



Nuclear

Client

United States Department of Energy (DOE)

Location

Golden, Colorado, USA

The major projects at Rocky Flats included the decontamination and demolition (D&D) of five large former plutonium production complexes; the D&D of 165 radioactive or chemically contaminated buildings, and 555 non-nuclear facilities; characterization and environmental restoration of soils and substructures contaminated with LLW, hazardous, and low-level mixed waste; and waste management.

Rocky Flats Closure

Project Description

On October 13, 2005, Kaiser-Hill Company LLC, a joint venture of CH2M HILL and Kaiser Engineers, announced completion of the Rocky Flats Closure Project, a 10-year project to clean up one of the most contaminated sites in the U. S. Department of Energy's nuclear weapons complex. The 6,200-acre site was the location of plutonium and uranium "trigger" production for the U.S. nuclear weapons arsenal from 1952 until 1989. More than 40 years of production left a legacy of contaminated buildings, soil and groundwater. A 1994 DOE study of plutonium vulnerabilities ranked two Rocky Flats buildings as the number one and number two most dangerous in the DOE complex.

Closure saved decades and billions of dollars

When Kaiser-Hill assumed management of Rocky Flats in 1995, DOE estimated it would take 65 years and \$30 billion to clean up and close Rocky Flats. Kaiser-Hill accelerated DOE's original cleanup/closure baseline, agreeing to complete the project by 2010 for approximately \$9B. The original scope of work included:



- Nuclear operations (processing radioactive materials to place them in a safe configuration)
- Environmental restoration
- Facility decontamination and demolition (D&D)
- Solid and liquid radioactive, hazardous and sanitary waste management
- Property and records management and disposition

Kaiser-Hill dispositioned more than 21 tons of special nuclear materials, cleaned up and demolished more than 800 facilities, and disposed of more than 550,000 cubic meters of radioactive waste. The project involved complex operations performed in a high-hazard environment within strict safety and environmental compliance parameters.

New contracting models

Kaiser-Hill operated under two innovative DOE contracting models at Rocky Flats. The first, awarded in 1995, was the first performance-based contract in DOE. It paid the contractor only for specific units of verifiable work. The model was in sharp contrast to the Maintenance & Operations (M&O) contracts of the day where contractors fee was based on subjective performance criteria.

The second and most innovative was the closure contract that DOE and Kaiser-Hill signed in 2000. It authorized the entire scope of work to clean up and close the site by a target date of December 15, 2006 and at a target cost of \$3.94 billion. Obtaining this closure contract was a direct result of Kaiser-Hill's prior performance, safety record, and development of an



aggressive yet credible plan to close the site decades earlier and for billions of dollars less.

At completion, the project had a positive cost variance of \$553.9 million and a positive schedule variance of \$438.2 million against the project baseline. We operated and managed 23 Category II, 22 Category III, and 35 radiological facilities, and processed, packaged, and shipped 106 metric tons (MT) of plutonium residues, and 6.1 metric tons of uranium metal and oxides.

Programmatic complexity



Nuclear material security. Throughout nuclear material handling operations, Rocky Flats was one of the most secure facilities in the world, which was particularly challenging with the constantly changing environment of a closure project. The security posture had to constantly evolve to accommodate handling, moving, processing, repackaging and shipping operations as well as construction and deconstruction activities. Security at Rocky Flats included Protection program management and operations (including Protective Security Force), physical security, personnel security, nuclear material control and accountability, information security, cyber security and counter intelligence. We designed a state-of-the art nuclear security system for the entire facility designed to eliminate the threat to nuclear material including highly purified plutonium and low grade waste material. Security included an electronically encrypted Perimeter Intrusion Detection and Assessment System, physical security systems, and one of the largest security forces in Colorado, with more than 200 highly trained officers authorized to use deadly force. The security program at Rocky Flats received the highest assessment rating by the DOE.

Orphan wastes. A significant challenge at Rocky Flats was dispositioning wastes that had no approved treatment or disposal method. Kaiser-Hill worked with our own technologists, the DOE, commercial treatment vendors, and waste disposal facilities to render these materials disposable.

Plutonium processing and handling. Two major processing programs at Rocky Flats were the Plutonium Residues Processing Program and the Plutonium Stabilization and Packaging System (PuSPS).

The residues program involved disposition of more than 106,000 kg of residues in various forms of scrap material containing greater than discard-quantities of plutonium. The program consisted of processing, stabilization, and disposition of over 100 MT of Pu residues in various forms: ash (26 MT); salts (16 MT); combustibles (20 MT); and dry/repack (40 MT) as well as design, construction, and startup.

The PuSPS, a cutting-edge plutonium processing technology, was used to safely process and dispose of 10,000 kg of plutonium metals and compounds. We converted the "cold" PuSPS prototype to a real-time production system. The PuSPS, designed and built by a foreign vendor to package radioactive material into a configuration for safe, long-term storage, did not perform to specifications. We made significant field modifications to overcome numerous hurdles in the development of this new technology to



achieve hot start-up. The program required development and implementation of Security and Nuclear Material Control and Accountability plans to ensure compliant material handling.

Technical complexity

Remediation of the Rocky Flats 903 Pad was the site's largest and most complex environmental cleanup project. The 903 pad was used from 1958 to 1967 for storing drums containing plutonium and uranium contaminated volatile organic compounds (VOCs). Leaking drums resulted in some of the worst contamination at the Rocky Flats site. Remediation involved removal of 32,000 tons of plutonium contaminated soil and asphalt.

Complex D&D projects included Building 776/777, which was highly contaminated by a major fire in 1969. When Kaiser-Hill arrived on site in 1995, the building contained thousands of containers of plutonium, most of it improperly packaged. Contaminated smoke and water from the 1969 fire infiltrated and contaminated conduit and pipe penetrations, and virtually every crack and crevice in the building, making decontamination very labor intensive. In addition, the building contained several large pieces of metal-working equipment, gloveboxes, and a 91,000 pound "Super Compactor", all contaminated from past operations.

Other complex decontamination included preparing Building 771 for safe demolition. The building had been used for recovery of plutonium from residues and scrap. One room in the building was called the "Infinity Room" because contamination levels exceeded the measurement capabilities of radiation detection equipment in use in the 1970s. Workers at the time abandoned decontamination efforts and sealed the room. Initial air samples in 2002 revealed airborne contamination up to 2,000 times the maximum limit for safe entry wearing supplied breathing equipment. Airborne contaminants were reduced using a glycerin-based fog, then further controlled using a spray fixative. The room was then dismantled using diamond-wire saws.