BUILDING 771

"THE MOST DANGEROUS BUILDING IN AMERICA" READY FOR DEMOLITION

Facility Facts

- Two-story, reinforced concrete building built into a hillside
- 175,000 square feet
- 240 plutonium-contaminated stainless steel gloveboxes
- 251 contaminated tanks containing more than 12,000 liters of contaminated liquids
- More than 50,000 feet of process piping systems containing 2,500 liters of liquids
- 7 highly contaminated filter plenums
- More than 50 kilograms of plutonium holdup
- Significant radioactive contamination due to past leaks, spills and a major fire in 1957

Introduction

With its complex piping systems, dangerous liquids, 240 gloveboxes and tremendous levels of contamination, B771 is the first nuclear facility of its type and magnitude to ever be decommissioned. Building 771 was one of the first major buildings to be constructed and placed into operations at Rocky Flats. It began operations in May 1953 and initially was the primary facility for plutonium operations at the site.

Forty years later, the Department of Energy concluded that Building 771 was its greatest vulnerability among all of the plutonium handling facilities in the country. In less than 10 years, workers have safely removed thousands of gallons of plutonium-contaminated liquids and sludge, tons of equipment and debris and cleaned the structure in preparation for safe demolition. Demolishing what the national media once called "the most dangerous building in America" will be a landmark in cleanup of the former U.S. nuclear weapons complex.

History and Process Description

Early operations at Building 771 included the production of plutonium weapons components and recovery of plutonium from recycled materials. After the construction of Building 776/777 in 1957, Building 771 operations focused solely on plutonium recovery – purification of plutonium scraps and residues to allow weapons grade plutonium to be recycled back into the weapons component manufacturing process. Recovery work involved the use of chemical solvents that often resulted in leaks and spills.

On Sept. 11, 1957, a fire started in a can of plutonium residue. Security inspectors discovered the flames from a burning glovebox. The fire spread to the glovebox exhaust filters and main plenum on the second floor of the building. Flammable vapors collecting in the main exhaust duct exploded, spreading plutonium contamination throughout much of the building. No major injuries were reported. The explosion of flammable vapors may have contributed to the release of plutonium outside the building.

Key Milestones

- 1953: Operations began in May
- 1957: Large fire spread plutonium contamination throughout much of the building
- 1993: Started stabilizing bottled plutonium solutions
- 1994: Began draining plutonium solutions from tanks
- 1997: High-priority plutonium solutions drained from all tanks
- 1997: All weapons-usable special nuclear materials removed
- 1998: Began draining and removing plutonium process piping
- 1999: High security area eliminated following removal of all attractive quantities of SNM "holdup"
- 2001: Last plutonium liquids removed and treated
- 2002: Last glovebox removed
- 2003: Facility no longer contains quantities of fissile material that could create a nuclear criticality

During routine operations in December 1988, a heat plume in the Building 771 incinerator was registered on film by a passing aircraft. Officials with the Environmental Protection Agency believed that illegal incinerator operations were being conducted. The EPA convinced authorities to issue a warrant to enter the plant to investigate the allegation. The investigation could not confirm the allegation but raised several safety concerns that ultimately led to the curtailment of site operations in 1989.

D & D Scope

A report issued in 1994 by the Department of Energy ranked Building 771 as its most vulnerable plutonium facility. The most urgent risks at Building 771 resulted from large quantities of plutonium solutions stored in aging tanks, process piping and four-liter bottles inside gloveboxes. Plutonium solutions are less stable than other forms of plutonium. Numerous leaks in the building's tanks and piping systems were also identified in the DOE's findings.

Initial cleanup work at Building 771 focused on the highest risks. Workers began stabilizing plutonium solutions stored in bottles in 1993. Workers began draining tanks in 1994 and by 1998 started draining and removing process piping. To ensure that the piping system posed no further hazard and to work with the safest conditions, pipes were removed immediately after draining. Because of the dangers of worker contamination from plutonium solutions and nuclear criticality safety concerns, the work was slow and carefully controlled. Solutions were drained using strict nuclear safety procedural controls.

Workers mitigated or eliminated other urgent risks that included accumulation of explosive hydrogen gas in tanks and process lines and plutonium metal and scraps stored in deteriorating containers. In 1997, workers completed draining all high-concentration plutonium solutions from tanks and removed all weapons-usable special nuclear materials from the building. By 1999, workers completed removing all plutonium "holdup." Holdup is residual plutonium from past operations and consists of small pieces of debris and particles that have accumulated inside gloveboxes, process piping and ducting.

The last radioactive liquids were drained from process piping in 2001 and, by 2003, the facility was cleaned to the point that a nuclear criticality accident was improbable.

While workers mitigated the risks posed by stored plutonium, others began removing highly-contaminated equipment from the facility. This work included the removal of 240 stainless steel gloveboxes, more than 250 tanks, more than 11 miles of process piping and all of the equipment used in plutonium recovery operations.

Cutting the contaminated gloveboxes, tanks and other equipment into a size that would fit into waste containers was difficult and rife with hazards. Workers wearing cumbersome protective clothing cut up glovebox sections that contained up to three-quarter-inch-thick stainless steel.

Workers also faced hazards posed by some of the most contaminated areas at Rocky Flats. Room 141, the building's infamous "infinity room" – so named because radiation levels inside pegged radiation detection equipment 25 years ago and prompted operators to seal and abandon the room – posed significant challenges. Initial readings in the room in 2002 revealed airborne plutonium contamination levels 2,000 times higher than maximum limit for safe entry. An innovative approach to control airborne levels using a glycerin-based fog, remotely pumped into the room, caused contamination to adhere to surfaces. Airborne contamination was reduced below limits, allowing workers to enter in supplied air breathing suits to remove and package equipment stored in the room and spray fixative to further control contamination.

The final and most labor-intensive job involved removing the room itself. Workers developed an innovative approach using diamond wire saws to cut the 3-foot-thick ceiling, floor and walls and

In 1995, tanks containing plutonium solutions.

Today, the building has been completely stripped of all equipment.

Workers drained and removed more than 11 miles of piping containing plutonium solutions.

Using plasma-arc torches to cut up stainless steel gloveboxes significantly improved safety.

then used concrete saws to cut the slabs into blocks suitable for packaging. The entire room was cut up and shipped to the Waste Isolation Pilot Plant in New Mexico, a transuranic waste receiving facility.

Similar high airborne contamination areas were encountered in two of the building's seven filter plenums.

Cleanup innovations developed at Building 771

Workers at Rocky Flats blazed the trail in the weapons complex for decommissioning and decontaminating plutonium facilities. Cleanup of Building 771 resulted in a number of significant D&D breakthroughs, many the result of simply applying a known technology to solve a nuclear cleanup problem.

- **Plasma-arc torches:** Large, highly-contaminated stainless steel gloveboxes and other large pieces of equipment need to be cut up to fit in standard waste shipping containers. To do this at Rocky Flats, workers uses mechanical Sawzalls and stainless steel "nibblers" to cut equipment within the confines of a tent structure erected to contain the spread of contamination. A notable feature of glovebox cutting at Building 771 was the development of plasma-arc cutting of gloveboxes which reduced exposure to workers and, because of the light weight compared to mechanical cutting equipment, eliminated industrial and ergonomic hazards.

- **Chemical decontamination:** Instead of cutting tanks and gloveboxes to pieces that fit in containers accepted by the Waste Isolation Pilot Plant in New Mexico, workers developed liquid cleaning agents that removed what was once thought to be irremovable contamination from the surfaces of tanks and gloveboxes. Decontaminating equipment to low-levels of radioactive contamination eliminated the need for size reduction because low-level radioactive waste can be shipped in much larger shipping containers.

Phases of decommissioning Building 771

Risk reduction/deactivation: Eliminating or reducing the most urgent risks, such as plutonium solutions stored in aging and leak-prone tanks and process piping.

Characterization: Thoroughly examining the facility to understand the extent of hazards, especially contamination.

Removal of special nuclear materials: Removing all special nuclear materials in the building, allowing its three high-security vaults to be eliminated. The elimination of special nuclear materials significantly reduced security requirements and enabled decommissioning to expand throughout the building.

Glovebox, tank and equipment dismantlement: Removing hundreds of highly-contaminated gloveboxes and tanks, many the size of a railcar, often requiring size reduction and significant decontamination efforts.

Plenum and piping dismantlement: Removing all contaminated piping systems and filter plenums.

"Infinity Room" decontamination and dismantlement: Cleaning up areas of the building where radiation levels "pegged" radiation detection equipment 25 years ago. These include an old pump room and a filter plenum.

All weapons-usable plutonium was removed in 1999.

Large tanks also had to be cut into pieces to fit in radioactive waste shipping containers.

Workers were required to wear cumbersome protective clothing while dismantling equipment.

Workers use ultra high pressure water jets to decontaminate the structure.

Structural decontamination: Removing residual contamination from the walls, floor and ceiling of the structure using ultra high-pressure water spray that blasts away layers of concrete.

Final survey: Survey to assure all areas of the facility are decontaminated to levels where demolition may proceed.

Demolition: Building demolished using heavy equipment and dust suppression.

Final site contouring and revegetation: The hillside will be recontoured to control runoff and the site will be reseeded with native grasses.

A worker removes an old, abandoned jackhammer from the "Infinity Room."

The walls, floor and ceiling of the "Infinity Room" were cut into blocks for shipment to a radioactive waste disposal site.

Contaminants of Concern

- Plutonium, uranium and americium
- Asbestos
- Beryllium
- PCBs
- Nitric and hydrochloric acid
- Hydrofluoric acid
- Sulfuric acid
- Sodium hydroxide
- Hydrogen fluoride
- Caustics
- Lead
- Argon

For more detailed information about the demolition of Building 771, please refer to the Rocky Flats Cleanup Agreement (RFCA) Standard Operating Protocols for decommissioning located on the Internet at www.RFETS.gov.

KAISER • HILL COMPANY

Make It Safe. Clean It Up. Close It Down.

For further information about Rocky Flats

Contact DOE Communication at (303) 966-4546, or Kaiser-Hill Communication at (303) 966-2882.