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Bechtel Jacobs Company LLC

DOE Contract No. DE-AC05-98OR22700
Job No. 23900
October 22, 2002

Mr. W. Don Seaborg
Paducah Site Manager
Department of Energy
P.O. Box 1410
Paducah, KY 42002-1410

Subject: Removal Action Work Plan (RAWP) for the C-410 Complex Infrastructure Decontamination and Decommissioning Project at the Paducah Gaseous Diffusion Plant (DOE/OR/07-2012&D2)

I-05116-0009

Dear Mr. Seaborg:

Enclosed herewith are 18 copies of the D2 version of the revised RAWP for the C-410 Infrastructure Decontamination and Decommissioning project at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky. This document includes the Sampling and Analysis Plan and the Waste Management Plan as appendices. It incorporates the responses to the comments made by the Kentucky Department of Environmental Protection and the Environmental Protection Agency.

This document is a primary document submitted in accordance with the requirements of the Federal Facility Agreement and subsequent agreements with the Kentucky Department for Environmental Protection and the United States Environmental Protection Agency, Region IV. Please forward the subject document to Mr. Robert H. Daniell of the Kentucky Department for Environmental Protection (seven copies) and to Mr. Carl Froede of the United States Environmental Protection Agency (three copies). Copies are also included in Redline/Strikeout form to provide to Mr. Daniell and Mr. Froede (two copies each). Suggested language is attached for your use. The remainder of the distribution will be issued by Bechtel Jacobs Company LLC according to the Primary and Secondary Documents Distribution listing. The Health and Safety Plan and Quality Assurance Project Plan are being submitted separately as secondary documents.

If you have any questions or require further information, please contact David Massey at (270) 441-5071.

Sincerely,

Gordon L. Dover
Paducah Manager of Projects

GLD:lj
LTR-PAD/DD-LJ-02-0016

Enclosure: 1) Subject document
2) Suggested language

c/enc: Distribution

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DOE/OR/07-2012&D2

Removal Action Work Plan for the C-410 Complex Infrastructure D&D Project at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

CERTIFICATION

Document Identification:

Removal Action Work Plan for the C-410 Complex Infrastructure D&D Project at the Paducah Gaseous Diffusion Plant Paducah, Kentucky, (DOE/OR/07-2002&D2)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

U.S. Department of Energy (DOE)
Owner and Operator

W. Don Seaborg, Paducah Site Manager — 10/22/02 Date Signed

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Bechtel Jacobs Company LLC
Co-Operator

Gordon L. Dover, Paducah Manager of Projects — 10/22/02 Date Signed

DOE/OR/07-2012&D2

Removal Action Work Plan for the C-410 Complex Infrastructure D&D Project at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued – October 2002

Prepared for the
U. S. Department of Energy
Office of Environmental Management

Environmental Management Activities at the
Paducah Gaseous Diffusion Plant
Paducah, Kentucky 42002
Managed by
Bechtel Jacobs Company LLC
for the
U.S. Department of Energy
under contract DE-AC05-98OR22700

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CONTENTS

FIGURES

TABLES

ACRONYMS

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
AM	Action Memorandum
ARARs	Applicable or Relevant and Appropriate Requirements
BJC	Bechtel Jacobs Company LLC
Complex	C-410 Complex
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EDE	effective does equivalent
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U. S. Environmental Protection Agency
ES&H	Environmental, Safety, and Health
FFA	Federal Facilities Agreement
FY	fiscal year
HASP	Health and Safety Plan
HF	hydrogen fluoride
ISMS	Integrated Safety Management System
KAR	Kentucky Administrative Regulations
LLW	low-level waste
NHPA	National Historic Preservation Act of 1996
NRC	Nuclear Regulatory Commission
NTCRA	non-time-critical removal action
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
QAPjP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RACM	regulated asbestos-containing material
RCRA	Resource Conservation and Recovery Act of 1976
RmAOs	Removal Action Objectives
RAWP	Removal Action Work Plan
S&M	Surveillance and Maintenance
SAP	Sampling and Analysis Plan
SWMU	Solid Waste Management Unit
T&E	threatened and endangered
TBC	to be considered
TSCA	Toxic Substances Control Act
USEC	United States Enrichment Corporation
WAC	Waste Acceptance Criteria
WMP	Waste Management Plan

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DEFINITIONS

Infrastructure	Building contents including but not limited to, process equipment and supports, piping, conduit, instrumentation, controls, communication equipment, lighting, power systems, and cooling systems. Excludes building structure, roofs, and slabs.

EXECUTIVE SUMMARY

This Removal Action Work Plan (RAWP) describes hazardous materials characterization/abatement and infrastructure and equipment removal at the C-410 Feed Plant Complex (Complex) at the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky. The primary emphasis of this RAWP is to provide details regarding project management, project execution, and applicable or relevant and appropriate requirements (ARARs) compliance measures. This document as well as the Waste Management Plan and Sampling and Analysis Plan are primary documents. The Quality Assurance Plan and Health and Safety Plan are secondary documents and will be placed in the post decision administrative record along with the primary documents.

The work will be performed as a non-time-critical removal action as part of the decontamination and decommissioning of the Complex. This particular removal action will remove the contents and support infrastructure from the buildings in the Complex as well as related systems exterior to the structures. Demolition and removal of the structures will be accomplished under separate work scope. An *Engineering Evaluation/Cost Analysis* (DOE/OR/07-1952 & D2 Rev. 1) and *Action Memorandum* (AM) (DOE/OR/7-2002 & D1) were prepared in 2001 and 2002 respectively, for the removal action covered in this RAWP.

The removal action supports the long-term remediation of the Complex. However, it does not include the building shell, lagoon, holding pond, or the underlying soil of the Complex. This will be addressed in other actions. Removal of the equipment and infrastructure will greatly reduce the risk of a release from the Complex. The infrastructure removal will remove the materials causing the highest potential risks, thereby significantly reducing the risk to current workers and potential off-site receptors in the event of building failure or further degradation.

The major radiological contaminants of concern are uranium and the associated daughter products as well as, Tc-99 and small quantities of transuranic compounds. Uranium contamination exists within or on the surface of most of the Complex facilities and equipment. Other materials likely to be present at the Complex include: asbestos-containing materials; PCBs; refrigerants; hydrogen fluoride; and other chemicals used to generate fluorine. Heavy metals such as lead, chromium, selenium, mercury, and cadmium, are also likely to be present.

The activities addressed by this RAWP include the characterization, removal, on-site or off-site treatment, if necessary, packaging, disposal, and reuse/recycle of process and ancillary equipment located within the Complex. This work will involve: identification; characterization; removal of residual material from equipment and piping; and segregation, packaging, transportation, and disposition of equipment, piping, and hazardous materials.

Materials and equipment generated from this removal action will be treated and disposed of at approved on-site or off-site facilities or reused/recycled in accordance with U.S. Department of Energy policies. Potential disposal sites include, but are not limited to: the Envirocare facility in Utah, the Nevada Test Site facility, or the on-site C-746-U Solid Waste Contained Landfill at PGDP.

Bechtel Jacobs Company LLC will self-perform the work described in this RAWP, using subcontractors as necessary. The project will be completed in accordance with Integrated Safety Management System practices and principles, including worker involvement. Supporting plans and documents will be developed to support the RAWP, AM and to ensure ARARs are met. The Waste Management Plan and Sampling and Analysis Plan are included as Appendices to the RAWP. The Quality Assurance Project Plan and Health and Safety Plan are issued as secondary documents, in conjunction with, but separately from, the RAWP. To facilitate a better understanding of the physical condition of the C-410 facility, a CD-ROM that contains 3-dimensional imagery of the various areas of the Complex has been provided with the RAWP.

The project schedule is dependent upon budget constraints for each fiscal year (FY).

1. INTRODUCTION AND PURPOSE

Activities involved in this Removal Action Work Plan (RAWP) address the infrastructure removal phase of Decontamination and Decommissioning (D&D) for the C-410 Complex (Complex). These activities will be conducted as a Non-Time-Critical Removal Action (NTCRA). This is the second of the three phases of the D&D Work Plan process. These include: (1) documentation (site evaluation), (2) NTCRA (infrastructure removal phase), and (3) facility structure D&D and environmental media characterization and remediation.

The U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Commonwealth of Kentucky have agreed to conduct D&D under the existing Federal Facilities Agreement (FFA) for the Paducah Gaseous Diffusion Plant (PGDP). Facilities designated for D&D will be identified as D&D operable units. The Complex is the first facility to undergo D&D at PGDP.

The Complex, located in the central portion of PGDP at the intersection of Tennessee Avenue and Eleventh Street, consists of three main process buildings and several auxiliary facilities, as shown in Fig. 1.1. These buildings and facilities include:

- C-410 Original Feed Plant and East and West Expansions
- C-410-A Second East Expansion of Feed Plant
- C-410-B HF Neutralization Lagoon
- C-410-C HF Neutralization Building
- C-410-D Fluorine Storage Building
- C-410-E Emergency HF Holding Pond
- C-410-F HF Storage Building (North)
- C-410-G HF Storage Building (Center)
- C-410-H HF Storage Building (South)
- C-410-I Ash Receiver Shelter
- C-410-J HF Storage Building (East)
- C-411 Cell Maintenance Building
- C-420 Green Salt Plant

This removal action excludes C-410-B and C-410–E because other environmental programs will address them. This removal action also excludes C-410-D because it is an operational facility leased to the United States Enrichment Corporation (USEC).

1.1 PURPOSE OF THE REMOVAL ACTION WORK PLAN

The *Engineering Evaluation/Cost Analysis for The C-410 Complex Infrastructure at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* [EE/CA] (DOE 2001a), approved December 13, 2001, documents and describes the evaluation of alternatives to address the potential threats posed to human health and the environment from the release or potential release of hazardous substances in the Complex. The *Action Memorandum for the Decontamination and Decommissioning of the C-410 Complex at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/07-2002&D1), has been submitted and subsequently approved by the regulatory agencies and signed by DOE on August 3, 2002. This RAWP provides details on how the NTCRA will be executed in accordance with the Action Memorandum (AM) and the Applicable or Relevant and Appropriate Requirement (ARARs).

1.2 SCOPE OF THE REMOVAL ACTION WORK PLAN

This RAWP, prepared in accordance with requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), utilizes *the Annotated Outlines for Documents Required by FFA and CERCLA for Oak Ridge Reservation Sites* (DOE 2000) as a guide for preparation of design reports/removal action work plans for the DOE Oak Ridge Operations Environmental Management Program.

The RAWP includes:

- Updated schedule for D&D activities and for subsequent documents;
- Description of plans and objectives for the infrastructure/contents removal action;
- A listing of ARARs that provide specific information regarding the measures that will be taken during removal action implementation. These ARARs coincide with those listed in the EE/CA

Elements of the RAWP include: organization, responsibilities, lines of authority, and operational strategy for the hazardous materials abatement involved in the D&D infrastructure removal action at the Complex. The primary emphasis of the RAWP is to supplement the AM information, and to provide greater detail regarding project management, project execution, and ARARs compliance measures. The scope of the RAWP pertains only to the hazardous materials characterization/abatement and infrastructure/contents removal at the Complex.

DOCUMENT No. DOE/OR/07-2002&D1

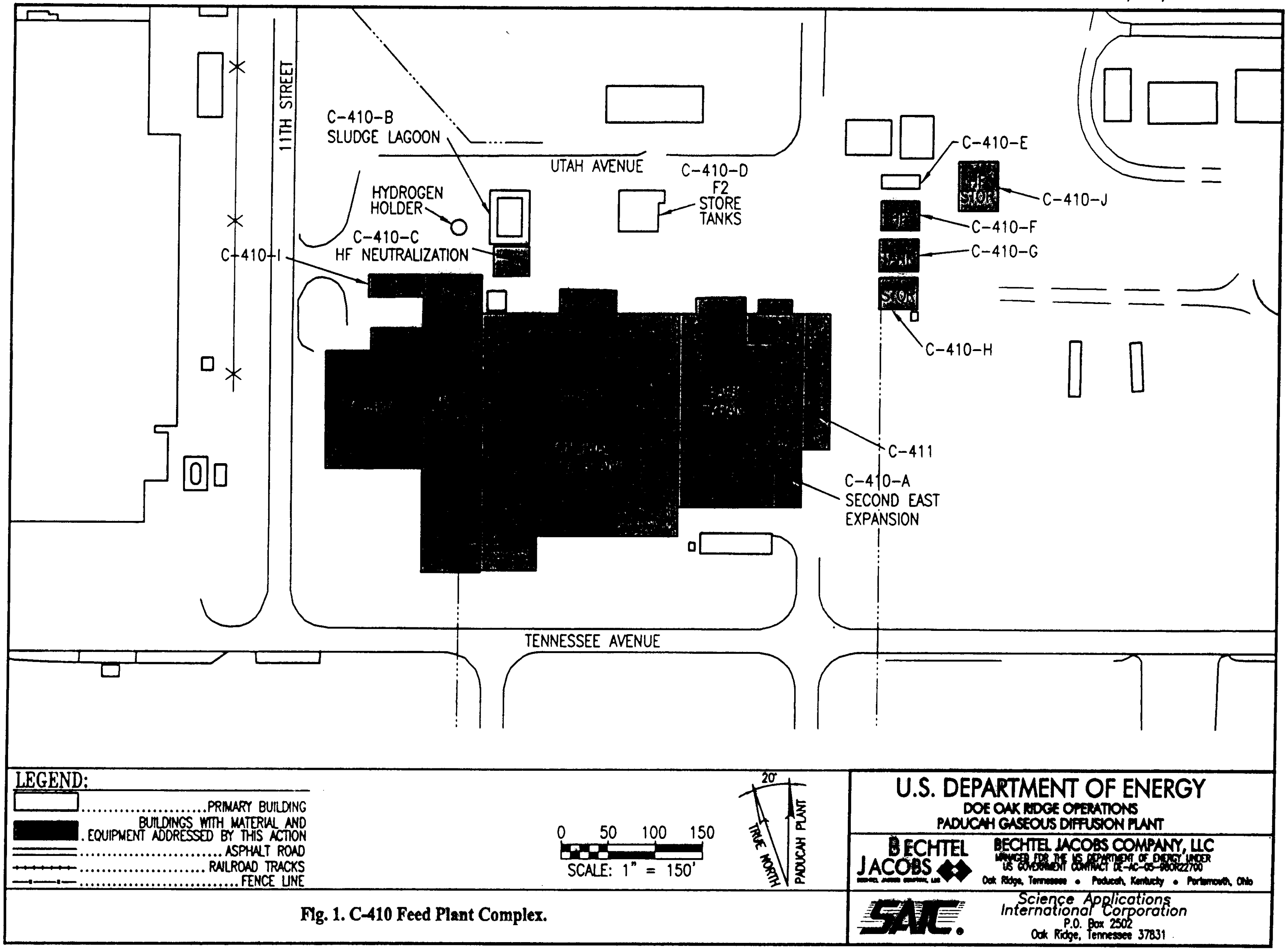

Fig. 1. C-410 Feed Plant Complex.

Figure No. /99049/DWGS/N826C410FPC

DATE 01-25-02

Fig. 1.1 C-410 Feed Plant Complex

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2. PROJECT ORGANIZATION

Bechtel Jacobs Company LLC (BJC) will be responsible for overall project execution under direction of the DOE Project Manager. BJC will implement the project with an integrated team consisting of direct hire and subcontracted support for key staff functions, including but not limited to: environmental compliance, radiological engineer and technicians, quality assurance, industrial hygiene, industrial safety, transportation and waste management, technical support, field supervision, and craft personnel.

Roles and responsibilities of the key members of the BJC project team include:

- Project Manager/Deputy Project Manager – Responsible for overall project performance, quality, schedule, and budget of work. Provides overall project direction, implementing corrective actions as necessary, ensuring compliance with safety and health requirements, and conducting readiness reviews.

- Environmental, Safety, and Health (ES&H) Representative – Ensures completion of all work for the removal action is performed in accordance with approved HASP and in compliance with ARARs.

- Quality Assurance/Quality Control (QA/QC) Manager – Ensures completion of all work for this removal action in accordance with the Quality Assurance Project Plan (QAPjP). Develops QA/QC procedures and implements administrative procedures, which govern both technical and non-technical work.

- Field Operations Superintendent – Oversees field activities and ensures that field operations follow established and approved plans and procedures.

- Project Engineer – Directly responsible for technical aspects of the project. Determines the technical approaches to be applied to the various tasks involved in the project.

- Waste Engineer - Provides oversight of the activities associated with the packaging, labeling, shipment and disposal of the wastes generated by the D&D activities. Works with project engineer, field superintendent, and lead engineer to ensure that wastes are handled in accordance with the appropriate regulatory and technical requirements.

- Lead Engineer - Coordinates the activities of the engineering and field operations to ensure that the individual tasks are completed on time and within the technical specifications.

- Front Line Manager –Coordinates individual field operations under the direction of the Field superintendent. Responsible for the day-to-day activities of the field crews.

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3. PROJECT DESCRIPTION

3.1 General Site Description

3.1.1 Buildings/Structures

The Complex consists of a grouping of single-story and multi-story facilities housing process equipment and support systems. The RAWP addresses all infrastructure and building contents in the Complex, excluding the lagoon (C-410-B) and holding pond (C-410-E), which are included in other units, and C-410-D because it is leased to the USEC.

To assist in understanding the scope of work of the RAWP, this plan includes a CD-ROM that uses three-dimensional imagery to depict the current condition of specific operating areas of the Complex. The CD-ROM contains a plot-plan of the primary Complex buildings. It also contains an image locator corresponding to the various areas in these buildings and a description of the activities that occurred in each of those areas. Appendix A contains the descriptions of each of the zones and a listing of the photos that are available for each zone. To further assist in the understanding of the Complex, a plot plan of the identifying respective zones has also been included in Appendix A.

The following is a description of the Complex buildings, including C-410 and C-420 and a projection of the contaminants expected to be present in each. It should be noted that such contaminants as asbestos-containing material (ACM), polychlorinated biphenyls (PCBs), heavy metals and low level radioactive compounds may be expected to occur in any or all of the buildings.

The Complex is located east of the C-400 Chemical Cleaning Building. Its primary mission was the production of UF_6 from UO_3. The process involved the conversion of UO_3 to UO_2 and, ultimately, the conversion of UO_2 to UF_4 or "green salt" in the C-420 Green Salt Plant. The UF_4 was converted into UF_6 in the C-410 Feed Plant. This area is expected to contain ACMs, PCBs, heavy metals such as mercury, cadmium, and selenium, various compounds of uranium in solid form, and low-level radioactive materials. In addition to the C-410, C-411, and C-420 Buildings, the following external structures are included in this action.

- C-410-C HF Neutralization Building is a steel-framed building with corrugated siding and a footprint encompassing 1088 ft^2. As fluorine cells were cleaned, electrolytes were removed and the cell heads were immersed in a water bath to remove residual material. The water from this bath exhibited a low pH and required neutralization prior to discharge. The neutralization building contained the facility to neutralize this water. The facility contains a slurry tank used for mixing the lime or soda ash and water prior to discharge to the neutralization process. In addition to the neutralization chemicals, the building is expected to contain residual quantities of HF.

- The HF Neutralization Tank is located north of the C-410 Feed Plant. This facility is an in-ground cylindrical concrete tank, 7.7 ft in diameter, lined with an acid-resistant liner and acid brick. The tank was used to neutralize waste F_2 cell HF. The effluent was discharged into the C-410-B Sludge Lagoon. This facility will contain low pH materials, and HF.

- C-410-F HF Storage Building consists of two tanks used for storage of HF for the C-410 process. This building is expected to contain residual HF.

- C-410-G and C-410-H HF Storage Buildings are both 1222 ft^2 prefabricated metal structures built over open concrete pits. These facilities each contain two storage tanks used for HF storage.

- C-410-I Ash Receiver Shelter is a 2000 ft^2 structural steel and corrugated-sided building used to store ash from the uranium tetrafluoride/fluorination process. It is expected to contain residual quantities of uranium compounds.

- C-410-J HF Storage Building is a 2024 ft^2 prefabricated metal structure over an open concrete pit, containing three storage tanks used to store HF for the C-410 process. It is expected to contain residual HF.

- C-411 Cell Maintenance Facility, an addition to the C-410 building was constructed and used for maintenance work on the F2 generation cells. C-411 consists of a single-story bay about 31-ft wide by 202-ft long. The exterior walls are concrete block and the roof is flat with built-up gravel surface roofing over an insulated metal deck. The framing is steel with continuous foundations for exterior walls. The contamination will be expected to be residual HF and/or F2 compounds. Volatile organic contamination could have originated from the cleaning chemicals.

- C-420 Green Salt Plant is a 46,800 ft^2, four-story, structural steel and corrugated asbestos-sided building. This facility converted UO_3 to UF_4 for further conversion in C-410. The building houses hoppers, conveyers, reactor towers, and other support equipment. A PCB spill site resulting from a transformer rupture in 1967 is located south of C-420 and west of C-410. This building is contaminated with various uranium compounds, ACM, PCBs, heavy metals, and HF.

- C-410-E HF Vent Surge Protection Tank is an above-ground tank with an estimated capacity of 150 gallons used for surge protection as part of the system that produced HF for the C-410 Feed Facility. It would be expected to contain uranium compounds and HF. This tank has been removed as a part of a Time Critical Removal Action due to the poor condition of the tank.

3.1.2 Process Description

The Complex was operated to convert UO_3 to UF_6 through a series of reactions involving gaseous hydrogen, HF, and F2. When uranium was received in the form U_3O_8, some preprocessing was required before introducing the material to the process. In the C-420 Green Salt Plant, the UO_3 was converted to UO_2 by a reduction reaction. The conversion of UO_2 to UF_4 was accomplished by hydrofluorination with hydrogen fluoride gas. The ultimate fluorination conversion of UF_4 to UF_6 with fluorine gas occurred in the C-410 Feed Plant. Prior to construction of the C-420 facility in 1956, the entire process was performed in the C- 410 facility.

UO_3 was received as a powder in 4.5-metric-ton (5-ton) containers, unloaded from rail cars by a crane in C-410, and transferred by carts via a freight-elevator to the top floor of C-420. The UO_3 powder was discharged into feed hoppers. The reduction of UO_3 to UO_2 was accomplished by reacting the UO_3 with hydrogen gas in a screw reactor. The UO_2 was collected in a seal hopper for further processing. The off-gas from the screw reactor was fed to a burner to remove the hydrogen gas. It was then sent to a settling chamber and a bag dust collector to remove particulates before discharge to the atmosphere.

The hydrofluorination of UO_2 to UF_4 (green salt) was accomplished in C-420 in horizontal-screw reactors. The UO_2 powder was fed from the seal hopper to three screw reactors operating in series. HF gas was fed countercurrent to the flow of UO_2. The off-gas was diverted to a cyclone separator, a carbon tube dust filter, and then to an HF recovery system. The HF recovery system consisted of two cooling systems used to condense the HF vapor to a liquid. The condensed HF was drained to rubber-lined storage tanks. The HF remaining in the vapor stream was sent to a scrubber, and the inert gases were discharged to the atmosphere through a fume stack.

The UF_4 powder was collected in a seal hopper, transferred to a weigh hopper, and then discharged into a closed conveyor. The conveyor carried the UF_4 powder into a large hopper in C-410 for further processing.

The fluorination conversion of UF_4 to UF_6 in tower reactors was accomplished in C-410. In this process, F2 gas and UF_4 were fed to the tower reactors. The UF_6 gas produced was discharged through two cyclone dust separators and a filter operating in series. The dust-free gas from the filter flowed into cold traps to condense the UF_6. The liquid in the cold traps was drained into cylinders mounted on scales. The cylinders were used to transfer the UF_6 to the cascade feed facilities.

The off-gas from the UF_4 to UF_6 conversion was sent to a F2 clean-up reactor, where additional UF_4 was introduced to react with any remaining F2 gas. The ash from the clean-up reactor was sent back to the storage hopper for reprocessing. The gas was vented through another set of cold traps to recover additional UF_6. The off-gas was then vented to a final cold trap to remove the last traces of UF_6. The off-gas from this cold trap was sent to a UF_6 absorber, a cyclone separator, and a filter before being discharged to the atmosphere.

The F2 gas used in the process was generated within C-410. Liquid HF was received in railcars. It was then transferred to the C-410 HF storage tanks outside the east end of C-410. Liquid HF was vaporized for use in the C-420 process. The HF product was routed to the fluorine production cells for conversion into fluorine gas and hydrogen gas via electrolysis. The F2 gas was used to convert UF_4 into UF_6.

The C-410 building is connected via overhead piping to the HF storage tanks. The HF tanks are connected via overhead piping to the C-340 Metals Plant, which is under Surveillance and Maintenance (S&M) in the D&D program. During the operation of C-340 from the 1950s to the 1970s, liquid HF was produced in C-340 and transferred to C-410 for use in the fluorination of UO_2 to UF_4.

3.1.3 Auxiliary Systems

The Complex includes a number of auxiliary systems. The following is a listing of auxiliary systems and their functions:

- <u>Water</u>: The C-611 Water Plant and PGDP water system supplied potable water and cooling water.
- <u>Electricity</u>: Two 2000-kVA, 13.8-kV transformers powering a 400-A, 4-kV direct current bus provided electrical power. Two double-ended substations provided power at 13.8-kV primary and 480-V secondary voltages. Each of the four transformers was rated at 1500/2000 kVA.
- <u>Heat</u>: Steam-heated air units heated the entire Complex. Roof-mounted exhaust fans vented the air. Outside air entered through wall-mounted auto damper intake louvers. Steam tracing, steam-heated air, as well as electrical resistance heated process piping.
- <u>Exhaust air</u>: Air exhausted from the F2 cell rooms and HF vaporizer room was discharged through stacks north of the fluorine plant.

- **Cooling**: A chilled water unit cooled the feed plant control room, change house, lunchroom, and laboratory. Individual window-mounted air conditioners cooled office areas on the west side of C-420.

- **Lighting**: Explosion-proof incandescent fixtures provided lighting in hazardous areas, with vapor-tight incandescent lighting used in other process areas. Fluorescent lighting lit office areas.

- **Refrigeration**: Refrigeration systems condensed UF_6 product and HF and F2 in off-gases from the reaction systems. Cold traps cooled by Freon™-12 removed HF and F2 from off-gases. A two-stage ammonia refrigeration system provided cooling to the Freon™-12 system. The ammonia system also cooled the glycol used in the cold traps to condense UF_6.

3.2 Operating History

3.2.1 Historical Operations

The Complex operated from the early 1950s through the mid-1960s. The facility was placed in standby for several years, before resuming operation in the mid-1970s until its final shutdown in 1977.

During the operational history of PGDP, uranium oxides recovered as spent fuel from nuclear reactors were processed intermittently. During these periods, the recovered oxides (reactor returns) accounted for an average of approximately 17 percent of the material fed to the uranium enrichment cascade. The Complex processed virtually the entire cascade feed.

Four of the fluorine generating cells continued operation until 1994 to provide fluorine for uranium enrichment cascade use.

During final shutdown, the C-410 process systems were purged and isolated. Interviews with former operators indicate that most of the systems were drained during shutdown; however, no records documenting these activities have been located.

After shutdown of the facility, the C-420 offices were used for other purposes, including an electrical shop, valve rebuilding, computer maintenance, training space, and health physics offices. During the uranium enrichment cascade upgrade and improvement programs, part of the original C-410 structure was used as a machine shop for refurbishing large body valves.

Stored materials and equipment were moved into the Complex from other parts of the plant following the end of feed material production. During the 1990s, visual and process knowledge characterization was performed of the equipment to identify potentially hazardous materials. Additionally, fluids were drained and characterized. Any identified hazardous wastes were placed into proper storage based on characterization results. As a result of the presence of the stored equipment and material and due to the potential for release from contamination present in the building due to building operations, the entire Complex was identified as Solid Waste Management Unit (SWMU) 478.

In 1995, the PGDP D&D program initiated the following actions to correct environmental issues associated with the Complex:

- Removal of 255 compressed gas cylinders;
- Collection and staging of approximately 1100 containers;

- Collection and removal of small containers of chemicals/materials;
- Characterization of contents of five sumps and one pit
- Characterization and placement of 12 breached fluorine cells in a Resource Conservation and Recovery Act (RCRA) storage area ;
- Draining and characterization of 220 gallons of oil from 166 items of shutdown equipment oil reservoirs;
- Cleaning of 137 wet oil sites;
- Draining of 165 gallons of oil from 2 ammonia refrigeration systems;
- Removal of Freon™ from 23 coolant systems;
- Plugging all accessible floor drains;
- Collection and removal of light bulbs, starters, waste mercury items, loose circuit boards, and other potentially RCRA-regulated items;
- Draining and characterization of 3245 gallons of liquids from eight non-uranium process tanks; and
- Removal of paint chips deposited as a result of passive degradation.

3.2.2 Current Status

The Complex is currently in shutdown status, under S&M in the D&D program, with few utilities in operating condition. Access and activities within the buildings are controlled.

Current activities involve minimal maintenance and storage of various plant materials. These materials include spare parts, and discarded equipment and materials from other areas of PGDP, much of it unrelated to the operational history of the Complex.

Investigations regarding the presence of hazardous and non-hazardous materials, conducted since the Complex shutdown, have provided the following information:

- Chemical products were physically removed from the $UO_3 \rightarrow UF_6$ process equipment by operating the equipment until all visible material had been evacuated. Residual amounts of these materials potentially remain within confined areas of the equipment. Oil has been drained from the ammonia refrigeration system. Freon™ has been removed from the Freon™ refrigeration system. The fluorine surge tank and the tanks in the HF storage tank farm are empty. Ethylene glycol has been drained from the cold trap coolant system. Pressure readings have been observed on some gauges. Until proved otherwise, process and instrument lines must be considered pressurized.

- Auxiliary process equipment such as the refrigeration systems, fluorine generators, and storage tanks, may contain residual hazardous chemicals such as potassium bifluoride.

- Interior and exterior surfaces of the process equipment exhibit radiological contamination. Radioactive contamination on the interior building surfaces ranges from non-detectable to high levels of contamination. Potential exists for internal and external exposure to alpha, beta, and gamma-emitting radionuclides. Uranium, transuranics, and technetium are suspected to be the primary radionuclides. Uranium above one percent enrichment has been identified in some areas. These materials originated from sources external to the Complex and are identified on the surfaces of equipment currently stored in the buildings. External surfaces may contain lead paint and asbestos. Much of the paint is exfoliating. Large quantities of ACMs are present in the facilities. Asbestos insulation is falling from the piping and equipment.

- Electrical equipment such as transformers, rectifiers, and capacitors within the Complex may contain PCB-based oil. Fluids such as lubricating fluids, hydraulic fluids, and dielectric fluids may not have been drained from all equipment such as motors and condensers. Some of these fluids may contain PCBs. Gaskets within the equipment and ventilation system may contain PCBs.

- Although mercury has been removed from most equipment, some mercury switches and manometers may be present in the Complex. Chromium compounds may have been deposited on the interior of the cooling system from the past use of chromium based corrosion inhibitors. Because previous investigations at other PGDP facilities have identified selenium in rectifiers, it is a possible contaminant. Cadmium has been identified in previous surveys. Therefore, the potential exists for its presence at the Complex.

- Stored materials and equipment were moved into the Complex from other parts of the plant following the end of feed material production. During the 1990s, visual and process knowledge characterization was performed of the equipment to identify potentially hazardous materials. Additionally, fluids were drained and characterized. Any identified hazardous wastes were placed into proper storage based on characterization results. The entire Complex was identified as SWMU 478. In accordance with the FFA (section IX) and Hazardous Waste Permit, DOE submitted an integrated removal/remedial site evaluation and SWMU assessment report for the Complex. DOE determined that a removal action was necessary. Accordingly, DOE is undertaking this removal action for the Complex in accordance with, and in satisfaction of, applicable requirements of the FFA, CERCLA, RCRA, and the Hazardous Waste Permit. As a part of the CERCLA infrastructure removal action, this stored equipment and materials will be removed, characterized and dispositioned, consistent with applicable requirements of RCRA and TSCA. During this characterization, the potential exists for generating hazardous wastes or TSCA regulated wastes, such as from removing fuses or light bulbs from equipment, or from lubricants present in motors or gearboxes. Any such wastes will be managed in accordance with applicable requirements.

Table 3.1 summarizes the contaminants expected to be present in the Complex.

Table 3.1. Summary of Contaminants

Contaminant[1]	Form
Uranium	UO_2, UO_3, UF_4, UF_6, U_3O_8, UO_2F_2
Am-241	Small quantities
Np-237	Small quantities
Cs-137	Small quantities
Co-60	Not detected
Pu	Trace Quantities
HF materials	Electrolyte, HF, LiF, KHF_2, H_2, F_2
Asbestos	Blankets, insulation, floor tiles
Lead	Paint
Mercury	Switches, manometers, DC arc tubes
PCBs	Light ballasts, gaskets, electrical insulation
Refrigerants	Freon, ammonia

Contaminant[1]	Form
Cadmium, selenium	Electrical components

[1] Radionuclides include their radioactive decay products.

3.3 REMOVAL ACTION OBJECTIVES (RmAOs)

RmAOs for the Complex form the basis for identifying and evaluating appropriate response actions. The RmAOs for this removal action are:

- remove the materials causing the highest potential risks (e.g., transferable radioactive materials, asbestos, and other hazardous materials such as PCBs); thereby, significantly reducing the risk to current employees and potential off-site receptors in the event of building failure or further degradation to levels within the CERCLA risk range and in compliance with ARARs;

- reduce the potential for public, worker, and environmental exposure to radioactive and hazardous substances caused by uncontrolled release from the buildings; and

- remove the infrastructure from the Complex buildings in preparation for future final cleanup decision-making for the remediation of the building structure and environmental media.

3.4 REMOVAL ACTION APPROACH

To accomplish the project on schedule, activities within the Complex will overlap as work progresses. For example, packaging and disposal of materials/equipment from one area may be in progress while removal of the materials/equipment in another area is being completed. The removal activities are shown in Figure 3.1.

These activities include:

- Planning,
- Site Preparation,
- Material/Equipment Identification,
- Chemical/Hazards Analysis,
- Hazard Mitigation/Controls,
- Equipment/Materials Characterization/Segregation,
- Equipment/Materials Removal,
- Waste Disposition, and
- Equipment Recycle/Reuse.

3.4.1 Planning

The infrastructure D&D process will require a highly integrated approach to ensure compliance with all technical, as well as regulatory and safety requirements. Planning for the D&D of the Complex infrastructure will incorporate the Integrated Safety Management System (ISMS) process. This includes: definition of the scope, analysis of the hazards, mitigation of the hazards, execution of the work, and feedback for improvement. In addition to the ES&H Plan, Sampling and Analysis Plan (SAP), Waste Management Plan (WMP), and

QAPjP, the planning process will include development of specific work packages for the various tasks involved in the activities described in this RAWP.

To facilitate planning and control, areas of the Complex have been divided into discrete zones. These zones are depicted in the IPIX images contained on the CD-ROM defined in Section 3.1.1. It is expected that specific removal activities will be performed on a system-by-system basis, while others will be performed zone-by-zone or combination of zones basis. The planning process must incorporate the flexibility to modify the approach to each removal task as the day-to-day results are developed and reviewed.

Characterization, an integral part of the process, is necessary to ensure a safe working environment, as well as to determine the proper disposition of materials from the Complex. Characterization will be performed in accordance with the SAP.

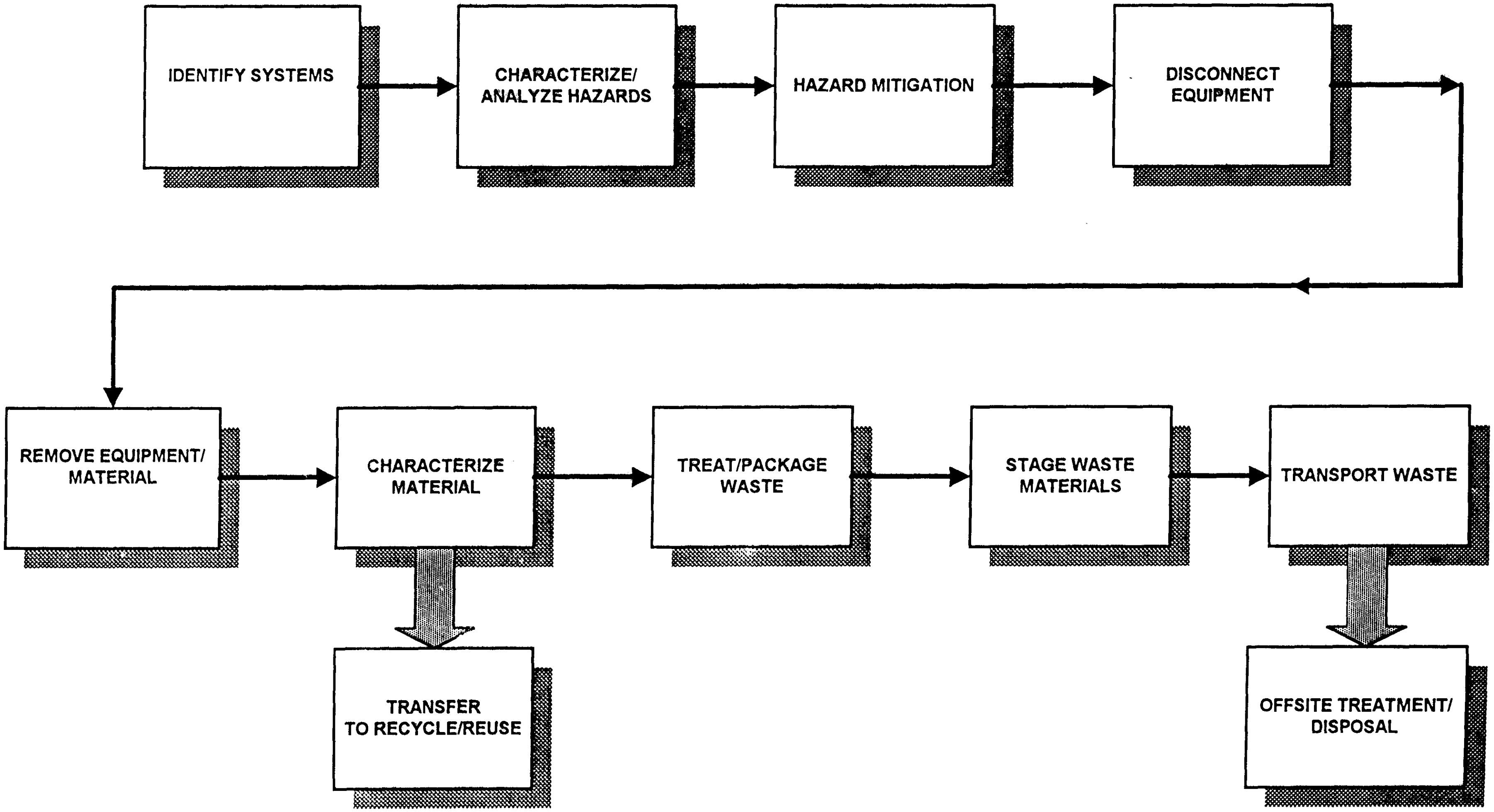
During purging and material removal, components of the systems will be visually inspected to determine if residual process materials are present. Where necessary, samples will be obtained from individual components of each system to identify and quantify possible contaminants. Hazards associated with each process system will be analyzed to develop a method for removing that system.

The waste materials generated during the dismantlement process will be sampled and analyzed to determine the potential exposures to the workers and environment, establish the levels of personal protection required, and establish disposal requirements. Depending upon the material characteristics, the material may be treated (as required) on-site and dispositioned in compliance with the ARARs and Waste Acceptance Criteria (WAC) of the designated disposal facility. If necessary, off-site treatment may be utilized to meet the disposal criteria.

Materials that have been removed will be sent to on-site processing areas in preparation for disposal. The size of some materials may be reduced to meet transportation or disposal criteria. Processed material will be packaged in accordance with applicable U.S. Department of Transportation (DOT) regulations as well as the WAC of the designated disposal facility, and placed in a staging area pending transportation to the final treatment/disposal site.

Equipment designated for potential recycle/reuse will be packaged, marked, and staged in a designated location for removal based on ARARs.

FIGURE 3.1 C-410 COMPLEX D&D PROCESS FLOWSHEET



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3.4.2 Site Preparation

The first activity of the D&D of the Complex infrastructure will be site preparation. The facility has been shut down for years with minimal maintenance. The facility originally operated with adequate utility sources (power, steam, water, etc.). The status of these systems must be evaluated to determine their condition and availability. Existing equipment in the building (cranes, vacuum systems, elevators, conveyors, etc.) will be evaluated to determine potential for use in the D&D activity.

Utilities and equipment identified for use will be repaired, certified, and tested prior to use. Necessary utilities and equipment that cannot be revived will be acquired through other means. Auxiliary equipment may be provided and installed on-site. If adequate space is not available within the Complex, then areas outside the Complex may be utilized.

During site preparation, specific areas of the Complex will be designated as: 1) material processing areas, 2) material packaging areas, and 3) staging areas.

If necessary, each designated processing, packaging, or staging area will be decontaminated, structurally modified, and equipped with the necessary utilities and equipment to accomplish its designated function. As the removal work progresses, these areas may be relocated to facilitate material movement.

3.4.2.1 Utility Requirements

Power: The power distribution system for the Complex was de-energized after flooding when a previous water leak damaged equipment. Currently, small generators supply power for most of the Complex. A new power supply has restored electricity to a small section of the Complex. These sources are insufficient to power all the equipment required for the removal process. Additional sources will be installed to provide the necessary power.

Water: Since the Complex is not heated, freeze protection for non-insulated water systems must be addressed. Existing isolation valves do not provide a positive shutoff for water entering the Complex. Water supply lines to the complex have been disconnected. A water source will be installed outside the buildings.

Steam: Although a steam source is available at the Complex, it is not expected to be used.

Air/Vacuum Piping: Existing air and vacuum piping systems may be required for purging and evacuation of the process systems. The air and vacuum piping are expected to be in usable condition, and can be returned to service. A system check will determine the need for repairs. A new vacuum system may be provided if repair of the existing system is not cost effective.

3.4.2.2 Equipment Requirements

The removal process will require standard construction equipment, such as forklifts and scissor lifts to manipulate material and assist in the removal process. This equipment may be specifically selected to operate within the confined spaces of the Complex. In addition, the following site-specific equipment will be used:

- Overhead cranes and freight elevators in the Complex will be critical to the removal of process equipment. This equipment was operational prior to facility shut down. They will be evaluated for use in the infrastructure D&D and either repaired or replaced.

- Central vacuum system may be used to control airborne emissions generated during removal work. An existing central vacuum system for Complex will be evaluated to determine its condition and to define the repairs/modifications necessary to improve its efficiency to acceptable levels. If necessary, new systems may be installed to replace or augment the existing vacuum system.

- Mobile asbestos decontamination units may be used in strategic locations to minimize exposure levels during the handling of asbestos-clad equipment and piping.

- A variety of equipment will be used to dismantle the equipment for removal. This equipment may include, but will not necessarily be limited to, mechanical and hydraulic shears, oxyacetylene or plasma arc torches, and mechanical piping cutters.

- Size reduction equipment will be utilized to reduce the size of the waste materials prior to packaging and disposal. These may include but will not necessarily be limited to shears, shredders, or compactors. Support equipment such as conveyers, labeling equipment, wrappers, etc. will also be used.

- An evacuation system will remove liquid and gaseous materials from equipment and piping if found necessary.

- Ventilation may be provided locally in areas being dismantled and associated with waste processing to control airborne particulates.

3.4.3 Material/ Equipment Identification

The Complex encompasses numerous chemical process systems as well as material and equipment that originated from external sources stored within the buildings. A preliminary determination of the various process systems and associated chemical compounds are listed in Table 3.2. Further identification will include definition of the piping, electrical, and instrumentation systems connected to each piece of equipment. The primary equipment in each system will be identified and used as the focus for disconnecting each component.

Table 3.2 Process Systems

PROCESS SYSTEM	PRIMARY MATERIAL
C-410 HF Reactors	HF
C-410 HY Reactors	H_2
C-410 F^2 Reactors	F2, Electrolyte (LiF)
C-410 Cold Traps/Refrigeration	U, CO_2
C-410 Vacuum Cleaning	UO_2, UO_3, UF_4
Ash Grinding	UO_2, UO_3, UF_4
C-420 F^2 Reactors	F2
C-420 Cold Traps/Refrigeration	Ethylene Glycol, U
C-420 HF	HF
C-420 UF_6	UO_2, UO_3, UF_4, UF_6
C-420 Vacuum Cleaning	UO_2, UO_3, UF_4
C-420 HF Recovery	HF, Freon™

SECONDARY SYSTEMS	
Steam	
Air	
Nitrogen	
Process Water	Water, chromium
Lube Oil	Oils, greases
Alumina Traps	UF_6, F_2, HF

During the D&D process, each of these systems will be evaluated to verify the types and quantities of chemicals, both primary and secondary that may exist in each component. This evaluation will involve the use of: 1) subject matter experts who were present during the operation and shutdown of the Complex, 2) review of available drawings and operations logs, and 3) sampling and analysis results, as necessary.

3.4.4 Chemical/Hazards Analysis

Many of the compounds will potentially impact worker and/or environmental safety. Material and equipment will be identified and analyzed to determine associated hazards. This analysis will involve: process knowledge from personnel who worked within the Complex, and a review of available documentation associated with operation of the Complex.

The analysis will include identification of hazardous energy sources such as equipment power connections and associated supply source(s). Hazardous energy sources will be secured prior to dismantlement of each system, consistent with Occupational Safety and Health Administration standards. Other potential hazards such as high-pressure gases, steam, and stored energy will be identified to prevent danger to workers or release to the environment. A portion of the piping is labeled. A methodology for marking the individual components for later identification during removal operations will be developed and implemented. Piping will be marked to ensure awareness of hazards involved with each system when preparing to open a system. After a system is opened, it will be marked to indicate its status.

Material/equipment potentially subject to RCRA, Toxic Substances Control Act (TSCA), or radiological regulations will be identified for future sampling and special handling procedures.

3.4.5 Hazard Mitigation/Controls

During implementation of this removal action, environmental compliance and worker safety will be controlled through various mechanisms, including but not limited to: sequencing of work, work practices, and physical controls or barriers.

Personnel will enter and exit the Complex facilities through boundary control stations to ensure radiological contamination is not carried out of the area. Physical controls such as sealing building vents to the extent practicable, plugging floor drains, cutting and capping water lines that enter the building, and routine vacuuming and housekeeping inside the building will be applied to minimize the potential for contaminant migration. Activities such as removal of asbestos will be performed in accordance with ARARs. Where feasible, physical barriers such as curtains or temporary containment enclosures will be utilized to minimize contaminant migration.

__Hazardous Energy:__ Hazardous energy sources such as steam and electrical power will be identified. Those sources will be de-energized and marked prior to implementation of the removal tasks. Removal activities that could be affected by these sources will only be initiated after appropriate verifications that the energy sources have been isolated. Lock out/tag out procedures will be applied. All hazardous energy sources will be considered active until proven otherwise.

Water: The D&D activities are not expected to generate significant aqueous discharge streams. The nature of the materials identified within the Complex would preclude the use of water in the decontamination activities. Water used for decontamination of personnel will be contained, treated and reused, or contained and transported to disposal. Shower water is treated in the PGDP Sanitary Wastewater Collection Treatment System. All identified floor drains have been plugged to eliminate the uncontrolled discharge of water from the building.

Air: C-410 infrastructure D&D is expected to generate air-borne radioactive particulate contamination, as well as chemical contaminants. The migration pathways for airborne emissions include vents, broken windows, wall penetrations, open doorways etc. Mitigation measures have been implemented to minimize emissions from the Complex. These include, but are not limited to: 1) plugging vents, 2) eliminating penetrations, 3) repair/replacement of broken windows, 4) controlling access for ingress/egress, and 5) installation of doors where necessary.

Vacuum collection and filtration systems will be used to control the air emissions in areas where activities are anticipated to result in increases in airborne contaminants.. Emissions produced from activities such as the system purging and the asbestos stabilization/removal will be: 1) contained and treated in systems in close proximity to the specific activity, or 2) conveyed via an emissions collection system to a containment/treatment system within the Complex and discharged within the buildings. Filtering/scrubbing mechanisms will be utilized to control airborne contamination levels.

Localized control and treatment are expected to minimize the air emissionsgenerated by the removal process. Preliminary air modeling of the predicted types and quantities of localized emissions to be generated during the D&D operation indicate that levels of off-site migration of contaminants of concern would not dictate the requirement for continuous monitoring.

In order to verify that the removal activities will not be detrimental to the air quality external to the Complex, a monitoring network will be installed in close proximity to the building. Contaminant levels will be monitored and recorded on a weekly basis. The results of the monitoring program will be included in the quarterly conferences with the regulatory agency personnel.

Sediment: Work will be scheduled to allow for implementation of sedimentation controls prior to initiating work with potential effects on the wastewater management program. Localized controls, such as silt fences, may be installed for activities with potential to generate sediment.

Hazardous Chemical: The method of removal of materials remaining in individual systems will depend on the location and state of the materials and the degree of environmental/worker exposure expected. If the solid material meets the WAC of the disposal facility designated to receive the equipment and piping in which it is contained, the material may remain in the equipment. The material may be sealed inside that section of pipe or equipment component and transferred to processing/packaging/staging areas.

Materials in gaseous or liquid form will be removed. An evacuation system including vacuum pumps or blowers may be used to remove materials. Once the material has been removed from equipment, that equipment will be marked as ready for disconnection. Materials removed from these systems will be managed in accordance with ARARs, including Kentucky Division of Air Quality regulations. Before declaring equipment ready for removal, the equipment will be characterized to determine the contaminants of concern and their concentration. If the material remains above acceptable concentration levels, appropriate measures will be applied to ensure worker safety and environmental compliance prior to removal. Materials will be characterized for eventual disposition in accordance with the SAP. Any regulated materials will be managed in accordance with ARARs.

3.4.6 Equipment/Materials Removal

The dismantlement process will involve isolation of individual pieces of equipment, including: disconnection of power sources; disconnection of instrumentation such as control wiring, thermocouples, and tubing to pressure gauges; and disconnection of piping, ductwork, or other mechanical equipment, such as hoppers and conveyors. If piping and equipment contain asbestos insulation, acceptable asbestos-management practices will be used.

Removal of smaller equipment may only involve disconnection from the connecting piping, support brackets, or hangers. Larger equipment may require dismantlement into smaller more manageable sections before movement to the processing/packaging areas.

Disconnected and/or dismantled equipment (such as piping, electrical equipment, conduit, work platforms, equipment support, and non-load bearing structures) will be removed, segregated and relocated to the processing/packaging areas, and ultimately to the staging areas. The processing/packaging areas may be used to further dismantle equipment, volume reduction to minimize transportation/disposal costs, and to perform any additional size reduction required to comply with the WAC for the designated disposal option.

Equipment will be characterized for eventual disposition in accordance with the SAP. Any regulated materials identified will be managed in accordance with ARARs.

3.4.7 Material/Equipment Characterization

Characterization will ensure a safe working environment and support the proper disposition of materials from the Complex. Generally, the sampling and characterization task will be an integral part of the work planning activity and, as such, will be included in the individual Work Packages. Characterization will be performed as a part of the ISMS process, to further define the work environment to ensure worker safety by enhancing worker awareness. These activities will also be performed to ensure that the wastes generated by the removal activity are in compliance with the WAC of the designated disposal facilities.

Characterization will be performed to define unidentified materials and to augment the information developed through process knowledge and historic data research to quantify materials that have been identified. The need to collect samples will be determined based on the characteristics and hazards of expected contents of a system or component; size of the component; and process knowledge regarding the techniques of shutdown of individual components. Characterization will be performed in accordance with the SAP.

During purging and material removal, components of the systems will be visually inspected to identify potential contamination. Where necessary, samples will be obtained from individual components of each system to identify and quantify possible contaminants. The waste materials generated during the dismantlement process will be sampled and analyzed to determine the potential exposures to the workers and environment, to establish the levels of personnel protection required. Depending upon the material characteristics, the material may be treated on-site (as required) and dispositioned in compliance with the ARARs and WAC of the designated disposal facility.

Materials that have been removed may be sent to on-site processing areas in preparation for disposal. The size of some materials may be reduced to meet transportation or disposal criteria. Processed material will be packaged in accordance with DOT regulations, and placed in a staging area pending transportation to the final treatment/disposal site.

Equipment designated for potential recycle/reuse will be packaged, marked, and staged in a designated location for removal based on ARARs.

3.4.8 Waste Disposition

Waste materials will be segregated, characterized, treated as necessary, staged, packaged, identified for recycle/reuse potential or disposed of in accordance with the WMP. Waste disposition for the D&D of the Complex infrastructure will be in accordance with ARARs.

D&D of the C-410 infrastructure will generate a variety of waste streams. The primary waste streams will be radiologically contaminated materials identified as low-level waste (LLW) and construction/demolition debris. Wastes such as PCB-containing liquids and electrical components, non-radioactive RCRA and/or mixed waste sludge or liquids, petroleum products, and solid waste will also be generated. A listing of potential waste streams is presented in WMP.

Material and equipment which was stored in the Complex following halting of feed production operations, will represent the remainder of the total requiring dispositioning.

3.4.8.1 Waste Segregation/Treatment

All waste materials will be separated into waste streams that conform to the WAC of the proposed disposal facility. The majority of this material will be low-level radioactive waste. However, it is expected that other waste streams may include RCRA or TSCA hazardous waste, mixed waste, or non-hazardous solid waste.

Characterization will be an integral part of the handling and disposition of materials from the Complex. As the material is removed, packaged, and containerized, characterization will be necessary to segregate the waste material in accordance with the compliance criteria of the available disposal facilities. These activities will involve the sampling and analysis of the material in accordance with the SAP.

Depending upon the characteristics of the materials removed from the Complex, it may be necessary to provide on-site or off-site treatment in order to comply with the WAC for the selected disposal facility. If treatment becomes necessary it will be performed within an existing permitted facility or within a specifically designed facility constructed and operated in accordance with regulatory guidelines. Mixed waste and RCRA waste will be treated, if necessary, to meet RCRA land disposal restrictions prior to disposal.

3.4.8.2 Waste Packaging

The waste generated during infrastructure D&D will be containerized for transportation and disposal. The waste streams and volume of waste requiring containers will depend extensively on the dismantlement technologies used and the disposal options selected. A variety of containers are available that would be appropriate for the different waste streams generated. Some examples of appropriate containers include Sea-land containers, intermodal containers, ST-boxes (B-25), steel drums, and polyethylene drums. Due to the diversity of waste that will be generated, it is anticipated that the full range of the container options will be used during implementation of the removal action. All wastes generated during this project will be packaged in accordance with relevant DOT, DOE, EPA, and/or Nuclear Regulatory Commission (NRC) regulations.

3.4.8.3 Waste Transportation

The waste streams may be described with one of the following six DOT proper shipping names:

- Low Specific Activity
- Surface Contaminated Objects
- Hazardous Waste, Solid/Liquid
- PCBs, Solid/Liquid
- Asbestos
- Solid Waste

Wastes not meeting the above classifications will be evaluated on a case-by-case basis for proper classification and packaging. Samples collected during the course of this project will be shipped in accordance with DOT rules, if transported by ground, or by International Air Transport Association/International Civil Aviation Organization rules if transported by air.

3.4.8.4 Waste Disposal

Disposal options that can be considered for the wastes generated during infrastructure D&D of the Complex are limited by the presence of radioisotopes on most of the equipment and materials at levels that exceed most industrial/sanitary landfills radioisotope limits. Three facilities are being evaluated as primary disposal options for the waste generated from the D&D activities: Nevada Test Site (NTS), the Envirocare Utah facility, and potential on-site disposal of non-hazardous solid waste at PGDP C-746-U landfill. Disposal at the onsite landfill will be consistent with WAC developed through an Authorized Limits Evaluation and Performance Evaluation for the landfill and with requirements for CERCLA wastes. Other facilities may be evaluated on an as needed basis. A summary of the waste disposal options for the various waste streams is presented in the WMP.

Additional disposal options will be evaluated for cost effectiveness and applicability at the time of shipment. The WMP provides information on each of the anticipated waste classifications and the preferred method of disposal. Alternatively, should the CERCLA disposal cell that has been proposed for the PGDP site be approved, much of the waste material generated by the D&D action could be deposited there.

3.4.9 Equipment Recycle/Reuse

The recycle and/or reuse of equipment and materials from the D&D activity will be consistent with DOE policy and federal and state requirements in place at the time of the occurrence. The Complex contains equipment that may have application within the current plant operations or in other manufacturing facilities. As such equipment is removed, it will be segregated and staged for transportation to the new application. Currently, DOE has imposed a moratorium on recycle of metals from DOE facilities. The reuse of equipment from this D&D activity will be designated for reuse within DOE and/or NRC approved facilities. Should the new location be an off-site facility, the equipment will be packaged and prepared for transport in accordance with the ARARs.

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4. PLANS AND WORK CONTROL DOCUMENTS

The following plans will be developed to ensure the proper execution of D&D of the Complex infrastructure, and to ensure compliance with the AM and ARARs:

4.1 Health and Safety Plan (HASP)

The HASP, which will comply with 29 CFR 1910.120, addresses hazards specific to each action and the associated work. This plan will also include information on how the project will comply with environmental laws and regulations.

4.2 Waste Management Plan (WMP)

The WMP (Appendix B) defines the potential waste streams from D&D of the C-410 infrastructure, establishes the alternative methods of disposal of each waste stream, and defines the requirements for the transportation of each category of waste.

4.3 Quality Assurance Project Plan (QAPjP)

The QAPjP will meet the quality requirements of 10 CFR 830.120 It establishes the requirements for quality control and assurance of activities associated with the D&D of the Complex infrastructure, and incorporates the protocols and procedures of the BJC Corporate QAPjP.

4.4 Sampling and Analysis Plan (SAP)

The SAP encompasses the sampling and analyses of multiple items, areas, and waste streams generated by the D&D of the Complex infrastructure. This plan differs from typical SAPs in that the items to be sampled, analyzed and characterized will be identified as the work progresses. Contaminants of concern will be identified, sampled, and analyzed for critical components. This plan defines the process for establishing sampling requirements for each task and subtask, selection of the proper sampling protocols, and communication of sampling for use in future activities.

4.5 Other Plans

It may be necessary to develop other plans and documents in addition to those identified previously. These may include, but are not limited to:

- Security Plan
- Transportation Plan
- Authorization Basis Documents (as required)

Authorization Basis documents include: facility safety analyses, evaluation of changes to the facility authorization basis, and nuclear safety evaluations. These documents meet DOE Orders for ensuring safe operation of facilities throughout their lifecycle. Modification to these documents will be prepared based on an evaluation of identified charges to the operation and/or facilities. These additional plans are considered secondary documents and may be provided for review purposes and will be placed in the Post Decision AR File as appropriate.

4.6 Task-Specific Work Instructions

Additional documents including activity hazard analysis and work permits will also be developed as the work progresses. These work instructions include detailed, task specific, work control documents, and, as such, are not planned for inclusion in the AR. Work Control Documents would be available for onsite regulatory agency review, if requested.

5. PROJECT SCHEDULE

Detailed schedules will be developed as the planning is completed for each major task of the project. The schedule is contingent upon budget constraints for each fiscal year (FY). This schedule is based on present budget projections.

Schedules for completion of activities set forth herein are estimates provided for informational purposes only and are not considered to be enforceable elements of the removal action or this document. The enforceable milestones and non-enforceable milestones for performance of activities included as part of the removal action are set forth in Appendix C and Appendix G of the FFA, respectively. Progress reports will be made through scheduled teleconferences or meetings with the EPA and Kentucky Department of Environmental Protection on a quarterly basis.

Any additional milestones, timetables, or deadlines for activities included as part of the removal action will be identified and established independent of this RAWP, in accordance with existing FFA protocols.

The schedule for the D&D activities will be addressed as a part of the dispute resolution of the Site Management Plan Schedule under the FFA.

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6. GOALS ATTAINMENT

The goals for the D&D of the infrastructure in the Complex are to:

- reduce the potential for a release of contaminants from the equipment and stored materials contained in the Complex due to deterioration of the aging buildings;
- reduce the potential for public exposure or release to the environment of radioactive and hazardous substances that could be caused by any uncontrolled releases from the Complex buildings;
- remove the contents, infrastructure, and stored materials from the Complex buildings in preparation for structure D&D; and
- complete the work safely within budget, on schedule, and in accordance with ISMS principles.

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7. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

7.1 INTRODUCTION

In accordance with Sect. 40 *Code of Federal Regulations* (*CFR*) 300.415(j) of the National Oil and Hazardous Substances Pollution Contingency Plan and DOE Headquarters guidance, DOE on-site removal actions conducted under CERCLA, as amended, are required to attain ARARs to the extent practicable, considering the exigencies of the situation. ARARs include only federal and state environmental or facility siting laws/regulations; they do not include occupational safety or worker radiation protection requirements. Additionally, per 40 *CFR* 300.405(g)(3), other advisories, criteria, or guidance may be considered in determining remedies [to-be-considered (TBC) category]. The D&D removal action alternatives for the Complex Infrastructure include removal of scrap metal, equipment, infrastructure, and any waste materials; decontamination of equipment or metal surfaces, if necessary; and removal of the structure/debris so that only the buildings shell remains. The removal action would comply with all identified ARARs/TBCs and would not require an ARAR waiver. ARARs are typically divided into three groups: (1) chemical-specific, (2) location-specific, and (3) action-specific. Tables C.1, C.2, and C.3 list the Chemical-, Location-, and Action-Specific ARARs/TBCs, respectively, for the D&D removal action. A brief description of key ARAR/TBC issues follows.

7.2 CHEMICAL-SPECIFIC ARARs/TBCs

Chemical-specific ARARs provide health or risk-based concentration limits or discharge limitations in various environmental media (i.e., surface water, groundwater, soil, and air) for specific hazardous substances, pollutants, or contaminants; these are listed on Table C.1 and discussed below.

The radiation dose to members of the public must not exceed 100-millirem/year total effective dose equivalent from all sources excluding dose contributions from background radiation, medical exposures, or voluntary participation in medical/research programs [10 *CFR* 20.1301(a)(1); 902 *KAR* 100:019 Section 10(1)] and must be reduced below this limit as low as reasonably achievable (ALARA) per 10 *CFR* 20.1101(b); 902 *KAR* 100:015 Section 2. This dose limit addresses exposure to radiation from all sources and activities (including both operations and removal/ actions) at a facility. In addition, DOE is required to use procedures to maintain the dose ALARA. Thus, the actual dose that the public might receive from any individual activity, such as this removal action, is expected to be a very small fraction of the 100-mrem/year dose limit. Unrestricted use of a facility after D&D would require limiting residual radioactivity distinguished from background to an average member of the critical group to 25 mrem and ALARA (10 *CFR* 20; 902 *KAR* 100:042, Section 2). This would generally apply after removal or lease of the building and soil, which will be addressed as part of subsequent actions.

7.3 LOCATION-SPECIFIC ARARS/TBCSs

Location-specific requirements establish restrictions on permissible concentrations of hazardous substances or establish requirements for how activities will be conducted because they are in special locations (i.e., wetlands, floodplains, critical habitats, historic districts, and streams). Table C.2 lists federal and state location-specific ARARs for protection of cultural or sensitive resources.

7.3.1 Floodplains and Wetlands

None of the activities associated with the removal action alternatives would be conducted within any floodplain. In addition, no wetlands are present at or near the vicinity of the buildings. Thus, no impacts to either floodplains or wetlands would result from any of the alternatives considered for this proposed removal action.

7.3.2 Threatened and Endangered Species (T&E)

None of the removal action alternatives would adversely impact any federally or state-listed T&E species located or seen at PGDP since most removal action activities will occur inside the buildings. Consequently, none of the requirements for protection of T&E species or critical habitat are included as ARARs.

7.3.3 Cultural Resources

This removal action will not involve outdoor excavation. No archeological surveys or inventory of historic structures have been conducted. The earliest structures at PGDP are approximately 50 years of age, and will need to be evaluated for eligibility or inclusion on the National Register of Historic Places in the near future.

7.4 ACTION-SPECIFIC ARARs/TBCs

Action-specific ARARs include operation, performance, and design requirements or limitations based on the waste types, media, and removal/ activities. ARARs for the D&D alternatives include requirements related to waste characterization, scrap metal removal, decontamination, waste storage, treatment and disposal and transportation of hazardous materials.

7.4.1 Building Remediation

The D&D alternatives include removal of scrap metal, equipment, infrastructure, any waste materials and debris; and where necessary, decontamination of equipment, metal surfaces, etc. Loose radioactive contamination, asbestos wastes, and/or fixtures (including any electrical equipment) would be removed as well. Any regulated Class I/II refrigerants found must be evacuated from any air-handling equipment. Requirements under the Clean Air Act of 1970 (CAA), as amended for control of asbestos, Class I/II refrigerant abatement, and/or radionuclide emissions included in Table C.3, would have to be met.

Reusable scrap metal may be segregated from the waste materials/debris. Any scrap metal otherwise considered hazardous waste under RCRA, as amended, regulations is not subject to RCRA Subtitle C requirements if it is intended for recycle or reuse. The Secretary of Energy has recently suspended the release of potentially contaminated scrap metals for recycling from DOE nuclear facilities. Clean structural steel would be released to scrap dealers or, if available, to a DOE-operated recycler provided this complies with guidance in effect during implementation of the removal action. Materials for unrestricted release must meet DOE Order 5400.5 TBC requirements listed on Table C.3 for residual surface radioactive contamination. PCB-contaminated equipment or metal surfaces will be decontaminated if intended for recycle or reuse in accordance with the requirements specified on Table C.3.

7.4.2 Waste Management

Building remediation may generate RCRA solid or hazardous waste (such as mercury switches, lead paint containing hazardous debris); low-level radioactive waste; mixed waste; asbestos-containing waste materials; PCB waste under TSCA, such as waste from fluorescent light bulbs and ballasts, capacitors, or drained equipment; PCB bulk-product waste; and PCB remediation wastes. Although some characterization has been completed, additional waste streams may be identified during removal action.

PCB bulk-product waste, as defined by 40 *CFR* 761.3, is derived from manufactured products containing PCBs in a non-liquid state where the concentration at the time of designation for disposal was greater than or equal to 50 ppm. It includes non-liquid bulk wastes and debris from demolition (of buildings and other man-made structures) that was manufactured, coated, or serviced with PCBs. Examples of bulk PCB product waste include: insulation, dried paints, varnishes, sealants, caulking, and gaskets.

PCB remediation waste, as defined in 40 *CFR* 761.3, contains PCBs as a result of a spill, release, or other unauthorized disposal. It includes rags and other debris generated as a result of any PCB-spill cleanup in buildings and other man-made structures containing concrete, wood floors, or walls contaminated from leaking PCBs or PCB-contaminated transformers. PCB remediation waste also includes PCB-contaminated nonporous surfaces such as smooth glass, unpainted marble, granite, or porous surfaces such as fiberglass, painted stone, and corroded metal.

All primary wastes, such as D&D debris and removed waste materials, and secondary wastes, such as contaminated personal protective equipment and decontamination wastes) generated during building remediation activities must be appropriately characterized as either RCRA (solid or hazardous waste), asbestos, PCB, radioactive waste(s), and/or mixed wastes and managed in accordance with appropriate RCRA, CAA, TSCA, or DOE Order requirements. Table C.3 lists the requirements associated with the characterization, storage, treatment, and disposal of these waste types.

7.4.3 Land Use Controls

In accordance with DOE Order 5400.5(IV)(6)(c), interim controls, including physical barriers, such as fences and signs, to prevent access, and appropriate radiological safety measures will be used if necessary to prevent disturbance of any residual radioactive material in the buildings or in the event the building structures are radioactively contaminated. Controls related to use of the building sites (land/media below the building) are unnecessary at this time because this removal action does not involve demolition of the buildings. A follow-up CERCLA action for the building sites is expected to be conducted.

7.4.4 Transportation

Any wastes transferred off-site or transported in commerce along public right-of-ways must meet requirements summarized in Table C.3, depending on the type of waste (RCRA, PCB, LLW, or mixed). Requirements include specifications for: packaging, labeling, marking, manifesting, and placarding for hazardous materials at 49 *CFR* 170–180 *et seq*. Transport of Complex wastes along PGDP on-site roads, which are inaccessible to the public, would not be considered "in commerce."

In addition, CERCLA Section 121(d)(3) provides that the off-site transfer of any hazardous substance, pollutant, or contaminant generated during CERCLA response actions be sent to a treatment, storage, or disposal facility that complies with applicable federal and state laws and has been approved by the EPA for acceptance of CERCLA waste (see also the "Off-Site Rule" at 40 *CFR* 300.440 *et seq)*. Accordingly, DOE will verify with the appropriate EPA regional contact that any needed off-site facility is acceptable for receipt of CERCLA wastes before transfer.

The C-746-U landfill is considered an onsite facility. Disposal of materials into this facility will be predicated upon demonsration of the long term protection of human health and the environment.

Table 7.1. Chemical-specific ARARs and TBC Guidance for D&D of the C-410 Complex

Action/medium	Requirements	Citations
Release of radionuclides into the environment	Exposure to individual members of the public from radiation shall not exceed a total EDE of 0.1 rem/year (100 mrem/year), exclusive of the dose contributions from background radiation, any medical administration the individual has received, or voluntary participation in medical/research programs—**relevant and appropriate**	10 *CFR* 20.1301(a)(1); 902 *KAR* 100:019 Section 10 (1)
	Shall use, to the extent practicable, procedures and engineering controls based on sound radiation protection principles to achieve doses to members of the public that are ALARA— **relevant and appropriate**	10 *CFR* 20.1101(b); 902 *KAR* 100:015 Section 2
Unrestricted use	A site shall be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a total EDE to an average member of the critical group that does not exceed 25 mrem/year and the residual radioactivity has been reduced to ALARA levels – **relevant and appropriate after removal or release of the building and soil.**	10 *CFR* 20.1402; 902 *KAR* 100:042 Section 2

ALARA = as low as reasonably achievable
ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
D&D = decontamination and decommissioning
EDE = effective dose equivalent
KAR = *Kentucky Administrative Regulations*
mrem = millirem
TBC = to be considered.

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Table 7.2. Location-specific ARARs and TBC Guidance for D&D of the C-410 Complex

Location characteristics	Requirements	Prerequisite	Citations
		Cultural resources	
Presence of historic properties (including artifacts, records, or remains located within such properties)	Must consider the adverse effects on historic properties per Sect. 106 of the NHPA	Undertaking [as defined in 36 *CFR* 800.16(y)] that has the potential to affect historic property on or eligible for inclusion on the National Register of Historic Places—**applicable**	36 *CFR* 800.1(a) 36 *CFR* 800.3
	Determine adverse effects per 36 *CFR* 800.5(a)(1), and if found, evaluate alternatives or modifications to the undertaking to avoid, minimize, or mitigate the adverse effects on the property.		36 *CFR* 800.5(a) and (d) 36 *CFR* 800.6

ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
D&D = decontamination and decommissioning
NHPA = National Historic Preservation Act of 1966
TBC = to be considered
RACM = regulated asbestos-containing material

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Table 7.3. Action-specific ARARs and TBC Guidance for D&D of the C-410 Complex

Action	Requirements	Prerequisite	Citations
	General construction standards		
Activities causing airborne radionuclide emissions	Shall not exceed those amounts that would cause any member of the public to receive an EDE of 10 mrem per year	Radionuclide emissions from point sources, as well as diffuse or fugitive emissions, at a DOE facility—**applicable**	40 *CFR* 61.92;
	Decontamination and waste removal standards		
Decontamination of radioactively contaminated equipment and building structure	Must meet surface contamination guidelines for residual activity provided in Fig. IV-1 of the DOE Order for specified radionuclides	Residual radioactive material on equipment and building structures for unrestricted use—**TBC**	DOE Order 5400.5(IV)(4)(d) and Fig. IV-1
Removal of refrigeration equipment	Disposal is prohibited of any such appliances that may vent or otherwise release to the environment any Class I or II substances as a refrigerant.	Appliances that contain Class I or II substances used as a refrigerant—**applicable**	40 *CFR* 82.154(a)
	No person may dispose of such appliances, with certain exceptions, without: • observing the required practices set forth in 40 *CFR* 82.156 and • using equipment that is certified for that type of appliance pursuant to 40 *CFR* 82.158.		40 *CFR* 82.154(b)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Removal of RACM from a facility	Procedures for asbestos emission control per 40 *CFR* 61.145(c)(1-10) shall be followed, as appropriate	Demolition of a facility containing RACM exceeding the volume requirements of 40 *CFR* 61.145(a)(1)—**applicable**	40 *CFR* 61.145(c); Chap. 1200-3-11-.02(2)(d)(3)
Decontamination of PCB nonporous surface ***(e.g., scrap metal)***	For unrestricted use, meet standard of: • 10 µg/100 cm^2 as measured by a standard wipe test (40 *CFR* 761.123) at locations selected in accordance with 40 *CFR* 761.300 *et seq*. and	Nonporous surfaces previously in contact with liquid PCBs, where no free-flowing liquids are present—**applicable**	40 *CFR* 761.79(b)(3)(i)(A)
	• clean to Visual Standard No. 2 of NACE. Verify compliance by visually inspecting all cleaned areas	Nonporous surfaces in contact with non-liquid PCBs—**applicable**	40 *CFR* 761.79(b)(3)(i)(B)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	For disposal in a smelter operating in accordance with 40 *CFR* 761.72(b), meet standard of: • <100 μg/100 cm^2 as measured by a standard wipe test (40 *CFR* 761.123) at locations selected in accordance with 40 *CFR* 761.300 *et seq*. and	Nonporous surfaces previously in contact with liquid PCBs at any concentration, where no free-flowing liquids are present—**applicable**	40 *CFR* 761.79(b)(3)(ii)(A)
	• clean to Visual Standard No. 3 of NACE. Verify compliance by visually inspecting all cleaned areas	Nonporous surfaces in contact with non-liquid PCBs (including nonporous surfaces covered with a porous surface, e.g., paint or coating on metal)—**applicable**	40 *CFR* 761.79(b)(3)(ii)(B)
Decontamination of movable equipment contaminated by PCBs	May decontaminate by: • swabbing surfaces that have contacted PCBs with a solvent; • a double wash/rinse as defined in 40 *CFR* 761.360-378; or • another applicable decontamination procedure under 40 *CFR* 761.79	Movable equipment contaminated by PCBs and used in storage areas, tools, and sampling equipment—**applicable**	40 *CFR* 761.79(c)(2)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Decontamination of metal surfaces in contact with PCBs	For surfaces in contact with liquid or non-liquid PCBs <500 ppm, may be decontaminated in an industrial furnace for purposes of disposal in accordance with 40 *CFR* 761.72	Use of thermal processes to decontaminate metal surfaces as required by 40 *CFR* 761.61 (a)(6)—**applicable**	40 *CFR* 761.79 (c)(6)(i)
	For surfaces in contact with liquid or non-liquid PCBs ≥500 ppm, may be smelted in an industrial furnace operating in accordance with Sect. 761.72(b), but must first be decontaminated in accordance with 40 *CFR* 761.72(a) or to a surface concentration of <100 μg/100 cm^2		40 *CFR* 761.79 (c)(6)(ii)
Decontamination of PCB-contaminated concrete	If commenced within 72 h of initial spill, ≤10 μg/100 cm^2 as measured by the standard wipe test (40 *CFR* 761.123)	Spill of liquid PCBs—**applicable**	40 *CFR* 761.79 (b)(4)
Decontamination of PCB-contaminated water	For discharge to a treatment works as defined in 40 *CFR* 503.9 (aa), or discharge to navigable waters, meet standard of <3 ppb PCBs; or KPDES permit limit at outfall compliance point	Water containing PCBs regulated for disposal— **applicable**	40 *CFR* 761.79 (b)(1)(ii)
	For unrestricted use, meet standard of 0.5 ppb PCBs		40 *CFR* 761.79(b)(1)(iii)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Decontamination of PCB-contaminated liquids	Meet standard of <2 ppm PCBs	Organic liquids and non-aqueous inorganic liquids containing PCBs—**applicable**	40 *CFR* 761.79(b)(2)
Decontamination of PCB-containers	Must flush the internal surfaces of the container three times with a solvent containing <50 ppm PCBs. Each rinse shall use a volume of the flushing solvent equal to approximately 10% of the PCB container capacity	PCB container as defined in 40 *CFR* 761.3— **applicable**	40 *CFR* 761.79(c)(1)
Waste generation, characterization, segregation, and storage—removed wastes, debris, and secondary wastes			
Characterization of solid waste ***(all primary and secondary wastes)***	Must determine if solid waste is hazardous waste or if waste is excluded under 40 *CFR* 261.4(b) [401 *KAR* 32:010 Section 4]; and	Generation of solid waste (as defined in 40 *CFR* 261.2) that is not excluded under 40 *CFR* 261.4(a)—**applicable**	40 *CFR* 262.11(a); 401 *KAR* 32:010 Section 2(1)
	Must determine if waste is listed under 40 *CFR* Part 261[401 *KAR* 31:040]; or		40 *CFR* 262.11(b); 401 *KAR* 32:010 Section 2(2)
	Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used.		40 *CFR* 262.11(c); 401 *KAR* 32:010 Section 3

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Must refer to Parts 261,262,264,265,266,268,and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste	Generation of solid waste which is determined to be hazardous—**applicable**	40 CFR 262.11(d); 401 *KAR* 32:010 Section 4
Characterization of hazardous waste ***(all primary and secondary wastes)***	Must obtain a detailed chemical and physical analysis on a representative sample of the waste(s), which at a minimum contains all the information that must be known to treat, store, or dispose of the waste in accordance with pertinent sections of 40 *CFR* 264 and 268	Generation of RCRA hazardous waste for storage, treatment, or disposal—**applicable**	40 *CFR* 264.13(a)(1); 401 *KAR* 34:020 Section 4(1)(a)
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the D001, D002, D012-D043 waste	Generation of RCRA characteristic hazardous waste (other than D001 High TOC Subcategory or treated by CMBST or RORGS) for storage, treatment or disposal – **applicable**	40 CFR 268.9(a) 401 *KAR* 37:010 Section 9(1)
	Must determine if the waste is restricted from land disposal under 40 *CFR* 268 *et seq*. by testing in accordance with prescribed methods or use of generator knowledge of waste		40 *CFR* 268.7; 401 *KAR* 37:010 Section 7

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Must determine each EPA Hazardous Waste Number (Waste Code) to determine the applicable treatment standards under 40 CFR 268.40 *et. seq.*		40 CFR 268.9(a) 401 *KAR* 37:010 Section 9(1)
Temporary storage of hazardous waste in containers ***(e.g., lead contaminated debris)***	A generator may accumulate hazardous waste at the facility provided that:	Accumulation of RCRA hazardous waste on-site (as defined in 40 *CFR* 260.10)—**applicable**	40 *CFR* 262.34(a); 401 *KAR* 32:030 Section 5
	• waste is placed in containers that comply with 40 *CFR* 265.171–173, and;		40 *CFR* 262.34(a)(1)(i); 401 *KAR* 32:030 Section 5(1)(a)
	• the date upon which accumulation begins is clearly marked and visible for inspection on each container;		40 *CFR* 262.34(a)(2); 401 *KAR* 32:030 Section 5(1)(b)
	• container is marked with the words "hazardous waste;"or		40 *CFR* 262.34(a)(3); 401 *KAR* 32:030 Section 5(1)(c)
	• container may be marked with other words that identify the contents.	Accumulation of 55 gal. or less of RCRA hazardous waste at or near any point of generation—**applicable**	40 *CFR* 262.34(c)(1); 401 *KAR* 32:030 Section 5(3)(a)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Use and management of hazardous waste in containers	If container is not in good condition (e.g., severe rusting, structural defects) or if it begins to leak, must transfer waste into container in good condition	Storage of RCRA hazardous waste in containers—**applicable**	40 *CFR* 265.171; 401 *KAR* 34:180 Section 2
	Use container made or lined with materials compatible with waste to be stored so that the ability of the container is not impaired		40 *CFR* 265.172; 401 *KAR* 34:180 Section 3
	Keep container closed during storage, except to add/remove waste		40 *CFR* 265.173(a); 401 *KAR* 34:180 Section 4(1)
	Open, handle, and store containers in a manner that will not cause containers to rupture or leak		40 *CFR* 265.173(b); 401 *KAR* 34:180 Section 4(2)
Storage of hazardous waste in container area	Area must have a containment system designed and operated in accordance with 40 *CFR* 264.175(b) [401 *KAR* 34:180 Section 6(2)].	Storage of RCRA-hazardous waste in containers with free liquids—**applicable**	40 *CFR* 264.175(a); 401 *KAR* 34:180 Section 6(1)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Area must be sloped or otherwise designed and operated to drain liquid from precipitation, or Containers must be elevated or otherwise protected from contact with accumulated liquid.	Storage of RCRA-hazardous waste in containers that do not contain free liquids—**applicable**	40 *CFR* 264.175(c); 401 *KAR* 34:180 Section 6(3)
Storage of RCRA lamps ***(e.g., fluorescent, mercury vapor)***	Must contain any lamp in containers or packages that are structurally sound, adequate to prevent breakage, and compatible with the contents of the lamps.	Management of "universal waste lamp" as defined in 40 CFR 273.9 that are RCRA characteristic hazardous waste—**applicable**	40 CFR 273.13(d)(1); 401 *KAR* 43:020 Section 4(4)(a)
	Containers must be closed, structurally sound, compatible with the contents of the lamps and must lack evidence of leakage, spillage, or damage that could cause leakage or releases of mercury or other hazardous constituents to the environment under reasonably foreseeable conditions.		40 CFR 273.13(d)(2); 401 *KAR* 43:020 Section 4(4)(a)
	Each lamp or a container or package in which such lamps are contained must be labeled or marked clearly with one of the following phrases: "Universal Waste-Lamp(s)," or "Waste Lamps," or "Used Lamps."		40 CFR 273.14(e); 401 *KAR* 43:020 Section 5(5)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Mark or label the individual item with the date the lamp(s) became a waste, or mark or label the container or package with date wastes received.		40 CFR 273.15(c)(1)-(6); 401 *KAR* 43:020 Section 6(3)
Characterization of LLW ***(e.g., radioactively contaminated equipment, debris)***	Shall be characterized using direct or indirect methods and the characterization documented in sufficient detail to ensure safe management and compliance with the WAC of the receiving facility	Generation of LLW for storage or disposal at a DOE facility—**TBC**	DOE M 435.1-1(IV)(I)
	Characterization data shall, at a minimum, include the following information relevant to the management of the waste:		DOE M 435.1-1(IV)(I)(2)(a)
	• physical and chemical characteristics;		DOE M 435.1-1(IV)(I)(2)(a)
	• volume, including the waste and any stabilization or absorbent media;		DOE M 435.1-1(IV)(I)(2)(b)
	• weight of the container and contents;		DOE M 435.1-1(IV)(I)(2)(c)
	• identities, activities, and concentration of major radionuclides;		DOE M 435.1-1(IV)(I)(2)(d)
	• characterization date;		DOE M 435.1-1(IV)(I)(2)(e)
	• generating source; and		DOE M 435.1-1(IV)(I)(2)(f)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	• any other information that may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with performance objectives.		DOE M 435.1-1(IV)(I)(2)(g)
Temporary storage of LLW ***(e.g., radioactively contaminated equipment, debris)***	Shall not be readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water	Management of LLW at a DOE facility—**TBC**	DOE M 435.1-1(IV)(N)(1)
	Shall be stored in a location and manner that protects the integrity of waste for the expected time of storage		DOE M 435.1-1(IV)(N)(3)
	Shall be managed to identify and segregate LLW from mixed waste		DOE M 435.1-1(IV)(N)(6)
Packaging of solid LLW for storage ***(e.g., radioactively contaminated equipment, debris)***	Shall be packaged in a manner that provides containment and protection for the duration of the anticipated storage period, and until disposal is achieved or until the waste has been removed from the container	Storage of LLW in containers at a DOE facility —**TBC**	DOE M 435.1-1(IV)(L)(1)(a)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container.		DOE M 435.1-1(IV)(L)(1)(b)
	Containers shall be marked such that their contents can be identified.		DOE M 435.1-1(IV)(L)(1)(c)
Segregation of scrap metal for recycle	Material is not subject to RCRA requirements for generators, transporters, and storage facilities under 40 *CFR* Parts 262 through 266, 268, 270, or 124.	Scrap metal [as defined in 40 *CFR* 261.1(c)(6)] intended for recycle—**applicable**	40 *CFR* 261.6(a)(3)(ii);
Release of scrap metal ***(e.g., metal piping, steel structures***)	Before being released, items shall be surveyed to determine whether both removable and total surface contamination (including contamination present on or under any coating) is greater than the levels given in Fig. IV-1 of the DOE Order, and that the contamination has been subjected to the ALARA process.	Radionuclide-contaminated scrap materials and equipment intended for recycle or reuse—**TBC**	DOE Order 5400.5(II)(5)(c)(1)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Management of asbestos-containing waste prior to disposal ***(e.g., transite siding, pipe lagging, insulation, and ceiling tiles)***	Discharge no visible emissions to the outside air, or use one of the emission control and waste treatment methods specified in paragraphs (a)(1) through (a)(4) of 40 *CFR* 61.150.	Collection, processing, packaging, or transporting of any asbestos-containing waste material generated by demolition activities — **applicable**	40 *CFR* 61.150(a);
Management of PCB waste ***(e.g., PCB liquids, PCB-contaminated articles, PCB bulk-product wastes)***	Any person storing or disposing of PCB waste must do so in accordance with 40 *CFR* 761, Subpart D.	Generation of waste containing PCBs at concentrations ≥50 ppm—**applicable**	40 *CFR* 761.50(a)
	Any person cleaning up and disposing of PCBs shall do so based on the concentration at which the PCBs are found.	Generation of PCB remediation waste (as defined in 40 *CFR* 761.3)—**applicable**	40 *CFR* 761.61
Management of PCB/ radioactive waste ***(e.g., PCB liquids, PCB-contaminated articles, PCB bulk-product wastes)***	Any person storing such waste must do so taking into account both its PCB concentration and radioactive properties, except as provided in 40 *CFR* 761.65(a)(1), (b)(1)(ii), and (c)(6)(i).	Generation for disposal of PCB/radioactive waste with ≥50 ppm PCBs—**applicable**	40 *CFR* 761.50(b)(7)(i)
	Any person disposing of such waste must do so taking into account both its PCB concentration and its radioactive properties.		40 *CFR* 761.50(b)(7)(ii)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	If, after taking into account only the PCB properties in the waste, the waste meets the requirements for disposal in a facility permitted, licensed, or registered by a state as a municipal or nonmunicipal nonhazardous waste landfill [e.g., PCB bulk-product waste under 40 *CFR* 761.62(b)(1)], the person may dispose of such waste without regard to the PCBs, based on its radioactive properties alone in accordance with applicable requirements.		
Temporary storage of PCB waste ***(e.g., PCB liquids, PCB-contaminated articles, PCB bulk-product wastes)***	Container(s) shall be marked as illustrated in 40 *CFR* 761.45(a).	Storage of PCBs and PCB items at concentrations ≥50 ppm for disposal— **applicable**	40 *CFR* 761.65(a)(1)
	Storage area must be properly marked as required by 40 *CFR* 761.40(a)(10).		40 *CFR* 761.65(c)(3)
	Any leaking PCB items and their contents shall be transferred immediately to a properly marked non-leaking container(s).		40 *CFR* 761.65(c)(5)
	The date shall be recorded when PCB items are removed from service, and the storage shall be managed such that PCB items can be located by this date. (Note: Date should be marked on the container.)	PCB items (includes PCB wastes) removed from service for disposal—**applicable**	40 *CFR* 761.65(c)(8)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Container(s) shall be in accordance with requirements set forth in DOT HMR at 49 *CFR* 171–180		40 *CFR* 761.65(c)(6)
Storage of PCB/radioactive waste in containers ***(e.g., PCB liquids, PCB-contaminated articles, PCB bulk-product wastes)***	For liquid wastes, containers must be non-leaking.	Storage of PCB/radioactive waste in containers other than those meeting DOT HMR performances standards—**applicable**	40 *CFR* 761.65(c)(6)(i)(A)
	For non-liquid wastes, containers must be designed to prevent buildup of liquids if such containers are stored in an area meeting the containment requirements of 40 *CFR* 761.65(b)(1)(ii).		40 *CFR* 761.65(c)(6)(i)(B)
	For both liquid and non-liquid wastes, containers must meet all regulations and requirements pertaining to nuclear criticality safety.		40 *CFR* 761.65(c)(6)(i)(C)
Storage of PCB waste and/or PCB/radioactive waste in a non-RCRA regulated unit	Storage facility must have or be:	Storage of PCBs and PCB items at concentrations ≥50 ppm for disposal— **applicable**	40 *CFR* 761.65(b)(1)
	• adequate roof and walls to prevent rainwater from reaching stored PCBs and PCB items;		40 *CFR* 761.65(b)(1)(i)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	• adequate floor that has continuous curbing with a minimum 6-in.-high curb. Floor and curb must provide a containment volume equal to at least two times the internal volume of the largest PCB article or container or 25% of the internal volume of all articles or containers stored there, whichever is greater. (*Note:* 6 in. minimum curbing not required for area storing PCB/radioactive waste);	Storage of PCB/radioactive waste (as defined in 40 *CFR* 761.3)—**applicable**	40 *CFR* 761.65(b)(1)(ii)
	• no drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from curbed area;		40 *CFR* 761.65(b)(1)(iii)
	• floors and curbing constructed of Portland cement, concrete, or a continuous, smooth, nonporous surface that prevents or minimizes penetration of PCBs; and		40 *CFR* 761.65(b)(1)(iv)
	• not located at a site that is below 100-year flood water elevation.		40 *CFR* 761.65(b)(1)(v)
	Storage area must be properly marked as required by 40 *CFR* 761.40(a)(10).		40 *CFR* 761.65(c)(3)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Storage of PCB waste and/or PCB/radioactive waste in a RCRA-regulated container storage area	Does not have to meet storage unit requirements in 40 *CFR* 761.65(b)(1) provided unit:	Storage of PCBs and PCB items designated for disposal—**applicable**	40 *CFR* 761.65(b)(2)
	• is permitted by EPA under RCRA Sect. 3004, or		40 *CFR* 761.65(b)(2)(i)
	• qualifies for interim status under RCRA Sect. 3005, or		40 *CFR* 761.65(b)(2)(ii)
	• is permitted by an authorized state under RCRA Sect. 3006, and		40 *CFR* 761.65(b)(2)(iii)
	• PCB spills cleaned up in accordance with Subpart G of 40 *CFR* 761.		40 *CFR* 761.65(c)(1)(iv)
Temporary storage of PCB remediation waste or bulk PCB bulk-product waste in a waste pile	Waste must be placed in a pile that:	Storage of PCB remediation waste or PCB bulk-product waste at cleanup site or site of generation for up to 180 days—**applicable**	40 *CFR* 761.65(c)(9)(i)
	• is designed and operated to control dispersal by wind, where necessary, by means other than wetting;		
	• does not generate leachate through decomposition or other reactions; and		40 *CFR* 761.65(c)(9)(ii)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	• is at a storage site with a liner designed, constructed, and installed to prevent any migration of wastes off or through liner into adjacent subsurface soil, groundwater, or surface water.		40 *CFR* 761.65(c)(9)(iii)(A)
	Liner must be:		
	• constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure because of pressure gradients, physical contact with waste or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;		40 *CFR* 761.65(c)(9)(iii)(A)(1)
	• placed on foundation or base capable of providing support to liner and resistance to pressure gradients above and below the liner to prevent failure because of settlement compression or uplift; and		40 *CFR* 761.65(c)(9)(iii)(A)(2)
	• installed to cover all surrounding earth likely to be in contact with waste.		40 *CFR* 761.65(c)(9)(iii)(A)(3)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Has a cover that meets the above requirements and installed to cover all of the stored waste likely to be contacted by precipitation, and is secured so as not to be functionally disabled by winds expected under normal weather conditions		40 *CFR* 761.65(c)(9)(iii)(B)
	Has a run-on control system designed, constructed, operated, and maintained such that it prevents flow on the stored waste during peak discharge from at least a 25-year storm, and collects and controls at least the water volume resulting from a 24-hour, 25-year storm		40 *CFR* 761.65(c)(q)(iii)(e)(1) and (2)
	Requirements of 40 *CFR* 761.65(c)(9) of this part may be modified under the risk-based disposal option of 40 *CFR* 761.61(c).		40 *CFR* 761.65(c)(9)(iv)
	Treatment/disposal of waste—removed wastes, debris, and secondary wastes		
Disposal of RCRA-hazardous waste in a land-based unit ***(e.g., debris with lead paint, mercury switches, etc.)***	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 *CFR* 268.40 before land disposal	Land disposal (as defined in 40 *CFR* 268.2) of restricted RCRA waste—**applicable**	40 *CFR* 268.40(a); 401 *KAR* 37:040 Section 1

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Disposal of RCRA wastewaters	Are not prohibited unless the wastes are subject to a specified method of treatment other than DEACT in 40 *CFR* 268.40, or are D003 reactive cyanide	Restricted RCRA characteristic hazardous waste waters managed in a treatment system that is NPDES permitted—**applicable**	40 *CFR* 268.1(c)(4)(iv); 401 *KAR* 37:010 Section 2 (5)(e)
Disposal of hazardous debris	May be land disposed if it meets the requirements in the table "Alternative Treatment Standards for Hazardous Debris" at 40 *CFR* 268.45 before land disposal or the debris is treated to the waste-specific treatment standard provided in 40 *CFR* 268.40 for the waste contaminating the debris	Land disposal (as defined in 40 *CFR* 268.2) of restricted RCRA-hazardous debris—**applicable**	40 *CFR* 268.45(a); 401 *KAR* 37:040 Section 6(1)
Disposal of treated hazardous debris	Debris treated by one of the specified extraction or destruction technologies on Table 1 of 40 *CFR* 268.45 and which no longer exhibits a characteristic is not a hazardous waste and need not be managed in RCRA Subtitle C facility Hazardous debris contaminated with listed waste that is treated by immobilization technology must be managed in a RCRA Subtitle C facility	Treated debris contaminated with RCRA-listed or characteristic waste—**applicable**	40 *CFR* 268.45(c); 401 *KAR* 37:040 Section 6(3)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Disposal of hazardous debris treatment residues	Except as provided in 268.45(d)(2) and (d)(4), residues from treatment of hazardous debris must be separated from debris, and such residues are subject to the waste-specific treatment standards for the waste contaminating the debris	Treated debris contaminated with RCRA-listed or characteristic waste—**applicable**	40 *CFR* 268.45(d)(1); 401 *KAR* 37:040 Section 6(4)(a)
Packaging of LLW for disposal ***(e.g., radioactively contaminated equipment, debris)***	Must not be packaged for disposal in cardboard or fiberboard boxes	Generation of LLW for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(1)(b)
	Must be solidified or packaged in sufficient absorbent material to absorb twice the volume of liquid	Generation of liquid LLW for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(1)(c)
	Shall contain as little free standing and non-corrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume	Generation of solid LLW containing liquid for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(1)(d)
	Must not be capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures or of explosive reaction with water	Generation of LLW for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(1)(e)
	Must not contain, or be capable of generating, quantities of toxic gases, vapor, or fumes	Generation of LLW for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(1)(f)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Must not be pyrophoric	Generation of LLW for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(1)(g)
	Gaseous waste must be packaged at a pressure not to exceed 1.5 atmospheres at 20 degrees C.	Generation of LLW for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(1)(h)
	Wastes containing hazardous, biological, pathogenic, or infectious material must be treated to reduce to the maximum extent practicable the potential hazard from the nonradiological materials.	Generation of LLW for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(1)(I)
	Must have structural stability either by processing the waste or placing the waste in a container or structure that provides stability after disposal	Generation of LLW for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(2)(a)(2)
	Must be converted into a form that contains as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5% of the volume of the waste for waste processed to a stable form	Generation of liquid LLW or LLW containing liquids for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(2)(b)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Void spaces within the waste and between the waste and its package must be reduced to the extent practicable.	Generation of LLW for disposal at a LLW disposal facility —**relevant and appropriate**	902 *KAR* 100:021 Section 7(2)(c)
Treatment of LLW	Treatment to provide more stable waste forms and to improve the long-term performance of a LLW disposal facility shall be implemented as necessary to meet the performance objectives of the disposal facility.	Generation of LLW for disposal at a LLW disposal facility—**TBC**	DOE M 435.1-1(IV)(O)
Treatment of uranium and thorium bearing LLW	Such wastes shall be properly conditioned so that the generation and escape of biogenic gases will not cause exceedance of Rn-222 emission limits of DOE Order 5400.5(IV)(6)(d)(1)(b) and will not result in premature structure failure of the facility	Placement of potentially biodegradable contaminated wastes in a long-term management facility —**TBC**	DOE Order 5400.5(IV)(6)(d)(1)(c)
Disposal of solid LLW ***(e.g., radioactively contaminated equipment, debris)***	LLW shall be certified as meeting waste acceptance requirements before it is transferred to the receiving facility.	Generation of LLW for disposal at a DOE facility—**TBC**	DOE M 435.1-01(IV)(J)(2)
Disposal of asbestos-containing waste material ***(e.g., transite siding, pipe lagging, insulation, and ceiling tiles)***	Shall be deposited as soon as practicable at:	Asbestos-containing waste material or RACM (except Category I non-friable asbestos-containing material) from demolition activities—**applicable**	40 *CFR* 61.150(b);

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	• an approved waste disposal site operated in accordance with 40 *CFR* 61.154, or		40 *CFR* 61.150(b)(1);
	• an EPA-approved site that converts RACM and asbestos-containing waste material into non-asbestos (asbestos-free) material according to the provisions of 40 *CFR* 61.155		40 *CFR* 61.150(b)(2);
Disposal of fluorescent light ballasts	Must be disposed of in a TSCA-approved disposal facility, as bulk-product waste under 40 *CFR* 761.62, or in accordance with the decontamination provisions of 40 *CFR* 761.79	Generation for disposal of fluorescent light ballasts containing PCBs in the potting material—**applicable**	40 *CFR* 761.60(b)(6)(iii)
Disposal of PCB capacitor(s)	Shall comply with all requirements of Sect. 761.60 unless it is known from label or nameplate information, manufacturer's literature, or chemical analysis that the capacitor does not contain PCBs	Generation of PCB Capacitors with ≥50 PCBs for disposal—**applicable**	40 *CFR* 761.60(b)(2)(i)
	May dispose of in a municipal solid waste landfill unless subject to 40 *CFR* 761.60(b)(2)(iv)	Generation for disposal of intact, non-leaking PCB small capacitors (as defined in 40 *CFR* 761.3)—**applicable**	40 *CFR* 761.60(b)(2)(ii)
	Shall dispose of in accordance with either of the following:	PCB large capacitor which contains ≥500 ppm PCBs—**applicable**	40 *CFR* 761.60(b)(2)(iii)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	• disposal in an incinerator that complies with 40 *CFR* 761.70, or • disposal in a chemical waste landfill that complies with 40 *CFR* 761.75		
	Shall dispose of in one of the following disposal facilities approved under this part: • incinerator under 40 *CFR* 761.70, • chemical waste landfill under 40 *CFR* 761.75, • high-efficiency boiler under 40 *CFR* 761.70, or • scrap metal recovery oven and smelter under 40 *CFR* 761.71	Disposal of large capacitors that contain ≥50 ppm but <500 ppm PCBs—**applicable**	40 *CFR* 761.60(b)(4)(ii)
Disposal of PCB-contaminated electrical equipment (except capacitors)	Must remove all free-flowing liquid from the electrical equipment and dispose of the removed liquid in accordance with 40 *CFR* 760.61(a) and Ky. Solid Waste Branch requirements. Residue must contain <50-ppm PCB concentration.	Generation of PCB-contaminated electrical equipment (as defined in 40 *CFR* 761.3) for disposal—**applicable**	40 *CFR* 761.60(b)(4)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Dispose of by one of the following methods:	Drained PCB-contaminated electrical equipment including any residual liquids— **applicable**	
	• in a facility permitted, licensed, or registered by a state to manage municipal solid waste or nonmunicipal nonhazardous waste;		40 *CFR* 761.60(b)(4)(i)(A)
	• in an industrial furnace operating in compliance with 40 *CFR* 761.72; or		40 *CFR* 761.60(b)(4)(i)(B)
	• in a disposal facility approved under this part.		40 *CFR* 761.60(b)(4)(i)(C)
Disposal of decontamination waste and residues	Such waste shall be disposed of at their existing PCB concentration unless otherwise specified in 40 *CFR* 761.79(g)(1-6).	PCB decontamination waste and residues— **applicable**	40 *CFR* 761.79(g)
Disposal of PCB-contaminated precipitation, condensation, leachate, or load separation	May be disposed in a chemical waste landfill which complies with 40 *CFR* 761.75 if:	PCB liquids at concentrations ≥50 ppm from incidental sources and associated with PCB articles or non-liquid PCB wastes—**applicable**	40 *CFR* 761.60(a)(3)
	• disposal does not violate 40 *CFR* 268.32(a) or 268.42(a)(1) and		40 *CFR* 761.60(a)(3)(i)
	• liquids do not exceed 500 ppm PCB and are not an ignitable waste as described in 40 *CFR* 761.75(b)(8)(iii)		40 *CFR* 761.60(a)(3)(ii)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Disposal of PCB-contaminated porous surfaces	Shall be disposed on-site or off-site as bulk PCB-remediation waste according to 40 *CFR* 761.61(a)(5)(i) or decontaminated for use according to 40 *CFR* 761.79(b)(4)	PCB remediation waste porous surfaces (as defined in 40 *CFR* 761.3)—**applicable**	40 *CFR* 761.61(a)(5)(iii)
Disposal of PCB-contaminated nonporous surfaces on-site	Shall be cleaned on-site or off-site to levels in 40 *CFR* 761.61(a)(4)(ii) using: • decontamination procedures under 40 *CFR* 761.79, • technologies approved under 40 *CFR* 761.60(e), or • risk-based procedures/technologies under Sect. 761.61(c)	PCB remediation waste nonporous surfaces (as defined in 40 *CFR* 761.3)—**applicable**	40 *CFR* 761.61(a)(56)(ii)(A)
Disposal of PCB-contaminated nonporous surfaces off-site	Shall be disposed of in accordance with 40 *CFR* 761.61(a)(5)(i)(B)(3)(ii) [sic] 40 *CFR* 761.61(a)(5)(i)(B)(2)(ii) Metal surfaces may be thermally decontaminated in accordance with 40 *CFR* 761.79(c)(6)(i).	PCB remediation waste nonporous surfaces (as defined in 40 *CFR* 761.3) having surface concentrations <100 μg/100 cm^2—**applicable**	40 *CFR* 761.61(a)(5)(ii)(B)(1)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Shall be disposed of in accordance with 40 *CFR* 761.61(a)(5)(i)(B)(3)(iii) [sic 40 *CFR* 761.61(a)(5)(i)(B)(2)(iii)]	PCB remediation waste nonporous surfaces having surface concentrations ≥100 μg/100 cm^2 —**applicable**	40 *CFR* 761.61 (a)(5)(ii)(B)(2)
	Metal surfaces may be thermally decontaminated in accordance with 40 *CFR* 761.79(c)(6)(ii).		
Disposal of PCB-contaminated articles ***(e.g., hydraulic machines, electrical equipment)***	Must remove all free-flowing liquid from the article, disposing of the liquid in compliance with the requirements of 40 *CFR* 761.60(a)(2) or (a)(3) and	Generation for disposal of PCB-contaminated articles (as defined in 40 *CFR* 761.3)— **applicable**	40 *CFR* 761.60(b)(6)(ii)
	Dispose by one of the following methods:	Disposal of PCB-contaminated articles with no free-flowing liquid—**applicable**	40 *CFR* 761.60(b)(6)(ii)
	• in accordance with the decontamination provisions at 40 *CFR* 761.79;		40 *CFR* 761.60(b)(6)(ii)(A)
	• in a facility permitted, licensed, or registered by a state to manage municipal solid waste or nonmunicipal nonhazardous waste;		40 *CFR* 761.60(b)(6)(ii)(B)
	• in an industrial furnace operating in compliance with 40 *CFR* 761.72; or		40 *CFR* 761.60(b)(6)(ii)(C)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	• in a disposal facility approved under this part		40 *CFR* 761.60(b)(6)(ii)(D)
Disposal of PCB articles	Must be disposed of:	Generation of PCB articles (with ≥500 ppm PCBs) for disposal—**applicable**	40 *CFR* 761.60(b)(6)(i)
	• in an incinerator that complies with 40 *CFR* 761.70 or		40 *CFR* 761.60(b)(6)(i)(A)
	• in a chemical waste landfill that complies with 40 *CFR* 761.75 [provided all liquids are removed (i.e., drained) and disposed in an incinerator that complies with 40 *CFR* 761.70]		40 *CFR* 761.60(b)(6)(i)(B)
Disposal of PCB liquids ***(e.g., from drained electrical equipment)***	Must be disposed of in an incinerator that complies with 40 *CFR* 761.70, except:	PCB liquids at concentrations ≥50 ppm— **applicable**	40 *CFR* 761.60(a)
	• for mineral oil dielectric fluid may be disposed of in a high-efficiency boiler according to 40 *CFR* 761.71(a) and	PCB liquids at concentrations ≥50 ppm and <500 ppm—**applicable**	40 *CFR* 761.60(a)(1)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	• for liquids other than mineral oil dielectric fluid, may be disposed of in a high-efficiency boiler according to 40 *CFR* 761.71(b)		40 *CFR* 761.60(a)(2)
Performance-based disposal of PCB remediation waste ***(e.g., contaminated building structure or materials)***	May dispose of by one of the following methods:	Disposal of non-liquid PCB remediation waste (including porous and non-porous surfaces contaminated from a leaking PCB transformer)—**applicable**	40 *CFR* 761.61(b)(2)
	• in a high-temperature incinerator approved under 40 *CFR* 761.70(b),		40 *CFR* 761.61(b)(2)(i)
	• by an alternate disposal method approved under 40 *CFR* 761.60(e),		
	• in a chemical waste landfill approved under 40 *CFR* 761.75,		
	• in a facility with a coordinated approval issued under 40 *CFR* 761.77, or		
	• through decontamination in accordance with 40 *CFR* 761.79		

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Disposal of PCB cleanup wastes ***(e.g., contaminated PPE, non-liquid cleaning materials)***	Shall be disposed of either: • in a facility permitted, licensed, or registered by a state to manage municipal solid waste under 40 *CFR* 258 or nonmunicipal, nonhazardous waste subject to 40 *CFR* 257.5 through 257.30; • in a RCRA Subtitle C landfill permitted by a state to accept PCB waste; • in an approved PCB disposal facility; or • through decontamination under 40 *CFR* 761.79(b) or (c)	Generation of non-liquid PCBs at any concentration during and from the cleanup of PCB remediation waste—**applicable**	40 *CFR* 761.61(a)(5)(v)(A)
Disposal of PCB cleaning solvents, abrasives, and equipment	May be reused after decontamination in accordance with 40 *CFR* 761.79	Generation of PCB wastes from the cleanup of PCB remediation waste—**applicable**	40 *CFR* 761.61(a)(5)(v)(B)
Performance-based disposal of PCB bulk-product waste ***(e.g., equipment, debris with PCB painted surfaces)***	May dispose of by one of the following:	Disposal of PCB bulk-product waste (as defined in 40 *CFR* 761.3)—**applicable**	40 *CFR* 761.62(a)
	• in an incinerator approved under 40 *CFR* 761.70,		40 *CFR* 761.62(a)(1)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	• in a chemical waste landfill approved under 40 *CFR* 761.75,		40 *CFR* 761.62(a)(2)
	• in a hazardous waste landfill permitted by EPA under Sect. 3004 of RCRA or by authorized state under Sect. 3006 of RCRA,		40 *CFR* 761.62(a)(3)
	• under alternate disposal approved under 40 *CFR* 761.60(e)		40 *CFR* 761.62(a)(4)
	• in accordance with decontamination provisions of 40 *CFR* 761.79, or		40 *CFR* 761.62(a)(5)
	• in accordance with thermal decontamination provisions of 40 *CFR* 761.79(e)(6) for metal surfaces in contact with PCBs		40 *CFR* 761.62(a)(6)
Disposal of PCB bulk-product waste in solid waste landfill	May dispose of in a facility permitted, licensed, or registered by a state as a municipal or nonmunicipal nonhazardous waste landfill	Non-liquid PCB bulk-product waste (known or presumed to leach <10 µg/L PCBs) that is not RCRA hazardous—**applicable**	40 *CFR* 761.62(b)(1)(i) and (ii)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	May dispose of in a facility permitted, licensed, or registered by a state as a municipal or nonmunicipal nonhazardous waste landfill if • PCB bulk-product waste has been segregated from organic liquids (organic liquids may not be disposed of in a landfill), and • leachate is collected from the landfill and monitored for PCBs	Other PCB bulk-product waste not meeting conditions of 40 *CFR* 761.62(b)(1) (e.g., paper/ felt gaskets contaminated by liquid PCBs)—**applicable**	40 *CFR* 761.62(b)(2)
Risk-based disposal of PCB bulk-product waste	May dispose of in a manner other than prescribed in 40 *CFR* 761.62(a) or (b) if receive approval in writing from EPA and the method (based on technical, environmental, or waste-specific characteristics) will not pose an unreasonable risk of injury to human health or the environment	Disposal of PCB bulk-product waste— **applicable**	40 *CFR* 761.62(c)
Land use controls—contaminated structures and facilities left in place			
Radioactive material left in place	A property may be maintained under interim management provided administrative controls are established to protect members of the public.	Residual radioactive material above guidelines in inaccessible locations which would be unreasonably costly to remove—**TBC**	DOE Order 5400.5(IV)(6)(c) (1)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
	Controls include, but are not limited to: periodic monitoring as appropriate, appropriate shielding, physical barriers (i.e., fences, warning signs) to prevent access, appropriate radiological safety measures during maintenance, renovation, demolition, or other activities that might disturb the residual radioactive material or cause it to migrate.		DOE Order 5400.5(IV)(6)(c) (2)
	Transportation		
Transportation of hazardous materials (including Class 7 radioactive materials)	Shall be subject to and must comply with all applicable provisions of the HMTA and HMR at 49 *CFR* 171–180 related to marking, labeling, placarding, packaging, emergency response, etc.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material — **applicable**	49 *CFR* 171.1(c)
Transportation of radioactive waste	Shall be packaged and transported in accordance with DOE Order 460.1A and DOE Order 460.2	Shipment of LLW and/or TRU waste off-site— **TBC**	DOE M 435.1-(I)(1)(E)(11)
Transportation of LLW	To the extent practical, the volume of the waste and the number of the shipments shall be minimized	Shipment of LLW off-site—**TBC**	DOE M 435.1-1(IV)(L)(2)

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Transportation of PCB wastes	Must comply with the manifesting provisions at 40 *CFR* 761.207 through 40 *CFR* 761.218	Relinquishment of control over PCB wastes by transporting, or offering for transport — **applicable**	40 *CFR* 761.207(a)
Transport of RCRA wastewaters to wastewater treatment facility	All tank systems, conveyance systems, and ancillary equipment used to store or transport waste to an on-site NPDES-permitted wastewater treatment facility are exempt from the requirements of RCRA Subtitle C standards.	On-site wastewater treatment units that are subject to regulation under Section 402 or Section 307(b) of the CWA (NPDES-permitted)—**applicable**	40 CFR 270.1(c)(2)(v) 401 *KAR* 38:010 Section 1(2)(b)(5)
Transportation of hazardous waste off-site	Must comply with the generator requirements of 40 *CFR* 262.20–23 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding, Sect. 262.40, 262.41(a) for record keeping requirements, and Sect. 262.12 to obtain EPA ID number	Off-site transportation of RCRA-hazardous waste—**applicable**	40 *CFR* 262.10(h); 401 *KAR* 32:030
	Must comply with the requirements of 40 *CFR* 263.11–263.31 A transporter who meets all applicable requirements of 49 *CFR* 171–179 and the requirements of 40 *CFR* 263.11 and 263.31 will be deemed in compliance with 40 *CFR* 263	Transportation of hazardous waste within the United States requiring a manifest—**applicable**	40 *CFR* 263.10(a); 401 *KAR* 33:010

Table 7.3. Action-specific ARARs and TBC guidance for D&D of the C-410 Complex (continued)

Action	Requirements	Prerequisite	Citations
Transportation of hazardous waste on-site	The generator manifesting requirements of 40 *CFR* 262.20–262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 *CFR* 263.30 and 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	Transportation of hazardous wastes on a public or private right-of-way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way—**applicable**	40 *CFR* 262.20(f); 401 *KAR* 32:020 Section 1(1)

ALARA = as low as reasonably achievable
ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
D&D = decontamination and decommissioning
DEACT = deactivation
DOE = U.S. Department of Energy
DOE M = *Radioactive Waste Management Manual*
DOT = U.S. Department of Transportation
EDE = effective dose equivalent
KAR = *Kentucky Administrative Regulations*
mrem = millirem
TRU = transuranic

REFERENCES

Action Memorandum (AM) (DOE/OR/7-2002 & D0) and *Engineering Evaluation/Cost Analysis* (EECA) (DOE/OR/07-1952 & D2 Rev. 1)

Engineering Evaluation/Cost Analysis for The C-410 Complex Infrastructure at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky [EE/CA] (DOE 2001a), approved December 13, 2001.

Action Memorandum for the Decontamination and Decommissioning of the C-410 Complex at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-2002&D0),

Annotated Outlines for Documents Required by FFA and CERCLA for Oak Ridge Reservation Sites (DOE 2000)

Engineering Evaluation/Cost Analysis (EECA) (DOE 2001a).

Section 40 *Code of Federal Regulations* (*CFR*) 300.415(j) of the National Oil and Hazardous Substances Pollution Contingency Plan

40 *CFR* 300.405(g)(3)

10 *CFR* 20.1301(a)(1); 902 *KAR* 100:019 Section 10(1)

10 *CFR* 20.1101(b); 902 *KAR* 100:015 Section 2.

10 *CFR* 20; 902 *KAR* 100:042, Section 2

40 *CFR* 761.3

49 *CFR* 170–180 *et seq*. (?)

CERCLA Section 121(d)(3)

Off-Site Rule at 40 *CFR* 300.440 *et seq*

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Zone	Photo	Photo Description
		door, HF tank farm, HF supply lines.
	M	This photo was taken at the northeast corner of the complex. Particular items of interest in this image include the following: cascade overhead tie-line, vent stacks, C-411 north roll-up door, HF tank farm, HF supply lines.
	N	This photo was taken on the east side of the complex. Particular items of interest in this image include the following: HF tank farm, cascade overhead tie-line.
	O	This photo was taken at the southeast corner of C-411. Particular items of interest in this image include the following: C-411 south roll-up door, portable electrical generator, cascade overhead tie-line, sea-land containers for D&D supply storage.
	P	This photo was taken at the southeast corner of the complex. Particular items of interest in this image include the following: covered storage area; roll-up doors servicing Zones 25, 31, and 44.
	Q	This photo was taken on the south side of the complex in front of the railcar area, Zone 44. Particular items of interest in this image include the following: Zone 44 roll-up door, cascade overhead tie-line, covered entrances to Zones 25 and 31.
	R	This photo was taken on the south side of the complex in front of the old shaker tray area (Zone 31). Particular items of interest in this image include the following: cascade overhead tie-line, covered entrances to Zones 25 and 31.
	S	This photo was taken at the southwest corner of the west expansion area. Particular items of interest in this image include the following: Zone 25 west roll-up door, propane tank.
	T	This photo was taken at the southwest corner of the complex, east of Photo A. Particular items of interest in this image include the following: Zone 25 west roll-up door, sea-land containers, propane tank.
	U	This photo was taken between two anhydrous HF tank buildings. Particular items of interest in this image include the following: anhydrous HF tanks, roof structure, interior catwalk platform, C-411 (background).
	V	This photo was taken inside one of the anhydrous HF tank buildings on the elevated walkway. Particular items of interest in this image include the following: anhydrous HF tanks, associated valving and transfer piping.
	W	This photo was taken between two rubber-lined aqueous HF tanks. Particular items of interest in this image include the following: rubber-lined aqueous HF tanks, HF overhead drain piping, HF loading/unloading platforms.
	X	This photo was taken along the railway servicing the HF tank farm. Particular items of interest in this image include the following: loading station for spent acid, unloading station for anhydrous HF, H_2SO_4 tank for RCW use.

Zone	Photo	Photo Description
		rolling stairs (stored materials).
64	A	Zone 64 is located on the 1st floor of the C-411 building. This area served as the F2 cell maintenance facility. Following neutralization in Zone 57, cells were rebuilt (e.g., copper bars, carbon blades, Monel skirt, etc. were installed) and tested to ensure operability. Cells were then filled with electrolyte in Zone 41 and conditioned in Zone 55, prior to installation in one of the cell rooms. Photo A was taken in the doorway between Zones 62 and 64. Particular items of interest in this image include the following: blower unit, forklift, and miscellaneous stored materials (Zone 62); view of F2 cells in Zone 62, U-shaped overhead crane rail, fire water supply, miscellaneous stored materials.
64	B	Zone 64 is located on the 1st floor of the C-411 building. This area served as the F2 cell maintenance facility. Following neutralization in Zone 57, cells were rebuilt (e.g., copper bars, carbon blades, Monel skirt, etc. were installed) and tested to ensure operability. Cells were then filled with electrolyte in Zone 41 and conditioned in Zone 55, prior to installation in one of the cell rooms. Photo B was taken near the center of the zone. Particular items of interest in this image include the following: considerable quantity of stored materials.
64	C	Zone 64 is located on the 1st floor of the C-411 building. This area served as the F2 cell maintenance facility. Following neutralization in Zone 57, cells were rebuilt (e.g., copper bars, carbon blades, Monel skirt, etc. were installed) and tested to ensure operability. Cells were then filled with electrolyte in Zone 41 and conditioned in Zone 55, prior to installation in one of the cell rooms. Photo C was taken in the northeast corner of the zone. Particular items of interest in this image include the following: north roll-up door, fire water supply, crane rail and hoist unit, miscellaneous stored materials.
	A	This photo was taken at the southwest corner of the complex. Particular items of interest in this image include the following: sea-land containers, Zone 25 west railcar roll-up door, C-420 building exhaust vents, C-420 office area parking.
	B	This photo was taken at the southwest corner of C-420. Particular items of interest in this image include the following: C-420 office area parking, C-420 building exhaust vents, C-420 electrical transformer.
	C	This photo was taken near the entrance to the C-420 office area. Particular items of interest in this image include the following: C-420 office entrance, ash receiver shed.
	D	This photo was taken near the ash receiver shed. Particular items of interest in this image include the following: ash receiver shed, C-420 truck alley roll-up door, access hatch for HF superheaters (3rd floor).
	E	This photo was taken at the northwest corner of the complex. Particular items of interest in this image include the following: H2 receiver, ash receiver shed, overhead process lines.
	F	This photo was taken north of the west expansion area. Particular items of interest in this image include the following: lime house, H2 receiver, overhead process lines, cascade F2 metering station, vent stacks.
	G	This photo was taken at the north side of the complex. Particular items of interest in this image include the following: lime house, H2 receiver, overhead process lines, cascade F2 metering station.
	H	This photo was taken near the covered HF receiver area. Particular items of interest in this image include the following: covered HF receiver area, vent stacks, cascade F2 metering station.
	I	This photo was taken near the vent stacks. Particular items of interest in this image include the following: vent stacks, F2 storage building.
	J	This photo was taken north of C-411. Particular items of interest in this image include the following: HF tank farm, cascade overhead tie-line, vent stacks.
	K	This photo was taken north of C-411, southwest of Photo J. Particular items of interest in this image include the following: vent stacks, C-411 north roll-up door, cascade overhead tie-line, HF tank farm.
	L	This photo was taken at the northeast corner of C-411. Particular items of interest in this image include the following: vent stacks, cascade overhead tie-line, C-411 north roll-up

Zone	Photo	Photo Description
		rooms for header cleaning. Photo A was taken in the center of the 58A area. Particular items of interest in this image include the following: piping/valving manifold.
59	A	Zone 59 is located on the 1st floor of the C-410 building. This area, part of the first east expansion, produced F2 by electrolysis for subsequent use in producing UF6 at the fluorination towers. The H2 produced was ultimately vented and burned. Photo A was taken in the north end of the zone. Particular items of interest in this image include the following: HF metering cabinet, empty F2 cell positions, cell bus work support framing with most of the bus work removed.
59	B	Zone 59 is located on the 1st floor of the C-410 building. This area, part of the first east expansion, produced F2 by electrolysis for subsequent use in producing UF6 at the fluorination towers. The H2 produced was ultimately vented and burned. Photo B was taken near the center of the zone. Particular items of interest in this image include the following: F2 cell piping, fume ducts, empty F2 cell positions, cell bus work support framing with most of the bus work removed.
60	A	Zone 60 is located on the 1st floor of the C-410 building. This area, part of the first east expansion, produced F2 by electrolysis for subsequent use in producing UF6 at the fluorination towers. The H2 produced was ultimately vented and burned. Photo A was taken in the north end of the zone. Particular items of interest in this image include the following: HF metering station, F2 cells on load stands, empty load stands, cell piping, cell bus work.
60	B	Zone 60 is located on the 1st floor of the C-410 building. This area, part of the first east expansion, produced F2 by electrolysis for subsequent use in producing UF6 at the fluorination towers. The H2 produced was ultimately vented and burned. Photo B was taken in the south end of the zone. Particular items of interest in this image include the following: HF metering station, F2 cells on load stands, empty load stands, cell piping, cell bus work including a good view of disconnect and bypass switches.
61	A	Zone 61 is located on the 1st floor of the C-410 building. This area provided electrical power control for the east expansion areas. It also housed ventilation supply fans, including two large filter rooms. Photo A was taken near the center of the fan room. Particular items of interest in this image include the following: supply vent duct, blower motor, steam station, doorway into Zone 63.
61	B	Zone 61 is located on the 1st floor of the C-410 building. This area provided electrical power control for the east expansion areas. It also housed ventilation supply fans, including two large filter rooms. Photo B was taken between the two rows of electrical cabinets in the west central portion of the substation room. Particular items of interest in this image include the following: electrical cabinets (some open), breaker rolled out between cabinets, ductwork.
62	A	Zone 62 is located on the 1st floor of the C-410 building. This area, part of the second east expansion, produced F2 by electrolysis for subsequent use in producing UF6 at the fluorination towers. The H2 produced was ultimately vented and burned. Photo A was taken in the north end of the zone. Particular items of interest in this image include the following: F2 cells, empty load stands, cell bus work, parts storage cabinets, doorway into outside area of Zone 62.
62	B	Zone 62 is located on the 1st floor of the C-410 building. This area, part of the second east expansion, produced F2 by electrolysis for subsequent use in producing UF6 at the fluorination towers. The H2 produced was ultimately vented and burned. Photo B was taken in the south end of the zone. Particular items of interest in this image include the following: F2 cells, empty load stands, cell bus work, parts storage cabinets, steam station, portable blower fan, doorway into Zone 63.
63	A	Zone 63 is located on the 1st floor of the C-410 building. This area provided electrical power for the Zone 62 cell room. Photo A was taken near the center of the zone with a view into the Zone 61 fan room. Particular items of interest in this image include the following: electrical cabinets, breaker rolled out of cabinet, water pump suction lines and

Zone	Photo	Photo Description
		generate F2 for cascade applications. Photo C was taken between the filter bank and the cell conditioning stands. Particular items of interest in this image include the following: filter bank, control panels, cell conditioning stands, cell bus work, entrance to Zone 56.
55	D	Zone 55 is located on the 1st floor of the C-410 building. This area served as the F2 cell conditioning area. Four stands were available to prepare (i.e., condition) cells to be installed on the operating bus. These positions could be operated as production cells if needed, and were operated as such for a period of time after building shutdown to generate F2 for cascade applications. Photo D was taken near the fluorine blower room. Particular items of interest in this image include the following: F2 blower room (door closed), filter bank, cell conditioning stands, F2 cell transport buggy.
55	E	Zone 55 is located on the 1st floor of the C-410 building. This area served as the F2 cell conditioning area. Four stands were available to prepare (i.e., condition) cells to be installed on the operating bus. These positions could be operated as production cells if needed, and were operated as such for a period of time after building shutdown to generate F2 for cascade applications. Photo E was taken near the doorway into Zone 60. Particular items of interest in this image include the following: view into 58A area, water pumps, view into Zone 60.
55	F	Zone 55 is located on the 1st floor of the C-410 building. This area served as the F2 cell conditioning area. Four stands were available to prepare (i.e., condition) cells to be installed on the operating bus. These positions could be operated as production cells if needed, and were operated as such for a period of time after building shutdown to generate F2 for cascade applications. Photo F was taken in the center of the local control room. Particular items of interest in this image include the following: control panels, miscellaneous trash.
55	G	Zone 55 is located on the 1st floor of the C-410 building. This area served as the F2 cell conditioning area. Four stands were available to prepare (i.e., condition) cells to be installed on the operating bus. These positions could be operated as production cells if needed, and were operated as such for a period of time after building shutdown to generate F2 for cascade applications. Photo G was taken in the north end of the local control room. Particular items of interest in this image include the following: control panels, miscellaneous trash.
56	A	Zone 56 is located on the 1st floor of the C-410 building. This area provided electricity for the four conditioning cell positions. Photo A was taken in the center of the zone. Particular items of interest in this image include the following: electrical cabinets.
57	A	Zone 57 is located on the 1st floor of the C-410 building. This area provided the capability to clean (i.e., purge/neutralize) F2 cells in two large neutralization vats prior to maintenance work in C-411. The procedure was to remove the cell head and place it in the shallow vat. The cell body was neutralized in the deep vat. Photo A was taken on the elevated platform in the middle of the room. Particular items of interest in this image include the following: neutralization tanks (deep tank for cell bodies, shallow tank with rotator/inverter for cell lids), steam station for heating tanks, air hose reel, overhead crane.
57	B	Zone 57 is located on the 1st floor of the C-410 building. This area provided the capability to clean (i.e., purge/neutralize) F2 cells in two large neutralization vats prior to maintenance work in C-411. The procedure was to remove the cell head and place it in the shallow vat. The cell body was neutralized in the deep vat. Photo B was taken at the north wall between the neutralization tanks. Particular items of interest in this image include the following: neutralization tanks (deep tank for cell bodies, shallow tank with rotator/inverter for cell lids), elevated platform, steam station for heating tanks, air hose reel, overhead crane, F2 cell load stands stacked in adjacent room.
58	A	Zone 58 is located on the 1st floor of the C-410 building. This area housed the F2 and H2 blower systems in separate rooms. These systems boosted the pressure of the F2 and H2 generated from the electrolytic cells. The H2 was pumped to the tank located in Zone 52 and eventually burned (flame arrestor) and vented. The F2 flowed to the filter columns in Zone 51, then to the tank located in Zone 52, and ultimately to the fluorination towers. In addition, a narrow room (Zone 58A) served as a valving manifold to isolate different cell

Zone	Photo	Photo Description
		make-up tank, F2 tank, miscellaneous stored materials.
52	C	Zone 52 is located on the mezzanine floor of the C-410 building. This area provided H2 and F2 surge volume. It also housed tempered water tanks and a large building ventilation/filter system. Photo C was taken at the north end of the NCS area. Particular items of interest in this image include the following: tempered water tanks, F2 tank, rusted F2 filters, miscellaneous stored materials.
52	D	Zone 52 is located on the mezzanine floor of the C-410 building. This area provided H2 and F2 surge volume. It also housed tempered water tanks and a large building ventilation/filter system. Photo D was taken along the west railing near the north NCS boundary rope overlooking Zone 40. Particular items of interest in this image include the following: F2 filters, tempered water tanks, miscellaneous stored materials, charge hoppers and G-17 valves (Zone 40).
52	E	Zone 52 is located on the mezzanine floor of the C-410 building. This area provided H2 and F2 surge volume. It also housed tempered water tanks and a large building ventilation/filter system. Photo E was taken at the south end of the NCS area. Particular items of interest in this image include the following: H2 tank, F2 tank, G-17 valve, plenum/filter housing, miscellaneous stored materials.
52	F	Zone 52 is located on the mezzanine floor of the C-410 building. This area provided H2 and F2 surge volume. It also housed tempered water tanks and a large building ventilation/filter system. Photo F was taken next to the plenum/filter room. Particular items of interest in this image include the following: breakers and switches on plenum room housing, miscellaneous stored materials.
52	G	Zone 52 is located on the mezzanine floor of the C-410 building. This area provided H2 and F2 surge volume. It also housed tempered water tanks and a large building ventilation/filter system. Photo G was taken along the south railing overlooking Zone 44. Particular items of interest in this image include the following: filter room, miscellaneous stored materials, view into Zone 44.
54	A	Zone 54 is located on the basement floor of the C-410 building. This area housed equipment that powered four of the F2 cell rooms (all but Zone 62). Photo A was taken at the north end of the zone. Particular items of interest in this image include the following: rectifier cabinets, electrical panels (vacuum tube visible), stored materials in corner, extensive ductwork.
54	B	Zone 54 is located on the basement floor of the C-410 building. This area housed equipment that powered four of the F2 cell rooms (all but Zone 62). Photo B was taken at the south end of the zone. Particular items of interest in this image include the following: electrical cabinets, sump pumps.
55	A	Zone 55 is located on the 1st floor of the C-410 building. This area served as the F2 cell conditioning area. Four stands were available to prepare (i.e., condition) cells to be installed on the operating bus. These positions could be operated as production cells if needed, and were operated as such for a period of time after building shutdown to generate F2 for cascade applications. Photo A was taken near the hydrogen blower room. Particular items of interest in this image include the following: H2 blower room, local control room, cell conditioning stands.
55	B	Zone 55 is located on the 1st floor of the C-410 building. This area served as the F2 cell conditioning area. Four stands were available to prepare (i.e., condition) cells to be installed on the operating bus. These positions could be operated as production cells if needed, and were operated as such for a period of time after building shutdown to generate F2 for cascade applications. Photo B was taken in the northwest corner of the zone. Particular items of interest in this image include the following: distant view into H2 blower room, local control room, view into Zone 41.
55	C	Zone 55 is located on the 1st floor of the C-410 building. This area served as the F2 cell conditioning area. Four stands were available to prepare (i.e., condition) cells to be installed on the operating bus. These positions could be operated as production cells if needed, and were operated as such for a period of time after building shutdown to

Zone	Photo	Photo Description
		vacuum blower, powder collection dump stations, suction/discharge lines.
50	A	Zone 50 is located on the mezzanine floor of the C-410 building. This area served as the changehouse for the C-410 complex and provided rest room facilities for personnel working in the C-410 building. Photo A was taken in the north locker area. Particular items of interest in this image include the following: lockers, benches, HVAC unit.
50	B	Zone 50 is located on the mezzanine floor of the C-410 building. This area served as the changehouse for the C-410 complex and provided rest room facilities for personnel working in the C-410 building. Photo B was taken in the shower area. Particular items of interest in this image include the following: shower piping, storage shelves.
51	A	Zone 51 is located on the mezzanine floor of the C-410 building. This area served as the F2 cell electrolyte mixing location, where potassium bifluoride and lithium fluoride were dumped to the mixing tanks. This zone also housed the F2 filtration columns, where F2 produced in the cell rooms was filtered prior to use at the fluorination towers. Photo A was taken near the large piping configuration in the center of the north end of the zone. Particular items of interest in this image include the following: extensive vessel/piping network, electrolyte dump hopper, top of electrolyte make-up tank, blower fan housing, view into Zone 39.
51	B	Zone 51 is located on the mezzanine floor of the C-410 building. This area served as the F2 cell electrolyte mixing location, where potassium bifluoride and lithium fluoride were dumped to the mixing tanks. This zone also housed the F2 filtration columns, where F2 produced in the cell rooms was filtered prior to use at the fluorination towers. Photo B was taken near the blower unit in the southwest corner of the zone. Particular items of interest in this image include the following: blower unit, F2 filters, electrolyte make-up tanks and dump hopper platforms.
51	C	Zone 51 is located on the mezzanine floor of the C-410 building. This area served as the F2 cell electrolyte mixing location, where potassium bifluoride and lithium fluoride were dumped to the mixing tanks. This zone also housed the F2 filtration columns, where F2 produced in the cell rooms was filtered prior to use at the fluorination towers. Photo C was taken just north of Photo B. Particular items of interest in this image include the following: F2 filters, tempered water tanks, blower housing, electrolyte make-up tanks and dump hoppers.
51	D	Zone 51 is located on the mezzanine floor of the C-410 building. This area served as the F2 cell electrolyte mixing location, where potassium bifluoride and lithium fluoride were dumped to the mixing tanks. This zone also housed the F2 filtration columns, where F2 produced in the cell rooms was filtered prior to use at the fluorination towers. Photo D was taken near the west electrolyte mixing tank. Particular items of interest in this image include the following: top of electrolyte make-up tank including HF line, electrolyte dump hopper, tempered water tanks.
51	E	Zone 51 is located on the mezzanine floor of the C-410 building. This area served as the F2 cell electrolyte mixing location, where potassium bifluoride and lithium fluoride were dumped to the mixing tanks. This zone also housed the F2 filtration columns, where F2 produced in the cell rooms was filtered prior to use at the fluorination towers. Photo E was taken in the northeast corner of the zone. Particular items of interest in this image include the following: wall heater unit, F2 filters, extensive vessel/piping network, vacuum system.
52	A	Zone 52 is located on the mezzanine floor of the C-410 building. This area provided H2 and F2 surge volume. It also housed tempered water tanks and a large building ventilation/filter system. Photo A was taken in front of the tempered water tanks. Particular items of interest in this image include the following: tempered water tanks, F2 filters, electrolyte make-up tank, F2 tank, miscellaneous stored materials.
52	B	Zone 52 is located on the mezzanine floor of the C-410 building. This area provided H2 and F2 surge volume. It also housed tempered water tanks and a large building ventilation/filter system. Photo B was taken just north of Photo A. Particular items of interest in this image include the following: tempered water tanks, F2 filters, electrolyte

Zone	Photo	Photo Description
		hoppers in the event the Zone 25 scales were inoperable. Photo D was taken at the northwest corner of the zone. Particular items of interest in this image include the following: south basement/mezzanine stairs, industrial oven, welding rig, portable vacuum, hoist cart, view into Zone 35 truck alley.
45	A	Zone 45 is located on the mezzanine floor of the C-410 building. This area was used as a general storage area (i.e., used as a junk room). Photo A was taken in the center of the accessible portion of the zone. Particular items of interest in this image include the following: powder flow test system, cathode ray oscillograph, considerable quantity of stored materials including red rubber gaskets and ash receiver gaskets.
47	A	Zone 47 is located on the mezzanine floor of the C-410 building. This area housed Alco cold trap refrigeration system components and piping, including the ammonia and CO2 systems. Photo A was taken in the southwest corner of the zone. Particular items of interest in this image include the following: northwest corner of vacuum room (Zone 49), cylinder stands, access hatch to Zone 33, large piping network, view down length of Zone 48.
47	B	Zone 47 is located on the mezzanine floor of the C-410 building. This area housed Alco cold trap refrigeration system components and piping, including the ammonia and CO2 systems. Photo B was taken near the stairwell. Particular items of interest in this image include the following: north side of vacuum room (Zone 49), large piping network, CO2 system components.
47	C	Zone 47 is located on the mezzanine floor of the C-410 building. This area housed Alco cold trap refrigeration system components and piping, including the ammonia and CO2 systems. Photo C was taken near the northeast corner of the zone. Particular items of interest in this image include the following: large piping network, shell-and-tube heat exchanger, CO2 converter, stairs to Zone 39.
48	A	Zone 48 is located on the mezzanine floor of the C-410 building. This area was used primarily as a pathway from the lower floor to the locker room and other areas of the C-410 mezzanine. Photo A was taken in the north end of the zone. Particular items of interest in this image include the following: southwest corner of vacuum room (Zone 49), north locker room entrance, view across to Zone 27.
48	B	Zone 48 is located on the mezzanine floor of the C-410 building. This area was used primarily as a pathway from the lower floor to the locker room and other areas of the C-410 mezzanine. Photo B was taken in the south end of the zone. Particular items of interest in this image include the following: electrical panels, piping manifold, miscellaneous pipe fittings.
48	C	Zone 48 is located on the mezzanine floor of the C-410 building. This area was used primarily as a pathway from the lower floor to the locker room and other areas of the C-410 mezzanine. Photo C was taken near the south mezzanine stairs. Particular items of interest in this image include the following: south locker room entrance, steam station for locker room hot water supply, nitrogen metering station.
48	D	Zone 48 is located on the mezzanine floor of the C-410 building. This area was used primarily as a pathway from the lower floor to the locker room and other areas of the C-410 mezzanine. Photo D was taken along the south railing, overlooking Zone 44. Particular items of interest in this image include the following: steam station for locker room hot water supply, south mezzanine stairs, south locker room entrance, view into Zone 44 below.
48	E	Zone 48 is located on the mezzanine floor of the C-410 building. This area was used primarily as a pathway from the lower floor to the locker room and other areas of the C-410 mezzanine. Photo E was taken just south of the center of the zone. Particular items of interest in this image include the following: electrical panels, piping manifold, miscellaneous pipe fittings.
49	A	Zone 49 is located on the mezzanine floor of the C-410 building. This area housed the C-410 building vacuum. It was similar in design and function to the vacuum system located on the mezzanine and ground floor levels of C-420. Photo A was taken in the north doorway to the zone. Particular items of interest in this image include the following:

Zone	Photo	Photo Description
		Particular items of interest in this image include the following: HF electric superheater, F2 cells in fill positions, view into Zone 55.
41	D	Zone 41 is located on the 1st floor of the C-410 building. This area served as the F2 cell fill area. Cells that had been repaired in C-411 were positioned on one of five stations where they were filled with electrolyte from the mixing tanks located in Zone 51. In addition, a F2 pumping station was operated in the NE corner of the zone to pressure the 410-D F2 tanks or cascade use up until the time the Zone 55 conditioning cells were shut down. Photo D was taken along the north wall. Particular items of interest in this image include the following: HF vaporizers (one with insulation removed), HF day tank, F2 cells in fill positions, cascade F2 pumping/metering area.
42	A	Zone 42 is located on the 1st floor of the C-410 building. This area produced F2 by electrolysis for subsequent use in producing UF6 at the fluorination towers. The H2 produced was ultimately vented and burned. Photo A was taken near the center of the zone. Particular items of interest in this image include the following: F2 cells on load stands, empty load stands, cell bus work, palletized materials, ventilation duct.
42	B	Zone 42 is located on the 1st floor of the C-410 building. This area produced F2 by electrolysis for subsequent use in producing UF6 at the fluorination towers. The H2 produced was ultimately vented and burned. Photo B was taken in the north end of the zone. Particular items of interest in this image include the following: F2 cells on load stands, cell bus work, palletized materials, metering stations, view of cells in fill positions (Zone 41).
43	A	Zone 43 is located on the 1st floor of the C-410 building. This area produced F2 by electrolysis for subsequent use in producing UF6 at the fluorination towers. The H2 produced was ultimately vented and burned. Photo A was taken near the center of the zone . Particular items of interest in this image include the following: F2 cells, cell bus work (good view of disconnect and bypass switches), palletized materials, cell piping.
44	A	Zone 44 is located on the 1st floor of the C-410 building. This area primarily received UF6 cylinders for filling at the drain stations. During the time that the vaporizer baths were operational, this zone also received full UF6 cylinders for feeding to the cascade. In addition, a set of accountability scales was located in this area for weighing charge hoppers in the event the Zone 25 scales were inoperable. Photo A was taken in the east end of the zone. Particular items of interest in this image include the following: pallets, metal drums, laundry cart, dump hopper, miscellaneous stored materials, view into Zone 43.
44	B	Zone 44 is located on the 1st floor of the C-410 building. This area primarily received UF6 cylinders for filling at the drain stations. During the time that the vaporizer baths were operational, this zone also received full UF6 cylinders for feeding to the cascade. In addition, a set of accountability scales was located in this area for weighing charge hoppers in the event the Zone 25 scales were inoperable. Photo B was taken in the center of the zone near the Zone 40 NCS boundary. Particular items of interest in this image include the following: roll-up door, miscellaneous stored materials, drums and pails in spill pan (Zone 40).
44	C	Zone 44 is located on the 1st floor of the C-410 building. This area primarily received UF6 cylinders for filling at the drain stations. During the time that the vaporizer baths were operational, this zone also received full UF6 cylinders for feeding to the cascade. In addition, a set of accountability scales was located in this area for weighing charge hoppers in the event the Zone 25 scales were inoperable. Photo C was taken in the west end of the zone. Particular items of interest in this image include the following: south mezzanine stairs from Zone 48, welding rig, industrial oven, portable vacuum, hoist cart, metal drum, tool box, miscellaneous stored materials.
44	D	Zone 44 is located on the 1st floor of the C-410 building. This area primarily received UF6 cylinders for filling at the drain stations. During the time that the vaporizer baths were operational, this zone also received full UF6 cylinders for feeding to the cascade. In addition, a set of accountability scales was located in this area for weighing charge

Zone	Photo	Photo Description
		north end of the platform in front of the Alco panels. Particular items of interest in this image include the following: Alco cold traps, Alco weight/pressure panel.
39	C	Zone 39 is located on the mezzanine floor of the C-410 building. This area served as the Alco cold trap area, where carryover UF6 from the Modine cold traps was frozen out and subsequently liquefied and drained to cylinders in Zone 38. Photo C was taken at the south end of the platform at the base of the Zone 51 stairs. Particular items of interest in this image include the following: Alco cold traps, view up into Zone 51, view down into Zone 40.
39	D	Zone 39 is located on the mezzanine floor of the C-410 building. This area served as the Alco cold trap area, where carryover UF6 from the Modine cold traps was frozen out and subsequently liquefied and drained to cylinders in Zone 38. Photo D was taken at the south end of the platform near the stairs to Zone 40. Particular items of interest in this image include the following: Alco cold traps, stairs up into Zone 51, view into Zone 40.
39	E	Zone 39 is located on the mezzanine floor of the C-410 building. This area served as the Alco cold trap area, where carryover UF6 from the Modine cold traps was frozen out and subsequently liquefied and drained to cylinders in Zone 38. Photo E was taken in the southeast corner of the zone. Particular items of interest in this image include the following: Alco cold traps, stairs to locker/storage room, view into Zone 40.
39	F	Zone 39 is located on the mezzanine floor of the C-410 building. This area served as the Alco cold trap area, where carryover UF6 from the Modine cold traps was frozen out and subsequently liquefied and drained to cylinders in Zone 38. Photo F was taken along the south railing, west of center, overlooking Zone 40. Particular items of interest in this image include the following: Alco cold traps, good view down into Zone 40 (particularly of charge hoppers).
40	A	Zone 40 is located on the 1st floor of the C-410 building. This area originally housed vaporizer baths, where UF6 cylinders (2-1/2- and 10-ton) were heated to feed material directly to the cascade. After the vaporizer facilities (C-333-A and C-337-A) were built, the C-410 baths were removed and the area was generally open and/or used for storage. After complex shutdown, the area housed a cascade valve repair shop. Photo A was taken just outside the northeast entrance to the control room. Particular items of interest in this image include the following: Alco UF6 drain station, control room entrance, alcohol tank, G-17 valve on cylinder cradle.
41	A	Zone 41 is located on the 1st floor of the C-410 building. This area served as the F2 cell fill area. Cells that had been repaired in C-411 were positioned on one of five stations where they were filled with electrolyte from the mixing tanks located in Zone 51. In addition, a F2 pumping station was operated in the NE corner of the zone to pressure the 410-D F2 tanks for cascade use up until the time the Zone 55 conditioning cells were shut down. Photo A was taken in the west side of the zone. Particular items of interest in this image include the following: F2 cell fill positions, cell room HF manifolds, HF electric superheaters.
41	B	Zone 41 is located on the 1st floor of the C-410 building. This area served as the F2 cell fill area. Cells that had been repaired in C-411 were positioned on one of five stations where they were filled with electrolyte from the mixing tanks located in Zone 51. In addition, a F2 pumping station was operated in the NE corner of the zone to pressure the 410-D F2 tanks or cascade use up until the time the Zone 55 conditioning cells were shut down. Photo B was taken in the southeast area of the zone. Particular items of interest in this image include the following: cell room HF manifold, HF electric superheater, F2 cells in fill positions, bottom of electrolyte make-up tank (protruding through ceiling).
41	C	Zone 41 is located on the 1st floor of the C-410 building. This area served as the F2 cell fill area. Cells that had been repaired in C-411 were positioned on one of five stations where they were filled with electrolyte from the mixing tanks located in Zone 51. In addition, a F2 pumping station was operated in the NE corner of the zone to pressure the 410-D F2 tanks or cascade use up until the time the Zone 55 conditioning cells were shut down. Photo C was taken in the east end of the zone, near the Zone 55 doorway.

Zone	Photo	Photo Description
36	E	Zone 36 is located on the 1st floor of the C-410 building. This area served as the C-410 operational control area for both F2 and UF6 production. The east panels allowed monitoring/control of the F2 plant. The west panels provided similar capability for UF6 production. Photo E was taken in the access area behind the east panels. Particular items of interest in this image include the following: alarm relay cabinet, telephone relay cabinet, panels and conduit.
36	F	Zone 36 is located on the 1st floor of the C-410 building. This area served as the C-410 operational control area for both F2 and UF6 production. The east panels allowed monitoring/control of the F2 plant. The west panels provided similar capability for UF6 production. Photo F was taken in the room north of the control room. Particular items of interest in this image include the following: north entrances to control room area, file cabinet.
37	A	Zone 37 is located on the 1st floor of the C-410 building. This area served as the quality control lab for the complex, providing a number of analytical capabilities included F2 concentration (bulb samples) and powder analysis. After the complex was shutdown in 1977, the laboratory area served as a corrosive gas test lab, supporting such activities as UF6 trapping studies. An office/lunchroom area was also located within the zone, north of the lab. Photo A was taken in the main laboratory area. Particular items of interest in this image include the following: lab benches and equipment, fume hood.
37	B	Zone 37 is located on the 1st floor of the C-410 building. This area served as the quality control lab for the complex, providing a number of analytical capabilities included F2 concentration (bulb samples) and powder analysis. After the complex was shutdown in 1977, the laboratory area served as a corrosive gas test lab, supporting such activities as UF6 trapping studies. An office/lunchroom area was also located within the zone, north of the lab. Photo B was taken in the work area near the doorway into the main laboratory area. Particular items of interest in this image include the following: work benches, wall cabinets, HVAC unit, miscellaneous stored materials.
37	C	Zone 37 is located on the 1st floor of the C-410 building. This area served as the quality control lab for the complex, providing a number of analytical capabilities included F2 concentration (bulb samples) and powder analysis. After the complex was shutdown in 1977, the laboratory area served as a corrosive gas test lab, supporting such activities as UF6 trapping studies. An office/lunchroom area was also located within the zone, north of the lab. Photo C was taken in the small room near the truck alley entrance. Particular items of interest in this image include the following: walk-in fume hood, lab oven, UF6 trap, test equipment.
37	D	Zone 37 is located on the 1st floor of the C-410 building. This area served as the quality control lab for the complex, providing a number of analytical capabilities included F2 concentration (bulb samples) and powder analysis. After the complex was shutdown in 1977, the laboratory area served as a corrosive gas test lab, supporting such activities as UF6 trapping studies. An office/lunchroom area was also located within the zone, north of the lab. Photo D was taken in the office/lunchroom area north of the lab. Particular items of interest in this image include the following: sink unit, countertop, cabinets, benches.
38	A	Zone 38 is located on the 1st floor of the C-410 building. This area housed the Alco cold trap drain station, as well as the alcohol tank and pumping system associated with the Alco heating cycle. Photo A was taken along the west boundary of the zone near the ammonia compressors in Zone 33. Particular items of interest in this image include the following: ammonia compressor (Zone 33), steam reducing station.
39	A	Zone 39 is located on the mezzanine floor of the C-410 building. This area served as the Alco cold trap area, where carryover UF6 from the Modine cold traps was frozen out and subsequently liquefied and drained to cylinders in Zone 38. Photo A was taken at the north end of the platform near the Alco panels. Particular items of interest in this image include the following: Alco cold traps, stairs up to Zone 51, stairs down to Zone 40.
39	B	Zone 39 is located on the mezzanine floor of the C-410 building. This area served as the Alco cold trap area, where carryover UF6 from the Modine cold traps was frozen out and subsequently liquefied and drained to cylinders in Zone 38. Photo B was taken at the

Zone	Photo	Photo Description
		primarily for storage. Photo C was taken near the northeast corner of the zone. Particular items of interest in this image include the following: B-25 boxes, metal drums, tool boxes, miscellaneous stored materials, view into Zone 28.
31	D	Zone 31 is located on the 1st floor of the C-410 building. This area, along with Zone 28, originally comprised the HF shaker tray area. With the construction of C-420, the shaker tray reactors were removed, providing a generally open floor area, which was used primarily for storage. Photo D was taken in the northwest corner of the zone. Particular items of interest in this image include the following: B-25 boxes, metal drums, miscellaneous stored materials, view into Zones 28 (down) and 27 (up).
31	E	Zone 31 is located on the 1st floor of the C-410 building. This area, along with Zone 28, originally comprised the HF shaker tray area. With the construction of C-420, the shaker tray reactors were removed, providing a generally open floor area, which was used primarily for storage. Photo E was taken along the west wall near the northwest corner of the zone. Particular items of interest in this image include the following: B-25 boxes, metal drums, miscellaneous stored materials.
33	A	Zone 33 is located on the 1st floor of the C-410 building. This area housed large ammonia compressors used in conjunction with the CO2 conversion system for UF6 freeze out in the Zone 37 Alco cold traps. The Freon room is also located in this zone, where R-12 was used for a period of time to freeze out UF6 in the Kelex cold traps. These traps were prone to plugging and removed as a result in the 1960s. The R-12 system was abandoned in place at that time. Photo A was taken along the north wall east of the Freon room. Particular items of interest in this image include the following: ammonia compressors, doorway to Freon room, stairway to basement and mezzanine levels.
33	B	Zone 33 is located on the 1st floor of the C-410 building. This area housed large ammonia compressors used in conjunction with the CO2 conversion system for UF6 freeze out in the Zone 37 Alco cold traps. The Freon room is also located in this zone, where R-12 was used for a period of time to freeze out UF6 in the Kelex cold traps. These traps were prone to plugging and removed as a result in the 1960s. The R-12 system was abandoned in place at that time. Photo B was taken near the northwest corner of the zone. Particular items of interest in this image include the following: roll-up door, waste water tank, access hatch to Zone 47 on mezzanine, filter room and associated vent duct (Zone 26).
36	A	Zone 36 is located on the 1st floor of the C-410 building. This area served as the C-410 operational control area for both F2 and UF6 production. The east panels allowed monitoring/control of the F2 plant. The west panels provided similar capability for UF6 production. Photo A was taken in the room at the south end of the zone. Particular items of interest in this image include the following: stored computer equipment.
36	B	Zone 36 is located on the 1st floor of the C-410 building. This area served as the C-410 operational control area for both F2 and UF6 production. The east panels allowed monitoring/control of the F2 plant. The west panels provided similar capability for UF6 production. Photo B was taken in front of the east panels. Particular items of interest in this image include the following: east bank of control panels, miscellaneous stored materials including computer equipment.
36	C	Zone 36 is located on the 1st floor of the C-410 building. This area served as the C-410 operational control area for both F2 and UF6 production. The east panels allowed monitoring/control of the F2 plant. The west panels provided similar capability for UF6 production. Photo C was taken in front of the west panels. Particular items of interest in this image include the following: east and west control panels, computer maintenance repair bench area.
36	D	Zone 36 is located on the 1st floor of the C-410 building. This area served as the C-410 operational control area for both F2 and UF6 production. The east panels allowed monitoring/control of the F2 plant. The west panels provided similar capability for UF6 production. Photo D was taken in the access area behind the west panels. Particular items of interest in this image include the following: relay cabinet, pneumatic instruments, electrical conduit, mesh cable trays.

Zone	Photo	Photo Description
27	CE	Zone 27 is a multi-level zone. This area consisted of three levels. The south end of the upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The north portion of the upper platform housed the fluid bed cleanup reactor used to remove unreacted F2 from the UF6 gas stream, along with the top portion of the two associated settling chambers. The lower platform and the pit area housed lower portions of the cleanup reactors, including the return powder conveyor system. Photo CE was taken on the 2nd floor in the middle of the Modine platform along the east railing. Particular items of interest in this image include the following: Modine cold traps, glycol valving manifold, view into various nearby zones.
27	AA	Zone 27 is a multi-level zone. This area consisted of three levels. The south end of the upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The north portion of the upper platform housed the fluid bed cleanup reactor used to remove unreacted F2 from the UF6 gas stream, along with the top portion of the two associated settling chambers. The lower platform and the pit area housed lower portions of the cleanup reactors, including the return powder conveyor system. Photo AA was taken on the pit floor near the Stage 1 cleanup reactor collection hopper. Particular items of interest in this image include the following: fluid bed cleanup reactor Stage 1 collection hopper, conveyor drive, vibrator unit, vibrator reostat panels.
28	A	Zone 28 is located on the pit floor of the C-410 building. This area consisted of two levels, which were originally part of the HF shaker tray area (in conjunction with Zone 31). With the construction of C-420, the shaker tray reactors were removed, providing a generally open floor area, which was used primarily for storage. Photo A was taken in the area near the west wall between Zones 26 and 27. Particular items of interest in this image include the following: Stage 1 and 2 fluid bed cleanup reactor collection hoppers, rotary feeder drive, vibrator unit (on conical bottom of Stage 2 collection hopper), conveyor, clean-out station, filter tube bundle transport housing.
28	B	Zone 28 is located on the pit floor of the C-410 building. This area consisted of two levels, which were originally part of the HF shaker tray area (in conjunction with Zone 31). With the construction of C-420, the shaker tray reactors were removed, providing a generally open floor area, which was used primarily for storage. Photo B was taken on the lower level in front of the cleanup reactor collection hoppers. Particular items of interest in this image include the following: Stage 1 and 2 fluid bed cleanup reactor collection hoppers, staged F2 cells, view of truck alley area (Zones 34 & 35), distant view of Zone 26.
28	C	Zone 28 is located on the pit floor of the C-410 building. This area consisted of two levels, which were originally part of the HF shaker tray area (in conjunction with Zone 31). With the construction of C-420, the shaker tray reactors were removed, providing a generally open floor area, which was used primarily for storage. Photo C was taken on the upper level closer to Zone 31. Particular items of interest in this image include the following: overhead glycol piping, wire mesh storage cage, computer equipment (stored material), miscellaneous stored materials.
31	A	Zone 31 is located on the 1st floor of the C-410 building. This area, along with Zone 28, originally comprised the HF shaker tray area. With the construction of C-420, the shaker tray reactors were removed, providing a generally open floor area, which was used primarily for storage. Photo A was taken near the center of the zone. Particular items of interest in this image include the following: B-25 boxes, diking materials, scales, miscellaneous stored materials.
31	B	Zone 31 is located on the 1st floor of the C-410 building. This area, along with Zone 28, originally comprised the HF shaker tray area. With the construction of C-420, the shaker tray reactors were removed, providing a generally open floor area, which was used primarily for storage. Photo B was taken in the southeast corner of the zone. Particular items of interest in this image include the following: miscellaneous stored materials.
31	C	Zone 31 is located on the 1st floor of the C-410 building. This area, along with Zone 28, originally comprised the HF shaker tray area. With the construction of C-420, the shaker tray reactors were removed, providing a generally open floor area, which was used

Zone	Photo	Photo Description
		conveyor system. Photo BA was taken on the 1st floor near the cleanup reactor. Particular items of interest in this image include the following: fluid bed cleanup reactor including view of clean-out port and interconnecting piping.
27	BB	Zone 27 is a multi-level zone. This area consisted of three levels. The south end of the upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The north portion of the upper platform housed the fluid bed cleanup reactor used to remove unreacted F2 from the UF6 gas stream, along with the top portion of the two associated settling chambers. The lower platform and the pit area housed lower portions of the cleanup reactors, including the return powder conveyor system. Photo BB was taken on the 1st floor between the two cleanup reactor collection hoppers. Particular items of interest in this image include the following: fluid bed cleanup reactor including view of clean-out port, collection hoppers with interconnecting piping.
27	CA	Zone 27 is a multi-level zone. This area consisted of three levels. The south end of the upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The north portion of the upper platform housed the fluid bed cleanup reactor used to remove unreacted F2 from the UF6 gas stream, along with the top portion of the two associated settling chambers. The lower platform and the pit area housed lower portions of the cleanup reactors, including the return powder conveyor system. Photo CA was taken on the 2nd floor at the southeast corner of the cleanup reactor platform. Particular items of interest in this image include the following: Modine cold trap, fluid bed cleanup reactor including Stage 1 & 2 collection hoppers.
27	CB	Zone 27 is a multi-level zone. This area consisted of three levels. The south end of the upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The north portion of the upper platform housed the fluid bed cleanup reactor used to remove unreacted F2 from the UF6 gas stream, along with the top portion of the two associated settling chambers. The lower platform and the pit area housed lower portions of the cleanup reactors, including the return powder conveyor system. Photo CB was taken on the 2nd floor at the north end of the cleanup reactor platform. Particular items of interest in this image include the following: UF4 feed hopper, spare UF4 dispersers, fluid bed reactor filter, blow-back valves, fluid bed reactor collection hopper interconnecting piping.
27	CC	Zone 27 is a multi-level zone. This area consisted of three levels. The south end of the upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The north portion of the upper platform housed the fluid bed cleanup reactor used to remove unreacted F2 from the UF6 gas stream, along with the top portion of the two associated settling chambers. The lower platform and the pit area housed lower portions of the cleanup reactors, including the return powder conveyor system. Photo CC was taken on the 2nd floor at the southeast corner of the Modine platform. Particular items of interest in this image include the following: Modine cold traps; glycol valving manifold; view across to Zone 26, Zone 31, and C-410 mezzanine zones and down into Zone 28.
27	CD	Zone 27 is a multi-level zone. This area consisted of three levels. The south end of the upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The north portion of the upper platform housed the fluid bed cleanup reactor used to remove unreacted F2 from the UF6 gas stream, along with the top portion of the two associated settling chambers. The lower platform and the pit area housed lower portions of the cleanup reactors, including the return powder conveyor system. Photo CD was taken on the 2nd floor at the southeast corner of the Modine platform (with some of the incoming light blocked). Particular items of interest in this image include the following: Modine cold traps; glycol valving manifold; view across to Zone 26, Zone 31, and C-410 mezzanine zones and down into Zone 28.

Zone	Photo	Photo Description
26	CB	Zone 26 is a multi-level zone. This area consisted of three levels. The main level housed four F2 towers. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo CB was taken on the 2nd floor between feed hoppers near the south railing. Particular items of interest in this image include the following: angled powder drop piping, F2 preheater, UF4 conveyor, UF4 feed hopper.
26	CC	Zone 26 is a multi-level zone. This area consisted of three levels. The main level housed four F2 towers. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo CC was taken on the 2nd floor at the west end of the walkway. Particular items of interest in this image include the following: F2 preheater, UF4 feed screw drive unit, UF4 disperser, UF4 feed hopper.
26	CD	Zone 26 is a multi-level zone. This area consisted of three levels. The main level housed four F2 towers. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo CD was taken on the 2nd floor at the east end of the walkway. Particular items of interest in this image include the following: F2 preheater, UF4 feed hopper, duct to outside vent.
26	AA	Zone 26 is a multi-level zone. This area consisted of three levels. The main level housed four F2 towers. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo AA was taken on the pit floor at the west end of the zone. Particular items of interest in this image include the following: ash receivers, condensate flash tank, filter room.
26	AB	Zone 26 is a multi-level zone. This area consisted of three levels. The main level housed four F2 towers. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo AB was taken on the pit floor near the northeast corner of the zone. Particular items of interest in this image include the following: filter room, steam condensate pumps, ash receivers, flooded basement (adjacent to Zone 53), view of upper levels of Zone 26 and into Zone 33.
26	AC	Zone 26 is a multi-level zone. This area consisted of three levels. The main level housed four F2 towers. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo AC was taken on the pit floor between two ash receivers. Particular items of interest in this image include the following: ash receivers, interconnecting cooling pipe, cyclone, staged F2 cells, sintered metal ash filter, UF4 conveyor.
27	BA	Zone 27 is a multi-level zone. This area consisted of three levels. The south end of the upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The north portion of the upper platform housed the fluid bed cleanup reactor used to remove unreacted F2 from the UF6 gas stream, along with the top portion of the two associated settling chambers. The lower platform and the pit area housed lower portions of the cleanup reactors, including the return powder

Zone	Photo	Photo Description
		Ash hoppers containing pulverized materials from C-400 were also equipped with feed valves in the area. Photo C was taken east of Photo B. Particular items of interest in this image include the following: UF6 drain stations/cylinder pit, B-25 boxes, waste insulation.
25	D	Zone 25 is located on the 1st floor of the C-410 building. This area was essentially a large open high-bay area. It served as the railcar loading/offloading area, where UO3 charge hoppers (40-gal drums in the early days of operation) were unloaded and staged. They were subsequently weighed, equipped with valves, rotated (using a large hopper rotator), and installed on transport carts to prepare them for feeding at the C-420 5th floor UO3 charge stations. This area also housed the accountability scales used for weighing incoming charge hoppers and outgoing UF6 cylinders, as well as the UF6 drain stations. Ash hoppers containing pulverized materials from C-400 were also equipped with feed valves in the area. Photo D was taken near the southwest corner of the zone. Particular items of interest in this image include the following: UF6 drain stations/cylinder pit, B-25 boxes, waste insulation, ammonia compressors (Zone 24).
25	E	Zone 25 is located on the 1st floor of the C-410 building. This area was essentially a large open high-bay area. It served as the railcar loading/offloading area, where UO3 charge hoppers (40-gal drums in the early days of operation) were unloaded and staged. They were subsequently weighed, equipped with valves, rotated (using a large hopper rotator), and installed on transport carts to prepare them for feeding at the C-420 5th floor UO3 charge stations. This area also housed the accountability scales used for weighing incoming charge hoppers and outgoing UF6 cylinders, as well as the UF6 drain stations. Ash hoppers containing pulverized materials from C-400 were also equipped with feed valves in the area. Photo E was taken near the center of the south wall. Particular items of interest in this image include the following: rail area, roll-up door, B-25 boxes, metal scoops on pallets, scale cart.
25	F	Zone 25 is located on the 1st floor of the C-410 building. This area was essentially a large open high-bay area. It served as the railcar loading/offloading area, where UO3 charge hoppers (40-gal drums in the early days of operation) were unloaded and staged. They were subsequently weighed, equipped with valves, rotated (using a large hopper rotator), and installed on transport carts to prepare them for feeding at the C-420 5th floor UO3 charge stations. This area also housed the accountability scales used for weighing incoming charge hoppers and outgoing UF6 cylinders, as well as the UF6 drain stations. Ash hoppers containing pulverized materials from C-400 were also equipped with feed valves in the area. Photo F was taken near the southeast corner of the zone, providing a view into Zone 31. Particular items of interest in this image include the following: west roll-up door, overhead high-capacity crane, B-25 boxes, palletized materials.
26	BA	Zone 26 is a multi-level zone. This area consisted of three levels. The main level housed four F2 towers. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo BA was taken on the 1st floor near the center of the zone. Particular items of interest in this image include the following: sintered metal filter from ash receiver, fluorination tower, air blow-back tank, instrument rack.
26	CA	Zone 26 is a multi-level zone. This area consisted of three levels. The main level housed four F2 towers. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo CA was taken on the 2nd floor on the walkway between Zones 26 and 27. Particular items of interest in this image include the following: fluid bed reactor components (Zone 27), overhead UF4 conveyor, F2 preheater (Zone 26).

Zone	Photo	Photo Description
24	AC	Zone 24 is a multi-level zone. This area consisted of two levels. The upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The lower level housed the ammonia refrigeration equipment used to cool the glycol employed in the Modine vessels for UF6 freeze out. Photo AC was taken on the 1st floor between the ammonia receivers on the west wall. Particular items of interest in this image include the following: glycol receivers, ammonia chillers.
24	BA	Zone 24 is a multi-level zone. This area consisted of two levels. The upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The lower level housed the ammonia refrigeration equipment used to cool the glycol employed in the Modine vessels for UF6 freeze out. Photo BA was taken on the 2nd floor in the southeast corner of the zone overlooking Zone 25. Particular items of interest in this image include the following: Modine cold traps, electrical panels, view into Zone 25.
24	BB	Zone 24 is a multi-level zone. This area consisted of two levels. The upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The lower level housed the ammonia refrigeration equipment used to cool the glycol employed in the Modine vessels for UF6 freeze out. Photo BB was taken on the 2nd floor in the southwest corner of the zone near the south stairs. Particular items of interest in this image include the following: Modine cold traps, glycol valving manifold servicing Modines, distant view into Zone 25.
24	BC	Zone 24 is a multi-level zone. This area consisted of two levels. The upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The lower level housed the ammonia refrigeration equipment used to cool the glycol employed in the Modine vessels for UF6 freeze out. Photo BC was taken on the 2nd floor at the boundary between Zones 23 and 24 along the east wall. Particular items of interest in this image include the following: Modine cold traps, electrical panels.
25	A	Zone 25 is located on the 1st floor of the C-410 building. This area was essentially a large open high-bay area. It served as the railcar loading/offloading area, where UO3 charge hoppers (40-gal drums in the early days of operation) were unloaded and staged. They were subsequently weighed, equipped with valves, rotated (using a large hopper rotator), and installed on transport carts to prepare them for feeding at the C-420 5th floor UO3 charge stations. This area also housed the accountability scales used for weighing incoming charge hoppers and outgoing UF6 cylinders, as well as the UF6 drain stations. Ash hoppers containing pulverized materials from C-400 were also equipped with feed valves in the area. Photo A was taken near the center of the zone. Particular items of interest in this image include the following: B-25 boxes, excess office chairs, welding rig, portable vacuum.
25	B	Zone 25 is located on the 1st floor of the C-410 building. This area was essentially a large open high-bay area. It served as the railcar loading/offloading area, where UO3 charge hoppers (40-gal drums in the early days of operation) were unloaded and staged. They were subsequently weighed, equipped with valves, rotated (using a large hopper rotator), and installed on transport carts to prepare them for feeding at the C-420 5th floor UO3 charge stations. This area also housed the accountability scales used for weighing incoming charge hoppers and outgoing UF6 cylinders, as well as the UF6 drain stations. Ash hoppers containing pulverized materials from C-400 were also equipped with feed valves in the area. Photo B was taken at the entrance to the elevator. Particular items of interest in this image include the following: B-25 boxes, nitrogen metering station, waste fiberglass insulation, view into freight elevator.
25	C	Zone 25 is located on the 1st floor of the C-410 building. This area was essentially a large open high-bay area. It served as the railcar loading/offloading area, where UO3 charge hoppers (40-gal drums in the early days of operation) were unloaded and staged. They were subsequently weighed, equipped with valves, rotated (using a large hopper rotator), and installed on transport carts to prepare them for feeding at the C-420 5th floor UO3 charge stations. This area also housed the accountability scales used for weighing incoming charge hoppers and outgoing UF6 cylinders, as well as the UF6 drain stations.

Zone	Photo	Photo Description
		the cleanup reactors and the HF superheater. Particular items of interest in this image include the following: bottom of cleanup reactor, cleanup reactor drive train, HF electric superheater, old HF steam superheaters.
22	AD	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo AD was taken on the pit floor between the HF superheater and the ash receivers. Particular items of interest in this image include the following: rectifiers, HF electric superheater, primary and secondary ash receivers including interconnecting cooling pipe.
23	AA	Zone 23 is a multi-level zone. This area consisted of two levels. The upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. Among other things, the lower level housed three glycol tanks used to heat/cool the Modine vessels. Photo AA was taken on the 1st floor at the southwest corner of the zone. Particular items of interest in this image include the following: glycol tanks, ammonia chiller, UF6 surge drum.
23	AB	Zone 23 is a multi-level zone. This area consisted of two levels. The upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. Among other things, the lower level housed three glycol tanks used to heat/cool the Modine vessels. Photo AB was taken on the 1st floor at the northeast corner of the zone. Particular items of interest in this image include the following: breaker panels, UF6 surge drum, glycol tanks, steam stations, plant air manifold.
23	BA	Zone 23 is a multi-level zone. This area consisted of two levels. The upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. Among other things, the lower level housed three glycol tanks used to heat/cool the Modine vessels. Photo BA was taken on the 2nd floor along the east walkway. Particular items of interest in this image include the following: Modine cold traps, Modine pressure/load cell panel.
23	BB	Zone 23 is a multi-level zone. This area consisted of two levels. The upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. Among other things, the lower level housed three glycol tanks used to heat/cool the Modine vessels. Photo BB was taken on the 2nd floor along the west walkway. Particular items of interest in this image include the following: Modine cold traps, glycol pressure panel, valving manifold for Modine glycol system.
24	AA	Zone 24 is a multi-level zone. This area consisted of two levels. The upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The lower level housed the ammonia refrigeration equipment used to cool the glycol employed in the Modine vessels for UF6 freeze out. Photo AA was taken on the 1st floor near the southwest corner of the zone. Particular items of interest in this image include the following: ammonia compressors, ammonia compressor panel, UF6 drain stations, glycol valving manifold for Modine cold traps.
24	AB	Zone 24 is a multi-level zone. This area consisted of two levels. The upper level housed three Modine cold traps used to freeze out UF6 for subsequent heating and draining to cylinders in Zone 25. The lower level housed the ammonia refrigeration equipment used to cool the glycol employed in the Modine vessels for UF6 freeze out. Photo AB was taken on the 1st floor between the UF6 drain station (Zone 25) and the UF6 surge drum in the southeast portion of the zone. Particular items of interest in this image include the following: ammonia compressors, UF6 drain stations, weight indicator panel, UF6 surge drum.

Zone	Photo	Photo Description
22	CB	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo CB was taken on the 2nd floor near the southeast corner of the zone on the elevated platform. Particular items of interest in this image include the following: conveyors and conveyor drives.
22	CC	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo CC was taken on the 2nd floor along the east wall near the north stairs. Particular items of interest in this image include the following: HF electric superheaters, UF4 feed hoppers, stairs to elevated platform at north end of zone.
22	CD	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo CD was taken on the 2nd floor on the uppermost level at the north wall. Particular items of interest in this image include the following: conveyor drive unit, cleanup reactor components, small overhead rail cranes.
22	AA	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo AA was taken on the pit floor along the southern portion of the west wall. Particular items of interest in this image include the following: reciprocating saw (stored material), UF4 drum-off station, filter ash receiver, UF4 weigh hopper, UF4 conveyor, spare fluid bed reactor collection hopper component.
22	AB	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo AB was taken on the pit floor along the northern portion of the west wall. Particular items of interest in this image include the following: wall heater unit, old HF steam superheaters, HF reactor screw, ash receiver jib crane.
22	AC	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo AC was taken on the pit floor between

Zone	Photo	Photo Description
20	D	Zone 20 is located on the 1st floor of the C-420 building. This area served as the C-420 office area. It also housed a break room and rest rooms for personnel working in the building. Photo D was taken in the hallway. Particular items of interest in this image include the following: personnel frisking stations, "surveyed item" table, view into decon area and down hall into dress-out area.
22	BA	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo BA was taken on the 1st floor between the cleanup reactors and the "Ex" line. Particular items of interest in this image include the following: cleanup reactors including clamshell heater sections, cooling screws, and gas expansion conical sections.
22	BB	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo BB was taken on the 1st floor between the two cleanup reactors. Particular items of interest in this image include the following: F2 and UF6 piping including heated F2 control valve housing, cleanup reactors including clamshell heater sections, cooling screws, and gas expansion conical sections.
22	BC	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo BC was taken on the 1st floor between the "Ax" and "Ex" lines near the pit railing. Particular items of interest in this image include the following: UF6 and F2 piping including heated F2 control valve housing, fluorination tower, sintered metal ash filter, cleanup reactors.
22	BD	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo BD was taken on the 1st floor in front of the "B" weigh hopper. Particular items of interest in this image include the following: UF4 storage hopper, fluorination tower, vibrator control panel, UF6 surge drum (Zone 24).
22	CA	Zone 22 is a multi-level zone. This area consisted of three levels. The main level housed five F2 towers and two UF4 storage hoppers, as well as a good portion of the components comprising the two UF6 cleanup reactors. UF4 was conveyor transported from the storage hoppers to feed hoppers located on the upper level, then subsequently screwed into powder dispersers at the top of the F2 towers. F2 was superheated and fed to the top of the towers as well on the upper floor. The unreacted powder (i.e., ash) fell to the pit area where it was collected in ash receivers. Photo CA was taken on the 2nd floor at the southwest corner of the zone. Particular items of interest in this image include the following: UF4 conveyors and drives, Modine cold traps (Zone 23), cylinder saddles (stored material).

Zone	Photo	Photo Description
16	E	Zone 16 is located on the 1st floor of the C-420 building. This area housed UF4 storage/transport equipment, including an elaborate conveyor system to transfer powder to the UF6 processing areas. Photo E was taken west of the UF4 storage hopper along the north wall. Particular items of interest in this image include the following: breaker panels; "C" UF4 storage hopper; horizontal, vertical, and angled conveyor sections.
16	F	Zone 16 is located on the 1st floor of the C-420 building. This area housed UF4 storage/transport equipment, including an elaborate conveyor system to transfer powder to the UF6 processing areas. Photo F was taken along the north wall near the vacuum room, west of Photo E. Particular items of interest in this image include the following: C-420 vacuum room, breaker panels, blower drive, "C" UF4 storage hopper.
16	G	Zone 16 is located on the 1st floor of the C-420 building. This area housed UF4 storage/transport equipment, including an elaborate conveyor system to transfer powder to the UF6 processing areas. Photo G was taken under the mezzanine at the "A" line UF4 weigh hopper. Particular items of interest in this image include the following: vacuum blower/motor drive, stored laundry equipment, UF4 weigh hopper, UF4 conveyor.
16	H	Zone 16 is located on the 1st floor of the C-420 building. This area housed UF4 storage/transport equipment, including an elaborate conveyor system to transfer powder to the UF6 processing areas. Photo H was taken between the control panels along the east wall. Particular items of interest in this image include the following: breaker panels.
17	A	Zone 17 is located on the 1st floor of the C-420 building. This area provided elevator access to the 1st floor, servicing the truck alley area. As such, it was generally an open area during the time the building was in operation. Photo A was taken near the freight elevator. Particular items of interest in this image include the following: mezzanine south stairs; freight elevator; lockers, tool boxes, and other miscellaneous stored materials.
17	B	Zone 17 is located on the 1st floor of the C-420 building. This area provided elevator access to the 1st floor, servicing the truck alley area. As such, it was generally an open area during the time the building was in operation. Photo B was taken in the west end of the zone. Particular items of interest in this image include the following: pipe rack, Tc-99 tank, miscellaneous stored equipment including shop tools and manlift.
18	A	Zone 18 is located on the 1st floor of the C-420 building. This area served as a truck alley and crane bay, providing access to all floors of the C-420 facility except the top floor. A movable extension platform was positioned as needed using the crane to allow parts/equipment to be positioned into the crane bay for hoisting purposes. Photo A was taken at the approximate center of the zone. Particular items of interest in this image include the following: rad bags, C-420 BCS, C-420 control room window (2nd floor), moveable maintenance platform (extending out from 4th floor, Zone 5), open view of C-420 levels (1st - 4th floors).
19	A	Zone 19 is located on the 1st floor of the C-420 building. This area housed the equipment that distributed power for all of the C-420 facility. Power was fed from the outside transformer at the SW corner of the building. Photo A was taken inside the doorway from Zone 17. Particular items of interest in this image include the following: electrical panels, storage cabinets/lockers, miscellaneous stored materials on floor.
20	A	Zone 20 is located on the 1st floor of the C-420 building. This area served as the C-420 office area. It also housed a break room and rest rooms for personnel working in the building. Photo A was taken in the present field office area. Particular items of interest in this image include the following: office furniture, supplies.
20	B	Zone 20 is located on the 1st floor of the C-420 building. This area served as the C-420 office area. It also housed a break room and rest rooms for personnel working in the building. Photo B was taken in the present decon area. Particular items of interest in this image include the following: PPE doffing stations, survey instruments.
20	C	Zone 20 is located on the 1st floor of the C-420 building. This area served as the C-420 office area. It also housed a break room and rest rooms for personnel working in the building. Photo C was taken in the present dress-out area. Particular items of interest in this image include the following: laundry carts containing PPE, fire water supply, LOTO board, furniture.

Zone	Photo	Photo Description
		drive control panel, N2 blow-back tank, "E" line reactor cooling duct blowers.
14	G	Zone 14 is located on the mezzanine floor of the C-420 building. This area served as the UF4 product take-off point and is where product cooling and sampling activities took place. The vacuum room for the building vacuum system was located at the north end of the zone. Cooling supply fans for "E" bank were located at the south end of the zone. Photo G was taken at the south end of the zone. Particular items of interest in this image include the following: "E" bank cooling supply fans, ductwork, and damper controls; bottom of "E" line Stage 2 reactor; N2 blow-back tank.
15	A	Zone 15 is located on the 1st floor of the C-420 building. This area originally housed the R-12 refrigeration system used in the condensing of HF in Zone 1. After installation of Karbate condensers for HF recovery, the R-12 system was abandoned in place. This area was later utilized as a repair shop to maintain the ~200 vibrators used in the powder processing areas. Photo A was taken in the northeast corner of the zone. Particular items of interest in this image include the following: condensate tank and pump assembly, storage cabinets, heavily insulated east wall piping configuration, miscellaneous stored materials.
15	B	Zone 15 is located on the 1st floor of the C-420 building. This area originally housed the R-12 refrigeration system used in the condensing of HF in Zone 1. After installation of Karbate condensers for HF recovery, the R-12 system was abandoned in place. This area was later utilized as a repair shop to maintain the ~200 vibrators used in the powder processing areas. Photo B was taken near the south wall, east of the center of the zone. Particular items of interest in this image include the following: crane rail, elevated duct platform, storage cabinets, miscellaneous stored materials, work bench.
15	C	Zone 15 is located on the 1st floor of the C-420 building. This area originally housed the R-12 refrigeration system used in the condensing of HF in Zone 1. After installation of Karbate condensers for HF recovery, the R-12 system was abandoned in place. This area was later utilized as a repair shop to maintain the ~200 vibrators used in the powder processing areas. Photo C was taken at the west door. Particular items of interest in this image include the following: centrifugal pump assembly, oil separator, elevated duct platform, condenser, motor/compressor assembly, R-12 accumulator, wire spools.
16	A	Zone 16 is located on the 1st floor of the C-420 building. This area housed UF4 storage/transport equipment, including an elaborate conveyor system to transfer powder to the UF6 processing areas. Photo A was taken near the east wall control panels at about the center of the zone. Particular items of interest in this image include the following: "C" UF4 storage hopper, breaker panels, UF4 weigh hoppers, UF4 conveyor system, "E" line reactor UF4 transfer screw, stored drums.
16	B	Zone 16 is located on the 1st floor of the C-420 building. This area housed UF4 storage/transport equipment, including an elaborate conveyor system to transfer powder to the UF6 processing areas. Photo B was taken north of Photo A. Particular items of interest in this image include the following: breaker panels, UF4 weigh hoppers, "C" UF4 storage hopper, UF4 conveyor system, conveyor control panel, stored drums.
16	C	Zone 16 is located on the 1st floor of the C-420 building. This area housed UF4 storage/transport equipment, including an elaborate conveyor system to transfer powder to the UF6 processing areas. Photo C was taken at the northwest corner of the zone. Particular items of interest in this image include the following: C-420 vacuum room, truck alley roll-up door, view into crane bay area (Zone 18).
16	D	Zone 16 is located on the 1st floor of the C-420 building. This area housed UF4 storage/transport equipment, including an elaborate conveyor system to transfer powder to the UF6 processing areas. Photo D was taken at the northeast corner of the zone, looking into the C-410 doorway (Zone 22). Particular items of interest in this image include the following: "C" UF4 storage hopper, doorway into Zone 22.

Zone	Photo	Photo Description
13	D	Zone 13 is located on the 2nd floor of the C-420 building. This area served as the operational control center for the C-420 facility. Photo D was taken near the center of the control panel area. Particular items of interest in this image include the following: "C" and "D" bank control panels.
13	E	Zone 13 is located on the 2nd floor of the C-420 building. This area served as the operational control center for the C-420 facility. Photo E was taken at the west end of the control panel area near the control room window. Particular items of interest in this image include the following: west control panels [primarily "A" and "B" bank panels, along with utility panels (e.g., gas flows)], air regulator manifold.
13	F	Zone 13 is located on the 2nd floor of the C-420 building. This area served as the operational control center for the C-420 facility. Photo F was taken along the north wall, near the northwest corner of the zone. Particular items of interest in this image include the following: electrical power panels, view inside instrument enclosure.
14	A	Zone 14 is located on the mezzanine floor of the C-420 building. This area served as the UF4 product take-off point and is where product cooling and sampling activities took place. The vacuum room for the building vacuum system was located at the north end of the zone. Cooling supply fans for "E" bank were located at the south end of the zone. Photo A was taken at the north end of the zone near the north stairs. Particular items of interest in this image include the following: UF4 seal hopper, UF4 feed screw, screw drive train, C-420 vacuum room.
14	B	Zone 14 is located on the mezzanine floor of the C-420 building. This area served as the UF4 product take-off point and is where product cooling and sampling activities took place. The vacuum room for the building vacuum system was located at the north end of the zone. Cooling supply fans for "E" bank were located at the south end of the zone. Photo B was taken south of Photo A along the crane bay rail. Particular items of interest in this image include the following: UF4 seal hopper, C-420 vacuum room, UF4 samplers, UF4 screw drive control panel.
14	C	Zone 14 is located on the mezzanine floor of the C-420 building. This area served as the UF4 product take-off point and is where product cooling and sampling activities took place. The vacuum room for the building vacuum system was located at the north end of the zone. Cooling supply fans for "E" bank were located at the south end of the zone. Photo C was taken in the middle of the equipment along the east rail. Particular items of interest in this image include the following: UF4 weigh hopper, UF4 cooling screw, UF4 seal hopper, drive screw assembly, top of "C" storage hopper and associated conveyor system.
14	D	Zone 14 is located on the mezzanine floor of the C-420 building. This area served as the UF4 product take-off point and is where product cooling and sampling activities took place. The vacuum room for the building vacuum system was located at the north end of the zone. Cooling supply fans for "E" bank were located at the south end of the zone. Photo D was taken south of Photo C in the middle of the equipment. Particular items of interest in this image include the following: UF4 seal hopper, air hose reel, UF4 weigh hopper, UF4 cooling screw, UF4 sampling port, vacuum exhaust over packing gland.
14	E	Zone 14 is located on the mezzanine floor of the C-420 building. This area served as the UF4 product take-off point and is where product cooling and sampling activities took place. The vacuum room for the building vacuum system was located at the north end of the zone. Cooling supply fans for "E" bank were located at the south end of the zone. Photo E was taken along the crane bay rail at the approximate center of the zone. Particular items of interest in this image include the following: UF4 seal hopper, vibrator mounting plate, UF4 weigh hopper, single-tube filter, screw along railing, sprockets for screws on railing, UF4 screw drive control panel.
14	F	Zone 14 is located on the mezzanine floor of the C-420 building. This area served as the UF4 product take-off point and is where product cooling and sampling activities took place. The vacuum room for the building vacuum system was located at the north end of the zone. Cooling supply fans for "E" bank were located at the south end of the zone. Photo F was taken south of Photo E along the crane bay rail. Particular items of interest in this image include the following: UF4 seal hopper and associated drive equipment, UF4 screw

Zone	Photo	Photo Description
11	B	Zone 11 is located on the 2nd floor of the C-420 building. This area served as the second of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. Three electric HF superheaters are located in this zone. Photo B was taken on the west side of the zone near the crane bay rail. Particular items of interest in this image include the following: HF screw reactor (end view) including screw access hatch, UF4 seal hopper, control room window across crane bay.
11	C	Zone 11 is located on the 2nd floor of the C-420 building. This area served as the second of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. Three electric HF superheaters are located in this zone. Photo C was taken at the south end of the zone in the middle of the equipment. Particular items of interest in this image include the following: Stage 1 & 2 "E" line reactors, "E" line intermediate seal hopper and carbon tube filter, UF4 seal hopper, HF electric superheaters, HF screw reactor, blanked cooling duct.
11	D	Zone 11 is located on the 2nd floor of the C-420 building. This area served as the second of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. Three electric HF superheaters are located in this zone. Photo D was taken a short distance north of Photo C. Particular items of interest in this image include the following: UF4 seal hopper, "E" line control panel, HF screw reactor, screw reactor drive train, HF electric superheaters.
11	E	Zone 11 is located on the 2nd floor of the C-420 building. This area served as the second of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. Three electric HF superheaters are located in this zone. Photo E was taken near the south stairwell. Particular items of interest in this image include the following: Stage 2 "E" line reactor, "E" line cooling ducts, HF electric superheaters.
11	F	Zone 11 is located on the 2nd floor of the C-420 building. This area served as the second of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. Three electric HF superheaters are located in this zone. Photo F was taken along the east wall at the north end of the zone. Particular items of interest in this image include the following: HF screw reactor (drive end view), screw reactor drive train, breaker panels.
12	A	Zone 12 is located on the 2nd floor of the C-420 building. This area provided elevator access to the 2nd floor. Sometimes used for interim spare parts staging, but generally a clear area when the building was operating. Photo A was taken west of the center of the zone. Particular items of interest in this image include the following: freight elevator, stored materials including HF drive units (one on wheels), HF reactor end plate, spare H2 reactor, "E" line drive units.
12	B	Zone 12 is located on the 2nd floor of the C-420 building. This area provided elevator access to the 2nd floor. Sometimes used for interim spare parts staging, but generally a clear area when the building was operating. Photo B was taken further east of Photo A, providing a view into Zone 11. Particular items of interest in this image include the following: freight elevator, stored materials.
13	A	Zone 13 is located on the 2nd floor of the C-420 building. This area served as the operational control center for the C-420 facility. Photo A was taken at the northeast corner of the zone, near the doorway leading into Zone 10. Particular items of interest in this image include the following: back of east control panels, "E" line control panels.
13	B	Zone 13 is located on the 2nd floor of the C-420 building. This area served as the operational control center for the C-420 facility. Photo B was taken at the southeast corner of the zone. Particular items of interest in this image include the following: "E" line control panels, view inside east control panel showing pneumatic instrumentation.
13	C	Zone 13 is located on the 2nd floor of the C-420 building. This area served as the operational control center for the C-420 facility. Photo C was taken at the east end of the control panel area. Particular items of interest in this image include the following: east control panels (primarily "D" and "E" bank control panels).

Zone	Photo	Photo Description
8	G	Zone 8 is located on the 3rd floor of the C-420 building. This area served as the first of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. A supply fan ventilation housing was located in the NW corner of the zone. Photo G was taken south of Photo F, near the "D" line UO2 seal hopper. Particular items of interest in this image include the following: UO2 seal hopper (with drive train removed), HF screw reactor drive train, screw drive & vibrator control panel.
8	H	Zone 8 is located on the 3rd floor of the C-420 building. This area served as the first of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. A supply fan ventilation housing was located in the NW corner of the zone. Photo H was taken in the southeast portion of the zone near the "E" line reactor. Particular items of interest in this image include the following: Stage 1 "E" line reactor, "E" line reactor cooling ducts, "E" line reactor stirrer controls, off-gas line & HF/off-gas filter, "E" line stirrer amp panel.
8	I	Zone 8 is located on the 3rd floor of the C-420 building. This area served as the first of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. A supply fan ventilation housing was located in the NW corner of the zone. Photo I was taken at the south end of the production lines near the south stairs. Particular items of interest in this image include the following: Stage 1 "E" line reactor, "E" line reactor cooling ducts, stirrer drive for Stage 2 "E" line reactor, south stairwell.
8	J	Zone 8 is located on the 3rd floor of the C-420 building. This area served as the first of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. A supply fan ventilation housing was located in the NW corner of the zone. Photo J was taken near the southwest corner of the zone on the upper level. Particular items of interest in this image include the following: "D" bank UO2 feed hopper, Stage 1 "E" line reactor, "E" line feed screw with heated bellows.
9	A	Zone 9 is located on the 3rd floor of the C-420 building. This area provided elevator access to the 3rd floor. The west portion of the zone was elevated and housed a supply fan ventilation housing. Photo A was taken on the upper platform, east of the supply fan. Particular items of interest in this image include the following: ventilation supply fan, screw rack, view of Zone 8 along crane bay railing.
9	B	Zone 9 is located on the 3rd floor of the C-420 building. This area provided elevator access to the 3rd floor. The west portion of the zone was elevated and housed a supply fan ventilation housing. Photo B was taken inside the supply fan housing. Particular items of interest in this image include the following: dampers and damper motors, access hatches.
10	A	Zone 10 is located on the 2nd floor of the C-420 building. This area housed the vaporizers where liquid HF, supplied from the HF tank farm, was vaporized, prior to being superheated on the 3rd floor. Hydrogen metering equipment was also located in this zone. Photo A was taken west of the center of the zone. Particular items of interest in this image include the following: HF vaporizers, H2 meter, emergency exhaust fan.
10	B	Zone 10 is located on the 2nd floor of the C-420 building. This area housed the vaporizers where liquid HF, supplied from the HF tank farm, was vaporized, prior to being superheated on the 3rd floor. Hydrogen metering equipment was also located in this zone. Photo B was taken south of Photo A near the roped area. Particular items of interest in this image include the following: HF vaporizers (frontal view) including level controls, H2 meter, emergency exhaust fan.
11	A	Zone 11 is located on the 2nd floor of the C-420 building. This area served as the second of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. Three electric HF superheaters are located in this zone. Photo A was taken at the north end of the zone, near the control room door. Particular items of interest in this image include the following: HF screw reactor with view of electric heater connections on side.

Zone	Photo	Photo Description
7	B	Zone 7 is located on the 3rd floor of the C-420 building. This area housed the HF superheaters. Steam and electric superheaters, operating in series, were employed to increase the temperature of the vaporized HF to prevent liquid entrainment. Liquefied HF would cause operational difficulties within the screw reactors, specifically caking/plugging of the powder. An experimental azeotropic recovery system to concentrate "weak" HF for reuse within the screw reactors was also located in this zone. Photo B was taken at the southeast corner of the zone near the door leading into Zone 8. Particular items of interest in this image include the following: HF electric superheater, HF valving manifold, HF steam superheaters.
7	C	Zone 7 is located on the 3rd floor of the C-420 building. This area housed the HF superheaters. Steam and electric superheaters, operating in series, were employed to increase the temperature of the vaporized HF to prevent liquid entrainment. Liquefied HF would cause operational difficulties within the screw reactors, specifically caking/plugging of the powder. An experimental azeotropic recovery system to concentrate "weak" HF for reuse within the screw reactors was also located in this zone. Photo C was taken along the north wall. Particular items of interest in this image include the following: HF electric superheater, HF steam superheaters.
8	A	Zone 8 is located on the 3rd floor of the C-420 building. This area served as the first of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. A supply fan ventilation housing was located in the NW corner of the zone. Photo A was taken at the northwest entrance to the zone in close proximity to the supply fan on the west side. Particular items of interest in this image include the following: supply fan, duct system.
8	B	Zone 8 is located on the 3rd floor of the C-420 building. This area served as the first of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. A supply fan ventilation housing was located in the NW corner of the zone. Photo B was taken inside the supply fan housing, located in the northwest portion of the zone. Particular items of interest in this image include the following: blower motor, damper system.
8	C	Zone 8 is located on the 3rd floor of the C-420 building. This area served as the first of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. A supply fan ventilation housing was located in the NW corner of the zone. Photo C was taken at the north end of the zone on the lower level. Particular items of interest in this image include the following: HF screw reactors, screw drive train.
8	D	Zone 8 is located on the 3rd floor of the C-420 building. This area served as the first of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. A supply fan ventilation housing was located in the NW corner of the zone. Photo D was taken at the north end of the zone on the upper platform, a short distance east of Photo C. Particular items of interest in this image include the following: HF screw reactor, UO2 feed screw, UO2 seal hopper, HF screw reactor cooling duct, electric heater connections (on side of reactor).
8	E	Zone 8 is located on the 3rd floor of the C-420 building. This area served as the first of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. A supply fan ventilation housing was located in the NW corner of the zone. Photo E was taken near the northeast corner of the zone in front of the "A" line UO2 seal hopper. Particular items of interest in this image include the following: UO2 seal hopper, electric vibrator unit, screw drive motor including gear reducer and tachometer, screw drive control panel, vacuum box for screw packing.
8	F	Zone 8 is located on the 3rd floor of the C-420 building. This area served as the first of two floors where conversion of UO2 to UF4 was accomplished using HF screw reactors and a two-stage fluid bed hydrofluorinator. A supply fan ventilation housing was located in the NW corner of the zone. Photo F was taken south of Photo E along the east wall, near the "C" line UO2 seal hopper. Particular items of interest in this image include the following: UO2 seal hopper, screw drive trains (close-up), HF screw reactor.

Zone	Photo	Photo Description
		metal heat shield.
5	G	Zone 5 is located on the 4th floor of the C-420 building. This area housed the two-stage H2 reactors and associated equipment and is where UO3 was reduced to UO2. A water treatment system was located in the NW corner of the zone. Photo G was taken near the equipment wrapped with asbestos tape near the crane bay rail. Particular items of interest in this image include the following: UO3 seal hopper, H2 reactor, H2 metering station, UO2 feed hopper.
5	H	Zone 5 is located on the 4th floor of the C-420 building. This area housed the two-stage H2 reactors and associated equipment and is where UO3 was reduced to UO2. A water treatment system was located in the NW corner of the zone. Photo H was taken at the south end of the zone. Particular items of interest in this image include the following: UO2 transfer hopper, UO2 feed hopper, carbon tube filter, H2 reactor, UO2 feed screw control panel, moveable mezzanine platform, doorway to Maintenance Shop.
5	I	Zone 5 is located on the 4th floor of the C-420 building. This area housed the two-stage H2 reactors and associated equipment and is where UO3 was reduced to UO2. A water treatment system was located in the NW corner of the zone. Photo I was taken at the southwest corner of the zone. Particular items of interest in this image include the following: UO2 feed hopper, carbon tube filter, outside of maintenance shop, moveable mezzanine platform, UO2 feed screw control panel, H2 reactor.
5	J	Zone 5 is located on the 4th floor of the C-420 building. This area housed the two-stage H2 reactors and associated equipment and is where UO3 was reduced to UO2. A water treatment system was located in the NW corner of the zone. Photo J was taken at the southeast corner of the zone near the south stairs. Particular items of interest in this image include the following: doorway to maintenance shop, HF carbon tube filter, Stage 1 "E" line reactor drive, top of "E" line carbon tube filter, "E" line reactor cooling duct, south stairwell.
6	A	Zone 6 is located on the 4th floor of the C-420 building. This area served as the maintenance shop where much of the HF screw reactor repair work was done. A restroom was located in the SW corner of the zone; the freight elevator was located in the SE corner. Photo A was taken along the south wall. Particular items of interest in this image include the following: freight elevator, work benches, storage cabinets.
6	B	Zone 6 is located on the 4th floor of the C-420 building. This area served as the maintenance shop where much of the HF screw reactor repair work was done. A restroom was located in the SW corner of the zone; the freight elevator was located in the SE corner. Photo B was taken at the southwest corner of the zone. Particular items of interest in this image include the following: restroom, work benches.
6	C	Zone 6 is located on the 4th floor of the C-420 building. This area served as the maintenance shop where much of the HF screw reactor repair work was done. A restroom was located in the SW corner of the zone; the freight elevator was located in the SE corner. Photo C was taken at the northwest corner of the zone. Particular items of interest in this image include the following: work benches, storage cabinets, screw drive belts, HF screw gaskets/packing glands.
7	A	Zone 7 is located on the 3rd floor of the C-420 building. This area housed the HF superheaters. Steam and electric superheaters, operating in series, were employed to increase the temperature of the vaporized HF to prevent liquid entrainment. Liquefied HF would cause operational difficulties within the screw reactors, specifically caking/plugging of the powder. An experimental azeotropic recovery system to concentrate "weak" HF for reuse within the screw reactors was also located in this zone. Photo A was taken near the center of the zone, but closer to the south wall. Particular items of interest in this image include the following: HF steam superheaters, HF electric superheater, HF valving manifold.

Zone	Photo	Photo Description
		large ventilation supply fan operated in the SW corner of the zone. Photo A was taken at the center of the zone. Particular items of interest in this image include the following: ventilation supply fan blower and housing, freight elevator.
4	A	Zone 4 is located on the 4th floor of the C-420 building. This area housed the HF metering station and thus served as the feed point for superheated HF to the screw reactors located on the 2nd and 3rd floors. Photo A was taken at the west end of the zone. Particular items of interest in this image include the following: experimental azeotropic HF recovery system, HF metering station (frontal view) including bypass lines and control valves.
4	B	Zone 4 is located on the 4th floor of the C-420 building. This area housed the HF metering station and thus served as the feed point for superheated HF to the screw reactors located on the 2nd and 3rd floors. Photo B was taken at the northeast corner of the zone. Particular items of interest in this image include the following: experimental azeotropic HF recovery system, HF metering station.
4	C	Zone 4 is located on the 4th floor of the C-420 building. This area housed the HF metering station and thus served as the feed point for superheated HF to the screw reactors located on the 2nd and 3rd floors. Photo C was taken at the east end of the zone, near the door into Zone 5. Particular items of interest in this image include the following: experimental azeotropic HF recovery system (frontal view), HF metering station.
5	A	Zone 5 is located on the 4th floor of the C-420 building. This area housed the two-stage H2 reactors and associated equipment and is where UO3 was reduced to UO2. A water treatment system was located in the NW corner of the zone. Photo A was taken at the doorway from Zone 4. Particular items of interest in this image include the following: UO2 processing equipment, water treatment system, experimental azeotropic HF recovery system (visible though Zone 4 doorway), air sampler, UO2 refeed hopper and feed screw.
5	B	Zone 5 is located on the 4th floor of the C-420 building. This area housed the two-stage H2 reactors and associated equipment and is where UO3 was reduced to UO2. A water treatment system was located in the NW corner of the zone. Photo B was taken at the north end of the zone, near the northeast corner of the crane bay. Particular items of interest in this image include the following: HF instrument cabinets, green salt (foreground) and oxide (background) dust collector drum-off stations, drum spool seal (on floor), water treatment system, UO2 feed screw control panel (back side), H2 metering station.
5	C	Zone 5 is located on the 4th floor of the C-420 building. This area housed the two-stage H2 reactors and associated equipment and is where UO3 was reduced to UO2. A water treatment system was located in the NW corner of the zone. Photo C was taken in the northwest portion of the zone. Particular items of interest in this image include the following: spare screw rack; water treatment system including resin tanks, brine tank, water meter, and associated piping and valves.
5	D	Zone 5 is located on the 4th floor of the C-420 building. This area housed the two-stage H2 reactors and associated equipment and is where UO3 was reduced to UO2. A water treatment system was located in the NW corner of the zone. Photo D was taken along the crane bay rail, just past the corner of the "L" configuration. Particular items of interest in this image include the following: H2 flow instrumentation (along mezzanine), H2 metering stations, UO2 feed screw control panel.
5	E	Zone 5 is located on the 4th floor of the C-420 building. This area housed the two-stage H2 reactors and associated equipment and is where UO3 was reduced to UO2. A water treatment system was located in the NW corner of the zone. Photo E was taken near the approximate center of the zone in the middle of the process equipment. Particular items of interest in this image include the following: H2 reactor (within clamshell), UO2 transfer hopper, H2 metering station.
5	F	Zone 5 is located on the 4th floor of the C-420 building. This area housed the two-stage H2 reactors and associated equipment and is where UO3 was reduced to UO2. A water treatment system was located in the NW corner of the zone. Photo F was taken along the east wall at the center of the zone. Particular items of interest in this image include the following: HF filter, UF4 refeed hopper (top section is cyclone unit), heated clamshell bellows, screw drive train, refeed screw, MG sets (selenium rectifiers), portable sheet

Appendix A
Zone Descriptions and Photo Identification

Zone	Photo	Photo Description
1	A	Zone 1 is located on the 5th floor of the C-420 building. Originally, this area housed condensers for recovering "weak" HF, which was drained to rubber-lined tanks and ultimately sold for aluminum pickling. Later, these condensers were replaced by vertical Karbate condensers which, due to their length, were mounted on the exterior of the building outside this area. At that time, this area became an equipment storage area. Photo A was taken at the center of the zone. Particular items of interest in this image include the following: elevated steam station, ductwork, debris.
2	A	Zone 2 is located on the 5th floor of the C-420 building. This area served as the initial UO3 feed point, where 5-ton hoppers were fed at four charge stations. The area also housed much of the off-gas processing/filtering equipment for C-420, as well as the oxide and green salt bag dust collection systems. Photo A was taken at the south end of the zone. Particular items of interest in this image include the following: settling chamber and H2 burner, UO2 transfer hopper and sintered metal filter, portable tube bundle transport container, ventilation supply fan housing (Zone 3).
2	B	Zone 2 is located on the 5th floor of the C-420 building. This area served as the initial UO3 feed point, where 5-ton hoppers were fed at four charge stations. The area also housed much of the off-gas processing/filtering equipment for C-420, as well as the oxide and green salt bag dust collection systems. Photo B was taken further north of Photo A in close proximity to the equipment. Particular items of interest in this image include the following: UO2 transfer hopper and sintered metal filter, portable tube bundle transport container, settling chamber and H2 burner, duct to oxide dust collector, temperature control duct from HF screw reactors, top of Monel tube filter.
2	C	Zone 2 is located on the 5th floor of the C-420 building. This area served as the initial UO3 feed point, where 5-ton hoppers were fed at four charge stations. The area also housed much of the off-gas processing/filtering equipment for C-420, as well as the oxide and green salt bag dust collection systems. Photo C was taken between the west wall and the charge stations. Particular items of interest in this image include the following: UO3 charge station, HF screw reactor cooling duct, burner control panel.
2	D	Zone 2 is located on the 5th floor of the C-420 building. This area served as the initial UO3 feed point, where 5-ton hoppers were fed at four charge stations. The area also housed much of the off-gas processing/filtering equipment for C-420, as well as the oxide and green salt bag dust collection systems. Photo D was taken at the north end of the zone within the equipment area. Particular items of interest in this image include the following: HF primary filter, HF backup filter, UO3 charge station, HF screw reactor cooling duct, local air cleaner.
2	E	Zone 2 is located on the 5th floor of the C-420 building. This area served as the initial UO3 feed point, where 5-ton hoppers were fed at four charge stations. The area also housed much of the off-gas processing/filtering equipment for C-420, as well as the oxide and green salt bag dust collection systems. Photo E was taken near the east wall at the north end of the zone. Particular items of interest in this image include the following: HF primary filter, UO2 transfer hopper and sintered metal filter, H2 burner control panel, H2 line to burner, HF screw reactor cooling duct, top of Monel tube filter.
2	F	Zone 2 is located on the 5th floor of the C-420 building. This area served as the initial UO3 feed point, where 5-ton hoppers were fed at four charge stations. The area also housed much of the off-gas processing/filtering equipment for C-420, as well as the oxide and green salt bag dust collection systems. Photo F was taken at the northeast corner of the zone, providing a look into Zone 1. Particular items of interest in this image include the following: HF primary filter, HF backup filter, UO2 transfer hopper and sintered metal filter, H2 burner enclosure.
3	A	Zone 3 is located on the 5th floor of the C-420 building. This area provided elevator access for transporting 5-ton charge hoppers to and from the UO3 charge stations. A

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MAP
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BJC / DMC

Sampling and Analysis Plan for the C-410 Complex Infrastructure D&D Project at the Paducah Gaseous Diffusion Plant Paducah, Kentucky

October 2002

Prepared by Bechtel Jacobs Company LLC

CONTENTS

TABLES

ACRONYMS

BJC	Bechtel Jacobs Company LLC
DOT	U.S. Department of Transportation
DQO	Data Quality Objectives
HP	Health Physics
IH	industrial hygiene
MDL	Method Detection Limit
NCS	Nuclear Criticality Safety
OREIS	Oak Ridge Environmental Information System
PEMS	Project Environmental Measurements System
PF	potentially fissile
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
SAP	Sampling and Analysis Plan
SME	subject matter expert
SMO	Sample Management Office
SVOA	semi-volatile organic analyses
TCLP	Toxicity Characteristic Leaching Procedure
TID	tamper indicator device
TOC	total organic carbon
VOA	volatile organic analyses

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1. INTRODUCTION

This Sampling and Analysis Plan (SAP) encompasses the sampling and analyses of multiple items, areas, and waste streams generated by the Decontamination and Decommissioning activities associated with the removal of the infrastructure of the C-410 Complex at the Paducah Gaseous Diffusion Plant near Paducah, Kentucky. The project is to be self- performed by Bechtel Jacobs Company LLC (BJC) with support from various subcontractors

This plan differs from typical SAPs in that the items to be sampled, analyzed and characterized are not fully identified at the writing of this plan. Those items will be identified as the work progresses. Contaminants of concern will be identified, and sampling and analyses will be performed on critical components of the process. This plan defines the process to establish the sampling requirements for each task and subtask, selection of the proper sampling protocols, and the communication of the sampling results to the proper team members for use in future activities.

BJC and its subcontractors are responsible for all sample management activities up to and including the delivery/shipment of the samples to the fixed based laboratories. Site sample management consists of those activities associated with site data collection and sample tracking to provide thoroughly documented and technically defensible data from each sampling event.

2. SAMPLING SCOPE

The purposes of the sampling are to gather information for Nuclear Criticality Safety (NCS) determinations and safety standards determination, monitor health and safety conditions, and identify safe and compliant storage, and disposal requirements (i.e., characterization). It is expected that some analyses may be performed at commercial labs. If that is the case, radiological screening analyses (rad screéns) of samples to be shipped will occur prior to shipment to provide information for transportation and notifications to the commercial labs.

This plan defines the general sampling methodology, the analytical requirements, and the Quality Control (QC) sampling strategy. Sampling and data collection as defined in this plan will ensure that the Data Quality Objectives (DQO) process is implemented, that requirements in *Test Methods for Evaluating Solid Wastes* (SW-846) are met, and that the data collected will meet the goals in *Quality Assured Data* (PA-5003). The DQO process to be followed for the various sampling classes is presented in Appendix A. Table 2.1 depicts the generalized approach to the methodologies used in the sampling program. These may be modified as specific situations dictate.

TABLE 2.1
WASTE STREAMS/SAMPLE MATRIX

WASTE STREAM	RCRA/TSCA	RADIOLOGICAL
PIPING	PK	NDA, SMEARS
EQUIPMENT	PK	NDA, SMEARS
PPE	LAB, PK	NDA
RAW MATERIALS	LAB, PK	

WASTE STREAM	RCRA/TSCA	RADIOLOGICAL
PRODUCT	LAB, PK	
TRANSITE	LAB, PK	NDA, SMEARS
CONCRETE DEBRIS	LAB, PK	NDA, SMEARS

PK – Process Knowledge
LAB – Laboratory
NDA – Non-Destructive Analyses

Generally, the sampling and characterization task will be an integral part of the work planning activity and, as such, will be included in the individual Work Packages. Characterization will be performed as a part of the ISMS process, to further define the work environment to ensure worker safety by enhancing worker awareness. These activities will also be performed to ensure that the wastes generated by the removal activity are in compliance with the Waste Acceptance Criteria of the waste disposal facilities.

Characterization will be performed to define unidentified materials and to augment the information developed through process knowledge and historic data research to quantify materials that have been identified. The need to collect samples will be determined based on the characteristics and hazards of expected contents of a system or component; size of the component; and process knowledge regarding the techniques of shutdown of individual components.

3. SAMPLE PLANNING

Sample planning will be in accordance with the DOE DQO process. Appendix A summarizes the DQO process for this project.

Sample planning and sample management activities will be documented using the Paducah Project Environmental Measurements (PEMS) databases. The following summarize the use of Paducah PEMS for all sample classes:

BJC will use project-specific Paducah PEMS for sample scheduling, collection, and tracking each sample and associated data from point of collection through final data reporting. Paducah PEMS tracking includes: field forms, chain-of-custody records, verification, assessment, validation, if applicable, hard copy data packages and electronic data deliverables. The *Paducah PEMS User's Guide*, BJC/PAD-34, will be used to obtain information about the Paducah PEMS system and the relationships with other databases within the Paducah Department of Energy (DOE) integrated data system.

BJC or subcontractor sample and data management personnel will be responsible for populating the planning temp tables in Paducah PEMS and submitting the populated table to the BJC Sample Management staff for review and acceptance. Upon acceptance of the planning temp tables, the project team will populate the real planned samples and samples-sent tables will be populated. In addition, based on laboratory bottle requirements provided by the BJC sample management staff, data management personnel will populate parameter group bottles and parameter group tables. BJC must accept Paducah PEMS before fieldwork may begin.

Data management personnel will enter required data as the project progresses. Field measurements, field notes, and observation data will be entered into the sampling logbook. This may include dimensions, locations, surface area calculations, etc. BJC enters information related to the fixed-based laboratory data packages and the tracking associated with the samples once the samples have been shipped to the laboratory and receipt of the samples has been verified. All waste sampling activities will be entered into Paducah PEMS and tracked by the waste project identification number.

BJC will perform system backups daily.

Security of Paducah PEMS and data used for the project is essential for the success of the project. All security precautions and procedures implemented are designed to minimize vulnerability of the data to unauthorized access or corruption. Access to the project-specific Paducah PEMS, changes to the project Paducah PEMS, the hard copy data files, and diskettes and tape backups are limited and are controlled by BJC.

4. ANALYTICAL LABORATORY CONTRACTING

Analytical laboratory contracting is the responsibility of the BJC Sample Management Office (SMO) for all sampling classes.

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5. SAMPLING CLASSES

For this project, sampling classes have been identified according to the purpose for sample collection. The classes include: NCS characterization, Industrial Hygiene (IH) initial entry sampling and monitoring, Health Physics (HP) initial entry sampling and monitoring, waste/material characterization (including waste produced), and radiological screening for sample shipments. Information on each class is provided below.

5.1 Nuclear Criticality Safety (NCS) Determination Sampling (Characterization of Potentially Fissionable Material)

It is possible that fissionable material may be present within the 410 Complex. Following the cessation of uranium hexafluoride production in the C-410 Complex, the facility was used for storage and staging of process equipment from the PGDP site, in some cases, equipment from other facilities. Some of this equipment originated in areas where fissionable materials were present.

During the initial investigations in the Complex Subject Matter Experts identified items that may have come in contact with potentially fissile uranium. These items were further evaluated for NCS concerns via visual inspections and were, in some cases, characterized with swipe samples and NDA testing.

Items that were part of the C-410 process or items that have not been exposed to potentially fissionable materials are considered NCS exempt and will not require further characterization to ensure worker safety. A total of nine potentially fissionable items have been identified and have been relocated to an appropriate storage area. These items will be dispositioned as part of the removal action. Characterization of any potentially fissionable materials identified in the future will be performed utilizing NCS criteria established in BJC procedures. The NCS status determination will be made by different approaches based on three scenarios, as described in the following information.

In order to perform these characterization activities in the most cost effrective basis, NDA techniques will be utilized wherever possible. NDA testing will be an integral part of the radiological waste characterization activity.

5.1.1 Items Containing No Uncharacterized Material

BJC procedures allow for NCS exemptions either by process knowledge (item or material is known and/or documented never to have been in the uranium enrichment cascade process), or by observation (when all interior and exterior surfaces of an item can be observed and no uncharacterized material is seen). Once the NCS Engineer has exempted an item for either of the above reasons, other sampling of the material may occur. Sampling requests for other than NCS wipes will not be made until items have been exempted. When NCS sampling is required, sampling requests will documented on the form in Attachment 2 and submitted to the waste engineer.

5.1.2 Items Containing Solid Material

If an item or material cannot be exempted, or if some interior surfaces cannot be observed, an assay sample (wipe) may be collected. Other wipe samples may be collected at the same time, but no sampling by other methods will occur until the assay results confirm that the solid does not contain material enriched to greater than 1 weight percent in uranium-235. If the assay results show material enriched to greater than 1 weight percent in uranium-235, then total uranium will be analyzed by RL-7124 (gamma).

The NCS status of the items containing solid material may also be determined through assay analyses of a solid sample. Samples will be collected and marked potentially fissile (PF).

5.1.3 Liquids

The NCS status of liquids will be determined through assay analyses of the liquid. Samples will be collected and marked PF.

It is possible that some of the liquids may exist in multiple phases in their current containers. If that is the case, each phase has the potential to have different levels of radiological constituents. Therefore, each phase will be sampled and its NCS status determined before the next lower phase can be sampled.

Table 5.1 will be utilized to plan and predict the number of NCS samples required and to assist in scheduling the sampling and analytical activities.

Table 5.1
NCS Sample Management

Sampling Purpose	Analytes	Analytical Method	Turnaround Time	Sample Type	Anticipated Number of Samples per Week		
NCS Determinations	% U-235	AS-7300	48 hours	Wipes			
	% U-235 Total Uranium	AS-7300 RL-7124	48 hours	Liquids			
	% U-235 Total Uranium	AS-7300 RL-7124	48 hours	Solids			

5.2 IH Sampling

Some IH sampling will be required for safety standard determinations. This sampling will occur during initial entry. The data will be used to determine safety standards and controls for subsequent work. Other IH sampling will occur for monitoring and documentation of personnel (breathing zone) and area work conditions. IH sample media will include filters, wipes, and air (SUMMA canisters). Additional samples will be collected for monitoring. IH sampling requests will be documented on the form in Attachment 3 and submitted to the data coordinator.

5.3 HP Sampling

HP sampling will be required to establish safety standards before work begins (wipe and air sampling). At the discretion of the project radiological control technician (RCT), wipe and air samples may be collected during the project and analyzed for the purpose of health physics personnel monitoring. Samples will be collected by the project RCT. HP sampling requests will be documented on the form in Attachment 4 and submitted to the data coordinator.

5.4 Waste/Material Characterization

The purpose of waste characterization sampling is to determine the regulatory status of the waste and requirements for safe and compliant storage and/or disposal. This will include sampling of waste generated as a result of the system neutralization and dismantlement phases of the project. The sample media may be solid or liquid. Data gathered from wipe sampling floors or equipment surfaces to identify the presence of PCB contamination is also included in this category. Anticipated analytical groups are shown below. Specific analytes (contaminants of concern) from these groups will be determined during the DQO process for the items/materials.

- Anions/fluorides
- Asbestos
- Dioxins/furans
- Herbicides/pesticides
- PCBs
- Toxicity Characteristic Leaching Procedure (TCLP) metals
- Bulk metals (oil matrix)
- Volatile organic analyses (VOAs)
- Semi-volatile organic analyses (SVOAs)
- Full radiological analyses (gross alpha/beta, rad alpha/beta, % uranium-235, and isotopic)
- Total organic carbon (TOC, used for SVOA blanks)
- Corrosivity
- Ignitability (flash point)

The applicable subject matter expert (SME) and waste engineer will make decisions regarding waste characterization sampling requirement, with input from other personnel, as applicable. Determination of sampling methodology, contaminants of concern, and required analyses will be documented on the forms shown in Attachment 5.

5.5 Radiological Screening

Samples to be analyzed at off-site commercial laboratories require radiological screen analyses for laboratory notification and Department of Transportation (DOT) decisions. Analyses will be performed at the on-site subcontractor laboratory.

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6. SAMPLING METHODOLOGY

The following information regarding sampling methodology will serve as a guide to sampling strategy determinations to be made by the applicable SME. These decisions are part of the DQO process, and will be documented on the sampling request forms, Attachment 5.

6.1 Sampling Location

Samples collected from an item or items should, in most cases, be representative.

Grab samples may be random or biased. Random grab samples are appropriate if potential contamination is randomly distributed on the item or within the container. Biased grab samples are appropriate to identify contamination at specific areas, and may produce results that reflect "hot spots," and are not necessarily representative of the item/container as a whole.

Composite samples will be representative of the waste by volume, mass, and surface area. Following are two examples of representative composite sampling:

- If two drums contain the same waste material, but one is full and the other is half full, then the composite aliquot from the full drum should be twice the volume of the composite aliquot from the half-full drum.
- For an individual item, samples should represent that item as a whole. For example, if a wooden pallet is stained over one-fourth of its surface, then the one-fourth of the sample should be from stained wood and the remaining three-fourths from unstained wood.

6.2 Sample Collection Techniques

Sample collection techniques depend upon the media and matrix of the material being sampled. The following techniques are applicable:

Table 6.1
Sample Collection Techniques

Media	Contamination Distribution	Sample Type	Collection Technique
Solids, small particles	Homogeneous	Grab	Scoop, auger
Solids, small particles	Non-homogeneous	Composite	Scoop, auger
Solids, large pieces	Homogeneous	Grab	Size-reduced by snips or scissors
Solids, large pieces	Non-homogeneous	Composite (or judgmental grab)	Size-reduced by snips or scissors
Sludge	Homogeneous	Grab	Scoop or coliwasa
Sludge	Non-homogeneous (multiple phases)	Composite	Coliwasa or scoop after mixing
Liquids	Homogeneous	Grab	Coliwasa, Bacon bomb,

Media	Contamination Distribution	Sample Type	Collection Technique
	(Single phase)		thief, dipper
Liquids	Non-homogeneous (Multiple phases)*	Composite	Coliwasa
Impermeable surface solids	Homogeneous	Grab	Wipe
Impermeable surface solids – hot spot determination	Homogeneous or Non-homogeneous	Judgmental grab	Wipe

* Phases will be separated in the field and submitted as separate samples.

6.3 Tamper Indicator Devices (TIDs)

TIDs will be placed on drum(s)/container(s), if applicable, after sampling is complete. The TID numbers will be documented in the sampling logbook.

7. DATA QUALITY INDICATORS

In addition to the primary objectives previously identified, the DQO process addresses several data quality indicators that support the generation of data of known quality.

7.1 Representativeness

Regulatory standards for identification generally apply to a representative sample or samples that exhibit, on average, the waste properties of the whole.

To ensure consistency, the waste engineer may use statistical approaches for determining the number and location of samples to collect.

7.2 Accuracy

Overall sampling accuracy refers to the closeness of sample results to the true value for the population being sampled. Sampling accuracy is increased by selection of an appropriate sampling approach. Increasing sample size also tends to improve accuracy.

Analytical accuracy may be measured in the laboratory by spiking samples with known concentrations of a specific analyte and comparing the known concentrations with measured results. This measure is one of the QC attributes checked during the quality assurance (QA) review of analytical data.

7.3 Precision

Sampling precision provides a measure of the reproducibility of results. Collecting duplicate samples from a single sampling location generates estimates of precision for sampling.

Estimates of analytical precision will be obtained by duplicate analysis of individual samples. Analytical precision is evaluated during the QA review of data.

7.4 Sensitivity

Sensitivity refers to the ability of a sampling scheme to detect a parameter at a given level. Sensitivity is maintained during sampling by ensuring that samples are handled in a way that does not adversely affect any parameters of concerns during sample collection or handling (i. e., volatilization of organics).

Analytical sensitivity is generally expressed in terms of the method detection limit (MDL) for a given analytical method. The combination of analytical instrumentation and method must have sufficient sensitivity to detect analytes in a specific matrix at or below the regulatory or other specified level.

Required MDLs are specified for work to be completed under Resource Conservation and Recovery Act (RCRA) analytical support contracts. Attainment of the contract-required detection limits is evaluated during review of analytical data. It is required that detection limits be reported at a level low enough to ensure that reported results are not impacted by either instrument fluctuation or blank contamination. This is typically one-fifth or less of the respective regulatory thresholds.

7.5 Completeness

Completeness is a data quality indicator defined as the amount of collected and valid data compared to the planned amount. Completeness is often expressed in terms of a percentage, and is a critical quality indicator that defines the total number of data points (expected value data points plus expected unusable points) that must be collected.

Completeness becomes a critical indicator for sampling when insufficient data are available to adequately characterize a population.

7.6 Comparability

Comparability is defined as a qualitative evaluation of whether the data are obtained using equivalent methods.

Comparability can also be a key quality indicator in establishing spatial or temporal correlation for similar populations (e.g., in evaluating similar populations from similar sources or a recurring generation from a single source over time).

Comparability has been used in evaluating the performance of different laboratories analyzing a set of samples from the same population.

8. SPLIT SAMPLING

Split sample requests from external agencies may be made through BJC project management. The BJC project team will contact the BJC SMO to request rad screening, to coordinate sample return, and to create a statement of work so that the analytical data received from the external agency can be managed and archived. Project samplers will collect both samples. Unless guidance is given otherwise, the following apply:

- Split samples will be collected at the same time to ensure consistent sampling conditions.
- If the material matrix is a liquid, samples may be collected sequentially. Care should be taken to ensure representativeness of the samples.
- If the material matrix is a solid, care should be taken to ensure that the sample is uniform and representative of the matrix from which it is obtained.
- Split samples may be relinquished to the external agency, or upon request, may be held until rad screens have been completed.

A complete narrative of the sampling event will be recorded in the sampling logbook, including the names of observers, participants in the sampling event, and the agencies they represent.

9. SAMPLE PRESERVATION/SHIPMENT

Waste samples will be preserved by maintaining the samples at 4° Celsius, $\pm$ 2°. QC samples are preserved as described in SW-846. When necessary, samples will be shipped to a laboratory that has been accepted and contracted by the BJC SMO.

Samples to be analyzed at offsite or commercial laboratories require rad screen analyses for laboratory notification and DOT decisions. The United States Enrichment Corporation analytical laboratory will perform rad screens. In accordance with DOE requirements, external rad wipe samples will be collected from the shipping containers.

The laboratory accepting samples for analysis will be notified of the rad screen results and will provide either written or verbal acceptance to allow the shipment of the samples to its facility. When the notification to the laboratory is performed, a copy will be provided to the BJC SMO.

Samples will be refrigerated and held under chain of custody until shipment is made. All sample shipments will be made in accordance with DOT hazardous materials regulations and according to standard BJC procedures.

10. QUALITY ASSURANCE

10.1 Quality Control Samples

QC samples will be tracked and will be collected at a rate that implements the requirements in PA-5003, *Quality Assured Data*. These are described below.

- One trip blank will be collected for each cooler containing VOA samples.
- Field equipment blanks will be collected at a rate of 5 percent, which will be tracked by the waste engineer.
- Field equipment blanks for SVOAs will be TOC.
- Field equipment blanks for PCBs will be wipes.
- Field equipment blanks for radiochemistry analyses (isotopic) will be wipes or water, depending upon the matrix of the waste being sampled.
- Duplicate samples will be collected at a rate of 5 percent, which will be tracked by the waste engineer.

10.2 Data Quality Goals

The following are applicable for the project:

- Precision will be evaluated during data assessment. Precision goals will be established for each type of analyte/matrix depending upon the characteristics of the materials to be sampled. For example, for the VOC, SVOC TCLP, and total metals analysis for solids liquids and air, precision goals as stated in SW-846 will be applied. Similar goals for asbestos analyses and radiological analyses will be established. Table 10.1 is a general illustration of the types of protocols anticipated to be applied to characterize the various types of materials that may be identified during the removal activities.
- Accuracy will be evaluated by review of the laboratory comments concerning matrix spike and matrix spike duplicate recoveries.
- Representativeness will be measured by evaluating the results for replicate samples.
- Completeness goals for sampling and analyses are 100 percent.
- Comparability is applicable to some IH and HP samples, where background data exists. If unexpected results are obtained (i.e., significantly different from existing data), the usability of the data will be evaluated during data assessment. For most waste/material characterization, historical data will be available, for comparability.

TABLE 10.1
WASTE STREAMS/SAMPLE MATRIX

WASTE STREAM	RCRA/TSCA	RADIOLOGICAL
PIPING	PK	NDA, SMEARS
EQUIPMENT	PK	NDA, SMEARS
PPE	LAB, PK	NDA
RAW MATERIALS	LAB, PK	
PRODUCT	LAB, PK	
TRANSITE	LAB, PK	NDA, SMEARS
CONCRETE DEBRIS	LAB, PK	NDA, SMEARS

PK – Process Knowledge
LAB – Laboratory
NDA – Non-Destructive Analyses

10.3 Chain of Custody

Analytical samples will be maintained under chain of custody. For all sampling classes, the chains of custody will be produced using the PEMS database. Copies of the chains of custody will be submitted to the BJC SMO upon delivery to the analytical laboratory.

For IH samples, the chains of custody will be produced using the PEMS database. Copies of the chains of custody will be maintained with the project files.

10.4 Documentation

Sampling personnel will document fieldwork in a sampling logbook.

The waste characterization request forms (Attachments 1-5) will provide documentation of sample planning for the DQO process.

11. DATA REVIEW AND USE

11.1 Data Review

Following receipt of analytical data, the data will be reviewed as described in PA-5003, *Quality Assured Data.* The data review will include verification, and validation. Data review goals are shown below.

- All data sets will receive 100 percent assessment (electronic and document reviews of specified data quality checks) by the laboratory performing the analyses following the guidance in *Quality Assured Data* (PA-5003).

- All data sets will receive 100 percent verification by the BJC SMO subcontractor (qualitative and quantitative evaluation) following the guidance in *Quality Assured Data* (PA-5003).

- Additionally, five percent of the validated data will be submitted to a third party consultant for review and verification. Formal verification is an integral part of the data review process to order to meet the project requirements and the requirements in *Quality Assured Data* (PA-5003).

11.2 Data Use

For characterization of populations where subsets of the population are sampled, statistical evaluation of the data will be applied using the guidance in *Test Methods for Evaluating Solid Wastes* (SW-846). The results of these evaluations and the criteria used will be documented. For radiochemistry evaluations, the error will be added to the reported result to provide a statistical upper bound. For NCS determinations, the use of data is specified in *PA-3003*.

Unless specifically exempted, data assessment must be completed and documented before data can be used for decision-making. All data must be loaded into the Paducah Oak Ridge Environmental Information System (OREIS) database prior to release to external agencies or companies. Final reports will incorporate only data that resides in Paducah OREIS.

In general, laboratory generated analytical data will be posted to PEMS. Data generated through process knowledge and non-destructive testing (NDA) may not be entered into the PEMS system. Due to the quantity of waste that will be generated and the associated frequency of shipment, posting of data into PEMS may not occur prior to waste shipment in every case.

12. REFERENCES

Test Methods for Evaluating Solid Wastes (SW-846)

Paducah PEMS User's Guide, BJC/PAD-34

PA-5003, *Quality Assured Data*

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Appendix A

Data Quality Objectives

This section summarizes the application of the seven steps of the DQO process for the project. Since this project will be ongoing and the application of the DQO process will be repeated throughout the project, this appendix does not give the results of the DQO process. Rather, it outlines the process to be applied for applicable Sampling Classes as described in Section 5.0.

1. NCS Sampling

(Note: The NCS status determination process is defined in BJC procedures and will be implemented by the project NCS engineer.)

1.1 *Problem Statement:* Items or materials have been identified for which an NCS status must be determined.
1.2 *The Decision and Alternative Actions:* Determine whether material is enriched to > 1.0 weight percent uranium-235. If material is enriched, implement NCS controls. If not, document as NCS-exempt.
1.3 *Inputs to the Decision:* Process knowledge based on source of the material and visual observation. Action level is 1.0 weight percent Uranium-235.
1.4 *Physical Boundaries:* No temporal boundaries. Spatial boundaries for sampling based on observation. Sample collection techniques based on media of material. (Documentation: Attachment 2 of this plan.)
1.5 *Decision Statement:* If the analytical result plus two times the sigma error is □ 1.0 weight percent uranium-235 for both of the two independent samples, then declare the item NCS-exempt. Otherwise, implement NCS controls.
1.6 *Decision Errors:* Decision errors are addressed by adding 2 sigma to the reported result.
1.7 *Design Optimization:* Defined by procedure.

2. IH Sampling (Initial Entry)

1.1 *Problem Statement:* Insufficient data exists to determine safety controls and standards.
1.2 *The Decision and Alternative Actions:* Determine the level and type of personal protective equipment (PPE) required for work in the area.
1.3 *Inputs to the Decision:* Process knowledge based on location, items in the area, and historical use of site. The action levels are various safety action levels.
1.4 *Physical Boundaries:* No temporal boundaries. Spatial boundaries for sampling based on observation and determination of areas with greatest likelihood for hazards. Sample collection techniques include both air samples and wipes.
1.5 *Decision Statement:* If the analytical results exceed the safety standard action limits, then identify appropriate controls.
1.6 *Decision Errors:* The likelihood of decision errors is minimized by duplicates samples where appropriate. When analytical results approach the action limits, the Environmental Safety and Health representative will opt for more conservative controls.
1.7 *Design Optimization:* Definitive data for initial entry. Field data for ambient conditions monitoring.

3. HP Sampling (Initial Entry)

1.1 *Problem Statement:* Insufficient data exists to determine safety controls and standards (Initial Entry).
1.2 *The Decision and Alternative Actions:* Determine the level and type of PPE required for work in the area.

1.3 *Inputs to the Decision:* Process knowledge based on location and results of previous HP site characterization sampling.
1.4 *Physical Boundaries:* No temporal boundaries. Spatial boundaries for sampling based on observation and determination of areas with greatest likelihood for hazards. Samples collected are wipes. (Documentation: Attachment 4 of this plan.)
1.5 *Decision Statement:* If the analytical results exceed the applicable action limits, then identify appropriate controls.
1.6 *Decision Errors:* The likelihood of decision errors is minimized by duplicates samples where appropriate. When analytical results approach the action limits, the HP representative will opt for more conservative controls.
1.7 *Design Optimization:* Definitive data for initial entry. Field data for ambient conditions monitoring.

4. Waste/Material Characterization

Consistent with disposal facility WAC's, process equipment will be treated as radiologically contaminated metal, as opposed managing each type of equipment as a distinct waste stream. Radiological contamination shall be quantified by NDA methodologies. RCRA/TSCA determinations for specific equipment and materials, transformers, light bulbs, mercury and some liquids) can be made by visual observations. Unidentifiable materials will be characterized on a case by case basis using standard industry practice.

Note: The steps below describe the process to be followed for unidentified items.

1.1 *Problem Statement:* Items and materials will be identified that may require characterization.
1.2 *The Decision and Alternative Actions:* Determine regulatory category of the waste. Repackage and/or move the waste into compliant storage if required by the applicable regulation; otherwise, leave the material in place.
1.3 *Inputs to the Decision:* Process knowledge based on source, labeling and observation. Contaminants of concern determined by potential waste category (RCRA, Toxic Substances Control Act [TSCA], low level waste asbestos, etc.) The action levels are specified in the applicable regulations.
1.4 *Physical Boundaries:* No temporal boundaries. Spatial boundaries for sampling based on observation and consideration of waste matrix.
1.5 *Decision Statement:* If the analytical results exceed the applicable action limits, then the waste will be characterized as regulated and managed appropriately.
1.6 *Decision Errors:* The likelihood of decision errors are minimized by duplicates samples where appropriate. When a population is characterized by statistical sampling, the upper bound of the confidence interval (90 percent, one-tailed) will be compared to the regulatory threshold. For radiochemical data, the error will be added to the reported result.
1.7 *Design Optimization:* To be determined for each item/material.

APPENDIX B

Attachment 1
Sampling and Analysis Planning Addendum

Attachment 2
NCS
Sample and Laboratory Analysis Request

Attachment 3
IH
Sample and Laboratory Analysis Request

Attachment 4
HP
Sample and Laboratory Analysis Request

Attachment 5
Waste Characterization
Sample and Laboratory Analysis Request

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Attachment 1-Sampling and Analysis Plan Addendum
Analytical Parameters, Methods and Anticipated Number of Samples

Waste Engineer:_______________ Date: __________

Sampling Purpose	Zone	SOW	Analytes	Analytical Method	Number of Samples	Sample Type	Turnaround Time	Data Deliverable (Report Only or Level III)

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Attachment 2-NCS Characterization Sample and Laboratory Analysis Request

NCS Representative: ______________________________ Date: ____________

Zone	Item Number	Item Description / Location	Media	Sample Number	Sample Date
			Solid/Liquid/Wipe		
			Solid/Liquid/Wipe		
			Solid/Liquid/Wipe		
			Solid/Liquid/Wipe		
			Solid/Liquid/Wipe		
			Solid/Liquid/Wipe		
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			Solid/Liquid/Wipe		
			Solid/Liquid/Wipe		
			Solid/Liquid/Wipe		
			Solid/Liquid/Wipe		

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Attachment 3
IH Monitoring Sample and Laboratory Analysis Request

IH Coordinator: ______________________________ **Date:** _____________

Zone	Location / Item	Analyses Requested	Media	Sample Number	Sample Date
			Air / Filter / Wipe		
			Air / Filter / Wipe		
			Air / Filter / Wipe		
			Air / Filter / Wipe		
			Air / Filter / Wipe		
			Air / Filter / Wipe		
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			Air / Filter / Wipe		
			Air / Filter / Wipe		
			Air / Filter / Wipe		

Attachment 4
HP Monitoring Sample and Laboratory Analysis Request

HP Representative: ________________________________ **Date:** ____________

Zone	Location / Item	Media	Sample Number	Sample Date
		Filter / Wipe		
		Filter / Wipe		
		Filter / Wipe		
		Filter / Wipe		
		Filter / Wipe		
		Filter / Wipe		
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		Filter / Wipe		

Attachment 5
Waste/Material Characterization Sample and Laboratory Analysis Request

Field Coordinator / Sample Requestor

Requestor: ________________________ Date: _______ Zone: ____________________ Staging location: ________________ _______

Waste description: (1 item or population per sheet)____

____

Potential material/source and process knowledge:____

____

ID number (items/containers to be sampled): ____

Other items/containers to be characterized in this population (ID numbers): __________________________________

Sample type: _______Random Grab _______Judgmental Grab (Location:________________________ _______)

_______Composite (single item/container) _______Composite (multiple items/containers) _______Sort/Segregate

Sampling device: _______Coliwasa _______Dipper _______Scoop _______Scissors/Snips _______Auger _______Wipes _______Other

ATTACHMENT 5 (Contd.)

Field Coordinator / Sample Requestor

Mark number of samples in appropriate boxes

Matrix	PCB	TCLP Metal	VOA	SVOA	Full Rad	Asbes-tos	Herbs/ Pests	Dioxins / Furans	Anions/ Fluor	Rad Alpha/ Beta	Flash Point	Corro-sivity	Other:	Sample Numbers	Project ID	SOW Number	Sample Date
Solids																	
Sludge																	
Liquids – aqueous																	
Liquids – oil		(Bulk)															
Wipes																	
Filter (IH samples)																	
Gas																	

DQO Concurrence: ____________________ Date: ____________

Notes: ____

APPENDIX C

WASTE MANAGEMENT PLAN FOR THE C-410 INFRASTRUCTURE D&D PROJECT AT THE PADUCAH GASEOUS DIFFUSION PLANT PADUCAH, KENTUCKY

WASTE MANAGEMENT PLAN FOR THE C-410 INFRASTRUCTURE D&D PROJECT AT THE PADUCAH GASEOUS DIFFUSION PLANT PADUCAH, KENTUCKY

October 2002

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CONTENTS

FIGURES

TABLES

ACRONYMS

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
BJC	Bechtel Jacobs Company LLC
CFR	*Code of Federal Regulations*
CLP	Contract Laboratory Program
Complex	C-410 Complex
D&D	Decontamination and Decommissioning
DL	detection limit
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPS	disintegrations per second
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
HASP	Health and Safety Plan
HP	Health Physics
LDR	Land Disposal Restrictions
LLRW	low-level radioactive waste
LLW	low-level waste
LSA	low specific assay
MDL	method detection limit
MS	matrix spike
MW	mixed waste
NCR	Nonconformance report
NTS	Nevada Test Site
NTSWAC	Nevada Test Site Waste Acceptance Criteria
PGDP	Paducah Gaseous Diffusion Plant
PK	process knowledge
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RH	remote handled
S&A	sampling and analysis
SAP	sampling and analysis plan
SME	subject matter expert
TID	tamper indicating device
TOC	total organic carbon
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
UDR	uranium deposit removal
WAC	Waste Acceptance Criteria
WCP	Waste Certification Program
WID	Waste Identification Documents
WIPP	Waste Inventory Pilot Plant
WMP	Waste Management Plan
WP	Waste Profile

1. INTRODUCTION

1.1 General

The Bechtel Jacobs Company LLC (BJC) C-410 Infrastructure Decontamination and Decommissioning (D&D) Waste Management Plan (WMP) details the implementation strategy for management of the various waste types [e.g., low-level waste (LLW), low-level mixed waste, transuranic (TRU) waste] generated during infrastructure D&D operations. Adherence to this WMP ensures that the wastes generated during D&D are properly characterized, handled, packaged, stored, and certified to meet the applicable BJC requirements and requirements for off-site treatment/disposal at an approved treatment, storage, and disposal facility (TSDF).

The WMP is structured to describe the methods by which the D&D work will comply with the BJC Waste Certification Program (WCP) requirements, disposal site criteria, applicable federal regulations (e.g., 40 CFR and 49 CFR), and applicable U.S. Department of Energy (DOE) orders or directives (e.g., DOE Order 435.1, *Radioactive Waste Management*).

This WMP provides information concerning the types of wastes generated by the D&D operations and describes the applicable waste characterization techniques [i.e., process knowledge (PK) and sampling and analysis (S&A) projected to be utilized in the successful completion of the project.]

1.2 Scope

This WMP describes the waste generation activities associated with Infrastructure D&D operations at the C-410 Feed Plant Complex (Complex).

Figure 1.1 illustrates the individual pre-removal activities included in the management of the wastes generated by the D&D process. A typical process flow diagram for processing the materials generated by the D&D activities from the point of extraction to the point of disposal is shown in Figure 1.2. These activities include, but are not limited to, identification, characterization, treatment, packaging, certification, transportation, and disposal of the waste. The controls stated in this plan address the anticipated waste categories.

The waste characterization process relies on both PK and S&A data for chemical and radiological characterization.

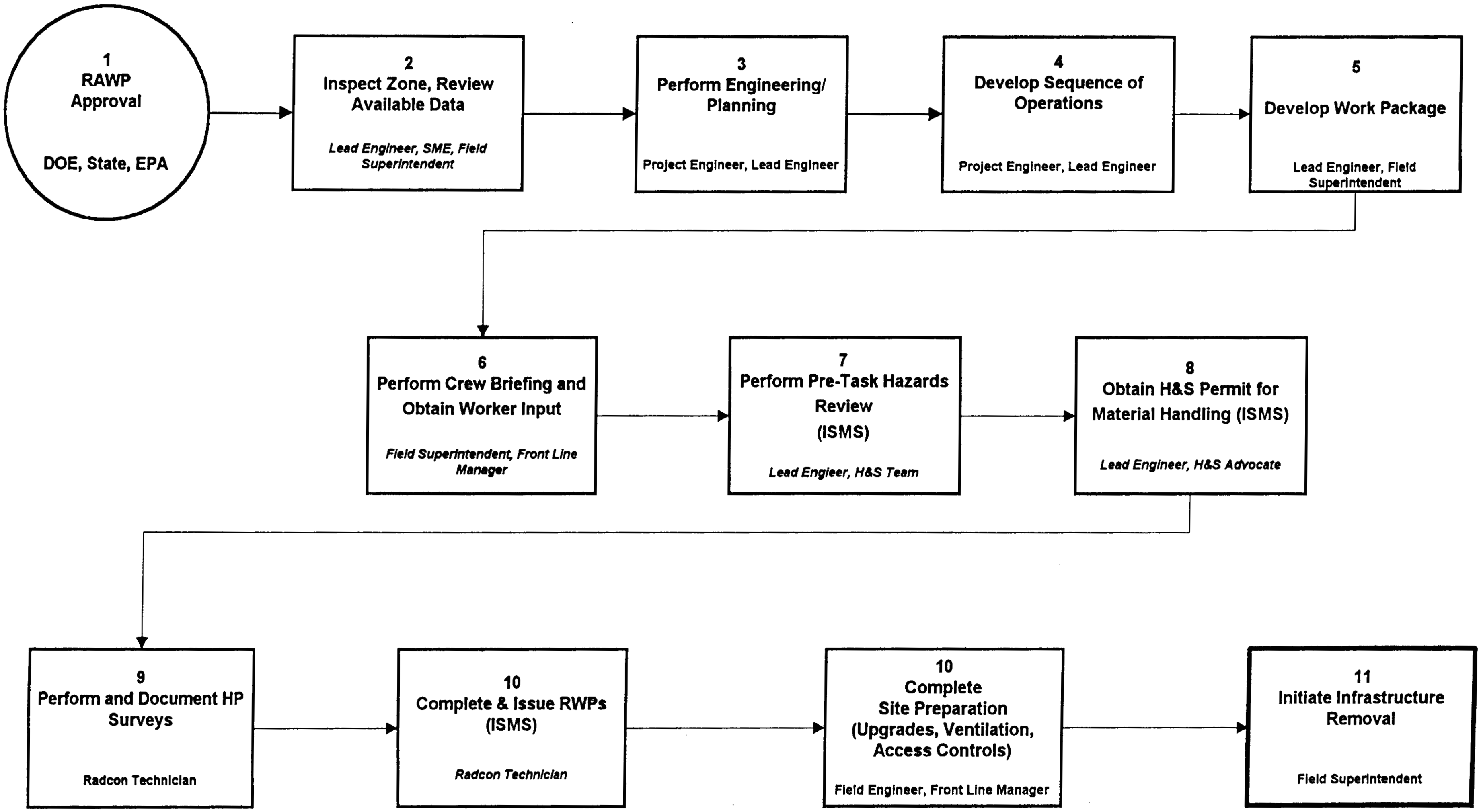
Wastes will be subjected to multiple waste management requirements. For purposes of this WMP, these are described in the context of on-site and off-site management programs. On-site requirements may include size reduction and packaging facilities, container storage facilities, on-site treatment facilities (as required), interim bulk storage facilities, and/or on-site disposal facilities. Off-site requirements may include resources for shipping low-level radioactive waste to the Nevada Test Site (NTS), Envirocare of Utah, Inc., and other disposal facilities as well as transportation of Resource Conservation and Recovery Act (RCRA)/Toxic Substances Control Act (TSCA) wastes to designated treatment, storage and disposal facilities (TSDFs).

1.3 Project Summary

The DOE, U.S. Environmental Protection Agency (EPA) and the Commonwealth of Kentucky have agreed to conduct D&D activities under the existing Federal Facilities Agreement for the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky. The C-410 Complex is the first facility at PGDP to undergo D&D. The Work Plan specifies three phases for D&D activities: 1) documentation process (site evaluation phase), 2) non-time-critical removal action (infrastructure removal phase), and 3) facility structure D&D and environmental media characterization and remediation. This plan addresses the infrastructure removal phase.

The C-410 infrastructure D&D will be conducted as an non-time-critical removal action. The objective of the infrastructure D&D activities is to remove building contents and physical infrastructure in preparation for demolition of the facility and disposal of the associated debris. During this activity, the building contents will be removed so that only the structures remain. To facilitate removal of the building contents radiological/chemical hazards and asbestos-containing materials (ACMs) will be identified and abated. Decontamination may be required. Further characterization activities will be performed to profile the materials for proper disposal.

C-410/420 Complex
Infrastructure D&D Project
Pre Removal Activities Flowchart



Large

MAP to

View Contact

270-441-5052

BJC/DMC

2. ORGANIZATION AND RESPONSIBILITIES

The information in this section describes the organization and responsibilities of critical functions associated with waste management activities for the D&D operations. The specific tasks and responsibilities performed by various individuals and organizations are further defined in appropriate work packages, specific operating procedures, and work authorization documents.

2.1 Project Manager

The BJC Project Manager, or designee, has oversight authority for specific operations associated with waste management during D&D operations. Those authorities/responsibilities include but are not limited to the following:

- Approving facility-specific waste generating, packaging, and processing procedures, where applicable,
- Ensuring that training and qualification requirements are met ,
- Ensuring that waste control procedures are implemented,
- Ensuring compliance with facility operating procedures,
- Approval of task scheduling,
- Approval of staffing plans,
- Review and approval of equipment selection, and
- Approval of shipment/disposal plans.

2.2 Sample Management Office

The D&D operations will require S&A for waste characterization purposes. The BJC-Paducah Sample Management Office will provide oversight for analytical support received by BJC or a designated subcontractor. Certified laboratory subcontractors will perform all analytical tasks. Assessment, validation, verification of analytical data will be accomplished in accordance with the procedures defined in the Sampling and Analysis Plan (SAP).

2.3 Waste Engineer

The waste engineer is responsible for ensuring compliance with the waste management practices defined in this plan D&D activities. Those responsibilities include, but are not limited to the following:

- Review segregation of waste based on characterization information,
- Inspection of containers before filling to ensure container integrity and the absence of prohibited materials,
- Monitoring the handling and packaging of waste to ensure that it is performed in a safe manner in accordance with applicable procedures and instructions,
- Verification that waste packages comply with applicable program requirements and project-specific procedures,
- Documentation waste generation, packaging, processing, and characterization,
- Coordination of shipment/disposal of wastes,
- Reporting nonconformance,

- Coordination actions necessary to correct nonconformance,
- Verification of accuracy of documentation procedures,
- Monitoring and documentation of packaging activities to ensure that approved procedures are implemented; and
- Ensuring that waste containers (loaded or unloaded) are protected from the elements.

2.4 Field Superintendent/Front Line Manager

The field superintendent and front-line managers are responsible for the day to day D&D operations. Specifically, their responsibilities include:

- Performing the daily crew briefings,
- Ensuring that the daily activities comply with all applicable permits, regulations and procedures,
- Scheduling crew activities,
- Monitoring and controlling labor and equipment resources, and
- Recommending proper equipment for removal activities.

2.5 Other

2.5.1 DOT Specialist

- Ensures that all shipments comply with appropriate Dot regulations
- Inspects packaging and loading procedures prior to shipment

2.5.2 Waste Certification Officer

- Ensures that waste preparation, packaging is in accordance with appropriate Waste Acceptance Criteria (WAC) of assigned disposal facility
- Verifies that Waste is assigned to proper disposal facility
- Reviews waste stream designations and waste profile documentation

2.6 Personnel Training and Qualification

All personnel involved in D&D waste generation operations will receive the level of training commensurate with their tasks. The training matrix for the activity is defined in the Health and Safety Plan (HASP).

Before commencement of operations, the front-line manager will review the training qualifications of assigned personnel to verify that individual training is in accordance with the HASP and the current work package. Personnel whose training qualifications are not current will be required to update delinquent training requirement(s), or be replaced with appropriately trained personnel.

3. CONTROLS

3.1 Identification and Control

Waste streams and waste packages are uniquely identified as they proceed from initial generation through packaging, storage, transportation, and emplacement at a waste disposal facility. Identification is accomplished through the use of container identification numbers, manifests, request for disposals, waste identification documents, process numbers, and work packages *Labeling and Management of Wastes PA-3010*.

Traceability of specific waste characteristics, waste generation sources, applicable chemical analyses, inspections, tests, and certifications to the individual waste sources are ensured following transfer to a TSDF for final disposal.

The D&D Container Log Sheet is the primary document that provides traceability. These sheets also document the characterization results, waste generation sources, applicable PK, and radiological data. A document package is completed for each waste package (i.e., container) and reviewed by the responsible waste engineer. Waste Profiles for disposal of LLW to NTS must follow BJC/PAD-215 *Profiling and Qualifying LLW Stream from Paducah to Disposal at NTS*.

BJC site personnel will attach a tamper-indicating device (TID) to each full container to ensure that inadvertent additions of nonconforming waste materials do not occur. TIDs will be applied to drums, boxes, and/or cargo containers.

3.2 Control of Processes

Waste treatment and packaging operations are controlled through use of defined processes and equipment, approved procedures and instructions, and documentation of operating conditions. Controls and/or verification steps are identified as part of the operating procedures for processes critical to the waste operations. Some processes may be self-performed by BJC. Such processes may include waste sampling and analysis, waste packaging, storage, and shipment.

3.3 Inspection

Inspections are utilized to evaluate the conformance of waste packages and items against waste acceptance and certification criteria, process control plans, waste packaging requirements, and inspection procedures. Inspection activities and their sequence are based on WAC requirements of the designated transportation and disposal operations, BJC requirements, and regulatory requirements.

3.4 Test Controls

Tests performed for this project are designed to verify that an activity is planned, controlled, and documented to ensure consistent, repeatable, and retrievable results. Test controls are performed routinely to substantiate waste certification and verify conformance to specifications and requirements with the applicable BJC Waste Certification Program (WCP) and TSDF. Examples of test controls include equipment calibration, background measurements, calibration checks for scales, and calibration source traceability.

3.5 Control of Test and Measuring Equipment

Test equipment and measuring devices bear, by label, evidence that they are currently calibrated or certified for use. Out-of-calibration devices are tagged and/or segregated and not used. On-site and off-site calibration of instruments, where required, is performed in a controlled environment. Standards are in accordance with the National Institute for Standards and Technology or other acceptable, known standard.

3.6 Marking, Handling, Storage, and Transfer

Wastes generated during D&D operations are packaged, staged, and shipped in a manner that will not alter their certification status. Packaging and staging shall ensure that radiation exposures comply with as low as reasonably achievable (ALARA) policy.

Marking and labeling requirements for on-site storage and off-site shipment are defined in the BJC WAC and the individual for offsite facilities.

3.7 Inspection, Test, and Operation Status

The status of waste certification activities is maintained from the point of waste generation to final disposal.

Nonconformance controls apply to items such as shipping packages, containers, handling devices, and waste packages that do not meet the appropriate TSDF criteria or other BJC-specific requirements shown in BJC-PQ-1440, *Control of Nonconforming Items and Services*.

BJC uses a nonconformance report (NCR) tracking system to identify nonconforming materials. Items that do not pass inspection will be marked with a reject or hold tag and an NCR completed. The tag identifies the NCR number, the container number, the waste stream number (if applicable), and a brief description of the deficiency. The waste engineer inspects containers before filling them.

If at any point a waste container or waste contents fail to pass inspection, an NCR is issued and the item is marked with a reject or hold tag. Anyone identifying a nonconformance may apply an NCR. If an NCR exists on any material prior to its transfer to any storage or disposal facility, the NCR must be rectified prior to transfer.

3.8 Corrective Actions

Corrective actions are initiated, documented, and tracked in accordance with BJC-PQ-1210, *Issues Management Program*.

Variances to approved and established procedures may be initiated and submitted for review to the BJC waste engineer, or other appropriate party, should effective waste management techniques dictate.

3.9 Quality Assurance Records

Quality Assurance (QA) records are maintained in order to furnish documented evidence that wastes are generated, packaged, inspected, assayed, analyzed, tested, and shipped according to the applicable requirements in OS-A-0201, *Records Management, Including Document Control*. All documents shall be processed as specified by applicable governing documents.

Paper records are defined by type and are considered valid records only if they are signed and dated by authorized personnel from the applicable organizations.

3.10 Purchased Items and Services

The purchase of materials, items, and services associated with D&D waste operations shall require the signature of the Project Engineer. Items and services purchased to support this WMP are controlled through the BJC-PA-3012, *Procurement and Inspection of Items Critical to the Paducah Waste Certification Program.* The specific quality controls are based on the assigned procurement level of the item or service.

Purchased items are controlled at all stages of procurement. Specifically, these include: requisition and purchase order preparation; specification and design development and approval; supplier evaluation, selection and approval; supplier bid evaluation and award; verification of commodity quality; control of nonconformance and corrective actions; acceptance of items; and maintenance of records.

3.11 Document Control

The authorization, preparation, review, acceptance, distribution, and updating of documents are subject to a formal control system. BJC procedure OS-A-0201 *Records Management, Including Document Control* provides the methodology and requirements for developing, revising, and controlling project-specific documents.

4. WASTE CHARACTERIZATION PROCESS

4.1 Waste Characterization Requirements

The BJC waste characterization activities incorporate the requirements of DOE Order 435.1, state and federal regulations, BJC requirements, and the WAC of the receiving facility. The wastes generated during D&D operations will be characterized to demonstrate that the waste type meets the applicable BJC requirements, the criteria set forth in the WAC of the designated treatment/disposal facility, and any other requirements affecting disposition of the materials. Methodologies for both radiological and chemical characterization are detailed in the SAP.

Waste will be characterized in accordance with approved procedures documented in the SAP. Typical types of waste characterization information include work packages, operational procedures, historical analytical data, nondestructive assay, PK, and applicable waste codes.

4.2 Process Knowledge

Throughout the waste characterization process, subject matter experts (SMEs) will provide technical support for areas such as waste packing, shipping, form completion, and waste characterization techniques.

Circumstances may exist when S&A is not feasible or necessary for determination of the presence of hazardous components (ALARA concerns). In these circumstances, the SME will provide PK to define the waste.

When waste characterization is based solely upon PK, the waste engineer will rely on established administrative and physical controls to support compliance with the applicable BJC requirements.

4.3 Analytical Knowledge

If PK does not allow for sufficient waste characterization, the project team will conduct S&A to further characterize the waste material.

If S&A is performed, it will be in accordance with recognized industry standards and methods such as the EPA's SW-846, *Test Methods for Evaluating Solid Waste* or the American Society for Testing and Materials methods.

4.4 Profile Process

BJC/PAD-11, Rev.3 provides the structure for the waste characterization workflow. This procedure identifies the basic requirements for handling and transfer of the waste.

5. PROCESS KNOWLEDGE

PK generally refers to any information the generator possesses about a waste stream. This knowledge may include operational knowledge recorded in procedures, developmental engineering studies, and industry publications. PK also can include historical data obtained from operations. RCRA regulations specifically allow a waste generator to apply knowledge of the hazard characteristics of the waste in light of the materials or the processes used. Listed waste determinations explicitly require PK to determine whether a waste meets one of the listing descriptions. Other regulatory programs implicitly require the use of some level of PK for waste identification (e.g., Category II non-friable asbestos-containing material).

During the D&D process, BJC will utilize a combination of historical data compiled during the operations of the Complex, results of environmental surveys performed after the facility was shutdown, and the knowledge base of a number of the personnel who were present during the operation and shutdown of the facility, to provide support required to adequately characterize the waste materials.

PK may be used with respect to a waste's regulatory status. PK to support a "not regulated" determination generally requires more supporting documentation than PK that supports a "regulated" determination. For making a "not regulated" determination, the assembled PK must thoroughly and reasonably support a case that the material either could not exhibit a hazard characteristic or it meets an exemption from regulation.

5.1 Knowledge of the Waste Matrix

The physical characteristics of the waste matrix may preclude the waste from exhibiting certain waste characteristics. For example, by definition, a non-liquid waste matrix is not capable of exhibiting the RCRA hazardous waste characteristic of corrosivity. In such cases, knowledge of the waste matrix is critical in determining the final methodologies for treatment and disposal of waste materials.

Likewise, bulk structural steel, with virtually no absorptive capacity, does not fail the RCRA toxicity characteristic (provided no surface coatings have been applied). In this example, even if surface coatings have been applied, knowledge of the characteristics of the coating may be used to support a "not regulated" determination for the entire waste form.

5.2 Knowledge of the Generating Process

PK may be used to demonstrate that the generating process was well documented and controlled and did not involve the use or generation of any materials that could cause a waste generated by the process to be regulated.

The key to evaluating processes is an understanding of the materials used in the process, the chemistry and physics of the process, and the materials generated from the process. Personnel who were involved during the operation and participated in the shutdown of the Complex are available to provide this knowledge base. Historical documents such as process drawings and operating logs will augment the information available from the operations personnel.

5.3 Cases when Process Knowledge is Most Appropriate

DOE and EPA have issued draft guidance for the characterization of mixed waste (MW) that provides information on the application of PK for waste determinations. The guidance states that PK is most appropriate for waste characterization when one or more of the following conditions exist:

1. Collection of representative samples from a waste stream is difficult due to its physical nature. This applies to solid matrices such as metals, glass, or wood materials.

2. Waste collection and analysis of material would result in unacceptable risk of radiation exposure. DOE policy requires that exposure to hazardous material must be maintained ALARA.

3. Waste is heterogeneous in composition to the extent that collecting a representative sample is difficult.

5.4 Objective Documentation for Process Knowledge

PK development requires the identification of objective information that supports the determination. Reliance upon objective evidence reduces the potential for a subsequent reviewer to reach a different determination regarding a waste determination. The rationale for the application of PK will be documented. Historical documents will be referenced, where possible.

6. SAMPLING AND ANALYSIS

The S&A process is designed to generate objective data of known quality to support decision-making regarding the regulatory status and management requirements for waste and materials. The Data Quality Objective (DQO) process is utilized to establish the quality and quantity of data required to satisfy decision-making needs. The Quality Assurance Project Plan establishes the framework for ensuring that DQOs are met for individual projects and that QA requirements are implemented on a consistent and appropriate basis throughout data gathering activities.

The SAP provides the direction for specific sampling activities. It references standard operating procedures to implement specific sampling requirements and is written generically to cover sampling activities that follow the same protocol during each sampling event.

6.1 Sampling Approaches

The plan for sample collection must be responsive to both regulatory and scientific objectives. Determination of whether a waste material should be categorized as a RCRA/TSCA waste will be based on the specifications defined in SW-846, *Test Methods for Evaluating Solid Waste*, Chapter Nine.

The D&D waste characterization process relies upon collecting representative samples that exhibit, on average, the properties of a whole population. Sampling accuracy is dependent upon collecting unbiased samples from a population. Three basic forms of random sampling will be utilized during the D&D operations, 1) simple random sampling, 2) stratified random sampling, and 3) systematic random sampling. Simple random sampling will be the basic approach applied to the majority of the waste.

6.1.1 Simple Random Sampling

In simple random sampling, each unit in the population (e.g., a container or an element of a grid) has an equal chance of being sampled. Simple random sampling is the default random sampling strategy when there is little information about contaminant distribution and a rationale for an alternate strategy does not exist.

To randomly select units within the population, each unit is sequentially numbered and a random number generator (for example, calculator program) or random number table is used to select the units to be sampled.

Simple random sampling is the basic approach adopted for waste generated by the C-410 removal operations.

6.1.2 Stratified Random Sampling

Stratified random sampling is used when there is information that suggests that the population can be divided into two or more strata that are similar in composition. Examples of information that may be used to identify strata within a population include:

- physical characteristics such as distinct phases or color patterns

- existing analytical data that indicate stratification
- identification of distinct batches or lots
- dates of generation

Stratified random sampling is employed when there is evidence of strata that may have different contaminant distributions. For example, a representative sample is collected from each phase in a container that exhibits multiple phases.

6.1.3 Systematic Random Sampling

Systematic random sampling involves randomly selecting the first unit from a population to be sampled and selecting subsequent units at fixed time or space intervals. This approach ensures that samples are distributed evenly across the population and simplifies the process of selecting units to be sampled.

Systematic random sampling can return inaccurate and/or imprecise data when unrecognized trends or cycles exist in the population; therefore, this type of sampling is not used for populations in which such variability may exist.

6.2 Sampling and Analysis Data to Support Decision-Making

RCRA regulations for population identification generally require that waste generators determine, with statistical confidence of 90 percent or greater, whether specified parameters of concern for a given population exceed a regulatory threshold (e.g., toxicity characteristic determinations).

RCRA characterizations also involve determining whether or not a population exhibits a particular attribute (e.g., free liquids determination).

For regulatory programs that do not specify required confidence levels for demonstrating compliance with respect to a numerical threshold (e.g., TSCA PCB regulations), a 90 percent confidence limit to support decision-making will be followed.

Identification of a listed hazardous waste may be based on a listing description. Once waste is identified as a listed hazardous waste, S&A results are generally required to demonstrate compliance with RCRA land disposal restrictions (LDRs).

6.3 Data Quality Indicators

The DQO process addresses data quality indicators that support the generation of data of known quality. These indicators are discussed in the SAP and Quality Assurance Project Plan.
These indicators include:

- Representativeness,
- Accuracy,
- Precision,
- Sensitivity,
- Completeness, and
- Comparability.

6.4 Statistical Treatment of Data

Analytical data will be validated per DQO requirements and reviewed for compliance against disposal facility WAC. Once the data have been validated, summary statistics will be developed to support decision-making. For decisions that require comparison with a regulatory threshold, a 90 percent confidence limit will be applied. Based on this evaluation the waste will be assigned specific handling, packaging, treatment, and disposal procedures.

7. WASTE DEFINITION/SEGREGATION

The overall strategy for waste disposal involves compliance with waste generation documents, and proper waste characterization that meets BJC requirements as well as any additional on-site and off-site TSDF criteria. The types of waste accepted and the requirements for waste acceptance at a disposal facility are discussed in the following sections.

The requirements for acceptance of LLW, MW, TRU waste, TRU MW, and hazardous wastes are defined through the BJC WCP Master Profile requirements. The Master Profile has been developed to address particular waste types generated by BJC and applicable subcontractors. Primarily, the Master Profile summarizes the requirements for on-site storage as well as disposal at off-site TSD facilities.

The Complex infrastructure D&D project will generate a variety of waste streams. The majority of these waste streams will be radiologically contaminated materials identified as LLW and construction/demolition debris. Wastes such as PCB-containing liquids and electrical components, non-radioactive RCRA and/or mixed waste sludges or liquids, and petroleum products will also be generated. Mixed waste and RCRA waste will be treated, if necessary, to meet RCRA LDRs prior to disposal.

All waste materials will be separated into waste streams that conform to the proposed disposal facility WAC and profile developed for its disposal. The majority of this material will require disposal as low-level radioactive waste, RCRA or TSCA hazardous waste, mixed waste, or non-hazardous solid waste. A listing of anticipated potential waste streams is presented in Table 7-1.

The total volume of waste generated in the Removal Action is projected to be approximately 12,300 $yd^{3.}$ The equipment and infrastructure represent a volume of approximately 10,000 yd^3. The remainder of the projected waste volume consists of stored materials.

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Table 7-1. Description of Potential Waste Streams

Waste streams	Description
Radioactively Contaminated Recyclable Metals	These materials consist of equipment, pipe, tubing, valves, etc., of sufficient size to be economically decontaminated for recycle. While DOE has significant and extensive limitations on releasing materials for free release, this option is included rather than dismissing recycling summarily. Fluorine cells and associated ancilllery equipment ar the most likely candidates for reuse.
Non-radioactive Recyclable Metals	These materials consist of equipment and larger diameter pipe, valves, and fittings from non-process areas and systems that meet appropriate radiological release criteria. As such, this scrap metal may be suitable for release without decontamination.
LLW, Debris	LLW debris are defined as radioactively contaminated, non-consolidated, solid material with a size > 6.4 cm (2.5 inch) and are managed separately from non-debris LLW because of differing characterization requirements. The waste streams within this category consist of scrap metal of insufficient size for economic recycle, scrap metal constructed from alloys dissimilar to those destined for recycle (i.e., brass, monel, and/or bronze) and miscellaneous debris waste types from process areas or systems.
LLW, Non-debris	The waste streams classified in this category are solid, liquid or sludge derived from project activities in Radiological Contamination Areas where the radioactivity may be dispersed within the waste matrix. The primary waste streams in this category are typically PPE, vacuum dusts, concrete dusts, floor sweep, spent shot, spent grit [from decontamination blasting], spent decontamination solutions, and various wastewater streams. These streams are separately categorized from LLW debris because of differences in characterization requirements or ultimate disposition.
Non-radioactive, Non-hazardous [Non-PCB] Solid Wastes	The waste streams in this category consist of both debris and non-debris wastes that can be certified as meeting radiological release criteria and are non-hazardous and non-PCB.
Radioactive ACM	This waste category includes ACM derived from process areas or systems such as process pipe insulation, feed-station seals and insulation, or concrete dusts from scabbling, or blasting ACM material.
Non-radioactive ACM	This waste category consists of ACM that can be demonstrated to meet the appropriate radiological release criteria.

Waste streams	Description
Radioactive PCB Wastes	This waste category encompasses PCB electrical equipment, PCB oils, process ventilation system components and other wastes contaminated from regulated sources and that are considered radioactive. Certain PCB wastes may be categorized as non-radioactive PCBs if radiological release criteria are met.
Non-radioactive PCB Wastes	PCB-electrical equipment and debris wastes or non-debris wastes that meet radiological release criteria.
Mixed Wastes	This waste category includes waste streams considered likely to have both a RCRA hazardous component and a radioactive component based on their origin within a radioactive materials management area, surface contamination exceeding release limits, or available characterization data. Among the wastes included in this category are inherently hazardous non-recyclable metal items, trap materials, concrete dusts from decontamination of [process] floors where lube oil leakage occurred, and radioactively contaminated lamps.
Hazardous Wastes	This waste category encompasses RCRA hazardous waste streams that meet radiological release criteria.
PCB/RCRA/Rad	PCB/RCRA/Rad wastes are those mixed wastes that also contain PCBs. This category also includes ACM co-mingled with mixed waste and PCBs. These wastes may include residual hydraulic fluids, concrete dust and wastewater, ventilation duct gaskets, and deposits within the ventilation ducts.
TRU	Transuranic elements were detected in process materials and the possibility exists that small quantities of transuranic waste could be encountered. TRU is most likely to accumulate in the ash receivers, most of which have been removed.

8. TREATMENT

Waste materials generated by D&D activities may require treatment to eliminate characteristic hazards. Treatment may also be necessary to comply with BJC regulatory and/or disposal facility requirements. Treatment may occur on-site, prior to packaging, or off-site at the designated disposal facility. On-site treatment may be necessary to comply with U.S. Department of Transportation (DOT) regulations for transportation of specific materials. Off-site treatment may be required to comply with the WAC of the selected disposal facility and RCRA LDRs.

Treatment could involve a variety of processes including, but not limited to, pH neutralization, stabilization of heavy metals, chemical conversion, or additive mixtures to reduce free water content.

Should it become necessary to perform treatment activities on-site, tasks will be performed by BJC personnel or designated subcontractors. Treatment will be planned and performed in strict compliance with the appropriate regulations and permits.

9. SIZE REDUCTION/PACKAGING

Waste will be collected, packaged, inspected, certified, and loaded for shipment in accordance with the Paducah WAC, BJC/PAD-11, PA-3011, and the WAC of the receiving facility. Where feasible, the material generated during the C-410 Complex infrastructure D&D will be size reduced. Shredders, compactors, balers and shears may be used to size reduce and/or volume reduce material to its lowest practical size and density. Size reduction will 1) facilitate material handling, 2) minimize required storage space and 3) reduce associated transportation and disposal costs. This policy will ensure that waste containers meet the minimum internal void space as required by the WAC of the disposal facilities. For example, the NTS WAC stipulates that the volume of the waste can be estimated as the internal volume of the container if: 1) the radionuclide concentration is evenly distributed throughout the waste, and 2) the material fills at least 90 percent of the waste container.

The physical characteristics of three categories of waste will influence the types of size reduction equipment to be applied during the Complex infrastructure D&D project.

- General trash – Combustible and non-combustible trash including plastics, rubber, filters, metal, glass, tools, desks, chairs, insulation, ductwork, etc.

- Scrap metal - Piping, conduit, small valves, instrumentation, supports, hangers, grating, railings, etc.

- Large equipment – Major process equipment items including: valves, tanks, separators, blending machines, structural metal, etc.

The quantities and characteristics of these wastes may vary appreciably. Each category of waste will be processed to ensure compliance with the WAC of the selected disposal facility. Volume reduction technology selected for each type of material will be independent of the radioactivity content. However, if elevated content of beta-gamma radioactivity is encountered, special shielding could be required.

Hand sorting is the simplest method of segregating wastes into constituents amenable to size reduction by a particular technology. Although this may best be done at the point of origin, the wastes may also be sorted after collection as part of a waste treatment operation. Auxiliary equipment such as cranes and forklifts, will be used to assist in handling the heavier materials.

It will be necessary to containerize a portion of the waste generated during D&D activities for transportation and/or disposal. The waste streams and volume of waste requiring containers will depend heavily upon the D&D technologies used and the disposal options selected.

A variety of containers are available for packaging the different waste streams that will be generated. Appropriate containers include: Sea-Land containers, intermodal containers, ST-boxes (B-25), steel drums, and polyethylene drums, Super-Sacks DOT approved containers), etc.. Due to the variety of waste that will be generated from the D&D activities, it is anticipated that all of the container options may be used during implementation of the removal action.

Size-reduction equipment will be utilized to size the waste materials sufficiently to ensure proper containers are used. Bulky, low-density materials such as ductwork and furniture and higher density materials, such as large diameter piping and small equipment components may be hydraulically sheared or manually cut into smaller sizes to facilitate loading, packaging, and placement into B-25 boxes or intermodal containers. Larger equipment may be wrapped with impervious film and loaded directly onto flatbed trucks or open topped Sea-Lands. Small components such as wiring, electronic equipment, or instrumentation may be contained in 55-gallon drums for transport to the disposal facility.

All wastes generated during activities associated with this project will be packaged in accordance with relevant DOT, DOE, EPA, and/or Nuclear Regulatory Commission regulations and disposal facility WAC requirements.

10. TRANSPORTATION

Proper transportation/shipment procedures shall be applied to the waste from the C-410 Complex D&D. The C-410 waste streams can be generally categorized by the following six DOT proper shipping names:

- Low Specific Activity,
- Surface Contaminated Objects,
- Hazardous Waste, Solid/Liquid,
- PCBs, Solid/Liquid, and
- Asbestos
- Solid Waste.

Waste not meeting the above classifications will be evaluated on a case-by-case basis for proper classification and packaging. Samples collected during the course of this project will be shipped in accordance with DOT rules when transported by ground.

Wastes are designated for offsite disposal will be transported by one of three methods:

- Over the road trucking,
- Railroad, or
- A combination of truck and rail.

Decisions regarding the selection of transportation alternatives will involve the location, WAC, logistics of the alternative disposal sites, technical requirements for handling waste material, and relative costs of each transportation alternative.

The primary criteria in considering transporting materials by truck are the size, (8 by 48 ft) and the weight limitations (approximately 20 tons) of a standard over-the-road trailer. Bulk materials may require over-sized load permits. Rail transportation of material is less expensive than trucking. However, at least one of the available disposal sites is not serviced by rail. For very heavy loads, railcars may be used. Gondola railcars (100 tons) may also be used for the transportation of debris-like material.

11. DISPOSAL SITES

The number of disposal options that can be considered for the disposal of certain waste generated during D&D activities at the C-410 Complex is somewhat limited. The presence of radioisotopes in the majority of the waste material precludes disposal at most industrial/sanitary landfills. Four facilities are being evaluated as disposal options for the majority of the waste generated from the D&D activities.

- NTS,
- Envirocare of Utah,
- On-site disposal at PGDP, and
- TSCA Incinerator, Oak Ridge.

The Waste Inventory Pilot Plant (WIPP) site in New Mexico is the anticipated disposal site for TRU materials in the unlikely event that they are identified. A broad-spectrum mixed waste contractor may be utilized for treatment. Other commercial facilities may be evaluated if they become available.

It should be noted that no CERCLA wastes will be disposed within an onsite PGDP landfill until Kentucky DEP and EPA agree such landfill may receive CERCLA materials. Wastes generated by this action will only be disposed in strict compliance with CERCLA requirements.

A summary of the waste disposal options for various waste streams is presented in Table 11-1.

Table 11-1. Summary of Disposal Options

Facility	Low-level radiological waste	Mixed waste	Non-radiological hazardous (RCRA) waste	Solid construction waste	TSCA waste	Asbestos waste	Liquid waste	Classified material	TRU
NTS	X					X		X	
Envirocare of Utah	X	X			X	X			
C-746-U Solid Waste Contained Landfill				X		X			
TSCA incinerator	X	X			X		X		
Permitted, off-site commercial facilities	X	X	X	X	X	X	X		
Paducah CERCLA Waste Disposal Facility (If Approved)	X	X	X	X	X	X		X	
WIPP									X

Notes: All waste accepted at NTS and Envirocare of Utah must be radiological waste.
Paducah CERCLA cell does not have regulatory approval. If approved, it is assumed to have WAC identical to Oak Ridge CERCLA cell.

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12. WASTE MANAGEMENT PATHWAYS

The following is a listing of the projected waste classifications expected to be generated by the D&D activities and their associated method of characterization, packaging, and disposal. Because the wastes produced by the D&D activities will be identified as the infrastructure is removed, definition of each waste stream and its characteristics will be a "real time" activity. The packaging, transportation, and disposal options will be evaluated as data becomes available.

Only solid waste that meets the C-746-U WAC will be considered for disposal in the C-746-U landfill as the onsite facility.

Offsite facilities will be selected based on their WAC for the specific waste stream and based on economics. Other waste disposal options will be considered, if they are available. If other waste disposal facilities are to be utilized, approval for receipt of CERCLA generated wastes from EPA Region where the disposal facility is located will be required.

12.1 Low Specific Assay

Low Specific Assay (LSA) materials consist of "material with limited specific activity." In general, this classification applies to floor sweepings containing low levels of radionuclides (□10^{-4} A_2/g for solids and gases, □10^{-5} A_2/g for liquids), natural or depleted uranium and thorium compounds or mixtures, and similar material. Radioisotope surveys will be obtained in order to properly characterize this material and health physics (HP) surveys will be conducted in accordance with DOT rules on the packages prior to shipment. LSA materials will be consigned exclusive use and will be packaged in "strong, tight" containers for disposal at NTS or Envirocare of Utah.

12.2 Surface-Contaminated Objects

Surface-Contaminated Objects are items that are not radioactive, but have radioactive material distributed on their surfaces, e.g., UO_2F_2 contaminated process piping. In order to properly characterize material for this classification, it will be necessary to obtain HP surveys for fixed and non-fixed (removable) contamination on all surfaces (interior and exterior), radioisotope reports for all isotopes present, and a determination of the surface area of each part. These materials will be consigned and packaged in "strong, tight" containers for disposal at NTS or Envirocare of Utah.

12.3 Hazardous Waste, Solid/Liquid

Hazardous Waste, Solid/Liquid describes waste subject to RCRA regulation, e.g., incandescent light bulbs, electric starters, etc. RCRA waste that contains radioactive contamination is considered mixed wastes. These wastes will be managed in accordance with RCRA rules and DOE orders. Characterization requirements for hazardous wastes include HP surveys, radioisotopic analysis (if contaminated), and laboratory analysis for expected RCRA constituents. PK will be used to determine what RCRA constituents may be present. If sufficient PK does not exist to make this determination, laboratory analysis will be performed. Packages will be compliant with DOT packing group III or as required by other contaminants that may be present.

Mixed RCRA/Rad wastes will be shipped to a broad-spectrum contractor for treatment prior to disposal at either Envirocare of Utah or NTS for disposal. Non-radioactive RCRA wastes will be consigned to a commercial hazardous waste disposal facility. Wastes that meet the WAC and all CERCLA requirements will be disposed of in the on-site landfill at such time as it becomes available.

12.4 PCBs, Solid/Liquid

PCBs have been used extensively at PGDP in process equipment. PCBs are subject to TSCA regulations. Characterization requirements for PCB wastes include HP surveys, radioisotopic analysis (if contaminated), and laboratory analysis in order to quantify the extent and type of PCB contamination present. Packages for these wastes will be compliant with DOT packing group III or as required by other contaminants present. Mixed PCB wastes will be shipped to Envirocare of Utah or NTS (subsequent to their receiving WAC approved for TSCA waste) for disposal. Non-radioactive PCB wastes will be consigned to the TSCA incinerator (if available).

12.5 Asbestos

Asbestos is evident in the majority of the areas of the C-410 Complex. Characterization requirements for asbestos wastes include HP surveys, radioisotope analysis (if contaminated), and laboratory analysis as required. Packages for these wastes will, at a minimum, be compliant with DOT packing group III. Other contaminants present may require alternative packaging. Radiological contaminated asbestos wastes will be shipped to NTS for disposal. Rad-free asbestos wastes will be consigned to the on-site C-746-U landfill if it is available or shipped to a local commercial landfill.

12.6 Transuranics

TRU materials will be shipped and disposed of at the WIPP site in New Mexico.

12.7 Classified Materials

Any classified materials that may be identified during the removal activities will be packaged and disposed in strict compliance with DOE guidelines.

12.8 Solid Wastes

Solid wastes that are neither radiologically contaminated nor RCRA/TSCA impacted will be disposed within the onsite C-746U landfill or offsite at a commercial facility. Materials that may meet these criteria are construction debris from the building demolition that has been analyzed to ensure that it meets the WAC for the designated landfill.

13. REFERENCES

1) Atomic Energy Act of 1954, as amended

2) DOE Order 435.1, Radioactive Waste Management, February 1997

3) U.S. Environmental Protection Agency's (EPA's) SW-846, *Test Methods for Evaluating Solid Waste*, or the American Society for Testing and Materials methods

4) WM-A-2001, *Generator Requirements for Transferring Waste*

5) SW-846, *Test Methods for Evaluating Solid Waste*, Chapter Nine

6) BJC-WM-2010, *Procurement and Inspection of Items Critical to the Oak Ridge Reservation Waste Certification Program*

7) BJC-PQ-1440, *Control of Nonconforming Items and Services*

8) BJC-PQ-1210, *Issues Management Program*

9) OS-A-0201, *Records Management, Including Document Control*

10) BJC/OR-734, *Waste Disposition Characterization Plan on the Oak Ridge Reservation, Oak Ridge, Tennessee*

11) BJC/PAD-11/R3 *Waste Acceptance Criteria for the DOE TSD Units at the Paducah Gaseous Diffusion Plant, Paducah, KY.*

12) OR-543, *Solid Radioactive Packaging Procedure*

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C-410 Infrastructure Removal Action Work Plan (RAWP) Comment Resolution Summary
10/21/02

No	Source	Comment	Response
1	EPA General Comment a	1. The content of the Removal Action Work Plan (RAWP) for D&D of the C-410 Complex Infrastructure is consistent with prior discussions among DOE and the regulatory agencies. However, there are several significant issues to be resolved prior to EPA concurrence with the plan for this action. These are discussed in the specific comments below, and include the following: a. The project schedule outline provided in Section 5. Project Schedule (page 27) is inadequate as it provides no means of tracking progress made (or problems encountered) during the course of this estimated six-year project duration. Additional reporting requirements must be made (e.g., monthly, quarterly, semi-annually) to ensure that the removal activities are progressing as planned;	The DOE agrees that a mechanism for progress tracking is required. DOE recommends scheduling and conducting a quarterly progress updates (alternating conference calls and face to face meetings) with the Commonwealth of Kentucky and the Environmental Protection Agency to discuss progress and issues. Text to be modified accordingly.
2	EPA General Comment b	b. A breakdown of what programmatic and sub-tier documents are planned to be made part of this action, and which are considered to be secondary documents, part of the Administrative Record, or separate from the CERCLA process should be included to clarify public and regulatory opportunities for review and input;	The RAWP as well as the Waste Management Plan and Sampling and Analysis Plan are considered primary documents. The Quality Assurance Plan and Health and Safety Plan are considered secondary documents and will be placed in the post decision Administrative record along with the primary documents.
3	EPA General Comment c	c. The conditions necessary to require characterization sampling, along with the documentation of that decision process, needs to be better defined; and	Generally, the sampling and characterization task will be an integral part of the work planning activity and, as such, will be included in the individual Work Packages. Characterization will be performed as a part of the ISMS process, to further define the work environment to ensure worker safety by enhancing worker awareness. These activities will also be performed to ensure that the wastes generated by the removal activity are in compliance with the Waste Acceptance Criteria of the waste disposal facilities.
4	EPA General Comment c	The conditions for use of the C-746-U Landfill as a disposal option for this action need to be clarified. The use of the C-746-U Landfill for disposal of uncontaminated solid waste is a practical and cost-effective approach to completing this action. However, to the extent that CERCLA waste may be disposed at the C-746-U Landfill requires some additional explanation by the DOE-PGDP along with the approval from the Kentucky Department for Environmental Protection.	Agree. The text will be modified to reflect onsite disposal will be consistent with Waste Acceptance Criteria developed through an Authorized Limits Evaluation and Performance Evaluation for the C-746-U Landfill.
5	EPA Specific Comment 1	Page 1, Section 1.1, 1st Paragraph, 2nd Sentence. The text describing the status of the Action Memorandum should be updated to reflect its current	Agree. Text will be revised to state the Action Memorandum has been approved by the regulatory

No	Source	Comment	Response
		status.	agencies and was signed by DOE on August 3, 2002.
6	EPA Specific Comment 1	Pages 7 and 8, Section 3.1.1, 3rd Paragraph, Bullets. The HF storage building referenced in the 2nd bullet does not have a letter designator. It appears the text may be referring to C-410-F; please clarify. Also, both the 1st and 8th bullets refer to C-410-C, one to the building and one to the tank. Please clarify if these are distinct units for purposes of this action. Finally, there does not appear to be a separate description of the C-410 Building, the East and West Expansions, and C-410-A (the Second East Expansion) in this list. Clarify whether this omission is intentional (i.e., the bullets describe auxiliary structures only) or an oversight.	Agree. The second bullet does refer to the C-410-F Tank. Text will be revised to incorporate the change. The C-410-C HF Neutralization Building and C-410-C HF Neutralization Tank are located immediately adjacent to each other. They are separate units, that will both be addressed by the action. The intent of the bullets is to discuss units that are external to the C-410 Building proper. This section was not intended to present a discussion of the East and West Expansions of the C-410 Complex. A discussion of the east and west expansion is included in the EE/CA, and provided on the CD-ROM, which was inadvertently not included in the D1 RAWP. It will be included with the D2. To clarify this intent, the following sentence will be added to the paragraph preceding the bullets: "In addition to the C-410, C-411, and C-420 Buildings, the following external structures are included in this action".
7	EPA Specific Comment 3	Page 21, Section 3.4.7, 2nd Paragraph, 2nd Sentence. Additional detail should be provided regarding the conditions that will determine the necessity of sampling. Reference to the appended Sampling and Analysis Plan would be an acceptable approach to resolving this issue.	Agree. Reference to the Sampling and Analysis Plan will be included in this Section. Text will also be modified to state that the need to collect samples will be determined based on the characteristics and hazards of expected contents of system or component; size of component; process knowledge regarding component shut down, etc.
8	EPA Specific Comment 4	Page 25, Section 4.5. Please clarify whether DOE envisions these additional planning documents as Secondary Documents under the Federal Facilities Agreement, and whether these documents will be included in the Administrative Record for this action.	This section discusses the Transportation Plan, Security Plan, and the Authorization Basis Documents which are internal documents necessary for management of the C-410 Complex, waste disposition, etc. Some of these documents (exceptions are the authorization basis documents) are considered Secondary Documents. Secondary documents will be placed in the Post Decision AR File, and other documents can be made

No	Source	Comment	Response
			available for regulatory agency review upon request. It should be noted that these documents evolve as the project changes.
9	EPA Specific Comment 5	Page 26, Section 4.6. Clarify whether the detailed work instructions will be included in the Administrative Record for this action.	These work instructions include very detailed, task specific work control documents, and, as such, are not planned for inclusion in the AR. Work Control Documents would be available for onsite regulatory agency review, if requested.
10	EPA Specific Comment 6	Page 27, section 5, Table 5.1. It is noted that there is no provision in the schedule for routine progress reporting on this action. It is typical and expected that Quarterly Updates and Annual Reports be provided over the duration of the action, followed by a Removal Action Report/Construction Completion Report at the completion of the action. The routine reporting would be expected to address schedule progress and general performance measures (e.g., tons of material removed and disposed by waste stream type). This is not intended to be an onerous or restrictive requirement, rather this will help fulfill DOE's obligation under CERCLA to keep the public and regulatory agencies informed about their activities	The DOE agrees that a mechanism for progress tracking is required. DOE recommends for scheduling and conducting a quarterly progress updates (alternating conference calls and meetings) with the Commonwealth of Kentucky and the Environmental Protection Agency to discuss progress and issues. Text to be modified accordingly. Additionally, a Post Construction Report, following completion of the Infrastructure Removal, will be included and added to the Schedule.
11	EPA Specific Comment 7	Pages 33 and 34, Section 7.4.4, 2nd Paragraph. Clarify whether DOE considers the C-746-U Landfill an off-site disposal facility or an onsite facility within the scope of this action (operable unit). This determination is key to defining the requisite CERCLA approval authority for the potential use of the C-746-U Landfill for disposal of CERCLA wastes. If the landfill is within the scope of the action, then a demonstration must be made that the wastes and facility are compatible with the long-term protection of human health and the environment. Otherwise, DOE should discuss gaining EPA approval for use of the C-746-U Landfill as an off-site disposal facility for CERCLA waste.	The C-746-U Landfill is considered an onsite facility. Prior to any disposal in the landfill long-term protection of human health and the environment will have to be demonstrated. The text will be modified to reflect this information.
12	EPA Specific Comment 8	It is agreed that most of the sampling decisions will be based on the professional judgment of the personnel performing the action. Further it is understood that this judgment will be based on a combination of competing factors (e.g., process knowledge, visual observations, field screening results, previous sampling results, and the anticipated disposal facility). However, the SAP should provide discussion of these factors, how they should be weighed against each other, and any minimum guidelines for the types or numbers of samples to be collected (e.g., if solid residue is present and radiological screening indicates alpha emissions greater than 5 times	Characterization will be performed to define unidentified materials and to augment the information developed through process knowledge and historic data research to quantify materials that have been identified. The need to collect samples will be determined based on the characteristics and hazards of expected contents of a system or component; size of the component; and process knowledge regarding the techniques of shutdown of individual components.

No	Source	Comment	Response
		background, a sample will be collected for analysis of isotopic uranium). Further, it is recommended that the characterization sample request form (SAP Appendix B, Attachment 5) be revised to include data fields substantiating the rationale for the type and number of samples. Particular attention should be paid to documenting wastes that are characterized solely based on process knowledge and field screening results.	
13	EPA Specific Comment 9	Page B-11, SAP, Section 10.2, 1st Paragraph, 1st Bullet. It is unclear that SW-846 provides applicable precision goals for the full range of matrices and analytes anticipated to be sampled during this action. DOE should verify the applicability of the stated data quality goals, and consider tabulating action-specific goals based on analytical method and sample matrix.	Precision will be evaluated during data assessment. Precision goals will be established for each type of analyte/matrix depending upon the characteristics of the materials to be sampled. For example, for the VOC, SVOC TCLP, and total metals analysis for solids liquids and air, precision goals as stated in SW-846 will be applied. Similar goals for asbestos analyses and radiological analyses will be established. Table 10.1 is a general illustration of the types of protocols anticipated to be applied to characterize the various types of materials that may be identified during the removal activities.
14	EPA Specific Comment 10	Page B-13, SAP, Section 11.1, 1st Paragraph, 3rd Bullet. Clarify what conditions might trigger data validation and verification.	Agree. All data receives verification prior to use. Five percent of data will receive validation.
15.	EPA Specific Comment 11	Page B-13, SAP, Section 11.2, 2nd Paragraph, 2nd Sentence. Clarify whether it is expected that this data will be posted to PEMS prior to waste disposal. If so, this would allow regulatory review and concurrence for any on-site disposal options.	DOE Plans to use process knowledge and non-destructive analyses (NDA) to the extent possible to characterize wastes. The use of NDA is consistent with comments from the Kentucky Radiation Health and Toxic Agents Branch. As such, this data may not be entered into the PEMS system. Laboratory generated analytical data will generally be posted to PEMS. However, other evaluation techniques or systems to evaluate data may also be used. Due to the quantity of waste that will be generated and associated frequency of shipments, posting of data into PEMS may not occur prior to waste disposal in every

No	Source	Comment	Response
			case.
16	EPA Specific Comment 12	Page B-18, SAP, Appendix A, Section 4, Step 1.1. Additional information regarding how items and materials will be identified for characterization should be included. Specifically, will a decision be made for each distinct waste stream (e.g.,, UO3 hoppers versus UO3 conveyors) and each matrix (e.g., solid residues versus equipment components) regarding the need for characterization sampling, and how will this decision be documented? It is recommended that a characterization plan, such as the revised Attachment 5 discussed above, be developed for each waste stream and matrix, and that these be included or summarized in the routine progress reporting and Administrative Record for this action.	Consistent with disposal facility WAC's, process equipment will be treated as radiologically contaminated metal, as opposed to managing each type of equipment as a distinct waste stream. Radiological contamination shall be quantified by NDA methodologies. RCRA/TSCA determinations for specific equipment and materials (transformers, light bulbs, mercury and some liquids) can be made by visual observations. Unidentifiable materials will be characterized on a case by case basis using standard industry practice. Characterization will be performed in accordance with the SAP. Characterization techniques to be applied to individual matrices are defined in Table 1.
17	EPA Specific Comment 13	Page C-3, WMP, Flowchart. It is assumed that the flow chart on this page is intended to be Figure 1.1 described in section 1.2. If this is the case, it is unclear how this flowchart "describes the waste generation activities" associated with this action. Please clarify.	Flowcharts were referenced incorrectly. The flowchart discussed in Section 1.2 is actually shown on page C-21.
18	EPA Specific Comment 14	Page C-21, WMP, Flowchart. Block 11 of the waste management process flowchart indicates that on-site disposal is an option for "rad contaminated waste." It is assumed that this refers to the potential CERCLA Waste Disposal facility that may be constructed at PGDP. If so, please distinguish this from the C-746-U landfill, and, if not, include the strict limitation for radiological waste associated with the C-746-U Landfill.	Flowchart will be clarified that only waste meeting the waste acceptance criteria developed in the authorized limits study will be disposed of in the C-746-U landfill. Since a CERCLA Cell is not likely to be an available disposal option, the reference to onsite disposal of radiologically contaminated material has been removed from the chart.
19	EPA Specific Comment 15	Page C-23, WMP, Section 11. Expand this discussion to acknowledge that all wastes generated during this project are CERCLA wastes, and that potential disposal facilities must comply with CERCLA requirements for disposal. Further, distinguish between and describe the on-site disposal options (i.e., the potential CERCLA Waste Disposal facility and the C-746-U Landfill), and the determination that these are on-site facilities relative to CERCLA (i.e., within the scope of the operable unit). As DOE is aware, EPA has express the need for additional documentation to allow for the disposal of CERCLA waste in either of these "on-site" disposal facilities.	Agree. Text will be modified to reflect that wastes generated as a result of this action are CERCLA Wastes, and compliance with CERCLA Requirements for disposal of such wastes is necessary. Based on expected completion date for the C-410 Removal Action, it is not likely that a CERCLA Cell will be constructed and available for waste disposal during the infrastructure removal. Therefore, the expected on-site disposal option for non-radiologically contaminated waste will be the C-746-U Landfill.

No	Source	Comment	Response
			DOE will demonstrate long-term protection of human health and the environment for any CERCLA Wastes disposed in the C-746-U Landfill via a performance assessment process.
20	EPA Specific Comment 16	Page C-27, WMP, Section 12. As noted above, additional discussion regarding CERCLA waste disposal requirements in terms of selecting on-site or off-site disposal facilities should be included. Additionally, the six waste management pathways discussed do not address classified waste nor solid waste. It is recommended that these additional pathways be included.	Solid waste and classified waste will be added to the discussion. Only solid waste (non radiological, non hazardous) will be considered for disposal at the C-746-U Landfill, as on-site facility. Offsite facilities will be selected (primarily Envirocare or NTS) based on their waste acceptance criteria for the specific waste stream, and based on economics. Other waste disposal options will be considered, if they are available. If other waste facilities are to be utilized, approval for receipt of CERCLA Generated wastes from the EPA will be required. If encountered, classified wastes will be either properly stored onsite or shipped offsite for long-term storage.
21	EPA Specific Comment 17	Page C-27, WMP, Section 12.3, 2nd Paragraph, 3rd Sentence. Clarify that in addition to meeting the WAC for on-site disposal, the waste must also meet CERCLA requirements (i.e., demonstration of long-term protectiveness to human health and the environment).	Agree.

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No	Source	Comment	Response
22	KY General Comment 1	Throughout this document there are references to the zones that will be individually addressed during the D&D Infrastructure removal process. However, this document does not contain a figure that illustrates the location of these zones. The lack of such a figure makes it difficult for the reader to visualize how this removal action has been organized and where different process equipment is located within the C-410 Complex. A figure must be added to the document that clearly indicates the locations of all zones. A table that identifies the major process systems that operated within each zones and briefly outlines the contaminants most likely to be found in each zone must accompany this figure.	Agree. A zone map is included. Additionally, DOE has developed a compact disk (CD) which provides a virtual tour of the C-410 Complex, including a base map showing each zone, multiple three dimensional photographs from each zone, and accompanying information on the specific equipment and materials handled in each zone. The CD, which includes the viewing software, was inadvertently omitted from the RAWP, but will be provided with the D2 version. This CD provides the zone map, as well as contaminant by zone information.
23	KY General Comment 2	Radiological air monitoring should be conducted at possible release points inside the Complex. For instance, if vents or other openings to the outside cannot be sealed then monitoring should be conducted near these openings. DOE should contact the Division of Air Quality to discuss the possibility of any fugitive air emissions that may occur as a result of this action. Revise the text accordingly.	Based on discussions with the Kentucky Division of Air Quality, a monitoring network will be installed in close proximity to the C-410 Complex. The Complex will be monitored in total, as opposed to specific monitors on individual vents or openings. Text change occurs in Section 3.4.5.
24	KY General Comment 3	Please provide a copy of the Integrated Safety Management System (ISMS) Process/Principles.	Agree. The ISMS Process Principles Document will be provided under separate cover.
25	KY General Comment 4	Progress reports should be submitted on a quarterly basis. Include quarterly progress reports on the project schedule.	The DOE agrees that a mechanism for progress tracking is required. DOE recommends for scheduling and conducting a quarterly updates (alternating conference calls and meetings) with the Commonwealth of Kentucky and the Environmental Protection Agency to discuss progress and issues. Text to be modified accordingly.
26	KY Specific Comment 1	Executive Summary, Page xii, 1st paragraph: DOE states here that based on current budget projections Infrastructure D&D will not be complete until 2009. Delete this statement. This schedule is in dispute, and will be addressed under the overarching Federal Facility Agreement, Site Management Plan Dispute that is currently at the SEC Level	Agree. Text removed.
27	KY Specific Comment 2	Section 3.4, Page 13, 1st paragraph: This paragraph refers to a Figure 3.3. This figure is not present within the document. Please add the figure or remove the reference.	Agree. The text is referring to the Figure on page 15. The text and figure will be corrected to identify this figure as Figure 3.1.
28	KY Specific Comment 3	Section 3.4, Page 15, Figure 3.2: This figure appears to be referred to as Figure 3.3 on Page 13 of Section 3.4. There does not appear to be a Figure 3.1. Modify the document as necessary to correct these inconsistencies.	Agree. The text is referring to the Figure on page 15. The text and figure will be corrected to identify this figure as Figure 3.1.

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No	Source	Comment	Response
29	KY Specific Comment 4	Section 5, Page 27, Table 5.1. See specific comment 1. Also, amend Table 5.1 to indicate that the RAWP was submitted in mid-July, not June 14, 2002. Delete the following schedules in Table 5.1: "Complete Removal/Containerization 2008" and "Complete Transportation/Disposal 2009". These schedules are in dispute and will be address under the overarching Federal Facility Agreement, Site Management Plan Dispute that is currently at the SEC Level.	Agree. Dates for Complete Removal/Containerization and Complete Transportation/Disposal changed to TBD, and a footnote added to Table noting the ongoing dispute.
30	KY Specific Comment 5	Section 7, Page 71, Table 7.3, Disposal of PCB Bulk-product waste in the solid waste landfill": The first bullet under the "Requirements" column states that "PCB bulk-product waste is segregated from organic liquids disposed of in the landfill." This statement should be reworded since it could be interpreted to mean that organic liquids can be disposed of in a solid waste landfill. Reword this statement.	Agree. Reworded "PCB Bulk-product waste has been segregated from organic liquids (organic liquids may not be disposed in such a landfill), and:"
31	KY Specific Comment 6	Section 11.1, Page B-13, 1st paragraph: This paragraph states that <u>some</u> of the analytical data collected during the course of this action <u>may</u> be validated. Some percentage of the analytical data must be validated. Modify the paragraph to indicate that this data will be validated and indicate the specific percentage (e. g. 10%) that will be validated.	Agree. Text will be modified to reflect that 5% of the data collected will be validated.
32	KY Specific Comment 7	Section 6.2, Page C-13, 4th paragraph: The paragraph identifies three types of random sampling that are to be employed during this action. These are simple random sampling, stratified random sampling, and systematic random sampling. However, no descriptions are given. Add a brief description to the text for each of these sampling types.	The following text has been included into the WMP. <u>Simple Random Sampling</u> In simple random sampling, each unit in the population (e.g., a container or an element of a grid) has an equal chance of being sampled. Simple random sampling is the default random sampling strategy when there is little information about contaminant distribution and a rationale for an alternate strategy does not exist. To randomly select units within the population, each unit is sequentially numbered and a random number generator (for example, calculator program) or random number table is used to select the units to be sampled. Simple random sampling is the basic approach adopted for waste generated by the C-410 removal operations. <u>Stratified Random Sampling</u>

No	Source	Comment	Response
			Stratified random sampling is used when there is information that suggests that the population can be divided into two or more strata that are similar in composition. Examples of information that may be used to identify strata within a population include: • physical characteristics such as distinct phases or color patterns • existing analytical data that indicate stratification • identification of distinct batches or lots • dates of generation Stratified random sampling is employed when there is evidence of strata that may have different contaminant distributions. For example, a representative sample is collected from each phase in a container that exhibits multiple phases. Systematic Random Sampling Systematic random sampling involves randomly selecting the first unit from a population to be sampled and selecting subsequent units at fixed time or space intervals. This approach ensures that samples are distributed evenly across the population and simplifies the process of selecting units to be sampled. Systematic random sampling can return inaccurate and/or imprecise data when unrecognized trends or cycles exist in the population; therefore, this type of sampling is not used for populations in which such variability may exist.
33	Kentucky Radiation Health and Toxic Agents Branch (KY RHTAB)	Appendix B, Page B-3, Section 4, "Analytical Laboratory Contracting, General comment. The USDOE must explain why fissionable material is present in the C-410 Building when evaluation of C-410 processes indicates that is should not be present. Furthermore, the USDOE must identify via waste manifests, screening, and/or historical information what material is potentially fissionable. A blanket assumption that all	Agree that the C-410 Operations should not result in presence of potentially fissile materials is correct. However, following the cessation of uranium hexafluoride production in the C-410 Complex, the facility was used for storage and staging area for process equipment from the Paducah Plant, and in some cases, process equipment from other facilities.

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No	Source	Comment	Response
	Comment 1	material in the facility is potentially fissionable will result in unnecessary radiological analyses and will grossly increase radiological laboratory costs.	Some of this equipment came from areas where fissionable materials were present. During the initial investigation activities at C-410, personnel knowledgeable of Paducah Diffusion Plant Operations and equipment inspected items in the C-410 Complex. Items were identified that originated from locations in the facility that had potential to come in contact with potentially fissile uranium. These items were further evaluated for NCS Concerns via visual inspections, swipe sampling, and if necessary, mass measurements using non-destructive assay techniques. Items that were a part of the C-410 process, or items which have not been exposed to potentially fissionable materials are considered NCS Exempt, and will not require further characterization for NCS Safety reasons. Screening items in this manner reduces items considered potentially fissile to minimize analytical costs. A total of 9 potentially fissionable items have been identified in C-410 to date. These items have been relocated to an appropriate storage area, and will be dipositioned as a part of the removal action. The text describing NCS Sampling is included in the event additional items are discovered that came from other facilities. Since the mid-1990's, activities within the building have been restricted due to worker health and safety concerns associated with airborne contaminants and the deteriorated condition of the structure. The Safety Authorization Basis (SAB) establishes the controls for safe operations in the C-410 Complex. However, the existing SAB does not completely evaluate the potential for the hold up of small quantities of transuranic materials (such as plutonium, neptunium, and americium) in process piping or equipment that handled recycled uranium. These materials may exist in sufficient quantities to necessitate changing the hazard

No	Source	Comment	Response
			categorization of the C-410 Complex from a "radiological facility" to a "Category 2" or "Category 3 Nuclear Facility". This change will result in requirements for preparation of a new authorization basis document, called a Basis for Interim Operation (BIO) for analyzing potential hazards and establishing hazard controls for disassembly and management of process piping and equipment. The BIO will be 10 Code of Federal Regulations (CFR) 830 compliant and meets the requirements of DOE-STD-3011-94. Completion and DOE approval of this SAB documentation is scheduled for early calendar year 2003; however, work will be sequenced to remove non-uranium containing equipment and piping while completing the new SAB.
34	KY RHTAB Comment 2	Appendix B, Page B-3, Section 4, "Analytical Laboratory Contracting", General Comment. Non-Destructive Analyses (NDA) should be utilized to identify materials that will required an NCS determination. NDA should also be utilized to screen, identify, and characterize potentially radioactive material in the C-410 Complex. Utilization of NDA will provide the USDOE with a thorough radioactive characterization and will significantly reduce analytical costs.	Agree. NDA will be utilized as a part of NCS Characterizations, if further NCS Characterization is required. NDA will also be utilized for radiological and waste characterization as a part of the C-410 Removal Action.
35	KY RHTAB Comment 3	Appendix B, Page B-7, Section 7, "Data Quality Indicators", General Comment. Measurement Quality Objectives (MQOs) for the various types of samples that are being collected and analyzed for this project should be clearly identified in the document.	This comment has been discussed with the regulatory agencies, and based on these discussions, existing text regarding Data Quality Objectives addresses this issue. No further clarification is required.
36	KY RHTAB Comment 4	Appendix B, Page B-13, Section 11, "Data Review and Use", General Comment. The USDOE should indicate in the text that data validation must be an integral part of any data processing plan. Additionally, the USDOE should state in the text that the data must be verified and validated prior to entry into a database.	Agree that data validation plays an important part in a data management plan. However, do not agree that all data must be validated prior to entry into a database. Please see response to Commonwealth of Kentucky Comment 6.

TABLE 1
WASTE STREAMS/SAMPLE MATRIX

WASTE STREAM	RCRA/TSCA	RADIOLOGICAL
PIPING	PK	NDA,SMEARS
EQUIPMENT	PK	NDA,SMEARS
PPE	LAB, PK	NDA,
RAW MATERIALS	LAB, PK	
PRODUCT	LAB, PK	
TRANSITE	LAB, PK	NDA, SMEARS
CONCRETE DEBRIS	LAB, PK	NDA, SMEARS