DOE/RL-2007-32
Revision 0

Field Implementation Work Plan for the Photographic Characterization of the 216-Z-9 Trench by Cameras and Crawler

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

United States
Department of Energy
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TERMS

AEA	Atomic Energy Act of 1954
ALARA	As Low As Reasonably Achievable
ARAR	Applicable, or Relevant and Appropriate Requirement
BACT	Best Available Control Technology
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CGI	Combustible Gas Indicator
CSER	Criticality Safety Evaluation Report
D&D	Decontamination and Decommissioning
DQO	Data Quality Objective
DOE	U.S. Department of Energy
DOE/RL	U.S. Department of Energy, Richland Operations Office
EJTA	Employee Job Task Analysis
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FH	Fluor Hanford, Inc.
GM	Geiger-Mueller
HAMMER	Hazardous Materials Management and Emergency Response
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High-Efficiency Particulate Air
LEL	Lower Explosive Limit
LIGO	Laser Interferometer Gravitational Wave Observatory
LLMW	Low-level Mixed Waste
LLW	Low-Level Waste
MEI	Maximally Exposed Individual
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PAM	Portable Alpha Meter
PFP	Plutonium Finishing Plant
PID	Photo Ionization Detector
PNNL	Pacific Northwest National Laboratory
PTE	Potential To Emit

QA	Quality Assurance
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RACT	Reasonably Available Control Technology
RCT	Radiological Control Technician
RWP	Radiological Work Permit
SSHO	Site Safety and Health Official
TAP	Toxic Air Pollutant
TRU	Transuranic
WAC	Washington Administrative Code
WCP	Work Control Package
WMP	Waste Management Plan

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerels	0.027	picocuries

1.0 INTRODUCTION

The 216-Z-9 Trench, located approximately 500 feet east of the Plutonium Finishing Plant (PFP), received approximately one million gallons of process waste liquids from the recovery of uranium and plutonium by extraction (RECUPLEX) process at PFP over the period of 1955 to 1962. The 216-Z-9 Trench is a 6.4-m (21-ft) deep underground disposal facility for liquid effluent with an enclosed cavern. A 23-cm (9-in) thick concrete slab measuring 27.4 m x 36.6 m (90 ft x 120 ft) covers the 216-Z-9 Trench. The trench is sloped inward towards its bottom and is approximately 9 m x 18 m (30 ft x 60 ft) at the floor (Figure 1). Because of the corrosive nature of the waste, the underside of the concrete slab was covered with acid-resistant tiles and the columns were protected with vitreous clay pipe; the floor of the trench is soil.

The process wastewater entering the 216-Z-9 Trench contained significant amounts of plutonium along with a variety of organic and inorganic constituents; the waste in general was fairly acidic. U.S. Department of Energy, Richland Operations (DOE/RL) installed equipment and mined soil from the floor of the trench to reduce the plutonium inventory over the period from August 1976 to July of 1978. An estimated quantity of approximately 30 to 50 kg of plutonium remains in the trench.

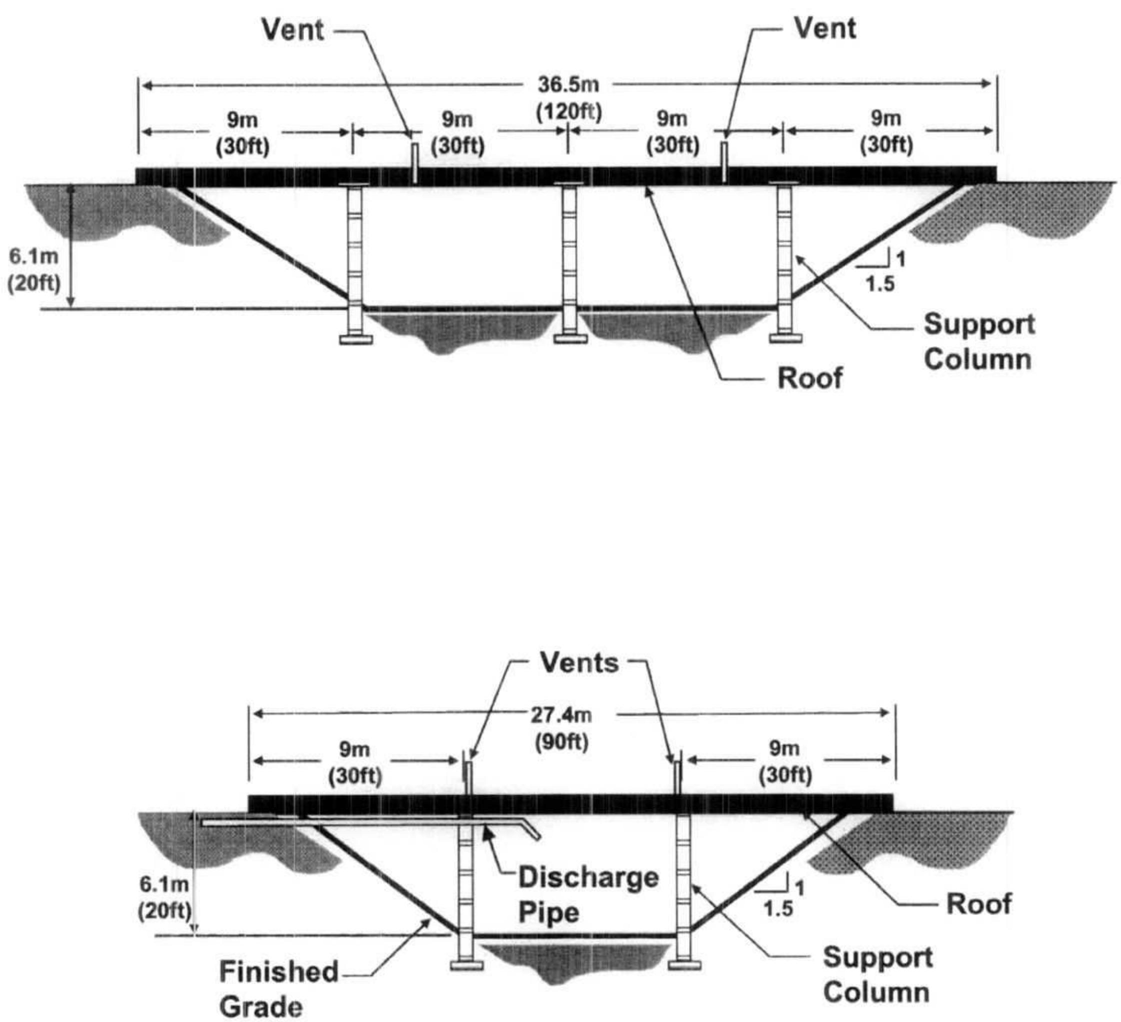
As part of the mining operation, three structures were installed to support these activities: 216-Z-9A, the Contaminated Soil Removal Building; 216-Z-9B, the Operator's Cubicle; and 216-Z-9C, the Mining Apparatus Enclosure. The removal of these structures was included in the scope of the *Action Memorandum for the Plutonium Finishing Plant Above-Grade Structures Non-Time Critical Removal Action* (DOE/RL-2005-13). DOE/RL, through Fluor Hanford (FH) is currently developing an approach to remove the above-grade structures and the mining equipment from the trench.

The concrete barrier over the top of the trench provides containment to prevent the aerial dispersal of radionuclide-contaminated soil. Containment is required until a final remedy is identified for the remaining soil contamination. DOE/RL is concerned that the moist, acidic environment within the trench may have affected the integrity of the concrete cover such that it may not have the structural integrity required to last until a final remedy can be implemented. Because the conditions in the trench cause concerns over personnel entry into the trench, DOE/RL is planning to insert a crawler with a camera through an existing 20-inch riser onto the floor of the 216-Z-9 Trench, as well as fixed-position camera. The cameras will be used to inspect the sub-grade portions of the concrete slab that covers the trench, as well as the supporting structure and soil mining equipment present in the trench. The resulting images will support a structural evaluation of the slab, an evaluation of the condition and options for removal of the mining equipment, and identification of conditions within the trench that could affect a manned entry if required.

The characterization and remediation of the soil and vadose zone contamination resulting from the disposal of liquid wastes to the 216-Z-9 Trench is being performed under the 200-PW-1 Operable Unit (OU); the U.S. Environmental Protection Agency (EPA) is the lead regulator for the 200-PW-1 OU. As noted above, DOE/RL is conducting the deactivation and demolition of the structures and mining equipment under their removal authority, using the action memorandum (DOE/RL-2005-13). The action memorandum includes authority, as necessary, for some stabilization of the crib until remedial activities for the crib can occur. Because of the overlap between the activities involving the 200-PW-1 OU site investigation and the D&D activities under the action memorandum, DOE/RL will coordinate the planning and work plan development for this project with EPA.

The following sections of this document describe the project scope (Section 2.0), quality assurance program including project organization (Section 3.0), and activities to ensure protection of human health and the environment (Section 4.0).

Figure 1-1. As-Built Section Views of the 216-Z-9 Trench.



2.0 SCOPE

Pursuant to the PFP Above Grade Action Memorandum (DOE/RL-2005-13), DOE/RL intends to gather information that will be used to support an evaluation of the structural condition of the concrete slab covering the 216-Z-9 Trench, the mining equipment within the trench to support the planning of its removal, and conditions within the trench, particularly conditions that would affect manned entry. The *Plutonium Finishing Plant (PFP) Complex End Point Criteria* (NMS-16404) document, submitted as a transition phase requirement of the Tri-Party Agreement, states that the 216-Z-9A, B, and C Building structures will be removed as well as the mining equipment in the trench. The removal of the mining equipment will depend on practicability, primarily associated with the ability of the trench cover slab to sustain the associated loads. The most practical method to obtain this information on the cover slab is to deploy a remote-controlled device with camera into the trench. Figure 2-1 provides an overview of the approach that will be used to deploy the crawler and cameras.

Pacific Northwest National Laboratories (PNNL) has been contracted by FH to provide a remote-controlled crawler that is mounted with a digital camera and lights (Figure 2-2), which is capable of obtaining high-resolution photographs within the trench. The crawler will be lowered into the trench through an existing, 20-inch diameter riser in the concrete cover. In addition, a second camera will be mounted on struts installed on the interior of an extension attached above the existing riser and extending approximately 10 feet into the trench. The camera will be used to monitor the progress and location of the crawler, as well as to provide additional photographs from a fixed location. The crawler and cameras will be controlled remotely using a laptop computer connected to the crawler and overview camera by means of multi-pin connections incorporated into a new riser cover.

The riser extension, crawler, and camera will be installed in the trench from within a containment structure emplaced over the top of the existing riser. The interior and exterior of the riser will be decontaminated, along with the interior of the containment structure, before the containment is removed. Any waste that is generated will be properly managed and disposed of according to the provisions of the Waste Management Plan (WMP) in Section 4.1 of this work plan.

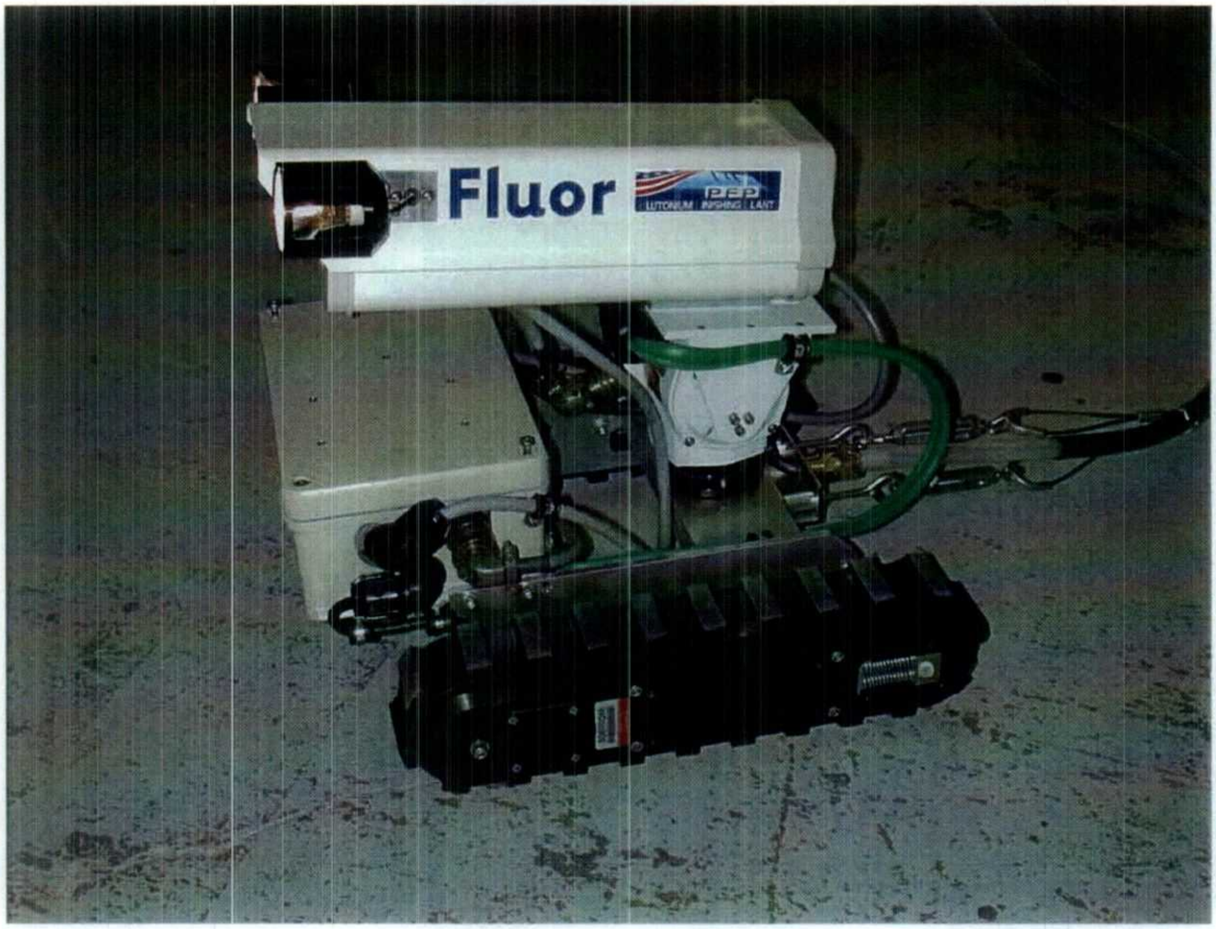
The crawler will traverse the floor of the trench on a pair of two-inch wide tracks. It will stop at set intervals to collect images of the underside of the concrete cover. The camera can obtain an image of the underside of the slab approximately 30 feet across from each location on the trench floor. Special attention will be given to gathering images that will allow characterization of the condition of the concrete, including the presence and condition of the acid-resistant tiles that were installed on the lower side of the slab to discourage corrosion, as well as the presence of cracks, spalling, or other signs of deterioration. This evaluation will also include the concrete support columns, their covering, and support pads. Images also will be collected to allow an evaluation of the condition of mining equipment to evaluate its condition and options for its removal, and conditions in the trench that must be factored into any decision related to manned entry. It is currently anticipated that the crawler and overview camera will remain in the trench at the conclusion of this data gathering activity in order to ensure their availability to support future information gathering at this location.

To allow the approval process to proceed, a second FH document with an HNF number was created, (HNF-33970).

Figure 2-1. Overview of The Approach That Will Be Used To Deploy The Crawler and Cameras.

The existing cover plate/lid on the north, 20-inch riser that penetrates the concrete slab over the 216-Z-9 Trench (see below) will be removed within a contamination sleeve and replaced with a temporary lid; the original cover plate will be removed and properly disposed of, and a containment structure installed (see Figure 4-2). After containment is in place, the temporary lid will be removed and an extension will be attached to the existing riser. A remote-controlled crawler (robot) equipped with a camera will be sealed into the containment structure, then lowered into the cavern. The crawler will enable the camera to be deployed throughout the cavern to photograph the underside and supporting structures of the slab, as well as the mining equipment. A second camera will be inserted through the riser to monitor the movement of the crawler, as well as to collect additional pictures of conditions beneath the slab. A lid that has been fitted with sealed penetrations for the camera and crawler controls will be installed. The containment structure will be decontaminated and removed. The controls for the camera and crawler will then be connected and the equipment activated.

Figure 2-2. Crawler with Camera Attached



3.0 QUALITY ASSURANCE PROJECT PLAN

The Quality Assurance Project Plan (QAPjP) documents the planning, implementation, and assessment procedures to support the implementation of specific quality assurance (QA) and quality control (QC) activities for a particular project.

The purpose of the Transition 216-Z-9 Project is to perform decommissioning and demolition of the above-grade structures of the 216-Z-9 Facility. Prior to this removal activity, DOE/RL plans to inspect the interior of the trench using a remote-controlled crawler (i.e., robot) mounted with a high-resolution camera to obtain images of the interior surfaces of the trench and its contents.

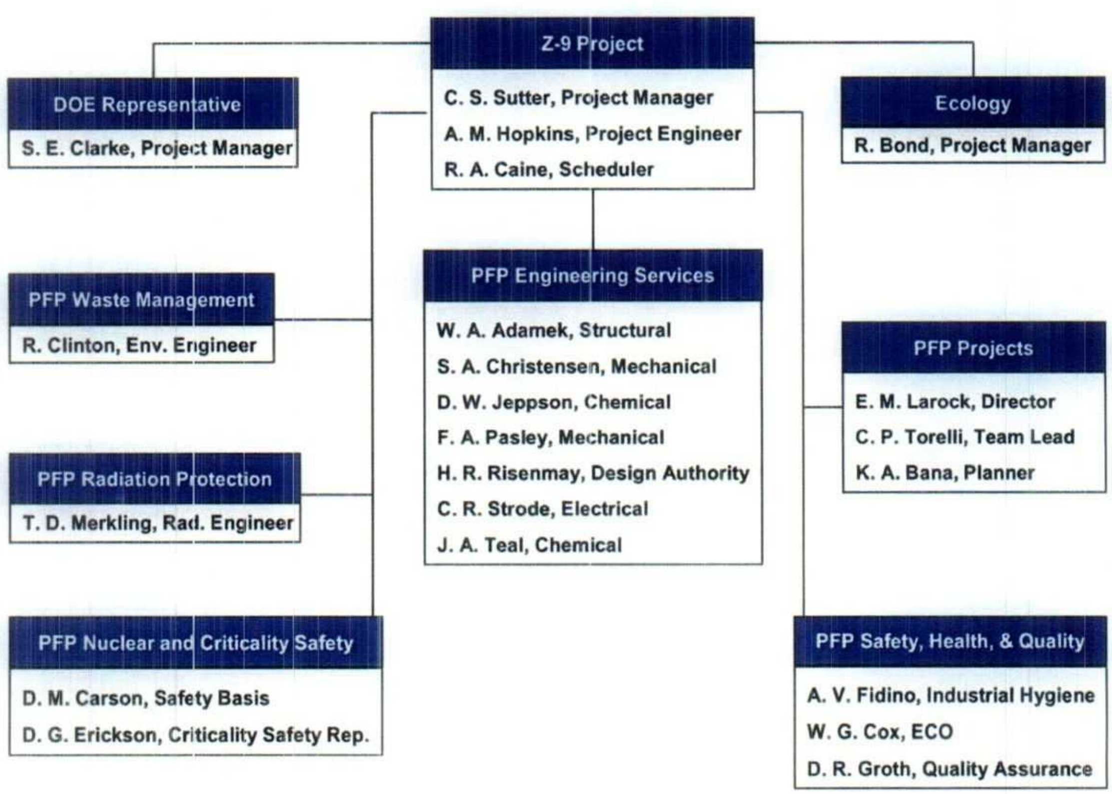
3.1 PROJECT MANAGEMENT

The following sections discuss the project/task organizational structure within the Plutonium Finishing Plan (PFP) project and the responsibilities of the various organizations.

3.1.1 Project and Task Organization

The PFP Project Manager shall be responsible for the deployment and operation of the equipment with the support of PFP Waste Management, Project Team Lead, Project Engineer, Field Sampling Staff, and Sample Data Management. The project/task organization for the D&D of the Transition 216-Z-9 Project is shown in Figure 3-1.

Figure 3-1. Project Organization Chart.



3.1.2 Roles and Responsibilities

This section identifies the relevant responsibilities of various organizations supporting the 216-Z-9 facilities and mining equipment characterization, and the deployment of the crawler and cameras, specifically.

<u>Z-9 Project Manager and Project Engineer</u>

- Prepare the characterization plan
- Oversee deployment of equipment
- Prepare the final characterization report.

<u>PFP Engineering Services</u>

- Support data collection for structural evaluation
- Provide technical evaluation of data for structural integrity.

<u>Field Sampling Personnel</u>

- Support/conduct deployment of equipment
- Document photography activities in a controlled logbook

<u>PFP Projects</u>

- Prepare work packages
- Conduct and document pre-job meetings
- Provide field support
- Provide coordination with other site organizations (Radiation Control, Safety, etc.) to support the sample team.

<u>PFP Safety, Health, & Quality</u>

- Provide industrial safety support and monitoring for the characterization team
- Provide the approved Activity Hazard Analysis
- Conduct random surveillances to verify compliance with requirements of this plan.

NOTE: The personal protective equipment to be worn during characterization shall be listed on the job-specific Activity Hazard Analysis and Radiation Work Permit, as required.

<u>PFP Radiation Protection</u>

- Provide radiation control coverage
- Recommend as low as reasonably achievable (ALARA) actions where necessary
- Provide the radiological work permit(s)
- Conduct radiological surveys.

Environmental Compliance Officer

The Environmental Compliance Officer also is "matrixed" to the PFP Task Lead and provides technical oversight, guidance, and concurrence on project and subcontracted environmental work, and develops appropriate mitigation measures with a goal of minimizing adverse environmental impacts. The Environmental Compliance Officer or designee also reviews plans, procedures and technical documents to ensure that all environmental requirements have been addressed, identifies environmental issues that affect operations, and may, at the discretion of the project manager, respond to environmental and regulatory issues or concerns raised by DOE and/or regulatory agency staff.

3.2 QUALITY OBJECTIVES AND CRITERIA

A Data Quality Objective (DQO) process was conducted to support data collection for the removal of the 216-Z-9 structures and equipment in accordance with the *Guidance for Data Quality Assessment, EPA QA/G-9* (EPA 1994). The results of the DQO process are documented in the *216-Z-9 Soil Removal Structures Supplement to the Data Quality Objectives for the Plutonium Finishing Plant Above-Grade Structures* (HNF-32545). Members of the Decontamination and Decommissioning (D&D) Project and Management teams provided input to the DQO process. The DQO and subsequent SAP, including QAPjP, are documented as HNF-33138. Key to the evaluation of structural concerns is the collection of visual data to support analysis of the slab itself (concrete and rebar), as well as the concrete support columns for the slab.

The QA objective of this plan is to develop implementation guidance that will provide data (i.e., a photographic record) of known and appropriate quality. Data quality for this aspect of the site investigation is dictated by the ability to obtain pictures of the interior of the cavern, including clear, high resolution photographs that will allow a qualitative assessment of the following features:

- The presence and condition of acid resistant tiles on the bottom surface of the slab;
- The condition of exposed concrete surfaces of the slab (i.e., presence of spalling, exposed rebar, cracks, etc.);
- The condition of the concrete support columns and the vitrified pipe cover;
- The condition of the soil mining equipment, including but not limited to the amount of soil residue, deterioration of hydraulic hoses, position of the equipment in the trench; and
- The overall stability of side slopes, particularly at the interface with the footings for the slab.

The following considerations are anticipated to impact the ability to achieve these goals:

- Access to locations within the trench that will allow observation and photographs of the key structural components;
- Adequate lighting to highlight details required to support evaluation;
- Sufficient resolution from the photographic equipment to capture the details for analysis by structural engineers; and
- The ability to identify the locations of the images captured by the camera.

3.3 SPECIAL TRAINING REQUIREMENTS/CERTIFICATIONS

Typical training or certification requirements that have been instituted by the FH Management Team are described in the *PFP Training and Administration Manual, D&D Training Plan*, FSP-PFP-1121, Chapter 24, (FSP-PFP-1121[24], 2006). The environmental safety and health training program also provides workers with the knowledge and skills necessary to safely execute assigned duties. A graded approach is used to ensure that workers receive a level of training commensurate with their responsibilities that complies with applicable DOE orders and government regulations. Specialized employee training includes pre-job briefings, on-the-job training, emergency preparedness, plan of the day, and facility/work site orientations which include all members of the PFP Building Emergency Response Organization.

Personnel who will be involved with the crawler and camera deployment in the field will be required to have documented, current, 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training, as well as participate in the mock up activity at the HAMMER facility.

3.4 DOCUMENTATION AND RECORDS

The following section describes the records that will be maintained to document the information gathered through this investigation.

3.4.1 Documentation for Field Survey Instrumentation

Approved work control packages and procedures will be utilized to document radiological measurements when implementing this work plan. Examples of the types of documentation for field survey instruction that will be used by PFP personnel performing work include:

- Instructions regarding the minimum requirements for documenting radiation and contamination surveys and air sampling surveys per *Occupational Radiation Protection*, Code of Federal Regulations, as amended (10 CFR 835);
- Instructions for managing the identification, creation, review, approval, storage, transfer, and retrieval of FH radiological records;
- The minimum standards and practices necessary for preparing, performing, and retaining radiological related records;
- The requirements associated with preparing and transporting regulated material (e.g., contaminated riser cover) on the Hanford Site; and
- Additional information regarding the collection of radiological health and safety data during the installation of the crawler and cameras can be found in the *216-Z-9 Soil Removal Structures and Equipment Sampling and Analysis Plan* (HNF-33138).

3.4.2 Documentation for Deployment of Crawler and Cameras

Approved work instructions will be used to direct and document the deployment and operations of the crawler and cameras within the 216-Z-9 Trench. The types of documentation that will be used by PFP and/or subcontractor personnel include:

- Instructions for installation of the crawler and cameras through the riser and into the trench, including installation of containment, removal of riser cover, inserting equipment, connection of controls, and installation of new riser cover;
- Instructions for testing the crawler and cameras; and

- Instructions for recording the images collected, including location of image, location of crawler, magnification used, resolution of image, date of image.

3.4.3 Collection and Storage of Photographic Images

Images will be captured by the remotely-operated camera(s) in the trench and transferred to the control laptop computer, which will be connected to the camera(s) via the multi-pin connector in the riser lid. Images will be stored on the laptop as they are acquired and transferred to an external hard drive for processing and backup. Manual back up to the external hard drive will take place at the end of each work day. The external hard drive will be transferred to PNNL at the end of the day for processing, where a secondary backup will take place.

3.5 MEASUREMENT/DATA ACQUISITION

The following sections present the requirements for crawler placement and image collection. This section also addresses the requirements for instrument calibration and maintenance, supply inspections, and data management.

3.5.1 Image Collection Methods/Requirements

There are two imaging systems; namely, the overview camera system which will be at a fixed location about fifteen feet below the riser, and the crawler-based camera which will be able to move about on the floor of the crib. The two cameras, including the lenses, are the same; only the deployment methods are different.

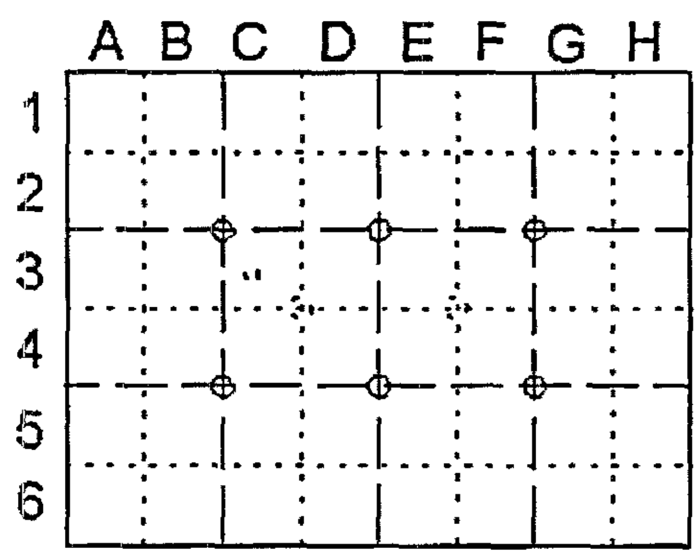
The cameras have zoom lenses to provide the option of close up images or wider fields of view. The overview camera can point in almost any direction except straight down at the crib floor. The crawler based camera has less range of motion, but can be pointed at any orientation inside of a quarter sphere. The boundaries of this quarter sphere are above the horizontal plane of the treads and in front of a vertical plane normal to the long axis of the crawler.

There are two modes of capturing images. One mode of operation is for the operator to point the camera using the control computer and take individual pictures of locations of interest. In this mode, the user inputs an individual image name for each image that is collected manually. The second mode of operation is for a series of overlapping images to be taken automatically. In this mode, the operator initiates the image collection, but the computer points the camera and collects the images. The images are assembled in a pre-programmed grid pattern that will create a set of files. Images will start at the top left of the frame and move to the bottom right. The timestamp will be used to sequence the files. At the end of the grid collection, the operator will manually move those files to a directory in the control laptop computer that will be named by the operator (e.g., West wall). Once the images from that segment are transferred, another set may be taken. Each camera stores data in its own directory within the laptop computer to separate the images collected with the crawler from the ones from the overview camera.

For the crawler-based camera, images taken in automatic mode will be primarily of the underside of the crib slab. The intent is to move the crawler to a location that provides a view of a particular section of the slab and take a series of pictures that cover an area at least 15 by 30 feet. It is very likely that features of the crib will be included in each series of pictures. Such features would include the columns, stairs, operator cubicle, clam shell, etc. The location and orientation of the crawler will be mapped on a grid, superimposed on the footprint of the trench (Figure 3-2) in order to accurately establish the location and subject of the images. The orientation and location can be determined from the overview camera or by an operator in the cubicle.

Figure 3-2. Location and Orientation of Crawler Grid

The grid system shown below will locate where the crawler is in the crib. North is to the left. The six columns are shown; these are thirty feet on center. The crib is broken into fifteen foot squares. Using a row and column designation will allow the project to establish the crawler location to within four or five feet. The software will store an eight digit code with the pictures. A code of C3SW0001, for example, would be a picture taken somewhere near the entry riser and with the crawler pointing generally toward the operator console. The pan and tilt angles are stored with the pictures as well. For the overview camera, just the pan and tilt information is stored to determine the pointing direction.



3.5.2 Image Storage and Custody Requirements

The primary concern to be addressed in this section is the tracking of image locations and numbers from data collection to reporting of the data. Without a clear information trail, data are not useful for supporting structural evaluation. Operators will use the date stamps from the images collected by the fixed and mobile cameras to establish a location. This information will be supplemented by a log of the crawler location, described in previous section 3.5.1, to establish the specific location of images that are collected.

3.5.3 Radiological Surveys

Alpha and beta/gamma surveys will be used to support the characterization activities as described in this work plan. Radiological surveys of the interior and exterior of the riser shall be conducted and reported prior to and subsequent to equipment installation. The following information will be disseminated to personnel performing work in support of this work instruction, as appropriate:

- Information regarding the Geiger-Mueller (GM) portable survey instrument, to include a physical description of the GM, radiation and energy response characteristics, calibration/maintenance and performance testing descriptions, and the application/operation of the instrument. The GM survey instrument is the most commonly used beta/gamma instrument on the Hanford Site utilized when performing removable surface contamination measurements and direct measurements of the total surface contamination.

- Information regarding the Portable Alpha Meter (PAM), to include a physical description of the PAM, radiation and energy response characteristics, calibration/maintenance and performance testing descriptions, and the application/operation of the instrument. The PAM survey instrument is the most commonly used alpha instrument on the Hanford Site utilized when performing removable surface contamination measurements and direct measurements of the total surface contamination.

3.6 QUALITY CONTROL REQUIREMENTS

This characterization effort relies on the collection of high-resolution images taken in sufficient light that details can be magnified to allow a qualified evaluation of structural components.

3.6.1 Quality Control Measures

The QC measures taken to support field operations performance are described below. FH conducted a dry-run of the installation at the Hazardous Materials Management and Emergency Response (HAMMER) Facility prior to deploying the crawler and cameras at the 216-Z-9 Trench. The crawler and cameras were checked as follows:

- Crawler: A simple functional check was made which included verifying that the motors operate properly, the pan tilt operates and is free from obstructions, and the camera zoom, focus, and iris operate appropriately.
- Cameras: A simple functional check was made prior to the system being deployed. This included verifying that the pan tilt operates and is free from obstructions, and the camera zoom, focus, and iris operate appropriately. A functional check was also made on the camera itself to ensure that images are being captured correctly.

3.6.2 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

This is essentially a one time deployment for the crawler and cameras. It is anticipated that over the period of a few days the cameras will gather as much information as practical to support the assessment of the slab integrity and other conditions on the trench. The systems will not be removed from the crib as part of this activity, unless necessary to perform minor corrective maintenance within the transfer glove bag at the 20-inch riser. The camera systems will remain installed in the crib, but there is no requirement for long-term operability. Although the cameras may be operable for a much longer period of time, they are not designed for preventative maintenance due to the nature of their environment.

3.6.3 Instrument Calibration and Frequency

Instrumentation calibration and frequency applies to both field and laboratory instrumentation.

Equipment used shall be calibrated in accordance with the requirements applicable to the instrumentation program that governs the instrument specific operation, which includes the frequency of calibration. This process applies primarily to field equipment that will be used to monitor ambient conditions to support health and safety concerns.

3.6.4 Field Documentation

Field documentation shall be kept as discussed in Section 3.4.

3.7 ASSESSMENT/OVERSIGHT

3.7.1 Assessments and Response Actions

There are multiple QA organizations involved in the oversight of activities discussed in this document. These organizations include the PFP field activities organization and the FH Central QA organization. Assessments are scheduled and completed as required by FH procedures and as described in the organization's QA program.

3.7.2 Reports to Management

Deficiencies identified by these assessments shall be reported in accordance with existing programmatic requirements. The Central FH QA group coordinates the corrective actions/deficiencies in accordance with the FH QA Program. Routine evaluation of data quality described for this project will be documented and filed along with the data in the project file.

4.0 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The following sections discuss the various programs that will be implemented to ensure the protection of human health and the environment during the deployment of this equipment.

4.1 WASTE MANAGEMENT

The PFP Waste Management organization will provide waste management services for the overall Transition 216-Z-9 Project removal activities, and for the deployment of the crawler and cameras through the 20-inch riser, specifically.

Only limited waste streams are anticipated as part of the riser opening and deployment of the equipment. The majority of this waste will be in a solid form and will designate as low-level waste (LLW). Waste management activities will be consistent with the applicable, or relevant and appropriate requirements (ARARs) identified in the *Action Memorandum for the Plutonium Finishing Plant Above-Grade Structures Non-Time Critical Removal Action* (DOE/RL-2005-13) and the *PFP Waste Management Plan* (DOE/RL-2005-16). Anticipated waste forms include: the existing riser cover, personnel protective clothing and equipment, and decontamination rags/wipes.

Waste generated as part of the deployment of the crawler and cameras and that meets the Environmental Restoration Disposal Facility (ERDF) waste acceptance criteria will be disposed to the ERDF. Alternative locations will be considered for waste disposal as necessary.

4.1.1 Waste Characterization and Designation

The waste characterization requirements to support the overall above-grade removal action were developed as part of a DQO process, *216-Z-9 Soil Removal Structure Supplement to the Data Quality Objectives for the Plutonium Finishing Plant Above-Grade Structures,* (HNF-32545, 2007). Waste will be characterized in accordance with the internal work requirements and processes, the requirements of the receiving facility, and the approved SAP (HNF-33138). Characterization will be conducted through process knowledge, sampling and analysis, and radiological surveys, as appropriate.

4.1.2 Waste Minimization and Recycling

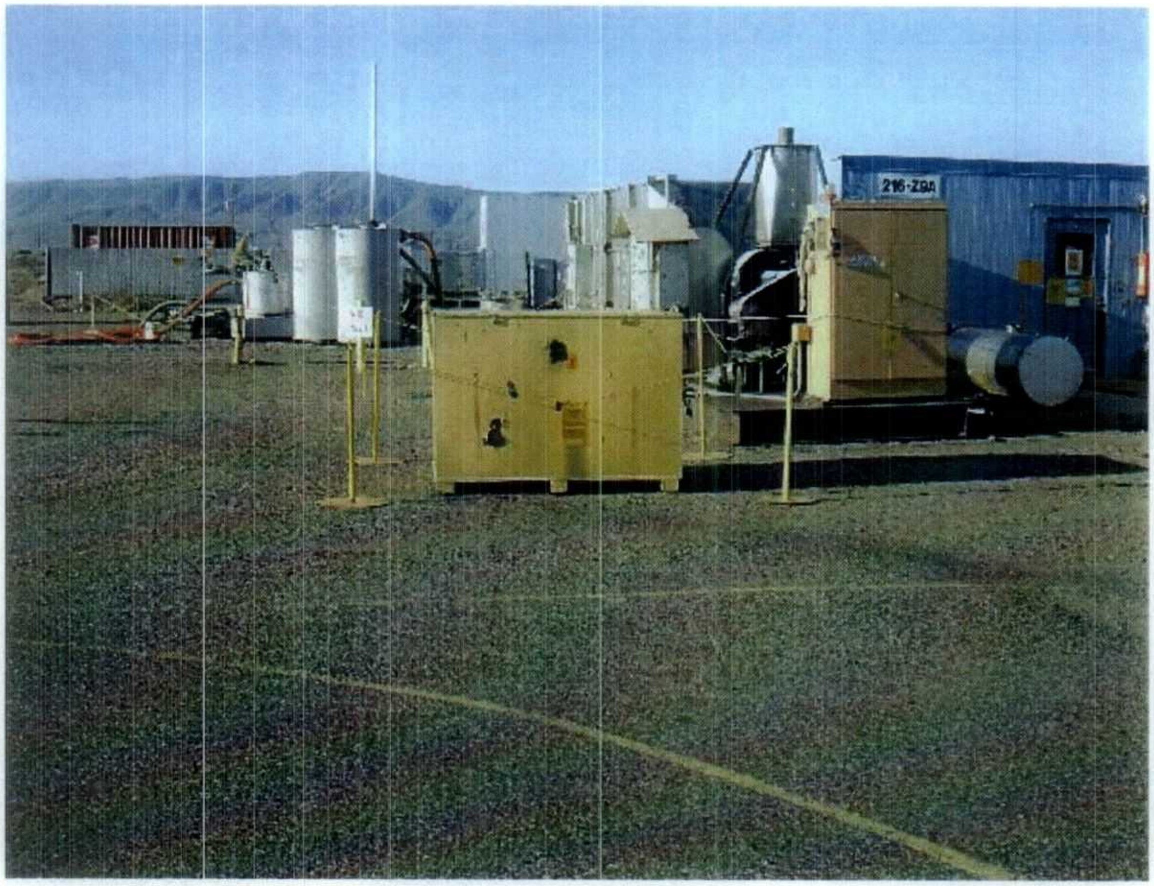
Waste generation will be kept to a minimum through waste separation and recycling. Waste will be segregated at the work site as it is generated, which will minimize the volume of regulated waste. Waste will be segregated into the following categories, as appropriate: Transuranic (TRU), TRU mixed, LLW, low-level mixed waste (LLMW), dangerous, and non-regulated/non-dangerous to ensure that all wastes are managed according to the most appropriate, applicable procedures.

4.1.3 Waste Handling, Packaging and Storage

Waste handling internal work requirements and processes, including containerizing and inspecting, will meet the requirements of CERCLA and the waste acceptance criteria of the disposal facility, as appropriate.

The PFP Waste Management Organization will arrange and manage shipping and disposal. Waste generated as part of the deployment of the inspection equipment in most cases will be consolidated at the existing *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) waste storage location, located near the 216-Z-9A Building (Figure 4-1). In some circumstances, waste may be moved and consolidated at the 212-Z PFP lag storage/CERCLA Waste Management Staging Area located northeast of PFP outside of the secure area.

Figure 4-1. 216-Z-9 Waste Storage Site



4.1.4 Waste Treatment

Waste that is prohibited from ERDF and that requires treatment will be managed by PFP and treated to meet the applicable acceptance criteria prior to disposal, or sent to a permitted TSD for appropriate disposition.

4.1.5 Waste Transportation and shipping

All shipments to off-site treatment disposal facilities will be made in accordance with U.S. *Department of Transportation Hazardous Materials Regulations,* (49 CFR 171-179), a DOE-approved transportation document, applicable sections of Washington Administrative Code (WAC), *Dangerous Waste Regulations* (WAC 173-303), and/or waste transportation internal work requirements and processes.

4.1.6 Waste Management Strategy

All waste will eventually be shipped to ERDF for disposal; no TRU waste is anticipated as part of the deployment activity. Each waste stream will require management to achieve specific packaging and disposal criteria; each waste stream is defined and discussed in the *Plutonium Finishing Plant Above-Grade Structures Waste Management Plan* (WMP), (DOE/RL-2005-16).

4.1.7 Release of Property

Given the limited nature of this activity and the materials that will be managed, it is not anticipated that any waste will be generated that will be suitable for offsite disposal, reuse, or release.

4.2 AIR MONITORING AND CONTROLS

Substantive requirements for air pollutant emissions, controls, and monitoring are derived from regulations promulgated under the federal Clean Air Act of 1990 and Amendments (42 USC 7401 et seq.), and the Washington Clean Air Act (RCW 70.94). The federal and delegated state implementing regulations addressing the *National Emission Standards for Hazardous Air Pollutants* Subpart H (40 CFR Part 61) require that the combined radionuclide airborne emissions from the U.S. DOE Hanford Site shall be controlled so as not to exceed amounts that would cause an exposure to any member of the public of greater than 10 millirem per year (mrem/yr) effective dose equivalent. The same regulations address point sources (i.e., stacks or vents) emitting radioactive airborne emissions, requiring monitoring of any such sources with a major potential for radioactive airborne emissions (i.e., those with a potential to provide greater than 0.1 mrem/yr effective dose equivalent to the maximum public receptor), and requiring periodic confirmatory measurement of any lesser source emissions, sufficient to verify low emissions.

Handling radiologically-contaminated materials during these activities has the potential to generate particulate and gaseous radioactive air emissions. Based on anticipated radiological conditions in the trench, conservative estimates of potential emissions were evaluated based on the unit dose factors in *Calculating Potential to Emit Radiological Releases and Doses* (DOE/RL-2006-29) to determine the annual potential to emit to the hypothetical maximum exposed public individual (MEI). The approved dose models show the MEI would be located at the Laser Interferometer Gravitational Wave Observatory (LIGO), situated 18,310 meters East/Southeast of the 200 West Area. The primary radionuclides of concern are plutonium 238, plutonium 239, plutonium 240, plutonium 241, plutonium 242, americium 241, uranium 234, uranium 235, uranium 236, uranium 237, uranium 238, and neptunium 237. Because the work activities will involve the air space within the crib, the activity is considered high risk; however, analysis has determined that these activities will have an unabated Potential to Emit (PTE) significantly below the 0.1 millirem/year exposure criterion for the MEI (see Figure 4-2 and Figure 4-3. Figure 4-2 shows the PTE calculations for deployment of the crawler and cameras into the trench. Figure 4-3 provides the calculations for the operations of the crawler in the trench. The calculations for deployment should be considered conservative because all of the dose for the deployment was attributed to americium 241, which has the highest dose per curie (Ci) of any of the contributing radionuclides, but makes up only a small percent of the isotopic mix.

The substantive requirements for evaluating a point source emitting radioactive airborne emissions found in The Washington State air program under *Monitoring, Testing and Quality Assurance* (WAC 246-247-075[1]) have been addressed. Field measurements performed by radiological technicians for potential contamination will provide confirmatory measurement of anticipated low emissions. Additionally, near facility ambient air monitoring is being performed at several locations around the

PFP Complex. As appropriate, these monitors will continue to be operated during activities and operations described in this work plan.

Figure 4-2. Radionuclide PTE for Deployment of Crawler and Cameras

Question:

Describe the quantity of radioactivity that will be displaced out of the 20-inch riser at 216-Z-9 when the crawler, plus a camera are lowered into the cavern.

Assumptions:

Crawler displacement = 1,100 in^3 (from PNNL)

Camera displacement = 1,100 in^3

Based upon recent sampling conducted for characterization, air quality in the cavern is assumed to be 10 times the "on-mask" level, which is 1 x 10 -11 mCi/cc of air; thus, air quality is assumed to be 1 x 10 -10 mCi/cc of air

Calculation:

1,100 in^3 + 1,100 in^3 = 2,200 in^3 of total air displaced

and 16.387 cc/in^3

2,200 in^3 x 16.387 cc/in^3 x 0.0000000001 mCi/cc = 3.60514E^{-06} mCi Released

Airspace Concentration

x 0.001 Ci/mCi = 3.60514E^{-09} Ci

x 17 mrem/Ci = 6.12874E^{-08} mrem

(assuming all of the isotopic exposure can be attributed to Am-241 for MEI at LIGO)

Comment:

To simplify the calculation associated with the deployment, the above calculation assumes all of the curie content of the radionuclide material is Americium 241. Americium has the highest curie content of the radionculide components in the isotopic mix; therefore, this result overestimates the potential exposure from the deployment. In order to further bound the potential for additional releases associated with potentially removing the crawler or camera for maintenance, the resulting value was multiplied by three (to reflect multiple entries), as shown below.

6.13E^{-08} mrem x 3 = 1.83862E^{-07} mrem

Figure 4-3. Radioactive Air Emissions Potentially Emitted to Air from Crawler Traveling in 216-Z-9 Trench

The "total remaining" Pu inventory at 216-Z-9 is estimated at 50 kg. For estimating "disturbed soil" and its Pu content, the sampled value at a depth of 23-30 cm, found on page 13 of ARH-2915, was used– i.e., 0.1 to 0.3 grams of Pu per liter of soil.

The weight/area ratio of the crawler is ~ ¼ as great as a person walking; therefore, 1/10 of an inch surface soil disturbance was adopted. The approximate travel rate of the crawler is 6 inches per second, so the tracks will not throw much material as they move.

Assuming a concentration of 0.1 to 0.3 grams of Pu per liter of soil (average = 0.2 g/l); where 1 liter = 61.023744 in^3, 0.2 g/l / 61 in^3/l = 0.0033 g Pu/in^3 of soil.

If we assume a 4" wide by 750 foot long area traversed by the crawler, at 12" per foot and 0.1"disturbed depth, = 3,600 $in.^3$ soil disturbed.

3,600 in^3 x 0.0033 g Pu/in^3 soil x 10-4 combined release fraction (based on 10-3 regulatory basis, plus 1 x 10-1 factor for damp soils, stagnant air space, and height of riser from floor of trench) = 11.88 x 10-4 = 0.0012 grams

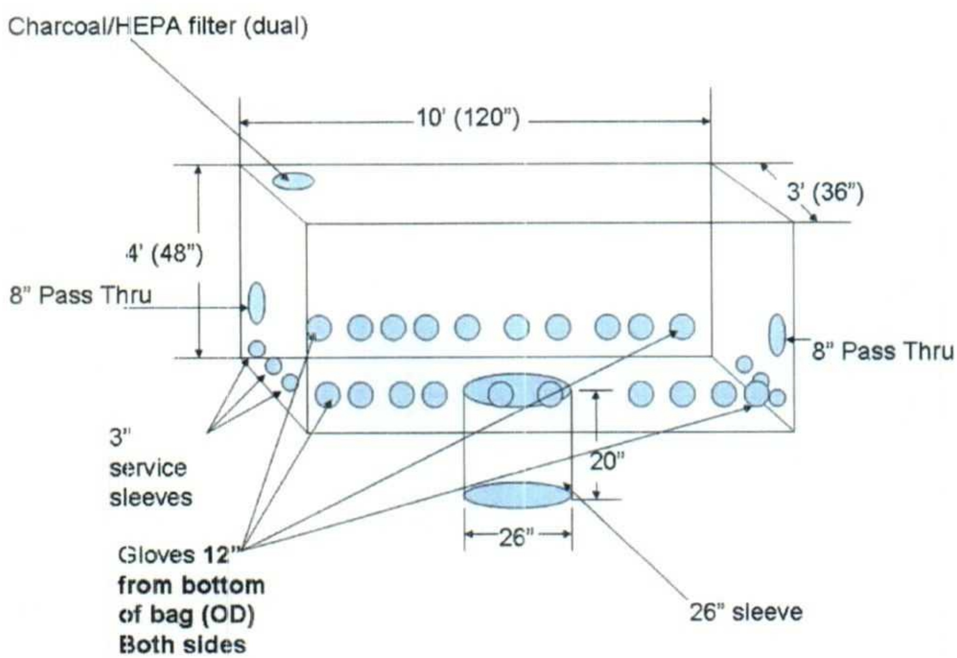
Column 1 Isotope	Column 2 *Wt% on Pu Mass Basis - decayed to 1/1/04*	Column 3 *Specific Activity in curies/ gram*	Column 4 Ci/g	Column 5 *Weight of each isotope in 0.0012 g emitted (in grams)*	Column 6 *Total Ci of each isotope emitted*	Column 7 *Dose/Unit* 200W to onsite Maximally Exposed Public Individual (MEI) at the LIGO, Release Height <40 m	Column 8 *Total Dose,* this isotope (mrem/yr Effective Dose Equivalent to MEI)
	(From HNF-22064, Rev. 0, P 55)	(from HNF-EP-0063, Rev. 13)	(Col. 2 x Col. 3)	(Col. 2 x .0012)	(Col. 3 x Col. 5)	(in mrem/Ci - from DOE/RL-2006-29, Rev.0)	(Col. 6 x Col. 7)
Pu 238	0.1100%	17.12	0.018832	0.00000132	2.25984E-05	10	2.25984E-04
Pu 239	93.7363%	0.0602	0.056429253	0.001124836	6.77151E-05	11	7.44866E-04
Pu 240	6.0850%	0.2269	0.013806865	0.00007302	1.65682E-05	11	1.82251E-04
Pu 241	0.1304%	103	0.134312	1.5648E-06	1.61174E-04	0.16	2.57879E-05
Pu 242	0.0373%	0.003054	1.13914E-06	4.476E-07	1.36697E-09	11	1.50367E-08
Am 241	0.2407%	3.43	0.00825601	2.8884E-06	9.90721E-06	17	1.68423E-04
U 234	0.0009%	0.006217	negl.				
U 235	0.0265%	2.161E-06	negl.				
U 236	0.0064%	0.00006486	negl.				
U 237	0.0000%		negl.				
U 238	0.0001%	3.361E-07	negl.				
Np 237	0.0032%	0.0007046	negl.				
Other	0.0000%		negl.				
Total			0.231637267				0.001347326

Control of airborne emissions must meet the substantive requirements of *Ambient Air Quality Standards and Emission Limits for Radionuclides,* WAC 246-247-040(4), and *General Standards for Maximum Permissible Emissions,* WAC 173-480-050(1).

Use of precautionary airborne controls, including the following, will address the ALARA-based substantive requirements [WAC 246-247-040(3)]:

- Minimized open status of entry riser.
- Glove containment chamber on the riser (see Figure 4-4), incorporating charcoal and High-Efficiency Particulate Air (HEPA) filters.
- Riser lid extension incorporating sealed penetrations for the camera and crawler controls.
- Decontamination prior to removal of the containment structure.
- No removal of crawler or camera controls following completion of work.
- Administrative and procedural precautions taken in accord with radiation control program, including radiological field surveys and contamination control measures which are detailed in the work package.

Figure 4-4. Glove Containment



4.2.1 Criteria/Toxic Air Pollutant (TAP) Emissions

Pursuant to WAC 173-460-080 requirements, an acceptable source impact analysis is required for Class A and Class B TAPs. The emissions estimations provided in this subsection have been prepared for the purpose of satisfying WAC 173-460-080 acceptable source impact analysis. Information is also provided to show compliance with the substantive requirements of WAC 173-400-040 and WAC 173-400-113. Table 4-1 shows results of laboratory analysis of headspace gases from the trench for butane, carbon tetrachloride, chloroform, methanol, propane and tetrachloroethene from samples collected in December 2006 and January 2007.

Table 4-1. *Volatile Organics Analysis for Industrial Hygiene Using Summa Canister.*

	216-Z-9 Headspace	
Sample Date	**12/11/2006**	**1/8/2007**
Sample #	**W060004104**	**W07GR00058**
Analyte		
Butane	33 ppb	ND
Carbon Tetrachloride	52 ppb	16 ppb
Chloroform	ND	ND
Methanol	14 ppb*	14 ppb**
Propane	22 ppb	ND
Tetrachloroethene	ND	ND

ND = Not Detected
*methanol was detected in the sample and the method blanks. The results for methanol could be due, at least partially, to system contamination.
**since it cannot be confirmed methanol is due solely to system contamination, methanol is included in the calculation of TAP emissions as a conservative measure.

Figure 4-5 shows supporting calculations for the potential emissions of toxic air pollutants (TAP) focused on the headspace samples associated with these activities; these values are well below concentrations that would cause a regulatory concern.

Figure 4-5. Calculation for Toxic Air Pollutant Emission from 216-Z-9 Trench as a Consequence of Deploying Crawler and Camera.

Analysis of results from collection of air samples from the 216-Z-9 Trench using SUMMA canisters *indicated the presence of Butane, at 33 ppb, and Carbon Tetrachloride, at 52 ppb in the air. Both Toxic* Air Pollutant (TAP) constituents were found in samples collected in December of 2006.

A calculation was performed to determine the inventory of these constituents that would be displaced by the introduction of the crawler with camera into the trench through the 20-inch riser.

The calculations related to expulsion of butane and carbon tetrachloride from the riser by lowering the robot and camera into the 216-Z-9 crib are based on: 1.) Recent gas samples taken from the crib and laboratory analyses, and 2.) An equation published by the "Center for Hazardous Substance Research (CHSR), Kansas State University, October 2006 as follows:

Concentration mg/m^3 = 0.0409 x concentration in ppm x molecular weight

In this instance, the molecular weights and concentrations of the two substances of interest are:

1.) the molecular weight of butane is ~58 at 33 ppb, and 2.) the molecular weight of carbon tetrachloride is ~154 at 52 ppb.

Values used in the calculations are presented below:

- The molecular weight of butane is ~58
- The molecular weight of carbon tetrachloride is ~154
- 1 liter is the equivalent of 61.023744 in^3
- 1 liter is equivalent of 1000 cc
- Concentration mg/m^3 = 0.0409 x concentration in ppm x molecular weight

The crawler with attached camera at 1,100 in^3 / 61.023744 in^3/l displaces ~18.026 liters.

The fixed-position addition is assumed to displace an amount equivalent to the crawler

18.026 liters x 2 = 36.05 liters

Figure 4-5. Calculation for Toxic Air Pollutant Emission from 216-Z-9 Trench as a Consequence of Deploying Crawler and Camera.

36.05 liters x 1000 cc/ liter = 36052 cc of gas displaced

For butane, detected @ 33 ppb:

$$0.0409 \times 0.033 \times 58.10 \text{ g butane} = 0.0784 \text{ mg/m}^3$$

$$36052 \text{ cc} \times 1 \text{ m}^3/10^6 \text{ cc} \times 0.0784 \text{ mg/1 m}^3 \times 1 \text{ g/1000 mg} = 2.8 \times 10^{-6} \text{ g butane}$$

For Carbon Tetrachloride, detected @ 52 ppb:

$$0.0409 \times 0.052 \times 153.82 \text{ g} = 0.327 \text{ mg/m}^3$$

$$36052 \text{ cc} \times 1\text{m}^3/ 10^6 \text{ cc} \times 0.327 \text{ mg/1 m}^3 \times 1 \text{ g/1000 mg} = 1.18 \times 10^{-5} \text{ g carbon tetrachloride}$$

For Methanol, detected at 14 ppb:

$$0.0409 \times 0.014 \times 32.04 \text{ g} = 0.0183 \text{mg/ m}^3$$

$$36052 \text{ cc} \times 1\text{m}^3/ 10^6 \text{ cc} \times 0.0183 \text{ mg/1 m}^3 \times 1 \text{ g/1000 mg} = 6.6 \times 10^{-7} \text{ g methanol}$$

The proposed activities within the scope of this work plan will consist of deploying a crawler and cameras into a riser over the Z-9 Trench to place the crawler on the floor of the trench. The proposed activities may increase the rate of TAP emissions through air displacement.

Pursuant to WAC 173-460-080(2)(e), small quantity emission rates may be used to demonstrate acceptable source impact analysis. The estimated TAP emission rates in Figure 4-5 are less than Small Quantity Emission rate values listed in WAC 173-460-080, as shown in Table 4-2.

Table 4-2. TAP Emission Rate Comparison

TAP	Class	ASIL	SQER	Estimated Emission
Carbon Tetrachloride	A	.067 μg/m^3	10#/year	.0000118g
Butane	B	6300 μg/m^3	5#/hr	.0000028g
Methanol	B	870 μg/m^3	5#/hr	.000000659g

Occupational monitoring will be used to verify low-levels of TAPs. Due to the low levels, no controls for TAP emissions are proposed other than attaching an activated granulated carbon filter to the glove bag structure (See Figure 4.4).

The substantive requirements for criteria pollutants per WAC 173-400-040 and WAC 173-400-113 are discussed here for completeness of review, although there is no reason to believe criteria pollutants could be emitted through this action. The deployment of the crawler and cameras displaces air in the crib head space. The crib head space does not contain odors, or heavy particulates and does not produce sulfur dioxide. Reasonably Available Control Technology (RACT) will be employed through use of containment (see Figure 4.4). Criteria pollutants requirements are listed below per WAC 173-400-040:

- *Visible emissions.* No person shall cause or allow the emission for more than three minutes, in any one hour, of an air contaminant from any emissions unit which at the emission point, or within a reasonable distance of the emission point, exceeds twenty percent opacity.
- *Fallout.* No person shall cause or allow the emission of particulate matter from any source to be deposited beyond the property under direct control of the owner or operator of the source in sufficient quantity to interfere unreasonably with the use and enjoyment of the property upon which the material is deposited.
- *Fugitive emissions.* The owner or operator of any emissions unit engaging in materials handling, construction, demolition or other operation which is a source of fugitive emission (if located in an attainment area and not impacting any nonattainment area) shall take reasonable precautions to prevent the release of air contaminants from the operations.
- *Odors.* Any person who shall cause or allow the generation of any odor from any source which may unreasonably interfere with any other property owner's use and enjoyment of his property must use recognized good practice and procedures to reduce these odors to a reasonable minimum.
- *Emissions detrimental to persons or property.* No person shall cause or allow the emission of any air contaminant from any source if it is detrimental to the health, safety, or welfare of any person, or causes damage to property or business.
- *Sulfur dioxide.* No person shall cause or allow the emission of a gas containing sulfur dioxide from any emissions unit in excess of one thousand ppm of sulfur dioxide on a dry basis, corrected to seven percent oxygen for combustion sources, and based on the average of any period of sixty consecutive minutes.

The Work Plan includes HEPA filtration for the control of particulate radiological emissions which will also control non-radiological particulate emissions. HEPA filtration is considered Best Available Control Technology (BACT) for radionuclide particulates and is implemented as RACT for the non-radionuclide visible and particulate emissions should there be any in the crib head space.

The substantive requirements of WAC 173-400-113 apply to new sources in attainment or unclassified areas. As relevant, the substantive requirements include:

- BACT shall be employed for all pollutants not previously emitted or whose emissions would increase as a result of the modification.
- Allowable emissions from the modification will not cause or contribute to a violation of any ambient air quality standard.
- If the modification will emit any toxic air pollutants regulated under WAC 173-460, the source meets all applicable requirements of that program.

The deployment activities will use RACT as described above. Based on the constituents in the crib head space and the small amount of air displacement, emissions from the work will not cause or contribute to a violation of any ambient air quality standard. The work process does not include combustion, and significant emission increases in new source review pollutants.

Therefore, all relevant and applicable regulations for criteria and toxic air emissions have been addressed and satisfied.

4.2.2 Occupational Monitoring

Table 4-3 identifies the monitoring techniques that may be used to evaluate the presence of non-radiological hazardous constituents or conditions in the air while deploying equipment in the 216-Z-9 Trench.

Table 4-3. Monitoring Techniques

Hazard	Suggested Method	Frequency of Samples
Carbon tetrachloride	*NIOSH 1003 Direct Reading	As Required
Methylene chloride	NIOSH 1005	As Required
Chloroform	NIOSH 1003	As Required
Methyl chloride	NIOSH 1001	As Required
Butane	**OSHA PV2010	As Required
Propane	NIOSH S87 (11-2)	As Required
Ergonomic	HNF-RD-8471Best Practice	As Required

*NIOSH – National Institute for Occupational Safety & Health

**OSHA – Occupational Safety and Health Administration

Radiological work is addressed in 10 CFR 835 and technical work procedures, and the specific radiological work permit (RWP).

Radiation monitoring: Radiological monitoring shall be performed in accordance with applicable technical assessments in place for ongoing air quality programs. Task specific requirements will be provided in the applicable RWP.

4.2.3 Ambient Air and Site Monitoring Procedures

4.2.3.1 Non-radiological Occupational Monitoring Instruments. Safety or Industrial Hygiene may require the use of instruments to monitor the work environment. The monitoring frequency will be determined by the Site Safety and Health Official (SSHO), see HNF 24404 PHASP. Monitoring instruments that may be used include:

- Photo-ionization Detector (PID): The PID may be used to monitor the work area for chemical contamination whenever potential exposure exists. Both the 10.6 eV and 11.7 eV lamps will be used as determined appropriate by the SSHO.
- Combustible Gas Indicator (CGI) meter: A meter with a minimum two gas capability; oxygen and LEL. Additional sensors may be added as needed.
- Personal sampling: Sample per procedures listed in Table 4-3.
- Colorimetric detector tubes: Colorimetric detector tubes may be used for the detection and semi quantitative estimation of gases and vapors.
- Portable heat stress monitor: Monitoring will be conducted with an area heat stress monitor, or equivalent instrument.
- Sound level meters: Noise levels will be monitored periodically during the operation of powered cutting tools, heavy machinery, and at the discretion of the SSHO.

- *Cold stress monitoring:* Temperature and wind chill data will be obtained from Pacific Northwest National Laboratory weather forecaster (phone 373 2716).

4.3 NUCLEAR SAFETY

Nuclear safety has been addressed through revisions to the PFP D&D Preliminary Hazard Analysis (HNF-15501 Rev OE and OF).

4.4 CRITICALITY SAFETY

Criticality safety has been addressed in *Criticality Safety Evaluation Report (CSER) 07-010, The Incredibility Analysis for the 216-Z-9 Facility*, HNF-33510, Rev. 0 (HNF-33510)

4.5 HEALTH AND SAFETY

The Programmatic Health and Safety Plan (PHASP) for the Plutonium Finishing Plant (PFP) closure Project, HNF-24404, Rev. 0 (HNF-24404) will provide the basis for health and safety procedures implemented for activities under this work plan. Based on previous analysis of emissions from the 216-Z-9 Trench, it has been determined that the controls (Glove Bag with charcoal and HEPA Filter and PPE for radiological considerations) that will be in place for this activity are adequate for worker protection and no additional monitoring or controls will be required.

5.0 REFERENCES

10 CFR 61, *Licensing Requirements for Land Disposal of Radioactive Waste*, Code of Federal Regulations, as amended.

10 CFR 835, *Occupational Radiation Protection*, Code of Federal Regulations, as amended.

40 CFR 51, *Requirements for Preparation, Adoption, and Submittal of Implementation Plans*, Code of Federal Regulations, as amended

40 CFR 61, *National Emission Standards for Hazardous Air Pollutants*, Code of Federal Regulations, as amended.

42 USC 7401, *Clean Air Act of 1990 and Amendments*, 42 United State Code 7401 et seq.).

49 CFR 171-179, "Department of Transportation Hazardous Materials Regulations" *Code of Federal Regulations*, (amended January 1, 1970).

CERCLA, *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 U.S.C. 9601, et seq.

DOE/RL-2005-13, *Action Memorandum for the Plutonium Finishing Plant Above-Grade Structures Non-Time Critical Removal Action*, U.S. Department of Energy, Richland, Washington.

DOE/RL-2005-16, *Plutonium Finishing Plant Above-Grade Structures Waste Management Plan*, U.S. Department of Energy, Richland, Washington.

DOE/RL-2006-29, *Calculating Potential to Emit Radiological Releases and Doses*, Rev. 0, dated May 2006, Richland, Washington.

EPA, 1994, *Guidance for Data Quality Assessment*, EPA QA/G-9, U.S. Environmental Protection Agency, Washington, D.C.

FSP-PFP-1121(24), 2006, *PFP Training and Administration Manual, D&D Training Plan*, FSP-PFP-1121, Chapter 24, Fluor Hanford, Inc. Richland, Washington.

HNF-24404, 2007, Rev. 1, *The Programmatic Health and Safety Plan (PHASP) for the Plutonium Finishing Plant (PFP) closure Project*, Fluor Hanford, Inc. Richland, Washington.

HNF-33138, *216-Z-9 Soil Removal Structures and Equipment Sampling and Analysis Plan*, Fluor Hanford, Inc. Richland, Washington.

HNF-33510, *Incredibility Analysis for the 216-Z-9 Facility*, Rev. 0, Fluor Hanford, Inc. Richland, Washington.

HNF-32545, 2007, *216-Z-9 Soil Removal Structure Supplement to the Data Quality Objectives for the Plutonium Finishing Plant Above-Grade Structures*, Fluor Hanford, Richland, Washington.

HNF-33970, 2007, *Structural Characterization Work Plan for the Photographic Characterization of the 216-Z-9 Trench by Cameras and Crawler*, Fluor Hanford, Richland, Washington.

NMS-16404, 2003, Rev. 0 Draft, *Plutonium Finishing Plant (PFP) Complex End Point Criteria*, Fluor Hanford, Inc. Richland, Washington.

RCW 70.94, *Washington Clean Air Act*, Revised Code of Washington 70.94.

WAC 173-303, *Dangerous Waste Regulations*, Washington Administrative Code, as amended.

WAC 173-480-050-(1), *General Standards For Maximum Permissible Emissions*, as amended.

WAC 246-247-040(4), *Ambient Air Quality Standards And Emission Limits For Radionuclides,* as amended.

WAC 246-247-075(3), *Monitoring, Testing and Quality Assurance*, Washington Administrative Code, as amended.

DOE APPROVAL SIGNATURE

The following signature pages provide documented agreement between the DOE, Ecology, and EPA for the *Field Implementation Work Plan for the Photographic Characterization of the 216-Z-9 Trench by Cameras and Crawler.*

6/6/07

Michael Weis,
Acting Manager
United States Department of Energy
Richland Operations Office

Date

ECOLOGY CONCURRENCE SIGNATURE

The following signature pages provide documented agreement between the DOE, Ecology, and EPA for the *Field Implementation Work Plan for the Photographic Characterization of the 216-Z-9 Trench by Cameras and Crawler.*

Rick Bond — June 5, 2007

Rick Bond, Program Manager
Washington State Department of Ecology

Date

EPA CONCURRENCE SIGNATURE

The following signature pages provide documented agreement between the DOE, Ecology, and EPA for the *Field Implementation Work Plan for the Photographic Characterization of the 216-Z-9 Trench by Cameras and Crawler.*

Craig Cameron — 6/5/2007

Craig Cameron, Manager — Date
U.S. Environmental Protection Agency