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A Change In Strategy For A CERCLA Removal Action Demolition Project In Progress Results In Overall Project Enhancements

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ABSTRACT
This paper discusses changes made in a demolition project at the Fernald Environmental Management Project (FEMP), a site on the National Priorities list (NPL), owned by the Department of Energy.

The project, to demolish fourteen uranium ore silos and their structure, was based on a Removal Action Work Plan, submitted and approved by the United States Environmental Protection Agency (USEPA), that integrated Comprehensive Environmental Response Compensation and Liability Act (CERCLA) requirements to remove the source of contamination and threat to public health and the environment. After the demolition contractor defaulted at 30% complete, completion of the project by the USEPA deadline was threatened. The recovery plan included re-evaluation of project documents in addition to the schedule. It was determined that re-interpretation of the removal action criteria, including design and Removal Action Work Plan, would eliminate road-blocks, and optimize resources, resulting in project completion by the original deadline even after lost-time in mobilizing another contractor.

This presentation will discuss the "lessons learned" by the project team and illustrate how simplification of construction methods resulted in enhancements to the environmental controls, improved material handing, and created a safer work environment.

INTRODUCTION
The Fernald Environmental Management Project (FEMP), owned by the Department of Energy (DOE), was used to process uranium for U.S. Defense programs. On-site production ceased in 1989 and the facility was placed on the National Priorities List (NPL) for remediation under the CERCLA process.

The former production area included the Plant 1 Ore Silos, which were constructed in 1953 and used to store cold metal oxide by-products from processing pitchblende and lower grade uranium ores, until they were "abandoned in place" in 1961. The Plant 1 Ore Silos included four forty-four feet high, and four ten feet high, glazed tile silos and six ten feet high reinforced concrete silos. The silos, built on open steel structures, were thirty-eight feet above grade. "Place Fig. 1 here" There were platforms and material conveying equipment above and below the silos. Residues remained in the silo cone bases with depths from one foot to about six feet.

When residues leaked from the deteriorated silos in 1991, demolition of the Plant 1 Ore Silos became a CERCLA Removal Action to speed the removal of radiological and safety hazards until final remediation of the Fernald site could be completed. A Removal Action is used to abate, minimize, stabilize, mitigate, or eliminate the release or threat of release of hazardous substances. A structural evaluation determined that, due to deterioration, the silo structures were overstressed and unable to withstand high wind forces. Demolition of the entire structure was warranted.

ORIGINAL DEMOLITION DESIGN

The initial Removal Action Work Plan listed 58 detailed, sequential steps to demolish the silos, one at a time. The demolition design required that all work be done in containment to prevent emissions of radiological contamination into the air. This containment consisted of scaffolding built around the silos and covered with plastic sheeting.

The containment sheathing had two curtain walls, an inner wall from the floor slab to the bottom of the silo and an outer wall that started above the slab near the bottom of the silo and enclosed the entire scaffold.

The ventilation system for the containments operated on three 4,000 cubic foot per minute (cfm) air-filtration devices (AFDs) equipped with High Efficiency Particulate Air (HEPA) filters. The units ventilated through a common duct and stack, which was monitored for emissions. The containment was ventilated using ducts routed to each silo which directed makeup air through the silo from outside the containment. To maintain a balance and steady number of air exchanges, multiple sizes of ductwork and configurations of air handlers were required.

The containment scaffold around the tile silos was designed to carry hoists that would suspend a large debris slide or "funnel." The funnel would fill the shipping container immediately below the cone. Only one silo was to be demolished at a time because a multiple hoisting system was to be used to suspend a waste container and debris slide inside the silo to catch dislodged tiles as they were thrown onto the debris slide. The intent was that only the filled container would be lowered to ground level to be disconnected and replaced with another container.

The proposed hoists, required to raise and lower a debris slide, would have been individually operated with little tolerance between the slide and the perimeter of the silo. There would have been no allowance for uneven movement of the slide, which could have jammed against the silo wall.

Additional scaffold height would have been needed to install the hoists over the silos. This height would have limited access to repair any mechanical problems. The designed weight of the hoists added dynamic loading to the scaffold and complicated the scaffold design and erection.

SUBCONTRACTOR DEFAULTS

In November 1993, the construction demolition subcontractor defaulted at 30 percent completion. It would have taken five months to rebid and mobilize a new contractor to complete the work. Those five months would have been lost-time and the project would not have been completed by the December 1994 USEPA deadline and could have resulted in major fines. Therefore, the site service contractor was chosen to complete the project.

CHANGE IN STRATEGY

Reevaluation of project documents revealed ways to improve the project schedule and worker safety through design changes and activity resequencing. Project limitations, imposed by the existing work plan, were also evaluated. This evaluation was outside the scope of normal construction review.

Because the Removal Action Work Plan was a USEPA approved legal document, the construction project team proposed the enhancements to CERCLA/RCRA Unit (CRU) project engineering, environmental engineering, and safety assessment team members. This project team wrote a document detailing the changes, "Plant 1 Ore Silos Removal Action Enhancements," which was presented to DOE and USEPA. Both agencies concurred, for both worker safety and environmental reasons, that the enhancements should be implemented.

The enhanced work plan outlined the criteria and Applicable or Relevant and Appropriate Requirements (ARARs) as concepts, rather than discrete steps. Work packages were written for the different types of tasks done, rather than for each step. Worker safety was enhanced by the elimination of work under a suspended load. Environmental controls were improved by fully enclosing the containment. The changes were made during the construction phase and incorporated construction supervision and worker input on work methods during the development of work packages for the field.

PROJECT ENHANCEMENTS

Many Plant 1 Ore Silo structural design assumptions and decisions were based on evaluations to determine the life expectancy of the silos during production. New structural surveys were performed based on demolition requirements. With some additional column repair, the Plant 1 Ore Silos had sufficient structural integrity for the work to be done.

The new demolition sequence made the structure and work area directly accessible to the workers, eliminating the need for manlifts while removing auxiliary platforms, decking, etc. For safety, worker access was still limited by the number of people allowed on scaffold planks.

The containment design was changed so that all sheeting went to the floor and divided the facility into three chambers of two tall and four short silos each. "Place Fig. 2 here" Thus the ventilation equipment would have adequate capacity to ventilate each chamber. More silos could then be demolished at a time. Make-up air was provided at the top of the containment to avoid worker exposure to airborne contamination. Additionally, bringing the sheeting to the floor provided better control of debris from demolition of the tile.

Since the previous subcontractor had not fabricated the ductwork for the tile silos, alternative duct routing was planned, which could use the existing duct from the concrete silos containment.
Additional savings resulted because the remaining ductwork was changed from stainless steel to galvanized and corrugated flexible duct.

The ductwork was run to the containment wall, with a branch to each chamber, to provide a minimum of seven air exchanges per hour in accordance with the plan requirements, within each chamber being worked in. The extensive ductwork of various diameters routed to the base of each silo was deleted.

To prevent the containment from becoming "dusty" with air-borne contamination, additional portable HEPA air-filtration devices were used at the base of the debris chute during the demo of each tile silo. The use of portable air-filtration devices meant more filter changes on the local units, which protected the filters in the 4,000 cfm units, which were difficult to change. The chute itself had a dust cover with duct taps sized to fit over a waste container. After the waste container was positioned under the chute, plastic was used to provide cover to the waste container to seal all voids. "Place Fig. 3 here"

This reconfiguration of the ductwork resulted in the duct being installed once, and allowed flexibility to do the same task on all the silos versus completely demolishing one silo before going to the next.

The decision to delete the hoist completely eliminated the safety risk to workers who would have been under the suspended load of the debris slide while connecting and disconnecting the shipping container. Eliminating the hoists allowed the scaffold roof to be lowered and sloped for drainage. The installation of the temporary roof was simplified and improved to a tube and clamp type of scaffold system verses extensive beam and headers bridging the scaffolding over the silo. Eliminating the use of the hoist made the scaffold safer by eliminating a sizable weight and reduced the anchoring needed for the scaffold footings.

Finally, the new approved plan used a combination of debris chutes and conveyors on the ground floor for movement of the waste containers. Personnel would not be required to move beneath the debris as it was being collected and moved to the waste containers. The use of chutes eliminated the need for additional electrical service and decreased the potential for mechanical failure.

Since the actual weight of the tile was unknown and there was concern over controlling the impact of falling tile into the waste container, a chute with a 45 degree off-set was used. The advantage of the off-set was that the crew loading the container, and monitoring the filters, were never under the crew breaking the tile. The chutes were made of steel to withstand impact loads and designed to prevent plugging. The silo cone bottom remained in place and funneled the debris into the chute. The impact of falling tile on the cone bottom and chute reduced the tile size so that waste containers could be efficiently loaded in compliance with the shipping weight limit.

Two sets of conveyors were mounted on the ground floor to slide the waste containers in and out of the containment. Use of the conveyor provided excellent control of the waste containers through the scaffold legs. Thus, a larger opening in the frame was not required for heavy equipment and access (i.e., fork truck). An airlock and staging area was set-up at the containment wall for the wipe-down of full waste containers to prevent spread of contamination.

An equipment mounted shear was used to demolish the steel structure rather than removing it piece-by-piece, by hand, using torch and rigging. Beside the speed at which it can cut, using the shear reduced worker risk of falls from elevated heights and exposure from lead-based paint and air-borne radiological contamination.

SUCCESSES

The Removal Action was completed safely with minimum worker or environmental exposure to contamination. The debris was containerized for shipment to an approved off-site disposal facility, the structural steel was staged for future disposition, and the concrete pads were locked-down for removal later in the demolition or the remediation of the site.

Working together, with a regard for worker safety paramount in all planning steps, resulted in a hazardous job done without incident. Although requirements, such as 100 percent tie-off of personnel, made work difficult at times, the labor force willingly complied with safety directives. "Place Fig 4 here" Summer work hours were changed to night shift because of excessive heat inside the containment. When the final structure had been demolished, this intensive eight month, 49,473 man hour, effort resulted in only four minor injuries.

Implementating changes to the Removal Action Work Plan resulted in the successful demolition of the Plant 1 Ore Silos one month ahead of the USEPA commitment date.

The lessons learned during this Removal Action include:

1. Use conventional demolition techniques, such as debris chutes.
2. Keep it simple. Don't overdesign.
3. Use a detailed work plan for field implementation, that parallels the intent of the regulatory document.
4. Be flexible. Unknown field conditions frequently happen during remediation projects.
5. Involve construction in the design phase. Communicate ideas and practical field implementation methods. Design change is expensive and results in lost time for field work.
6. Keep lines of communication with regulators open. Don't be afraid to sell enhancements, especially ones that improve safety and environmental outcomes.