed, through careful consideration of current and forecasted meteorological conditions and scheduled activities for the day. The location of each portable station, the work zone(s), and wind direction are recorded for each day. Exceedances of action levels shown in Table 5-1 for any COCs must be immediately reported to the SSHO, PM, and the USACE contracting officer's representative (COR).

4.3.3 Occupational Air Monitoring

PBZ monitors are placed on selected workers to evaluate potential exposures to radionuclides, beryllium, and lead during work activities. PBZ pumps are worn on field personnel (e.g., equipment operators, waste technicians, and laborers) who all wear powered air-purifying respirators (PAPRs) with a protection factor of 1000 and a full ensemble of PPE while also wearing the PBZ monitors. Those individuals working with potentially contaminated material or in the closest proximity to the material are assumed to represent the worst-case scenario for potential exposure, regardless of PPE and other controls that further reduce exposure potentials. As such, workers are selected for inclusion in the occupational air monitoring program based on their proximity to the material in question and/or job tasks involving working with the material. Detailed information is documented on how the occupational air sampling data is used.

4.3.4 Meteorological Monitoring

A meteorological station (Campbell Scientific CR1000, or equivalent) equipped with a solar panel and battery for remote operation is placed along the site perimeter on the west side of the site (see Figure 3-1). The system measures wind speed, temperature, wind direction, relative humidity, and barometric pressure. The system records 15-minute average values for each

parameter (wind speed and direction, temperature, relative humidity, and barometric pressure), and the data is maintained in an on-site database. Additionally, the station has a rain gauge to determine inches of rain in a 24-hour period. The station has been hardwired to operate on line power and the battery serves as a back power supply, thereby supporting uninterrupted operation of the station. The station is also designed with wireless capability for data download.

4.3.5 Sample Designation and Sample Identification Codes

Samples collected are assigned unique sample identification numbers. These numbers are necessary to identify and track each of the samples collected for analysis during completion of the project. Each sample is identified by a unique alpha numeric code to maintain consistency and comparability of sample location identification for the duration of the project. In addition, the sample identification numbers are used to identify and retrieve the analytical results received from the laboratory as well as other data related to the samples. The sample identification nomenclature is defined in the QAPP/SAP (PLN-60066-005; USACE 2020b).

4.3.6 Instrument/Equipment Testing, Inspection, and Maintenance

Table 4-2 identifies the equipment and maintenance required to ensure system operability. Calibration and maintenance frequencies must be in accordance with manufacturer requirements and the QAPP/SAP (PLN-60066-005; USACE 2020b).

Table 4-2. Equipment Maintenance Schedule

System/Component	Maintenance Activity	Frequency	Responsibility	Position
Personal sampling pumps	Flow rate calibration	Daily	Site	Safety & health technician or RCT
Low-volume sampler flowmeter (F&J Specialty Products, Inc., LV-22)	Flow rate verification	Weekly	Site	RCT
	Calibration	Semiannual	Site	RCT
Total suspended particulate monitor (Met One ES 642 TSP Monitoring System)	Visual inspection of filters and replacement as necessary	Semiannual	Site	RCT
	Flow check (three points)	Monitored real time on 15-minute averages	Site	RCT
	Calibration	Semiannual	Site	RCT
Meteorological instruments (Campbell Scientific CR1000)	Calibration	Biannual	Vendor	N/A
Personal aerosol monitor (TSI AM520)	Calibration	Annual	Vendor	N/A
Air flow calibrator	Calibration	Annual	Vendor	N/A

4.3.7 Program Assessments and Response Actions

If an air monitoring result shows elevated levels (at or above the action level), field personnel are notified by the SSHO. The meteorological data (e.g., wind direction/speed, temperature, humidity) is evaluated as part of this response. In addition, adjacent off-site activities (e.g., agricultural, vehicle traffic) and the location of the site activities will also be considered as part of this response. The following actions are taken, as appropriate:

- If action levels or limits are exceeded, perform the following:
    - Review the preliminary data for validity and if valid promptly suspend or, for action level exceedance, modify the operations.
    - For limit exceedance, promptly review notification requirements to determine if notification of off-site personnel and organizations is required.
    - Promptly investigate the cause of the event and determine if mitigation is required, ensuring that all potential on-site sources are adequately investigated.

- Document events caused by non-site-related sources, such as plowing and harvesting, high humidity affecting the instruments, exhaust emissions from operating equipment, or other factors unrelated to the site activity.
- If the situation requires any mitigation, document the event and summarize the data, the cause of the measured value(s), and any corrective measures implemented as a result of the event. The PM performs these follow-up actions.

Upon collection of sufficient surface contamination and airborne analysis data, a negative exposure assessment (NEA) is utilized to demonstrate that changes to the frequency and type of sampling can be made. The NEA is to follow SOP #2 guidelines established by NWP and USACE Certified Industrial Hygiene Managers during the soil remediation project. NEAs will be submitted to the USACE for review and approval. NEAs are used to indicate that controls are sufficient and the environment is acceptable to allow for downgrading of PPE in an area. Additionally, exposure assessments (EA) are used to indicate that controls are sufficient and the environment is acceptable to allow for downgrading of boundaries in an area. The EA is to follow SOP #3 guidelines established by NWP and USACE Certified Industrial Hygiene Managers during the remediation project. A site map indicating the area of the NEA as well as activities reflected in the NEA is included in the assessment.

4.3.8 Documentation and Records

4.3.8.1 Field Log

Throughout performance of the project, field logs are maintained. Information to be recorded in these logs/forms includes:

- A description of work activities associated with any elevated air monitoring measurements.
- Locations of each fixed and portable air monitoring station and handheld monitoring locations for the day.
- Any corrective actions conducted due to elevated real-time air monitoring concentrations.
- Sample media collection and receipt dates, conditions, and numbers.
- Copies of chain-of-custody forms.
- Sampling equipment installation, operation, and removal dates.
- Sampling equipment calibration dates and results.
- General weather conditions.
- Any unusual situations that may affect the samples or sampling.
- Start and stop times.

4.3.8.2 Data Management

Surface samples, swipe samples, and air monitoring data are obtained from a variety of sources, including real-time monitoring, handheld and observational monitoring, particulate sampling, and laboratory analyses.

The following measurements require management:

- Real-time particulate matter (TSP) at background, fixed, and portable monitoring locations (datalogger).
- Filter samples for radionuclides (gross alpha/beta), beryllium, and lead at fixed and portable monitoring locations.
- Filter samples for individual radionuclides (Ra-226, Th-230, U-234, and U-238) at fixed and portable monitoring locations.
- Handheld real-time particulate matter at portable monitoring locations.

- Personal air monitors.
- Real-time meteorological parameters at meteorological monitoring location (datalogger).

4.3.9 Reporting

This section discusses the data reporting program. It includes reporting on exceedances of action levels, weekly data summaries, monthly data summaries, and reporting at conclusion of perimeter monitoring.

4.3.9.1 Exceedances

Monitoring results are immediately reported to the PM, RSO, SSHO, and the USACE (i.e., COR and resident engineer) when action levels and/or limits have been exceeded, to discuss prompt evaluation and response to potential emissions.

The RSO, SSHO, and PM, in consultation with USACE, will decide when shutdown and startup criteria have been met.

4.3.9.2 Weekly Data Summaries

North Wind Site Services presents USACE the following weekly data summaries for the meteorological station, fixed perimeter monitoring stations, and portable monitoring stations:

- Maximum 15-minute average concentrations of real-time TSP.
- Average 15-minute wind speed, wind direction, relative humidity, and air temperature data.
- Site activities, including monitoring, that triggered a response action.
- Air monitoring station locations.

4.3.9.3 Monthly Data Summaries

North Wind Site Services provides USACE the following monthly data summaries in electronic format for the fixed perimeter monitoring stations and portable monitoring stations:

- Maximum 24-hour average concentrations of TSP, radionuclides (gross alpha/beta), beryllium, and lead from low-volume filter samples.
- Maximum 24-hour average concentrations of individual radionuclides (Ra-226, Th-230, U-234, and U-238).
- Site activities, including monitoring, that triggered a response action, if any.
- Air monitoring station locations.

As a separate report, North Wind Site Services provides monthly data summaries electronically, in a format acceptable to USACE, for beryllium and lead personal air monitoring, and beryllium surface sampling.

4.3.9.4 Reporting at Conclusion of Perimeter Monitoring

North Wind Site Services will provide to USACE an air monitoring report at the conclusion of the perimeter air monitoring program. The report shall provide:

- All real-time air monitoring results in a database or spreadsheet. This includes statistical summaries (tabulated mean, standard deviation, percentiles by monitor location and month) and graphical summaries.
- All filter sampling and analytical results in a database or spreadsheet. This includes statistical summaries (tabulated mean, standard deviation, percentiles by monitor location and month) and graphical summaries.
- All meteorological data in a database or spreadsheet. This includes statistical summaries (tabulated mean, standard deviation, percentiles by monitor location and month) and graphical summaries (such as boxplots by monitor location and month).
- A summary of air monitoring results above the action levels and limits, if any, corresponding site activities, and response actions taken.
- Figures that identify fixed and portable air monitoring stations associated with each work area.

4.3.10 Training

The SHM, RSO, and SSHO ensure that the following instructions specific to this project have been presented to site project personnel implementing this plan:

- Overview of the air monitoring plan.
- Organization responsibilities, lines of communication, and authorities.
- Sample handling and chain-of-custody.
- Quality control considerations.
- Documentation requirements.
- Response actions.
- Notification requirements.

5. LIMITS

The housekeeping criterion for beryllium of 3 µg/100 cm^2 is used to identify areas where additional housekeeping procedures should be implemented. Areas where the housekeeping criterion is being applied include the CRZ side of the Access Control Conex and the CRZ side of the IH Conex. The CRZ side of the Access Control Conex and the CRZ side of the IH Conex are where personnel working in the EZ begin the doffing process (i.e., PAPRs, Tyvek, nitrile gloves, and rubber boots). The surface contamination action level for the SZ, and for the release of items from governmental control, to off-site locations, is 0.2 µg/100 cm^2. Areas in the SZ that exceed the free-release criterion will indicate that additional housekeeping procedures should be implemented in those areas. Equipment being released to off-site locations but remaining in governmental control will fall under the housekeeping criterion of 3.0 µg/100 cm^2. This equipment will be sampled periodically to ensure it is being maintained at the housekeeping criterion.

Radiological limits for acceptable levels of surface contamination (Pamphlet DA PM 385-24 [U.S. Army 2015], Table 5-3, “Screening levels for clearance”) are presented in Table 5-2 and are applied to equipment and material release. The surface screening values are for total contamination. Removable contamination screening values are set at 10 percent of those for total contamination. The purpose of this goal is to maintain contamination levels and personnel exposures ALARA. As a general practice, Army organizations do not release volumetric radioactively contaminated materials or items for unrestricted use. Release criterion of 0.2 µg/100 cm^2 Be is for releasing equipment/materials to the SZ.

Table 5-1. Air Monitoring Limits

Contaminant of Concern	Location	Action Level	Limit	Units	References
Asbestos	Work Area	0.1	0.2	f/cc	1
Be	Perimeter	None	0.01	µg/m^3	2
Be	Work area/PBZ	0.1	0.2	µg/m^3	3
Pb	Perimeter	None	0.15	µg/m^3	4
Pb	Work area/PBZ	30.0	50.0	µg/m^3	5
Radioactivity, gross alpha	Work area/PBZ	1.2E-12	6E-12	µCi/mL	6
Radioactivity, gross alpha	Perimeter	4.0E-15	2.0E-14	µCi/mL	6
Radioactivity, gross beta	Work area/PBZ	6.0E-11	3.0E-10	µCi/mL	7
Radioactivity, gross beta	Perimeter	2E-13	1E-12	µCi/mL	7
Respirable particles not otherwise specified (TSP)	Work area/PBZ	1.5	3.0	mg/m^3	8
Respirable silica, crystalline – quartz and cristobalite	Work area/PBZ	0.0125	0.025	mg/m^3	9
Ra-226 derived air concentration (DAC)	Work area/PBZ	6.0E-11	3.0E-10	µCi/mL	9
Ra-226	Perimeter	1.8E-13	9.0E-13	µCi/mL	10
Th-230 (DAC)	Work area/PBZ	1.2E-12	6.0E-12	µCi/mL	9
Th-230	Perimeter	6.0E-15	3.0E-14	µCi/mL	10
U234 (DAC)	Work area/PBZ	6E-11	3E-10	µCi/mL	9
U-234	Perimeter	2E-13	1E-12	µCi/mL	10
U-238 (DAC)	Work area/PBZ	6E-11	3E-10	µCi/mL	9
U-238	Perimeter	2E-13	1E-12	µCi/mL	10

References:

1. Occupational Safety and Health Administration permissible exposure limit (29 CFR 1910.1000).
2. 40 CFR 61 Part C, National Emission Standard for Beryllium. NESHAPS ambient air standard for beryllium production facilities, 30-day average.
3. USACE Buffalo District Occupational Exposure Level for Beryllium 7 July 2020, approved waiver from USACE Engineering Manual 385-1-1 (Safety and Health) requirement by USACE Headquarters Safety Office. To be applied within the personal breathing zone of site workers; averaged over 8 hours, with action triggered at half this level.
4. Ohio Administrative Code 3745-25-02 (F), Ohio Ambient Air Quality Standard for lead, arithmetic mean concentration over 3month period.
5. Occupational Safety and Health Administration permissible exposure limit (29 CFR 1910.1025).
6. 10 CFR 20, Appendix B, Values for Th-230 used as most conservative surrogate for alpha activity of all radionuclides combined. Derived Air Concentration, occupational value for inhalation, assumes exposure limited to 2000 hours/year. Most conservative inhalation properties assumed of radionuclide, controls dose to the public, annual average.
7. 10 CFR 20, Appendix B, Values for U-238 Class W because there is no historical evidence of high-fired uranium at the site (warranting use of Class Y) surrogate for beta activity of all radionuclides combined. Effluent limit for annual dose to the public. Most conservative inhalation properties assumed of radionuclide, controls dose to the public, annual average.
8. American Conference of Governmental Industrial Hygienists threshold limit value 2015.
9. 10 CFR 20, Appendix B, Values for individual radionuclides, Derived Air Concentration, occupational value for inhalation, assumes exposure limited to 2000 hours/year.
10. 10 CFR 20, Appendix B, Values for individual radionuclides, effluent limit for annual dose to the public, annual average, action level at 20% (ALARA requirement).

Table 5-2. Radiological Screening Levels for Clearance

Radionuclide Groups[1]	Total Contamination Screening Levels (S.I. Units)[2] becquerels per square centimeter or becquerels per gram (Bq/cm^2 or Bq/g)[3]	Total Contamination Surface Screening (Conventional Units)[2] disintegrations per minute (dpm/100 cm^2)	Volume Screening (Conventional Units)[2] (pCi/g)
Group 1 Radium, Thorium, and Transuranics: ^{210}Po, ^{210}Pb, ^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{237}Np, ^{239}Pu, ^{240}Pu, ^{241}Am, ^{244}Cm and associated decay chains[4], and others[1]	0.1	600	3
Group 2 Uranium and Selected High Dose Beta-Gamma Emitters: ^{22}Na, ^{54}Mn, ^{58}Co, ^{60}Co, ^{65}Zn, ^{90}Sr, ^{94}Nb, ^{106}Ru, ^{110m}Ag, ^{124}Sb, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{192}Ir, ^{234}U, ^{235}U, ^{238}U, Natural Uranium[5], and others[1]	1	6,000	30
Group 3 General Beta-Gamma Emitters: ^{24}Na, ^{36}Cl, ^{59}Fe, ^{109}Cd, ^{131}I, ^{129}I, ^{144}Ce, ^{198}Au, ^{241}Pu, and others[1]	10	60,000	300
Group 4 Other Beta-Gamma Emitters: ^{3}H, ^{14}C, ^{32}P, ^{35}S, ^{45}Ca, ^{51}Cr, ^{55}Fe, ^{63}Ni, ^{89}Sr, ^{99}Tc, ^{111}In, ^{125}I, ^{147}Pm, and others[1]	100	600,000	3,000

1. To determine the specific group for radionuclides not shown, a comparison of the effective dose factors, by exposure pathway, listed in Table A.1 of National Council on Radiation Protection and Measurements Report No. 123 (NCRP 1996) for the radionuclides in question and the radionuclides in the general groups above are performed and a determination of the proper group made, based on similarity of the factors.
2. Rounded to one significant figure.
3. The screening levels shown are used for either surface activity concentration (in units of Bq/cm^2) or volume activity concentration (in units of Bq/g). These groupings were determined based on similarity of the scenario modeling results, as described in Annex B of ANSI N13.12.
4. For decay chains, the screening levels represent the total activity (that is, the activity of the parent plus the activity of all progeny) present.
5. Where the Natural Uranium activity equals 48.9% from U-238, plus 48.9% from U-234, plus 2.25% from U-235.

6. EXTENDED SHUTDOWN

If site activities are shut down for an extended period of time, then additional steps are taken to ensure that no inadvertent contaminant migration occurs. These additional measures address work areas, equipment, tools, and facilities, as follows:

- Work areas are stabilized, and if remediation/deconstruction is not complete in a disturbed area, clean cover or fixative is applied to provide a barrier for contamination control.
- Tools and equipment are decontaminated to the extent necessary; if leaving the site, then tools and equipment must meet the free-release criteria. For tools and equipment that are stored in the EZ during the shutdown, the housekeeping standard for the EZ applies. Contamination surveys are performed and documented for the as-left condition. Any equipment or tools with elevated levels of contamination are covered or have fixative applied to provide a barrier for contamination control.
- Facilities are cleaned, and a final round of contamination surveys performed. Facilities in the SZ must meet the release criteria, while facilities within the EZ or CRZ may exceed the release criteria, provided that areas with contamination are covered or have fixative applied. In addition, these facilities (or areas within) must be properly posted/labeled.

Air monitoring continues for a minimum of one week after all site activities with contaminated materials are complete. If air monitoring results are all below criteria, then the site is shut down with no additional monitoring until activities resume.

7. REFERENCES

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U.S. Army, 2015, *The Army Radiation Safety Program*, Pamphlet DA PAM 385-24, U.S. Army, November 30, 2015.

ATTACHMENT 1
Survey Plan for Luckey Building Deconstruction

Survey Plan for Luckey Building Deconstruction

1 Introduction

On July 26, 2006, the United States Army Corps of Engineers (USACE) signed the Record of Decision (ROD) for Soils Operable Unit, Luckey Site, Luckey, Ohio (USACE 2006). The ROD identifies beryllium (Be), lead (Pb), radium-226 (Ra-226), thorium-230 (Th-230), uranium-234 (U-234), and uranium-238 (U-238) as Formerly Utilized Sites Remedial Action Program (FUSRAP)-related constituents of concern (COCs) in soils. Between November 2009 and April 2010, USACE performed additional environmental sampling to address data gaps and reduce uncertainty regarding the vertical and horizontal extent of FUSRAP-related contaminated soils (USACE 2011). Sampling data indicates that FUSRAP-contaminated soils are located under a portion of the former production facility buildings.

Radiation surveys conducted during the FUSRAP remedial investigation (USACE 2000) found areas within the former production and annex buildings with elevated radioactivity, the majority of which were in the ceiling beams. Beryllium sampling conducted during the remedial investigation found beryllium surface and dust contamination, as well as beryllium in some of the building materials (paint, brick, concrete, etc.), in the former production and annex buildings.

1.1 Purpose

The purpose of this survey is to confirm and supplement past surveys and sampling efforts in two specific areas of interest:

- Radiation and contamination measurements of accessible floor areas within the production building, maintenance building, and main office building at the Luckey site.
- Collection of subsurface soils, using direct-push sampling methods and gamma logging technologies within the footprint of former buildings.

These survey results data may be used by USACE and North Wind Site Services to augment and/or confirm historical measurements and support future site characterization, remediation, or release decisions.

1.2 Contaminants of Concern

The USACE identified six COCs posing unacceptable risks to human health at the Luckey Site: beryllium, lead, Ra-226, Th-230, U-234, and U-238.

- Radiation surveys identified areas within the production annex (now demolished) that contained activity above Nuclear Regulatory Commission (NRC) surface contamination guidelines for release to the public.
- Beryllium swipe samples identified removable contamination in the production annex, production building, laboratory, and maintenance building.

- Buildings that contain significant concentrations of beryllium within the construction materials (paint, brick, and concrete) include the former laboratory, maintenance building, production building, and production annex (now demolished).
- Elevated levels of beryllium were detected in subsurface soil samples collected adjacent to and beneath the production annex (now demolished).

2 Data Quality Objectives

This supplemental survey was developed in accordance with the guidance presented in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM 2000) in order to follow the data quality objective (DQO) process. The DQO process is meant to assure that the type, quantity, and quality of environmental data collected in decision making will be appropriate to substantiate stakeholder decisions. It provides systematic procedures for defining the criteria that the survey design should satisfy, including when and where to perform measurements, the level of decision errors for the survey, and how many measurements to perform. The DQOs for the site are to obtain data of sufficient quality and quantity to prove, within a specified degree of confidence, the residual radioactivity levels, beryllium, and lead on the slab, subsurface soils, and surrounding soils of the former buildings' footprint(s).

2.1 Cleanup Criteria

The cleanup goals (CGs) are concentrations of COCs, when considered independently of other COCs that may be collocated, that present an unacceptable health risk to the critical receptor, the subsistence farmer. The CGs for the COCs at the Luckey Site were documented in the ROD (USACE 2006). The approved CGs for beryllium and lead are 131 mg/kg and 400 mg/kg, respectively. The soil CGs for the individual radionuclides of concern (ROC) represent radioactivity levels above the site background radioactivity corresponding to 25 millirem per year (mrem/year). The approved CGs are shown in Table 1. The CGs for ROCs shown in Table 1 do not include background.

Table 1. COCs, their Respective CGs, and Background for the Luckey Site

Contaminant	Cleanup Goal	Mean Background
Beryllium	131 mg/kg	0.90 mg/kg
Lead	400 mg/kg	15.10 mg/kg
Radium-226	2.0 pCi/g	1.75 pCi/g
Thorium-230	5.8 pCi/g	2.11 pCi/g
Uranium-234	26 pCi/g	1.64 pCi/g
Uranium-238	26 pCi/g	1.63 pCi/g

2.1.1 Beryllium and Lead

Results of both total and removable contamination measurements will be compared to the Radiological Levels for Clearance found in the radiation protection plan (PLN-60066-014; USACE 2020b). The housekeeping criterion for beryllium of 3 µg/100 cm^2 is used to identify areas where additional housekeeping procedures should be implemented. Results of removable beryllium measurements are compared to a limit of 0.2 µg/100 cm^2. Materials and equipment that exceed 0.2 µg/100 cm^2 removal beryllium are not removed from the exclusion zone until decontaminated, resurveyed, and demonstrated to meet the release criteria. Since there is not a removable lead criterion, the removable lead measurements will be documented and maintained for trending and information usage.

2.1.2 Radiological

Direct survey results and swipes will be compared to the radiological limits for acceptable levels of surface contamination criteria in ANSI N13.12, *Surface and Volume Radioactivity Standards for Clearance* (ANSI 1999). The surface screening values are for total contamination. Removable contamination screening values are set at 10 percent of those for total contamination. If radioactive contamination is found in excess of 60 dpm/100 cm^2 then additional housekeeping should be performed. Table 2 provides surface and volume radioactivity standards.

Table 2. Surface and Volume Radioactivity Standards

Radionuclide Groups[1]	**Screening levels (S.I. Units)[2] (Bq/cm^2 or Bq/g)[3]**	**Surface screening (Conventional Units)[2] (dpm/100 cm^2)**	**Volume screening (Conventional Units)[2] (pCi/g)**
Group 1 **Radium, Thorium, and Transuranics:** **Po-210, Pb-210, Ra-226, Ra-228, Th-228, Th-230, Th-232, Np-237, Pu-239, Pu-240, Am-241, Cm-244 and associated decay chains[4], and others[1]**	0.1	600	3
Group 2 **Uranium and Selected High Dose Beta-Gamma Emitters:** **Na-22, Mn-54, Co-58, Co-60, Zn-65, Sr-90, Nb-94, Ru-106, Ag-110m, Sb-124, Cs-134, Cs-137, Eu-152, Eu-154, Ir-192, U-234, U-235, U-238, Natural Uranium[5], and others[1]**	1	6,000	30
Group 3 **General Beta-Gamma Emitters:** **Na-24, Cl-36, Fe-59, Cd-109, I-131, I-129, Ce-144, Au-198, Pu-241, and others[1]**	10	60,000	300
Group 4 **Other Beta-Gamma Emitters:** **H-3, C-14, P-32, S-35, Ca-45, Cr-51, Fe-55, Ni-63, Sr-89, Tc-99, In-111,** **I-125, Pm-147, and others[1]**	100	600,000	3,000

1) To determine the specific group for radionuclides not shown, a comparison of the effective dose factors, by exposure pathway, listed in Table A.1 of National Council on Radiation Protection and Measurements (NCRP) Report No. 123 (NCRP 1996) for the radionuclides in question and the radionuclides in the general groups above shall be performed and a determination of the proper group made, based on similarity of the factors.
2) Rounded to one significant figure.
3) The screening levels shown are used for either surface activity concentration (in units of Bq/cm^2), or volume activity concentration (in units of Bq/g). These groupings were determined based on similarity of the scenario modeling results, as described in Annex B of ANSI N13.12
4) For decay chains, the screening levels represent the total activity (that is, the activity of the parent plus the activity of all progeny) present.
5) Where the natural uranium activity equals 48.9 percent from U-238, plus 48.9 percent from U-234, plus 2.25 percent from U-235.

Note: Radionuclides were assigned to groups that were protective of 10 μSv/y (1.0 mrem/y) and were limited to four groups for ease of application, as discussed in Annex B of ANSI N13.12.

The gamma scan survey and integrated alpha/beta activity scan survey are intended to locate areas of elevated activity warranting additional biased static measurements/swipe tests, as determined by the Project Certified Health Physicist (Project CHP).

2.2 Study Boundaries

The boundaries of the study will include:

- Accessible slab floor surface of deconstructed buildings.
- Intact building surfaces or any other remaining structures associated with the building.
- Soils surrounding the footer of each building for a distance outward 15 feet.
- Because the extent to the contaminated soil beneath the buildings has not been fully delineated, a depth of 12 feet below ground surface will be assumed.

3 Survey Design

The sodium-iodide gamma survey will be performed as an initial step. Although normally reserved for outdoor MARSSIM surveys, this feature was added to address stakeholder concerns and determine if any larger previously unidentified deposits of elevated residual radioactivity are present that might not otherwise be detectable due to floor surface conditions-coverings.

Unbiased locations for each building survey unit will be determined using a triangular systematic grid pattern with a random starting point. The building floor and surrounding soil survey units will be optimized to maximize sample effort. Per MARSSIM a Class 2 survey units of concrete surfaces can be up to 1,000 m^2 and soil surfaces up to 10,000 m^2. During sample placement, the buildings' slab(s) will be divided into approximately 1,000 m^2 large survey units. The soil surrounding the building footprint will be a separate survey unit up to 10,000 m^2. Each survey unit will have 11 systematic sample locations assigned for consistency with the existing final status survey plan (PLN-5508; USACE 2020a).

If an unbiased location occurs in an inaccessible area, the survey team will collect the measurements at an alternate random location from within the survey unit to ensure that the minimum required measurements are obtained.

3.1 Sampling

Residual radioactivity, beryllium, or lead contamination on or embedded within the immediate surfaces of the slab within a building or in the soils surrounding or below the building will be determined as follows:

- 100% gamma survey of readily accessible building areas using portable sodium-iodide detectors to identify any potential deposits of volumetric residual radioactivity otherwise attenuated from detection using alpha-beta surface scan survey instruments.

- Collection of unbiased swipes at floor surface locations to assess removable radioactivity and/or beryllium and lead contamination within each survey unit.
- Collection of swipes on floor surfaces at biased locations to follow-up unexplained abnormally elevated readings identified from gamma surveys.
- Penetration of the slab using augers or air rotary methods to collect volumetric soil samples of subsurface soils for 12 feet below grade surface. The collection of soil from the soil bores under the building will confirm scanning results and assess potential deposits of beryllium or lead.

3.2 Gamma Survey

Gamma scan surveys will be performed over all accessible floor surfaces throughout the footprint of buildings using a Ludlum 44-20 sodium iodide detector (or equivalent paired) to a Ludlum model 2221 scaler/ratemeter. The survey will be performed following MARSSIM (MARSSIM 2000) protocol by walking straight parallel lines at a speed of 0.5 meters per second over an area with the detector kept a fixed distance from the floor. Survey passes will be approximately 1 meter apart. Data from the scaler/ratemeter will be automatically logged. Gamma raw measurement data will be plotted for visual review and evaluation, and to identify anomalies in the distribution of measurement data. The average and standard deviation of the entire dataset will be calculated, and the locations of the highest activity measurement will be identified.

3.3 Unbiased Measurement Locations

Surface swipe samples will be performed at each location for radiological activity and beryllium. Prior to sampling, the survey location will be brushed to remove loose surface dirt.

- Clean and dry filter paper will be lightly wiped across an area approximately 100 cm^2 area in an "S" like pattern. The filters will be sent to the on-site laboratory for gross alpha and gross beta analysis.
- Measurements for removable beryllium are made using a pre-moistened surface sample medium wiped with moderate pressure in an "S" pattern, over a surface area of 100 cm^2. The surface samples are analyzed for lead and beryllium via optical fluorescence with a BeFinder® detector or inductively coupled plasma mass spectrometer.

3.4 Biased Measurement Locations

Biased measurement locations will be assigned by the Project CHP and based upon the results from the gamma survey or other empirical evidence. Surface swipes will be performed at each biased sample location.

- Clean and dry filter paper will be lightly wiped across an area approximately 100 cm^2 area in an "S" like pattern. The filters will be sent to the onsite laboratory for gross alpha and gross beta analysis.

- Measurements for removable beryllium are made using a pre-moistened surface sample medium wiped with moderate pressure in an "S" pattern, over a surface area of 100 cm^2. The surface samples are analyzed for lead and beryllium via optical fluorescence with a BeFinder® detector or inductively coupled plasma mass spectrometer.

3.5 Subsurface Soil Locations

Unbiased measurement locations will be assigned throughout the building floor based upon a systematic survey design. Using an auger or air rotary bit, the concrete slab will be penetrated to the soil beneath. If rebar is encountered or the slab is thicker than anticipated, the location may be adjusted. A volumetric sample of the concrete will be collected for radiological, beryllium, and lead analyses. Once the slab is penetrated, a continuous soil sample will be collected from the soils beneath the slab to a termination depth of 12 feet below grade surface. Generally, a single sample will be sent to the laboratory for beryllium or lead analyses; however, this approach may be adjusted if the soil shows evidence of multiple areas of interest.

4 Site Preparation

Areas are considered accessible for survey only if all potentially hazardous conditions in the work area are adequately evaluated and addressed, permitting safe personnel access. Areas occupied by items that require greater effort to move will be deemed inaccessible areas. Prior to surveys, dirt and surface debris should be removed as much as possible.

5 References

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