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Phased Construction Completion Report for Bldg. K-1401 of the Remaining Facilities Demolition Project at the East Tennessee Technology Park Oak Ridge, Tennessee

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Phased Construction Completion Report for Bldg. K-1401 of the Remaining Facilities Demolition Project at the East Tennessee Technology Park Oak Ridge, Tennessee

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

BECHTEL JACOBS COMPANY LLC
managing the
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East Tennessee Technology Park
Y-12 National Security Complex Oak Ridge National Laboratory
under contract DE-AC05-98OR22700
for the
U.S. DEPARTMENT OF ENERGY

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CONTENTS

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FIGURES

TABLES

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ACRONYMS

CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EMWMF	Environmental Management Waste Management Facility
ETTP	East Tennessee Technology Park
WHP	Waste Handling Plan

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EXECUTIVE SUMMARY

This Phased Construction Completion Report documents the demolition of Bldg. K-1401, Maintenance Building, addressed in the *Action Memorandum for the Remaining Facilities Demolition Project at East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2003a) as a Comprehensive Environmental Response, Compensation, and Liability Act of 1980 non-time-critical removal action. The objectives of the removal action (DOE 2003a) — to eliminate the source of potential contamination, to eliminate the threat of potential future releases, and/or to eliminate the threats to the general public and the environment — were met.

The end state of this action is for the slab to remain with all penetrations sealed and grouted or backfilled. The basement and pits remain open. There is residual radiological and polychlorinated biphenyl contamination on the slab and basement. A fixative was applied to the area on the pad contaminated with polychlorinated biphenyls. Interim land-use controls will be maintained until final remediation decisions are made under the Zone 2 Record of Decision (DOE 2005a).

Demolition of Bldg. K-1401 was completed for $26,820, 000.

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1. INTRODUCTION

This Phased Construction Completion Report documents the demolition of Bldg. K-1401, Maintenance Building, addressed in the *Action Memorandum for the Remaining Facilities Demolition Project at East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2003a) as a Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (DOE 2003b) non-time-critical removal action. The purposes of this Phased Construction Completion Report are to:

- Describe the demolition activities completed.
- Document the post-demolition conditions.

The documents that govern this action are the Engineering Evaluation/Cost Analysis (DOE 2000); Action Memorandum (DOE 2003a); Standard Operating Protocol (DOE 2003c); Waste Handling Plan (WHP), Part 1 (DOE 2003d); and Waste Handling Plan, Part 2 (DOE 2005b; DOE 2005c).

The scope of this action, as required by the Action Memorandum (DOE 2003a), is to demolish Bldg. K-1401 and dispose of the demolition waste.

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2. SITE AND FACILITY DESCRIPTION

2.1 SITE DESCRIPTION

The East Tennessee Technology Park (ETTP), (formerly known as the Oak Ridge Gaseous Diffusion Plant and the K-25 Site), began operations in World War II as part of the Manhattan Project. The original mission was to produce enriched uranium for use in atomic weapons. The plant produced enriched uranium for the commercial nuclear power industry from 1945 to 1985. Uranium production at ETTP was terminated in 1987. The site is managed by the U.S. Department of Energy (DOE).

The primary contaminants of concern at ETTP follow:

- In groundwater—volatile organic compounds (trichloroethene is generally the most prevalent compound)
- In sediments—inorganic elements, radionuclides, and polychlorinated biphenyls
- In soils—inorganic elements, radionuclides, semivolatile organic compounds, particularly the polycyclic aromatic hydrocarbons, and volatile organic compounds
- In facilities—radionuclides and polychlorinated biphenyls (abandoned facilities also pose a safety hazard to workers.)

2.2 FACILITY HISTORY

Bldg. K-1401, Maintenance Building, was constructed in the early 1940s as a maintenance facility supporting the gaseous diffusion process. Pieces of process equipment, such as motors, converters, and compressors, were brought into the facility to be cleaned or repaired. Since most of this equipment came from process areas, various amounts and types of radiological contamination were present, thus contaminating the equipment and surfaces of Bldg. K-1401. Radiological contamination in the building consisted primarily of uranium isotopes and ^{99}Technetium. After shutdown of the uranium enrichment process, Bldg. K-1401 continued to support other activities at ETTP. Areas of the building that were not being used to support other activities at ETTP were utilized for the storage of radiologically contaminated and suspected radiologically contaminated equipment and material. Subsequently, the majority of the space in Bldg. K-1401 was leased and occupied by private companies under the management of the Community Reuse Organization of East Tennessee (BJC 2004).

2.3 FACILITY DESCRIPTION

Figure 1 schematically depicts the general location of Bldg. K-1401. A floor plan is in Fig. 2, and a discussion of the main areas of the building follows.

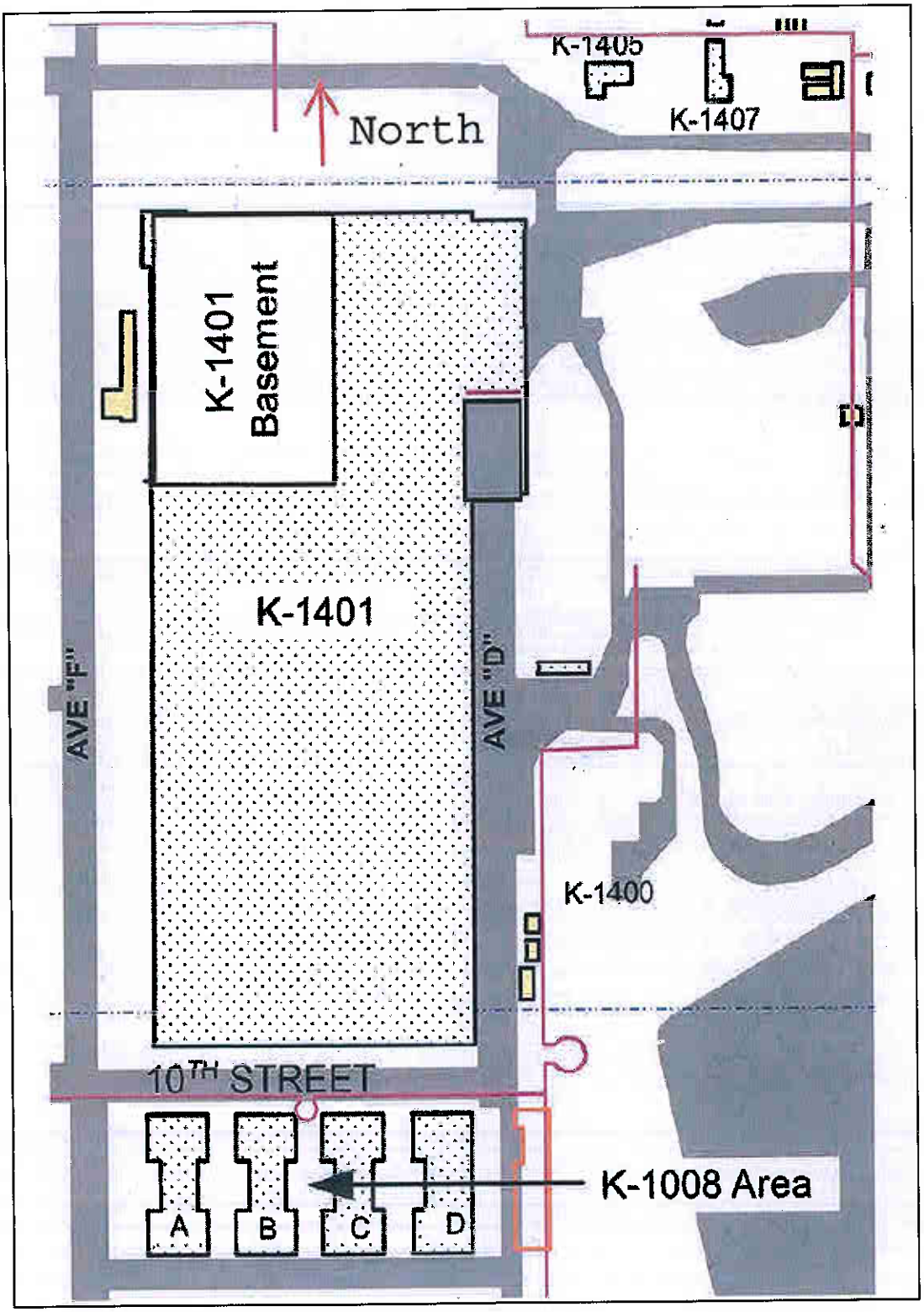

Fig. 1. Location of Bldg. K-1401.

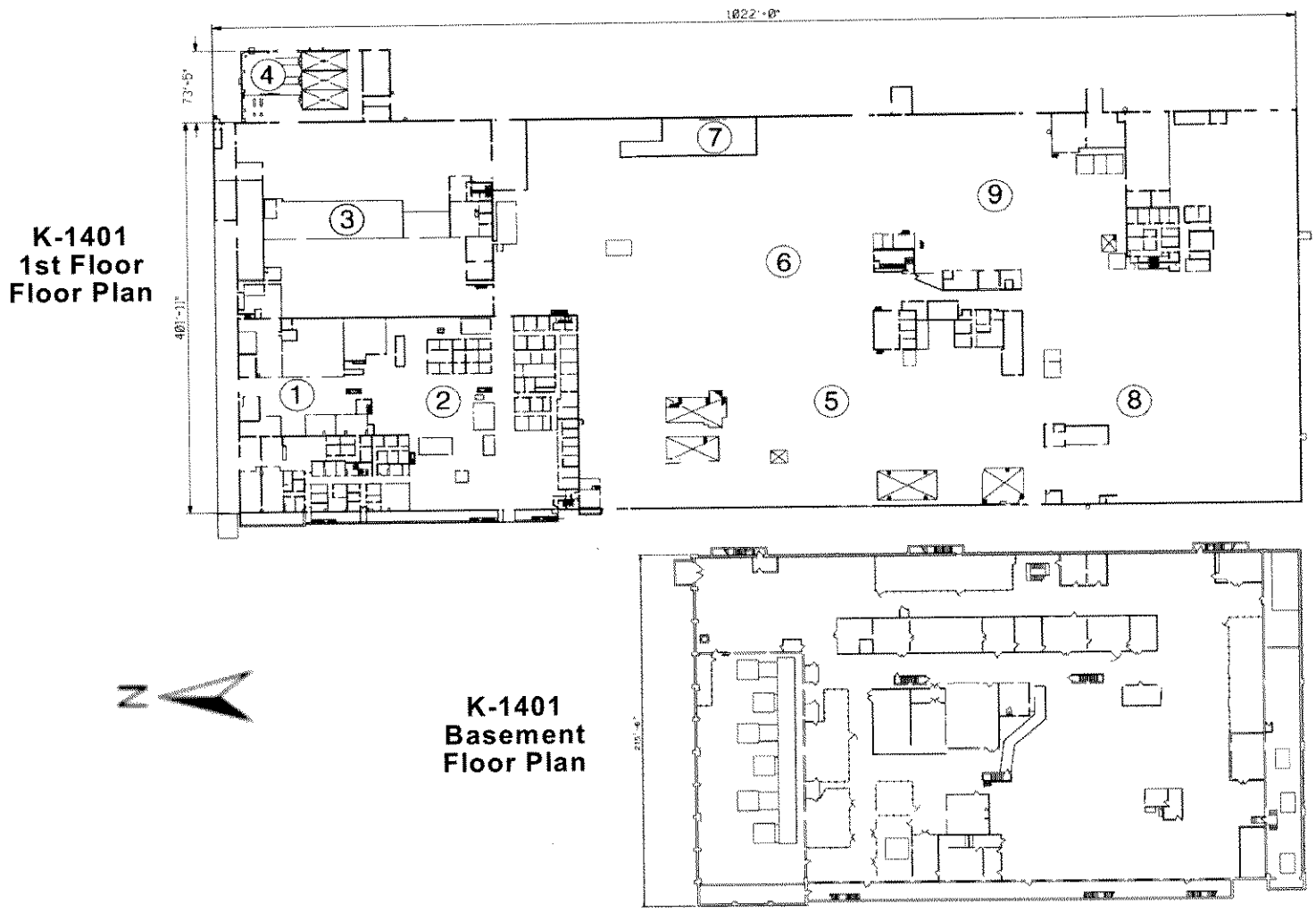

Fig. 2. Floor plan of Bldg. K-1401.

Bldg. K-1401 was primarily a single-story, high-bay structure on a concrete slab. Fig. 2 presents the floor plan of Bldg. K-1401. The building had a steel frame, and the exterior walls were constructed with brick and corrugated asbestos-cement (transite) siding. The roof was tar and gravel (BJC 2004). Bldg. K-1401 was rectangular measuring about 400 ft. x 1000 ft. x 32 ft. tall. There was a basement measuring approximately 200 ft. x 340 ft. in the northwest corner of the building. An addition to the building measuring approximately 73 ft. x 113 ft. x 17 ft. tall was located on the northeast corner of the building.

A summary of past activities is given below by facility area:

- **Area 1**. This area contained offices, laboratories, and test areas. The laboratory area was used for the development and testing of instrumentation systems used in the cascades. In the 1940s and 1950s, a 20-stage gaseous diffusion pilot plant was located where Rooms 255 and E4 were located. It was removed in the late 1950s. The development and testing laboratories were mostly abandoned and were used to store abandoned equipment and materials. Room 255 was a stress-testing laboratory.

- **Area 2.** In the 1970s, converters from Bldg. K-27 were treated in the stands with fluorine before being sent to the gaseous diffusion plant in Paducah, Kentucky. Room E4 in the northeast corner of Area 2, which was built in the 1970s, contained the Seal Laboratory and compressor test stands. Four idle furnace stands were located in the southwest section of the area and were enclosed by drywall structures.

- **Area 3**. Area 3 was composed of three large high-bay areas separated by two walls running north and south. The west two areas were the Jig and Fixture Shops. These rooms contained drill presses, lathes, and milling machines. Much of the equipment was hydraulic in nature and contained lubricating oils. There was evidence on the floors that incidental spills occurred. Each room had an overhead crane that traversed the length of the room. There were offices in several locations.

  The east portion of Area 3 was used in conjunction with Area 4 to install, test, and assemble barrier tube bundles in the process converters. This operation lasted from the 1940s into the 1980s, and large quantities of fluorine were used in the process.

  A cinder block room was constructed in the northeast corner of Area 3 for the temporary storage of pesticides that were moved from Bldg. K-1407 in 1989. The pesticides were stored in this room for 2 ½ years until a permanent storage room was constructed.

  All equipment was removed from the east room of Area 3. This room had numerous areas of contamination on the floor, and several attempts were made to remove it, with little success.

- **Area 4**. Area 4 contained three large walk-in furnaces used to treat converters, prepared in Area 3. Prior to demolition, the area to the north of the furnaces in Area 4 had been decontaminated, and the large, metal heat-treating oven had been removed. Three large tanks located in a room to the south of the furnaces contained potassium hydroxide. The potassium hydroxide tanks associated with the furnaces in Area 4 were in place, but empty.

- **Area 5.** This area was a large, open high bay divided into areas for fabrication and maintenance of various types of equipment. It contained machine shop-type equipment, such as drill presses, lathes, and milling machines, as well as areas for cleaning, repairing, and assembling equipment. As equipment became idle in the 1990s, the area began to collect abandoned equipment and material and was posted as a radiological contamination area. In 1997–98, the equipment and material in this area were removed, and the floor and walls (up to 8 ft.) of the area were decontaminated. Areas 5 and 6 received most of the attention during the 1998 project to decontaminate portions of the floor space of Bldg. K-1401. The abandoned equipment and materials were removed. Several pits in the area were associated with some of the previous larger equipment.

- **Area 6.** The northern section of this area was the pump shop. It was used to repair and/or rebuild the pumps used in the uranium enrichment process. When the gaseous diffusion process was shut down in 1985, the area began to collect abandoned contaminated and potentially contaminated equipment and material. The northern section of Area 6 was posted as a radiologically contaminated area until 1998. In 1997–98, the equipment and material in this area were removed, and the area was decontaminated as described in Area 5.

  In the southwest corner of Area 6 were a two-story office and break area and the Quality Control Test Facility. The test facility was used for industrial radiography by X-ray, hydrostatic testing, load testing of slings, checking pressure relief valves and gas pressure regulators, and volumetric testing and recertification of gas cylinders. The test facility was shut down due to extensive radiological contamination. In 1993, operations resumed after decontamination of the area was completed.

  All the equipment and abandoned materials that were in the northern section of this area were removed prior to demolition, and the area was decontaminated.

- **Area 7.** Area 7 contained the Blakeslee degreasers and acid baths that were used, beginning in 1944, for degreasing and cleaning operations for various-sized and -shaped parts associated with the uranium enrichment process. Acids, alkalis, detergents, and organic vapor degreasers were used in this process. The cleaning facility was expanded and modified in the early 1970s to accommodate the cascade improvement and cascade upgrade program. Trichloroethylene was the common degreaser from the 1940s through the 1960s but was replaced by trichloroethane in the 1970s. The degreasers are metal tanks that sit in pits in the building's foundation. There was an annular space of 18 inches to 2 feet between the tanks and the foundation. Three tanks were used to remove oil and grease contamination from process piping, motors, and other equipment. The acid baths were used to remove rust and scale from process piping and for pickling of nickel and monel piping and parts. Hydrochloric acid and trichloroethane used in the degreasers and baths were stored in tanks across Avenue "D" on the east side of the building. The degreasers were closed under the technical requirements of Resource Conservation and Recovery Act once operations ceased in 1991.

  Residual mercury contamination was present in the pits outside the tanks due to the cleaning of material from mercury recovery operations in Bldg. K-1420. The only identified releases from this area were through the K-1401 Acid Lines.

  Dip tanks were once located in an addition on the northeast corner of the building. These tanks contained trichloroethane, hydrochloric acid, and other solvents used for equipment cleaning and degreasing operations.

- **Area 8.** This area was the motor shop, where electric motors from the process buildings were repaired. There were two walk-in ovens, a spray booth, and hydraulic equipment for refurbishing the motors. The ovens and spray booth had possible internal radiological contamination. In the 1990s, the area was converted to the Hoisting and Lifting Mobile Equipment Training Facility. The ovens were removed in the late 1990s. There were three offices in the northern portion of this area.

- **Area 9.** The northern section of Area 9 housed weld shops during the operation of the uranium enrichment process, an oil storage room, and the Cordex™ Room.[1] The southern section contained the sheet metal shop, a carpenter shop, a janitorial storage, a pesticide storage room, a weld shop, and offices. The Cordex™ Room was divided into three rooms and contained dimensional inspection equipment, weld rod storage, and the breathing air compressor. The oil storage room contained 83 55-gallon drums of various oils used for lubricating the equipment and machinery throughout the building. There was a fenced area (20 × 20 ft.) that contained a covered pit with a piece of equipment that was posted as containing internal radioactive contamination. The janitorial storage area contained numerous cleaning supplies and the pesticide storage room. A battery-charging station was also located in this area.

- **Loading dock.** On the north of Bldg. K-1401 was a loading dock. The dock had an overhead gantry crane that spanned the dock and a railroad siding that served the dock.

- **Basement.** There was stairway access to the basement area in the northwest corner of the first floor. The basement area of Bldg. K-1401 was located under Areas 1 and 2. It was in use from 1944 to 1987. Process equipment in this area originally supported the converter conditioning stands on the first floor of the building. Fluorine for the test and treatment facilities in Area 2 was piped from Bldg. K-1302 (Fluorine Storage Facility) through the basement. Most of the basement area originally contained process equipment and piping. Some of the process piping was removed in calendar year 2000. Canals were below the basement floor slab to distribute ventilation air throughout the basement. Ventilation fans for each of the five canals continuously blew air over the standing groundwater in the canals and discharged that air into the basement.

- The ventilation system for circulating air to the main floor of Bldg. K-1401 was constructed of transite material. This transite ductwork connected to the large ventilation fans through metal ductwork that had polychlorinated biphenyl gaskets. Numerous pieces of equipment in Bldg. K-1401 had the potential to contain oils with polychlorinated biphenyl contamination. Freon® was located in air-conditioning units throughout the basement. Chemicals and materials located in the basement are potentially radioactively contaminated.

- **Roof.** A radiological survey and characterization for hazardous materials on the northern section of the roof of Bldg. K-1401 was conducted in 1996. The core sample that was collected to support characterization of hazardous materials was comprised of multiple layers, including a base sheet, two layers of insulation (perlite/cellulose layer and a foam sheathing layer), felt, and asphalt/pitch. The radiological survey determined that radioactive material contaminated above DOE Order 5400.5 (DOE 1993) limits was present on the following roof components: penthouse, an 8 × 10-ft. roof area, vent pipe cover, air intake unit (louver), and ventilator stack.

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[1] Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

- **Drain Lines.** The Bldg. K-1401 Acid Line runs underground along the east side of Bldg. K-1401 and was used to transfer corrosive solutions from Bldg. K-1401 to the Bldg. K-1407-A Neutralization Facility. The line was taken out of service in 1987. Waste streams that were transported through this line include degreaser solvents, caustics, and acids used to clean equipment contaminated with uranium hexafluoride.

- **Vent Lines.** The vent line originating at Bldg. K-1401 extended from the north side of the building to the railroad tracks. The line was constructed of 3-, 4-, and 6-in.-diameter pipe and was suspended 20–30 ft. above the ground. The line was used to transport exhaust gases from Bldg. K-1401 to the K-1300 Stack.

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3. PROJECT DESCRIPTION

The objectives of the overall removal action (DOE 2003a) are to demolish the facilities in order to eliminate the:

- Source of potential contamination.
- Threat of potential future releases.
- Threats to the general public and the environment.

The applicable or relevant and appropriate requirements are contained in the Action Memorandum (DOE 2003a) and Standard Operating Protocol (DOE 2003c).

The scope of the overall removal action, as required by the Action Memorandum (DOE 2003a), includes:

- Characterization of facilities and debris, as required for waste segregation and worker safety.
- Abatement of asbestos and hazardous materials.
- Removal of equipment.
- Demolition of above-grade structures to the concrete slab (remediation of slabs, basements, and underlying soil is the responsibility of the ETTP Remedial Actions Project consistent with the ETTP Zone 1 [DOE 2002], Zone 2 [DOE 2005a], and future Sitewide Records of Decision).
- Control of any residual contamination on concrete slabs, basements, or soil surfaces that will be exposed after completion of demolition actions.
- Disposal of wastes generated from the demolition activities.

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4. DEMOLITION ACTIVITIES

Below is a summary of the demolition activities, the attainment of project objectives, unexpected occurrences, end state, and deviations from governing documents.

4.1 DEMOLITION ACTIVITIES

Bldg. K-1401 (Fig. 3) was demolished as follows:

- Completed pre-WHP (DOE 2005b; DOE 2005c) activities in the basement:
  - DOE requested and received approval from the Environmental Protection Agency and Tennessee Department of Environment and Conservation to perform specific work in the basement prior to the approval of the WHP. The basement was a storage area and was classified as a Contamination Area with several High Contamination Areas. Materials that were left in the basement were packaged in appropriate containers to be shipped upon approval of the WHP. Remaining unpackaged material was relocated in the basement to allow access to clean out the process lines and for asbestos abatement. The process lines were purged and steam cleaned to remove hazardous material. Class 1 asbestos removal was conducted to support the process line clean out. The asbestos material was stored in Bldg. K-1401 until approval of the WHP. Equipment in the basement was removed prior to demolition of the basement.
  - The building slab was posted a Contamination Area.
  - Anomalous material generated from the demolition of Predominately Uncontaminated or Low-Risk Low Complexity facilities being stored in Bldg. K-1401 was appropriately characterized and disposed before demolition of Bldg. K-1401.

Fig. 3. Bldg. K-1401.

- The sump pumps in the basement were operated until no longer required to support demolition.
- The utilities connected to Bldg. K-1401 were deactivated.
- Universal waste was radiologically surveyed for release from the Contamination Area and disposed at a commercial facility.
- Liquids and oils were drained/removed and disposed as follows:
  - Liquid waste pumped from the basement during demolition initially was sent for treatment and disposal at the ETTP Central Neutralization Facility, followed by treatment at the K-1401-A treatment facility and disposal to the sanitary sewer.
  - Oils were sent for treatment and disposal at the ETTP Toxic Substances Control Act incinerator.
- Hazardous wastes were removed for treatment and disposal by an off-site vendor.
- Selected equipment and materials from the first floor and basement were staged and disposed at the Environmental Management Waste Management Facility (EMWMF) and Y-12 Landfill.
- Areas of high radiological contamination, and with waste regulated by the Resource Conservation and Recovery Act, were staged and disposed at EnergySolutions.
- Equipment and piping in the basement with high 99Technetium contamination were size reduced and placed in ST-90 containers for shipment to EnergySolutions. This equipment and piping were removed prior to demolition of the building.
- Asbestos was removed, double-wrapped, and shipped to EMWMF.
- The remaining building structure and its contents were demolished and disposed at EMWMF (Fig. 4).
  - Loose contamination remaining inside the facility was sprayed with a fixative prior to demolition.
  - Equipment with loose contamination that could not be demolished with the facility was removed from the facility, wrapped, and disposed at EMWMF and EnergySolutions.
  - The facility was demolished and size-reduced with mechanical equipment. The floor over the basement was collapsed into the basement. Any debris in the basement from the demolition of the first floor slab was removed and disposed with the balance of the Bldg. K-1401 waste. All debris was loaded into dump trucks and hauled to EMWMF for disposal.

Fig. 4. Bldg. K-1401 during demolition.

4.2 ATTAINMENT OF OBJECTIVES

The objectives of this action (DOE 2003a) were met as shown below:

- Demolished facilities reduce the threat of release of hazardous substances from the deteriorating structures, remove potential hazards to on-site personnel from contaminated above-slab structures, and reduce the potential hazards of residual contamination from the slab.
- Survey results were documented and provided to the ETTP Remedial Action Project for further evaluation for the remaining slab.
- The National Historic Preservation Act, Sect. 106, process was followed, resulting in a Memorandum of Agreement to demolish the facilities.
- Aquatic resources were protected by implementing best management practices of installing hay bales around storm drains and runoff areas to control water flow through the demolition areas.
- Ambient air monitoring was conducted during the demolition process to ensure no release of particulates and radiological contaminants and the protection of workers removing asbestos.
- Radiological perimeter surveys were performed before and after demolition to ensure contaminant migration did not occur.
- Amended water solutions were used during the asbestos abatement process to prevent release of airborne particulates.
- Wastes were properly disposed.
- The radiological controls in place and implemented during demolition indicate that contamination did not migrate from the control areas at levels that created new or elevated contamination zones surrounding the building.

4.3 UNEXPECTED OCCURRENCE

During demolition of Bldg. K-1401, the following unexpected occurrence took place. On the afternoon of August 7, 2007, the project team discovered that a section of process gas vent pipe pre-identified not to be included in EMWMF waste profile for Waste Lot 14.14 (Bldg. K-1401 demolition waste) was not located with other such pre-identified waste. At the time of discovery, the project was downsizing process pipe waste and packaging it in ST-90 boxes for shipment off-site to a commercial disposal facility. The project immediately suspended shipments of waste to EMWMF and began searching for the section of pipe. This search uncovered a 12 ft. section of the pipe. The next morning, the project initiated an investigation to evaluate the loss of control of the waste and intensified the search of all debris piles at the Bldg. K-1401 site. On August 17, 2007, an additional 20 ft. section of the pipe was found.

The pipe in question was the chloride tri-fluorine process gas vent pipe that came out of the west basement wall, ran up the west side of the building, and vented to the atmosphere at the top of the building above the roof line. The pipe was approximately 65 ft. in length, 4 in. in diameter, made of copper, and painted green and beige to match the exterior of the building. This paint scheme made this pipe very difficult to recognize, as it blended in with the other structural building debris.

The two sections (12 ft. and 20 ft.) of the pipe that were found were segregated and placed in ST-90 boxes for shipment off-site to a commercial disposal facility. The remaining 33 ft. of pipe were disposed at the EMWMF. The pipe was characterized for disposal under an approved waste profile for Energy*Solutions* using coupon samples from pipe inside the basement. The pipe was not contaminated with Resource Conservation and Recovery Act hazardous waste or polychlorinated biphenyl waste. It was contaminated with ^{99}Technetium, with an upper confidence level 95% concentration of ~30,000 pCi/g. The sum of fractions for the pipe was 110, and the effect on the volumetric sum of fractions for the EMWMF is negligible (a 10^{-4} effect). The pipe meets the administrative and physical waste acceptance criteria for the EMWMF and has no impact for future disposal of waste at the EMWMF.

On August 20, 2007, a management assessment of the Bldg. K-1401 demolition project approved the resumption of shipments to EMWMF. Shipments were resumed on August 21, 2007.

Three coupon samples from the recovered portion of the vent pipe were collected on October 1, 2007 for use in characterizing the portion of that pipe that was disposed in the EMWMF. Results from the analyses performed on the coupon samples confirmed that the pipe was copper and was not a hazardous waste. The ^{99}Technetium results were also very close to the values used to characterize the pipe for Energy*Solutions* disposal (15,300 pCi/g, 11,100 pCi/g, and 21,800 pCi/g). These results yield a slightly lower sum of fractions (approximately 102) and confirm a negligible effect on the volumetric sum of fractions for the EMWMF.

4.4 END STATE

The concrete slab (Fig. 5), basement (Fig. 6), and pits (Fig. 7 and 8) remain. Plans are for the basement and pits to be backfilled and the slab to be removed by the end of Fiscal Year 2008. The basement, pits, and a small portion of the slab are posted as a radiological Contamination Area. The remaining portion of the slab is posted as a Fixed Contamination Area (Fig. 9). Some areas were surveyed and released as clean when the residual radiological contamination was below the release limits of DOE Order 5400.5 (DOE 1993). Table 1 contains a summary of the results of the basement radiological survey, and Table 2 contains a summary of the slab survey. The survey results for the pits indicate no remedial action is necessary as part of the Zone 2 Record of Decision (DOE 2005a).

The basement floor and slab are contaminated with polychlorinated biphenyls. The concentration in the basement is below the cleanup levels defined in the Zone 2 Record of Decision (DOE 2005a), and a fixative was applied to the contaminated location (Fig. 10) on the pad. This characterization information was provided to the Remedial Action Program. Interim land-use controls have been implemented (see Sect. 9) until final remediation decisions are made under the Zone 2 Record of Decision (DOE 2005a).

Based on the surveys performed and the remaining postings for the slab, annual radiological surveys will be performed until remediation activities take place.

Fig. 5. Bldg. K-1401 slab.

Fig. 6. Bldg. K-1401 basement.

Fig. 7. Bldg. K-1401 typical pit.

Fig. 8. Bldg. K-1401 typical pit.

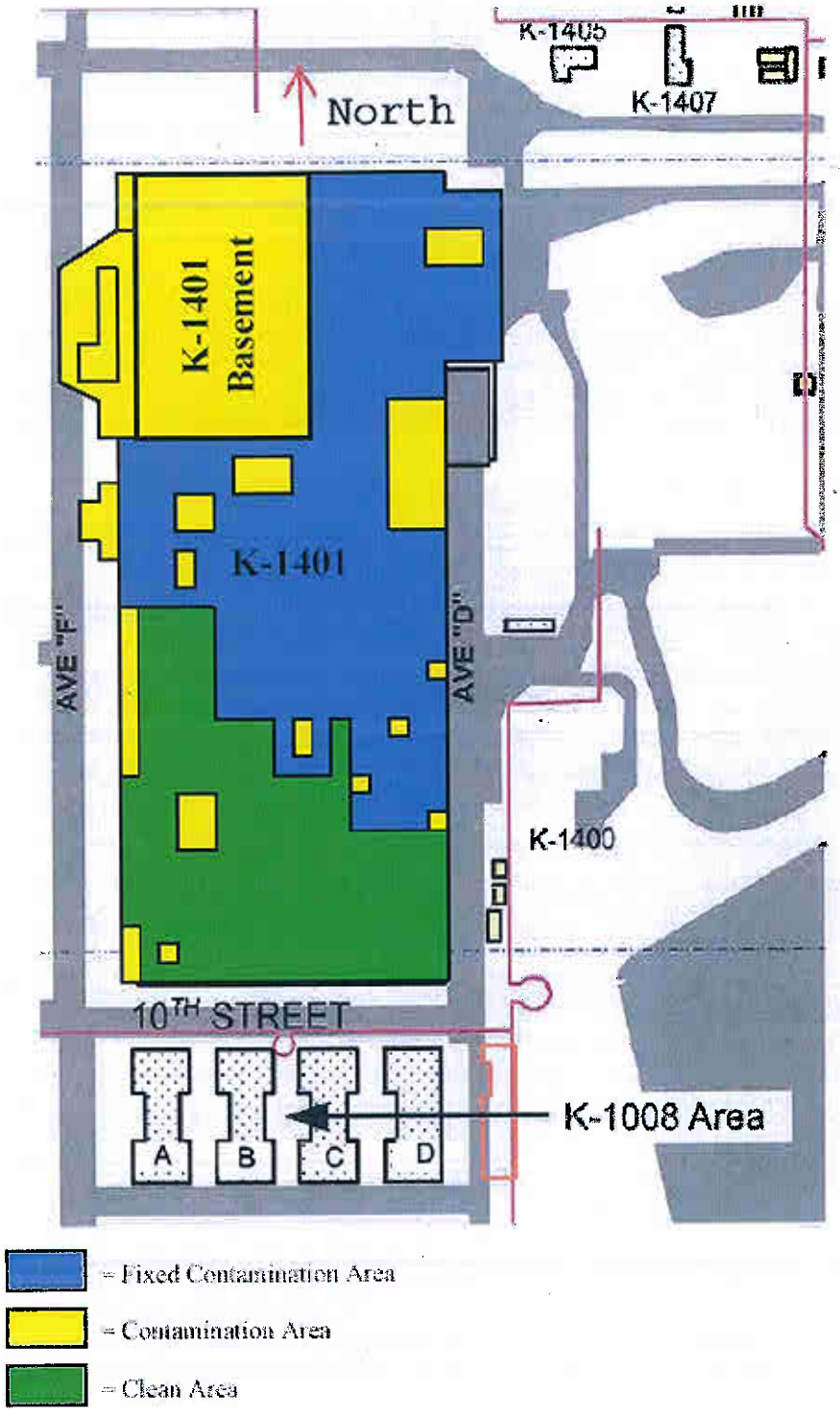

Fig. 9. Radiological sample results on the slab.

Table 1. Radiological survey results in basement.

Date	Survey #	Location	**Alpha smear** Frequency low / high	**Beta smear** Frequency low / high	**Alpha total** Frequency low / high	**Beta total** Frequency low / high
5/7/2007	07-AreaA-0502	Basement, East Wall, column line F	0 / 27 <L_c	0 / 27 <L_c	5 / 27 33 / 85	3 / 27 519 / 2661
5/30/2007	07-AreaA-0586	Basement, South Wall	0 / 12 <L_c	2 / 12 264 / 352	4 / 12 18 / 43	9 / 12 225 / 1435
5/2/2007	07-AreaA-0484	Basement, North Fan room	1 / 74 73	1 / 74 655	30 / 73 24 / 125	12 / 73 455 / 5210
5/7/2007	07-AreaA-0501	Basement, southeast corner	0 / 12 <L_c	1 / 12 277	3 / 12 27 / 63	11 / 12 277 / 1164
5/9/2007	07-AreaA-0511	Basement, west wall	3 / 24 27 / 96	4 / 24 619 / 6633	8 / 24 46 / 211	10 / 24 1094 / 94355
5/9/2007	07-AreaA-0512	Basement, northwest corner	3 / 26 18 / 225	3 / 26 450 / 21490	10 / 26 18 / 354	26 / 26 380 / 70470
5/10/2007	07-AreaA-0525	Basement, northwest end	0 / 16 <L_c	0 / 16 <L_c	9 / 16 18 / 82	15 / 16 275 / 35305
5/11/2007	07-AreaA-0523	Basement, west side	14 / 40 17 / 101	19 / 40 667 / 11481	32 / 40 17 / 2292	40 / 40 896 / 268177
5/15/2007	07-AreaA-0533	Basement, center area	61 / 62 9 / 612	37 / 62 862 / 44812	61 / 62 8 / 5671	62 / 62 1486 / 5729340
5/16/2007	07-AreaA-0542	Basement, northeast end	4 / 50 17 / 300	7 / 50 597 / 5138	21 / 50 17 / 740	37 / 50 628 / 197874
5/17/2007	07-AreaA-0539	Basement, east area	8 / 35 12 / 41	0 / 35 <L_c	25 / 35 5 / 323	28 / 35 270 / 57412
5/18/2007	07-AreaA-0550	Basement, center area	6 / 34 14 / 243	5 / 34 366 / 13824	16 / 34 15 / 605	34 / 34 305 / 34072
5/23/2007	07-AreaA-0568	Basement, southwest area	9 / 24 26 / 288	22 / 24 262 / 2409	22 / 24 37 / 1333	24 / 24 635 / 32921
5/30/2007	07-AreaA-0580	Basement, HCA areas	32 / 33 15 / 2877	33 / 33 670 / 19856	33 / 33 8 / 11739	33 / 33 7660 / 1895890

<Lc = less than the instrument detection level
Frequency = number of measurements performed resulting in determinations exceeding Lc
Low/High = lowest positive result/highest positive result for the survey
FCA = fixed contamination area
CA = contamination area
*The low/high activity is reported in this table in dpm/100 square centimeters.

Table 2. Radiological survey results on slab

Date	Survey #	Location	Slab Status	**Alpha smear** Frequency low / high	**Beta smear** Frequency low / high	**Alpha total** Frequency low / high	**Beta total** Frequency low / high
12/8/2006	200612081DUDESK002	Slab, south end middle section	< 5400.5	N/A	N/A	11 / 80 26 / 40	74 / 80 372 / 1008
2/20/2007	20070220UDDESK002	Slab, south end	FCA	0 / 34 <L_c	0 / 34 <L_c	N/A	N/A
2/27/2007	20070228HG2DESK001	Slab, south end	FCA	0 / 49 <L_c	0 / 49 <L_c	N/A	N/A
3/12/2007	200703124GSDESK001	Slab, south end	< 5400.5	N/A	N/A	0 / 50 <L_c	3 / 50 282 / 290
10/24/2007	07-AreaA-0953	Slab, northwest corner	< 5400.5	0 / 10 <L_c	0 / 10 <L_c	0 / 55 <L_c	0 / 55 <L_c
10/24/2007	07-AreaA-0954	Slab, northwest corner	< 5400.5	1 / 50 21	0 / 50 <L_c	0 /50 <L_c	1 / 50 517
10/26/2007	07-AreaA-0965	Slab, northeast corner	FCA	1 / 50 21	1 / 50 249	N/A	N/A
10/29/2007	07-AreaA-0957	Slab, northeast section	FCA	0 / 40 <L_c	0 / 40 <L_c	N/A	N/A
10/30/2007	07-AreaA-0959	Slab, northeast section	FCA	0 / 40 <L_c	0 / 40 <L_c	N/A	N/A
10/31/2007	07-AreaA-0964	Slab, northeast section	FCA	0 / 40 <L_c	0 / 40 <L_c	N/A	N/A
11/2/2007	07-AreaA-0966	Slab, east center section	FCA	0 / 106 <L_c	0 / 106 <L_c	N/A	N/A
11/6/2007	07-AreaA-0975	Slab, east center section	FCA	0 / 15 <L_c	0 / 15 <L_c	N/A	N/A
11/6/2007	07-AreaA-0972	Slab, west center section	FCA	0 / 20 <L_c	0 / 20 <L_c	N/A	N/A

<Lc = less than the instrument detection level
Frequency = number of measurements performed resulting in determinations exceeding Lc
Low/High = lowest positive result/highest positive result for the survey
FCA = fixed contamination area
CA = contamination area
*The low/high activity is reported in this table in dpm/100 square centimeters.

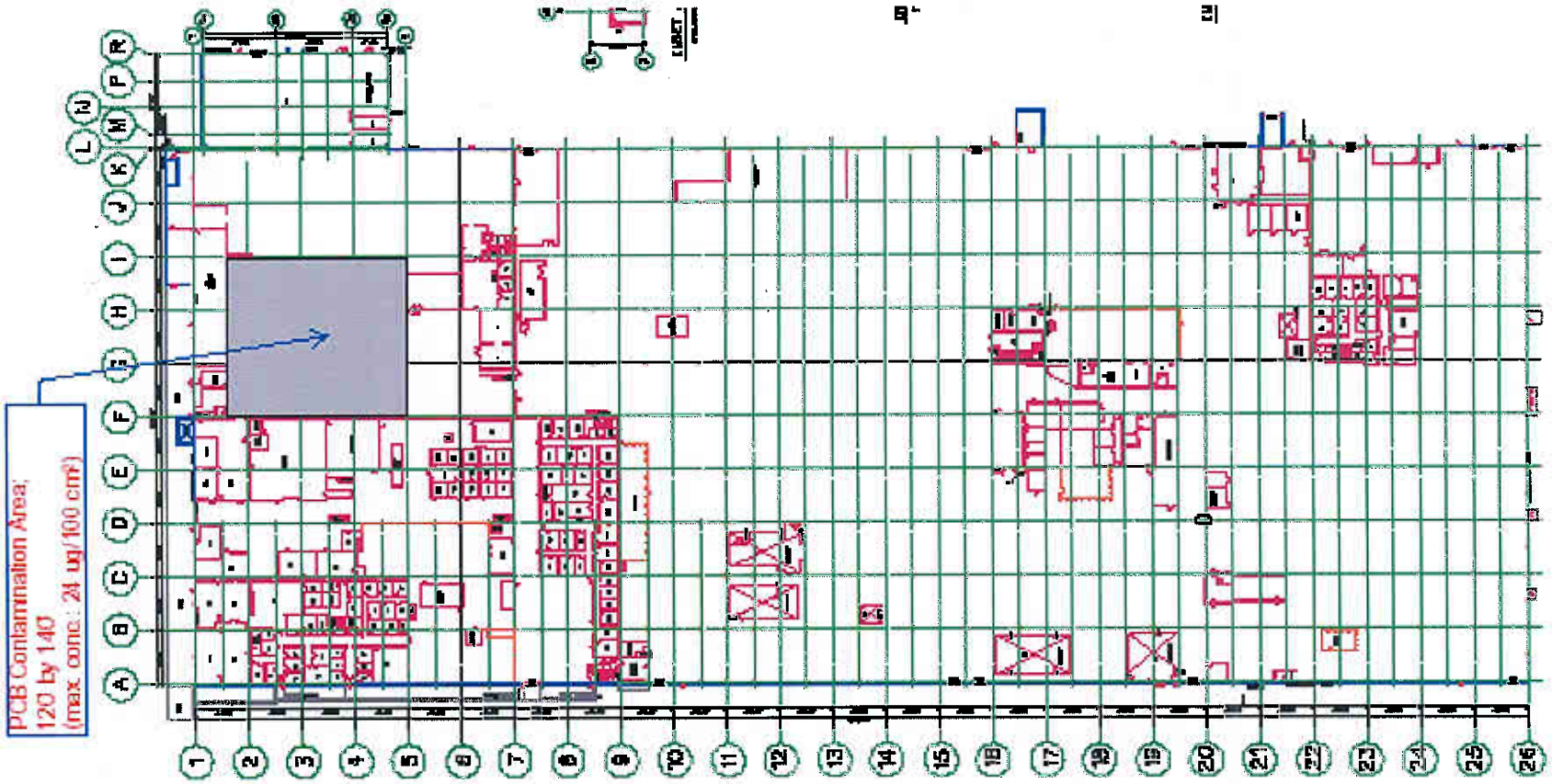

Fig. 10. Location where fixative was applied to polychlorinated biphenyl contamination on the slab.

4.5 DEVIATIONS FROM GOVERNING DOCUMENTS

Deviations from the Action Memorandum (DOE 2003a) are listed below:

- The demolition was not performed by a subcontractor but was self-performed by Bechtel Jacobs Company LLC.

Deviations from the Standard Operating Protocol (DOE 2003c) are listed below:

- The demolition was not performed by a subcontractor but was self-performed by Bechtel Jacobs Company LLC.
- No evaluation of alternatives to reduce waste volumes was prepared because that issue was addressed at a program level. Other than implementing best management practices, volume reduction is not addressed in project level documents.

Deviations from the Waste Handling Plan, Part 1 (DOE 2003d) are listed below:

- The demolition was not performed by a subcontractor but was self-performed by Bechtel Jacobs Company LLC.
- No evaluation of alternatives to reduce waste volumes was prepared because that issue was addressed at a program level. Other than implementing best management practices, volume reduction is not addressed in project level documents.

Deviations from the Waste Handling Plan, Part 2 (DOE 2005b) are listed below:

- A portion of the vent pipe was disposed at the EMWMF rather than off-site.

5. WASTE MANAGEMENT AND TRANSPORTATION ACTIVITIES

Waste management activities consisted of waste material being segregated, characterized, packaged, marked, and labeled in accordance with the WHP (DOE 2005b, DOE 2005c). The waste types, volumes, and disposal facilities are presented in Table 3.

Table 3. Waste disposal

Waste Type	Volume (cubic feet)	Disposal Outlet
Building demolition debris	842,341	EMWMF–WL 14.14
Building demolition debris–vent pipe	7	EMWMF–WL 14.18
Building demolition debris-vent pipe	7	EnergySolutions
Building demolition debris	2079	EnergySolutions
Building demolition debris	810	Off-site recycler
Building demolition debris	702	Y-12 Landfill
Universal waste	897	Off-site vendor
Liquid waste pumped from basement (8/24/06–10/2/06)	73,845 (552,364 gal.)	CNF
Liquid waste pumped from basement (10/2/06–7/30/07)	736,517 (5,509,146 gal.)	Sanitary sewer
Oil	15 (115 gal.)	TSCA Incinerator
Hazardous waste	702	Off-site vendor
Total	1,657,922	

CNF = Central Neutralization Facility
EMWMF = Environmental Management Waste Management Facility
TSCA = Toxic Substances Control Act
WL = Waste Lot

The two EMWMF waste lots are described below:

- Waste Lot 14.14: EMWMF Waste Lot 14.14 includes the structure, contents, and equipment from Bldg. K-1401.
- Waste Lot 14.18: EMWMF Waste Lot 14.18 includes the vent pipe.

The universal waste consisted of light bulbs and batteries. Demolition debris that was recycled was lead sheets from the X-ray room. Personal protective equipment was disposed with the building debris.

Liquid waste was pumped from the basement to support demolition. Initially, it was treated at the Central Neutralization Facility and then at an on-site pre-treatment facility and discharged to the sanitary sewer.

6. COST AND SCHEDULE

Demolition of Bldg. K-1401 was completed for a cost of $26,820,000 as detailed in Table 4.

Table 4. Cost (SX1000)

Characterization	603
Deactivation	90
Demolition	24,685
Project management	1,442
Total	**26,820**

Since this action represents only a portion of the scope in the Action Memorandum (DOE 2003a), a comparison of the total costs will be provided in the Removal Action Report.

A summary schedule for this action is shown below:

- Start Removal Action – August 23, 2004
- Start Building Demolition (structural) – August 24, 2006
- Complete Demolition – September 28, 2007
- Complete Waste Disposal – February 28, 2008

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7. OPERATION AND MAINTENANCE PLANS

No long-term operation and maintenance requirements are associated with this action.

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8. MONITORING

Monitoring of the Bldg. K-1401 slab will be performed on an interim basis until a final remediation decision is made as part of the Zone 2 ROD (DOE 2005a). A summary of the monitoring is in Table 5. Following is a more detailed explanation of the interim monitoring to be performed.

Table 5. Monitoring summary

Location	Type	Parameters	Frequency
Storm drains 180 and 190	Environmental	Gross alpha, gross beta, uranium isotopic, technetium-99	Storm water discharges are characterized during each NPDES permitting period. The maximum amount of time a NPDES permit can be issued is 5 years.
Mitchell Branch at the K-1700 Weir	Environmental	Gross alpha, gross beta, uranium isotopic, technetium-99	Annual
K-1401 Pad	Radiological	Removable	Annual

Environmental monitoring will be performed in accordance with 10 Code of Federal Regulations (*CFR*) 835, DOE Orders 450.1 (DOE 2003b) and 5400.5 (DOE 1993), and the National Pollutant Discharge Elimination System storm water permit until remediation is complete. In general, storm water runoff from concrete pads is not sampled. Instead the radiation contamination control and surveillance program is used to meet the DOE Order 5400.5 requirements because outdoor radiological contamination is controlled through the radiation control posting and radiological control effort. When a slab, field, or building is posted for radiological controls, then the area becomes part of the radiological surveillance and monitoring program. If radiological contamination is found to be migrating out of the contamination area, then additional controls are implemented to control the contamination. The frequency and level of surveillance and monitoring is established at each site by the radiation engineers responsible for the program. The Environmental Compliance Program determines the effectiveness of the radiation control program through the ongoing storm drain outfall sampling and the instream water sampling in Mitchell Branch, K-1007-P1 Pond, and K-901-A Pond. This sampling is compared to screening levels established at 4% of DOE Order 5400.5 derived concentration guideline levels to maintain discharges as low as reasonably achievable. When the screening levels are exceeded, a field investigation is conducted to determine the source of radiological release. Corrective measures, such as upgraded storm water erosion controls, are implemented as needed. Specifically, radiological monitoring of the perimeter will be performed, and radiation controls will be maintained as long as the need exists. There is a continuous evaluation of the control program during demolition and remediation, and following remediation an appropriate program will be developed.

The storm water runoff from the Bldg. K-1401 pad is drained by storm drains180 and 190 into the Mitchell Branch. The surface water from Mitchell Branch will be monitored on at least an annual basis for at a minimum the following parameters: gross alpha, gross beta, uranium isotopic, and technetium-99. The storm water discharges from storm drains 180 and 190 are characterized fully during each National Pollutant Discharge Elimination System permitting period in accordance with storm water pollution prevention plans. The permits can be issued for a period as long as five years although the current ETTP storm water permit was issued for a four year period so that the expiration date will be consistent with the State of Tennessee watershed schedule for this area of the state. The storm drains 180 and 190 characterization monitoring will at a minimum include the following parameters: gross alpha, gross beta, uranium isotopic, and technetium-99.

Bechtel Jacobs Company LLC and its subcontractors perform radiological work at ETTP. DOE section of the CFR that governs radiological operations at DOE facilities is 10 CFR 835, Occupational Radiation Protection. 10 CFR 835, Subpart B, section (a) states "A DOE activity shall be conducted in compliance with a documented radiation protection program as approved by DOE". Bechtel Jacobs Company LLC operates under a DOE approved radiation protection program, portions of which are incorporated into "Radiation Protection Program Description for Bechtel-Jacobs Company LLC Oak Ridge, Tennessee" (BJC 2007).

The 10 CFR 835 requirements that relate to monitoring of areas are found in Subpart E, Section 401(a) that states: (a) Monitoring of individuals and areas shall be performed to:

- Demonstrate compliance with the regulations in this part;
- Document radiological conditions;
- Detect changes in radiological conditions;
- Detect the gradual buildup of radioactive material;
- Verify the effectiveness of engineering and process controls in containing radioactive material and reducing radiation exposure; and
- Identify and control potential sources of individual exposure to radiation and or radioactive material.

The requirements relative to Fixed Contamination Areas are found in Subpart L, Section 1102(c) that states: (c) Areas accessible to individuals where the measured total surface contamination levels exceed, but the removable surface contamination levels are less than, corresponding surface contamination values specified in appendix D of (10 CFR 835), shall be controlled as follows when located outside of radiological areas: (1) The area shall be routinely monitored to ensure the removable surface contamination level remains below the removable surface contamination values specified in appendix D to 10 CFR 835; and (2) The area shall be conspicuously marked to warn individuals of the contaminated status. The values specified in 10 CFR 835, Appendix D and the BJC administrative release values are presented in Table 6.

Table 6. Surface contamination values[1] in dpm/100cm2[2]

Radionuclide	Removable [2], [2]		Total (Fixed + removable)[2, 3]	
	10 CFR 835	**BJC Admin**	**10 CFR 835**	**BJC Admin**
U-nat, U-235, U-238, and associated decay products	1,000 [4]	800	5,000 [5]	4,000
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129,	20	20	500	500
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200	160	1,000	800
Beta-Gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted in[5]	1,000	800	5,000	4,000
Tritium and Tritiated compounds[6]	10,000	8,000	N/A	N/A

[2] The amount of removable radioactive material per 100 cm2 of surface area should be determined by swiping the area with dry filter or soft absorbent paper, applying moderate pressure, and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. (Note: the use of dry material may not be appropriate for tritium). When removable contamination on objects or surface area less than 100 cm2 is determined, the activity per unit area shall be base on the actual area and the entire surface shall be swiped. It is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

[3] The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm2 is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to above the surface contamination value if: (1) from measurements of a representative number of sections it is determined that the average contamination level exceeds the applicable value; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm2 area exceeds three times the applicable value.

[4] Alpha

[5] This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

[6] Tritium contamination may diffuse into the volume or matrix of materials. Evaluations of surface contamination shall consider the extent to which such contamination may migrate to the surface in order to ensure the surface contamination value provided in this appendix is not exceeded. Once this contamination migrates to the surface, it may be removable, not fixed, therefore, a "Total" value does not apply.

BJC procedural requirements relative to monitoring of areas are found in Section B, "Workplace Monitoring" that states: (1) Assure that radiation and contamination surveys are performed on a frequency necessary to document radiological conditions in the workplace, detect changes in radiological conditions, and verify the effectiveness of physical design features in reducing exposures, and (2) Perform routine and task specific radiation and contamination surveys on a frequency:

- As specified by the routine radiological survey schedule, Radiological Work Permits, RADCON Procedures, and as directed by supervision;
- Daily for contamination at active Boundary Control Stations;
- Routinely in offices and break/lunch rooms that have the potential for contamination; and
- Before, during and after work (if appropriate) that has the potential for causing changes in radiation exposure or contamination conditions.

The Workplace Monitoring Topical Guide (BJC 2006) provides guidance on contamination monitoring frequencies and states: Contamination monitoring programs should be reviewed annually by the Project Health Physicist to ensure that appropriate surveys are performed at a frequency that is consistent with existing and potential hazards and activities planned in the area. The following survey frequencies are suggested and should be modified in a documented annual monitoring program review, as necessary, to ensure that area hazards are adequately characterized based upon facility-specific experience:

- Prior to transfer of equipment and material from one Radiological Buffer Area, that is established for contamination control to another, unless the material was monitored immediately prior to this transfer, such as upon removal from a Contamination Area;
- Prior to transfer of equipment and material from High Contamination Areas within Radiological Buffer Areas unless precautions such as bagging or wrapping are taken prior to transfer;
- Daily, at Contamination Area control points, change areas, or step-off pads when in use, or in accordance with a shift in high use situations;
- Daily, in office space located in the Radiological Buffer Areas;
- Daily, in lunch rooms or eating areas near the Radiological Buffer Areas;
- Daily in accessible areas where operations are under way that are likely to produce hot particles;
- Weekly, in routinely occupied Radiological Buffer Areas;
- Weekly, or upon entry, if entries are less frequent in Contamination Areas and other areas where materials having removable contamination exceeding surface value guidelines are handled or stored;
- Weekly, or upon entry, if entries are less frequent, where Contamination Area boundaries or postings are located;

- During initial entry into a known or suspected Contamination Area, periodically during work, at the completion of a job, or as specified in an Radiation Work Permit;
- At least annually, in and around areas of fixed contamination;
- After a leak or spill of radioactive materials.

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9. LAND-USE CONTROLS

Interim land-use controls are required following completion of this action to control access to the portion of the remaining concrete slab that has residual polychlorinated biphenyl contamination and is posted as a radiological Contamination Area. The interim controls will remain in place until the Remedial Action Project determines if additional remediation of the slab is necessary. The Zone 1 (DOE 2002), Zone 2 (DOE 2005a), and future Sitewide Records of Decision will establish final land-use controls following remediation of ETTP.

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10. REFERENCES

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DOE 2005c. *Waste Handling Plan – Part 2 for Bldg. K-1401 of the Remaining Facilities Demolition Project at the East Tennessee Technology Park, Oak Ridge, Tennessee*, DOE/OR/01-2209&D1 &R1/DEL, Environmental Management Program, Oak Ridge, TN.

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