

Buildings 371 and 374 (371/374) Closeout Briefing Summary

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Briefing Summary Revision Number

Rev 0 (12/05)

Approximate Location

Northing: 750,500 (approximate centers of both 371 and 374)

Easting: 2,082,250 (approximate center of 371); 2,082,600 (approximate center of 374)

Location Relationship to other Site areas: 371/374 were located in the northwest portion of the former Industrial Area. They were somewhat isolated from other site buildings. They were to the west of the 700 area (771, 776/777, 707, etc.) and to the north of the garage and fire station.

Historical Information

(For a detailed history on 371/374, see References 1 and 2; the following section relies heavily on language used in References 1 and 2.)

371

Although originally envisioned in 1968 as a modern, more automated replacement for all Building 771 and some Building 776/777 operations, 371 became a logistical nightmare for Pu operations. The design, construction, and finally the initial Pu operations were fraught with difficulties. Building start-up initially scheduled for 1976 was delayed by numerous problems until 1980. Initial costs for 371 were projected to be \$70 million; by final completion in 1980 the costs had risen to \$214 million, a cost over-run of about 300% from the initial budget. This author has heard the terms “albatross” and “boondoggle” used many times by site workers to describe 371 problems. The heart of 371’s operational difficulties lay in 2 areas:

- attempting to transfer the more hands-on 771 and 776/777 operations into almost fully automated, remotely-controlled processes in 371; and,
- new Pu control inventory requirements which made 371’s design almost obsolete even though it was considered state-of-the-art (371’s complex design with miles and miles of piping and processing equipment lent itself to buildups of Pu-containing material in the process or “hold-up” that posed Pu inventory control problems).

371 was a 4-level structure constructed of heavily reinforced concrete built to withstand design-basis tornados and earthquakes (see Figure 1, page 5). Its 315,000 ft² consisted of the main floor (ground level) housing most of the Pu operations, a small attic containing utilities, a basement (same basic footprint as main floor) containing air filtration and other process equipment, and a smaller sub-basement.

The following is a brief timeline of 371’s history:

- 1968 – 1980 – initial concept of 371 followed by years of design and construction problems;
- 1980 – construction completed, Pu pyrochemical recovery operations began (molten salt extraction) on limited pilot-scale basis (not full-scale production);
- 1980 – first electrorefining pyrochemical operation (pilot-scale);
- 1980 – pilot-scale aqueous (acid dissolution/ion exchange) Pu recovery operations;
- 1980 – first Pu metal “button” produced in 371 by aqueous recovery operations;
- 1980 – aqueous Pu recovery operations shut down in April 1980 due to significant Pu inventory control problems;

- 1980 – 1985 – DOE and Rockwell began attempts to modify 371's Pu production operations to improve process throughput and inventory control;
- 1986 – electrorefining operations ceased after very limited Pu metal production;
- 1988 – pyrochemical operations ceased ending all major Pu recovery operations in 371;
- 1988 – 2003 – special nuclear material (SNM) and waste storage facility for most of this period; from about 1998 through 2003 high Pu content residues were processed and packaged as TRU waste for shipment to the WIPP disposal site in New Mexico and SNM was processed and packaged by the PuSPS (Pu stabilization and automated packaging system) for shipment to the DOE Savannah River Site in South Carolina.
- 2003 – 2005 – 371 was emptied of equipment and utilities, and the remaining structure was decontaminated per RFCA guidelines and then demolished, regraded, and revegetated.

374

374 was built under the same roof as 371 similar to the way 776 and 777 were constructed. 374 was designed as the liquid waste treatment facility serving the site to replace the aging waste treatment facilities in 774 much like 371 was designed to replace aging Pu operations facilities in 771 and some in 776/777. 374 consisted of a main floor, a basement, and a smaller mezzanine. Although built to withstand winds up to 150 miles per hour, its structure was not required to be as robust as 371 since 374 housed Pu waste operations, not Pu production operations.

The 374 waste treatment system was designed to treat liquid low-level radioactively contaminated wastes received from various site locations. Wastes were piped into 374 from Buildings 122, 371, 428, 443, 444, 566, 559, 707, 774, 776, 778, 865, 881, and 883. 374 was also designed to receive "batch" shipments of wastes shipped by vehicle from site locations. Waste treatment typically consisted of acid neutralization, sludge solidification, radioactive decontamination, evaporation, and the "saltcrete" process. The saltcrete process was designed to use a spray-dryer to transform liquid wastes into a solid particulate waste that could be blended with cement resulting in a compliant, monolithic waste block. If the waste block met certain disposal site requirements it could be shipped off-site for disposal. Although the conceptual design seemed promising, operational difficulties in the saltcrete process proved to be substantial. Non-compliant waste forms were generated which required additional processing. It required many years of process improvements before the saltcrete process achieved substantial compliant process outputs.

Pre-remediation Characterization Data

(Note: 371 & 374 discussions are combined in the remaining briefing sections)

Many contaminants of concern (COCs) were identified in 371/374 due to the complex nature of Pu production and waste treatment activities in both buildings. These COCs included:

- radionuclides such as Pu, Am, and U isotopes (many locations which exceeded wildlife worker action levels, WRW ALs);
- metals such as Ag, As, Ba, Be, Cr, Cu, Mn, Ni, Pb, Sr, and Zn (some locations which exceeded WRW ALs as well as ecological screening levels, ESLs);
- VOCs such as chlorinated solvents, acetone, toluene, and benzyl alcohol; and,
- SVOCs/PCBs such as anthracenes, pyrenes, phthalates, nathenes, fluoranthenes, and aroclor-type PCBs.

Remedial Actions Taken

(see Reference 1 for a detailed description of the remediation process)

371/374 were remediated in a phased approach. The original D&D plan called for the use of heavy equipment to demolish the structure after decontamination had occurred. Subsequently the site modified the initial D&D plan to use explosives to collapse the main floor into the basement and sub-basement. The explosive demolition was to occur after the main floor had either been cleaned to free-release levels or any main floor structure containing radioactive contamination had been removed as radioactive waste.

When this change was proposed for the use of explosive demolition it caused some amount of consternation within the Rocky Flats Coalition of Local Governments and surrounding communities due to fears of radioactive contamination in the basement and sub-basement being explosively released into the atmosphere. In addition, using explosives was not universally accepted by all site personnel. In fact, based on D&D (decontamination & demolition) experiences from 771/774, personnel from 771/774 were able to convince 371/374 personnel to drop the idea of explosive demolition and use traditional heavy equipment demolition. This change in direction back to the original demolition plan was due to the same type of decontamination problems in 371/374 as the site experienced in 771/774. Basically as 371/374 decontamination progressed it became readily apparent to the site and regulators that the main floor could not be decontaminated to acceptable levels to allow the use of explosive demolition. Instead the new D&D plan called for 371/374 to be demolished starting in the lowest level of each building and working their way up to grade. This proved to be a successful approach.

Figure 2, page 6, is a photo from August 2005 showing the last remaining section of the 371 main floor undergoing demolition. 371/374 was remediated, re-graded, and re-vegetated by September 2005 – about 67,000 m³ of clean backfill was used to achieve the final land configuration. The 371/374 remedial action helped the site achieve early physical closure on October 13, 2005, instead of the projected December 16, 2006, contractual physical closure date estimate.

Demolition wastes from 371/374 primarily consisted of low level radioactive wastes (LLW, <100 nanocuries per gram of waste), transuranic wastes (>100 nCi/g of waste), and free-release (non-radioactive, non-hazardous) wastes such as sanitary wastes (shipped to local sanitary landfills in the Front Range) and building concrete rubble recycled for fill uses on site. Thousands of tons of LLW were shipped for disposal via rail or truck to Envirocare in Utah and by truck only to the Nevada Test Site. Lesser amounts of TRU waste was shipped in highly specialized transportation containers (TRUPACT II) loaded on special trucks to the TRU waste disposal site, WIPP in New Mexico.

Post-remediation Remaining Contamination

As with the basements in 771/774, the regulators allowed the site to leave Pu contamination in place on remaining 371/374 foundations which were deeper than 6 feet below final grade. The site had to ensure that any remaining contamination was decontaminated to a maximum allowable level of 7 nanocuries of Pu contamination per gram of concrete averaged across the remaining slab thickness. If any areas exceeded 7nCi/g Pu contamination they would have to be removed and disposed of as LLW. For those areas which were <7nCi/g Pu contamination a protective fixative had to be placed over the contamination prior to demolition. The protective fixative also had to be applied to those areas which needed to be removed as LLW if they were >7nCi/g Pu contamination. Based on pre-demolition radiological surveys of 371/374, the site estimates that there is approximately one gram of Pu remaining on buried foundations in

371/374. There are no remaining areas of 371/374 which contain COCs other than Pu which exceed WRW ALs.

Potential Exposure Pathways to Remaining Contamination

The decision to allow remaining Pu contamination on building foundations deeper than 6 feet below final grade for the 771/774 and 371/374 building complexes was not without some controversy. While many members of the local communities supported the regulators' decision, others did not. Concerns were expressed about groundwater moving through the contaminated foundations, perhaps mobilizing Pu and Am contamination and transporting it downgradient to perhaps be expressed as contaminated surface water entering North Walnut Creek. As a result of these public concerns, the regulators agreed to require the site to install additional groundwater monitoring wells in the vicinity of the two building complexes. In the case of 371/374 several additional wells were installed downgradient from the locations of the buried foundations. These wells were located to the north and east of the foundations and will be monitored for Pu and Am activity. Although it is a well-established fact based on the independent work of the Actinide Migration Evaluation Panel, that Pu and Am at Rocky Flats, because of their chemical speciation, are very immobile in groundwater, the regulators agreed to require the additional monitoring to help bolster public confidence in the site remediation.

If extreme erosion and earth movements occurred sometime in the future exposing the contaminated building foundations, it is possible the contamination could be mobilized in runoff surface water and make its way downstream to North Walnut Creek. However, this is an unlikely scenario. The final land configuration of 371/364 is designed to control erosion through the use of gentle contours and revegetation. It is possible that severe earth movements exposing the buried foundations to surface water could occur due to future earthquakes but the likelihood is remote.

Long-term Stewardship Controls

The 371/374 area will remain as part of the DOE-retained lands after closure and will be monitored for evidence of groundwater contamination using groundwater monitoring wells as discussed above. The additional groundwater wells are intended to provide additional confirmation that indeed the Pu and Am contamination in the 371/374 buried slabs is not migrating in groundwater toward North Walnut Creek. Regular inspections of the remediated area will be performed to ensure erosion control and revegetation measures are functioning properly. As with all of the DOE-retained lands there are prohibitions on new buildings, groundwater pumping and other institutional controls in place designed to ensure adequate long-term stewardship of the remedy.

Notes

None at this time.

Document references

1. [Decommissioning Closeout Report for the 371 Closure Project, Revision 1, November 2005](#) (document path, CERCLA AR# pending)
2. [Historic American Engineering Record, Rocky Flats Plant](#) (document path, DOE RFETS home page/historical information/HAER database). Use the following link: <http://192.149.55.183/HAER/base/Buildings/371.htm>

Figure 1. Photo of 371/374 (circa 1980's) looking Northeast. A large portion of 371 was below grade, the basement and sub-basement. 374 also had a basement but no sub-basement. 374's location was about the eastern 1/3 of the 371/374 footprint. Also note the high-security perimeter security zone (PSZ) features in the photo.



Figure 2. Photo from August 2005 looking southwest at the final demolition stage of 371/374 main floor.

