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Department of Energy
ROCKY FLATS FIELD OFFICE
10808 HIGHWAY 93, UNIT A
GOLDEN, COLORADO 80403-8200

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DIST.	LTR	ENC
BERARDINI, J. H.	X	
BOGNAR, E. S.	X	
BROOKS, L.	X	
BUTLER, L.	X	
CROCKETT, G. A.		
DECK, C. A.	X	
DEGENHART, K. R.	X	
DIETER, T. J.		
DIETERLE, S. E.		
FERRERA, D. W.	X	
GIACOMINI, J. J.		
HIETT, S. B.	X	
ISOM, J. H.		
LINDSAY, D. C.	X	
LONG, J. W.		
LYLE, J. L.		
MARTINEZ, L. A.	X	
NAGEL, R. E.	X	
NORTH, K.	X	
PARKER, A. M.	X	
RODGERS, A. D.		
SHELTON, D. C.	X	
SPEARS, M. S.		
TRICE, K. D.		
TUOR, N. R.	X	
WILLIAMS, J. L.		
ZAHM, C.	X	
Wiemelt, K	X	
Nesta, S	X	
Foss, D	X	

Demolition is currently scheduled for November 8, 2003. Questions may be directed to Steve Tower at (303) 966-2133.

Sincerely,

Joseph A. Legare
Assistant Manager
for Environment and Stewardship

Enclosure

cc w/o Encl.:
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KAISER ♦ HILL, LLC

EVALUATION DEMOLITION METHODS

for

771 and 881 Concrete Stacks

Rocky Flats Environmental Technology Site

October 2003

1. Introduction

This documents evaluates the potential means for demolition of the 771 and 881 Concrete Stacks at the Rocky Flats Environmental Technology Site (RFETS). The mechanical demolition methods selected for evaluation were based upon the type of the structure and included diamond wire cutting, crane with a clamshell and sleeve, explosives, cabling (lay-over), and use of a wrecking ball. Upon initial review, it became apparent that cabling and the use of a wrecking ball were not practicable options because the ability to control dust and the demolition process is limited and the health and safety risks are too great. Accordingly, this report focuses upon diamond cutting, crane with a clamshell and sleeve, and the use of explosives.

This report was prepared in accordance with the guidance in the RSOP for Facility Disposition. The evaluation for both stacks was combined because the stacks are similar enough that the methods would have negligible differences. In accordance with the RSOP, this evaluation will be included in the administrative record for both projects. In addition to this evaluation, a pre-demolition survey report and a notification letter submitted in accordance with the RSOP for Facility Disposition[1] must be prepared and approved by the regulators that verifies that the structures meet the unrestricted release criteria. In addition, a demolition plan will be prepared and a briefing will be provided to interested stakeholders on the survey results and demolition process.

1.1. 771 Stack

The stack was designed and constructed to provide maximum exhaust capabilities through elevated release and adequate airflow capacities. The Building 771 stack is a reinforced concrete stack at the southeast corner of Building 771. The stack has an inside diameter of 10 feet, the base underground is 19 feet across, and the stack rises 150 feet aboveground. The stack wall is 6 inches thick at the top and 11.5 inches thick of reinforced concrete at the base. The stack is connected to Building 771 via an underground tunnel that connects the stack to the B771 ventilation system. Currently, the stack has a metal rack at the top for characterization purposes. That rack will be removed before demolition.

Reconnaissance level characterization indicated there was greater than 300 dpm/100 cm^2 on the floor and base of the stack (18 feet and below). The project will scabble (mechanical impact) and hydrolaze (water impact) decontamination methods on the lower 25 feet of the stack. Once the bottom 25 feet of the stack is decontaminated, the area will be resurveyed to verify the stack meets the unrestricted release criteria.

1.2. 881 Stack

The 881 stack is approximately 133' in height with approximately 30 feet of that height being underground. The outside diameter at the base is 19 feet 7.5 inches and the inside diameter at the base is 17 feet and 7.5 inches, resulting in a concrete thickness of approximately 1 foot. The stack is connected to 881 with a tunnel that enters the first floor of the facility.

[1] The 771/774 Decommissioning Operation Plan, Modification 3 was the notification for the 771/774 Closure Project.

Reconnaissance level characterization found no contamination above unrestricted release on the interior and exterior surface of the stack. A pre-demolition survey is currently being conducted to verify the stack meets the unrestricted release criteria in accordance with the data quality objectives in the Site Pre-Demolition Survey Plan.

2. Evaluation Scope

The evaluation only includes demolition activities. Activities before and after demolition are the same regardless of the demolition method. Before initiating demolition activities, the 771 and 881 stacks will be prepared in the following manner:

- The stack will be isolated from all airflows.
- The *Pre-Demolition Survey Report* will be complete and approved by DOE and LRA.
- The below grade opening will be plugged, capped, blind flanged or covered with protective covering, as appropriate.
- The Demolition Plan will be completed.

3. Evaluation Summary

Table 1 contains the demolition method evaluation summary for the 771 and 881 Stacks with explosives versus mechanical means. The following sections summarize the results of the evaluation of demolition techniques for the stack. In addition, each section indicates the preferred method for demolition with respect to the criteria.

The purpose of the evaluation is to determine, which of the methods are viable for demolition of the stack. The evaluation is somewhat subjective and may indicate that all of the methods evaluated are viable, but some are preferred for different areas. For example, diamond wire cutting will create substantially less dust than explosives or crane with clamshell and sleeve, but explosives or crane with clamshell and sleeve may be safer for the project worker than diamond wire cutting because the workers are not in the immediate work area.

3.1. Health and Safety Evaluation

The health and safety evaluation was prepared using the roundtable approach. A certified safety professional developed the activities, hazards, and controls associated with the demolition, which is summarized in Table 1. With explosive demolition, the risk to personnel, equipment and property is minimal due to the establishment of a controlled blast perimeter. The health and safety evaluation indicates that explosive demolition is the safest alternative for demolishing the 771 and 881 stacks.

3.2. Environmental

The environmental evaluation was prepared using the roundtable approach. An environmental subject matter expert outlined the potential impacts associated with each method of demolition, which is summarized in Table 1.

The environmental evaluation indicates that environmental impacts are minimal for each of the demolition methods. Diamond wire cutting creates the least amount of dust. Explosives and

crane with a clamshell and sleeve create essentially the same amount of dust, but the generation duration is substantially different. Even though explosives may create a larger dust cloud at the point of detonation, this dust occurs for only a very short period of time and can be reduced through the use of water misting. In addition, with explosives the time of demolition can be selected when the environmental conditions are most favorable (i.e., wind velocity).

Dust from mechanical means may be less at any given point in time but will continue for a period no less than 4 weeks. This continual dust for an extended period will be harder to consistently minimize. The dust control system employed during the use of explosives will be established before the explosives are placed. This system will deliver a mist before and until dust is abated after detonation. While, manual dust control, which consists of an operator wetting the structures with a fire hose during demolition, is considered a 50% direct control measure for fugitive dust. The environmental evaluation indicates that explosives and the diamond wire cutting are both equally safe alternatives for demolishing the 771 and 881 stacks.

3.3. Structural

The structural evaluation was prepared using the roundtable approach. A structural engineer evaluated the effectiveness of each method of demolition, which is summarized in Table 1.

The structural evaluation indicates that both explosives and mechanical demolition are viable demolition techniques if the stack concrete has maintained its design strength. If the stack concrete has not maintained its design strength over the past 50 years, explosives will be a more efficient demolition method for this particular structure. Explosives would be the preferred method because it will 1) require less preparation and demolition duration; and 2) not require personnel or scaffolding to be near or around the structure during actual demolition.

3.4. Economic

The economic evaluation was based on the demolition costs, which were provided by demolition subcontractors. Costs associated with removing the material after demolition were not included due to those costs being required and necessary regardless of method used. The economic evaluation indicates that for a stack, the explosive demolition is the best value.

4. Conclusion

Based on the evaluation, the 771 and 881 stacks should be demolished with explosives. The determining criterion for selecting explosive demolition is predominantly the benefits to worker health and safety. The explosive demolition removes the worker and equipment from the hazards and the other demolition methods do not.

Table 1. Demolition Evaluation

	Explosives	Mechanical Means	
		Crane with a clamshell and sleeve	Diamond Wire Cutting
Project Description[2]	The project area will be set up with a primary and secondary exclusion zone. The primary zone will be a 100-foot radius around the stack. Only authorized personnel will be allowed in this area. The secondary exclusion zone (1,000 feet) will be implemented during the detonation. No personnel, waste containers, or vehicles will be allowed within this area until the detonation has occurred and an "All Clear" signal has been given. A drill pattern will be marked on the stack; the objective of the shot will be to down the entire stack in a straight fall. Approximately 40-50 holes will be drilled into the stack. Chainlink fence and geotextile will be wrapped around the base to minimize flying debris. Holes will be cut into the fabric to facilitate the placement of explosives. It is anticipated that approximately 57 pounds of explosives will be required. Nonelectric detonators will be used. A dust control system will be established before the explosives are placed. This system will deliver a mist before and until dust is abated after detonation. It is anticipated that the stack can be prepared and detonated on the same day. The debris will be loaded out on subsequent days with mechanical equipment.	The project area will be established by roping off a 1000 feet radius around the stack. Only authorized personnel will be allowed in this area. To drop the stack mechanically, sections of concrete would be crunched with the use of a crane attached with a clamp shell starting at the top and continuing lower to the ground. A protective ring will be placed around the stack to catch falling debris and funnel that debris inside the stack itself. A hole or tunnel will be created at the base of the stack to remove the debris as it is generated. A spotter will be used to coordinate equipment movement and the dust control activity. Dust control will consist of a person on the ground with a hose. Water will be applied as needed to the area that is being worked by the excavator. It is anticipated that the stack can be demolished in approximately four weeks.	The project area will be established by roping off a 1000 feet radius around the stack. Only authorized personnel will be allowed in this area. Diamond wire cutting involves a series of guide pulleys that draw a loop of multi strand wire strung with a series of diamond beads and spacers through a cut. The required length of the wire is obtained by assembling standard length sections of wire end-to-end using screwed sleeves. A contact tension is kept on the wire, and this force with the spinning wire cuts a path through concrete and rebar. Linear wire speed is adjustable from 0 to 5,900 feet per minute, and wire tension can be adjusted from 1 to 330 pounds. The wire is wrapped around the object to be cut and tension is applied. To drop the stack piece by piece mechanically, sections of concrete would be cut from the stack starting at the top and lowered to the ground. A spotter will be used to coordinate equipment movement and the dust control activity. Dust control will consist of a person on the ground with a hose. Water will be applied as needed to the area that is being worked. It is anticipated that the stack can be demolished in four weeks.

[2] The project descriptions are based on proposed demolition processes; the actual processes may differ slightly and will be documented in the Demolition Plan

Table 1. Demolition Evaluation

	Explosives	Mechanical Means	
		Crane with a clamshell and sleeve	Diamond Wire Cutting
Health and Safety	This method has minimal hazards to the worker and equipment. The primary control is the use of a specialist in the explosives field. Potential hazard sources: • Struck by (flying debris, insects) • Falls from elevations (ladders) • Falls on same level (uneven ground conditions - slips, trips) • Rubbed or abraded (masonry drill) • Bodily reaction/overexertion (noise exposure, ergonomic concerns) • Contact with electric current (electric power tools, generator) • Contact with temperature extremes (environment – heat stress) • Contact with dust (generated from drilling) • Unplanned detonation (explosives) • Minimal noise issues – explosion takes only a couple minutes, KH expects it to be easier to ensure all personnel use adequate hearing protection throughout the activity.	This method has medium hazards to the worker and equipment. The primary controls are the use of a spotter, JHAs, and the use of trained and qualified personnel. Potential hazard sources: • Struck by (heavy equipment, concrete, flying debris, insects) • Falls from elevations (ladders) • Falls on same level (uneven ground conditions – slips, trips) • Caught in, under, or between (heavy equipment) • Bodily reaction/overexertion (noise exposure, ergonomic concerns) • Overexertion (lifting, pulling, pushing materials and equipment) • Contact with electric current (electric power tools, generator, overhead lines) • Contact with temperature extremes (environment – heat stress) • Contact with dust (generated during demolition) • Motorized equipment accident (track hoe, front end loader, trucks) • Major noise issues – crane with a clamshell and sleeve will take a longer period and requires some workers to be in close proximity to the concrete breaking tools.	This method has medium hazards to the worker and equipment. The primary controls are the structural supports, as needed, JHAs, and the use of trained and qualified personnel. Potential hazard sources: • Struck by (heavy equipment, concrete, flying debris, insects) • Falls on same level (uneven ground conditions – slips, trips) • Caught in, under, or between (equipment or debris) • Rubbed or abraded • Bodily reaction/overexertion (noise exposure, ergonomic concerns) • Overexertion (lifting, pulling, pushing materials and equipment) • Contact with electric current • Contact with temperature extremes (environment – heat stress) • Contact with dust (generated during cutting and debris movement) • Motorized equipment accident (track hoe, front end loader, trucks) • Major noise issues – longer time period requiring large equipment to remove the chunks of concrete and steel, and requires some workers to be in close proximity to the concrete breaking tools.

Table 1. Demolition Evaluation

	Explosives	Mechanical Means	
		Crane with a clamshell and sleeve	**Diamond Wire Cutting**
Environmental	This method has minimal environmental impacts. • Impacts to air quality: fugitive dust will be controlled by an automated deluge system that will result in little or no dust generation during and immediately following the detonation. Vehicle and equipment emissions are less with this method due to the one-day duration. • Minimal to no impacts to water quality are expected. • Minimal impacts to soils are expected from the falling structure. No soil contamination or erosion impacts are expected as these are not contaminated facilities. • No impacts to wildlife are expected. Efforts will be taken to cordon off the area to wildlife. • This method will generate little additional waste (chain link or geotextile containment only) when compared to the mechanical methods. • Resource use is minimized by this method as the demolition duration is limited to one day.	This method has medium environmental impacts. • Impacts to air quality: fugitive dust will be controlled by an operator wetting the structure with a fire hose. This will result in more dust generation during the lengthy demolition process. Vehicle and equipment emissions will be higher with this method due to the duration. • Minimal impacts to water quality may occur such as runoff generated during and after dust control. • Minimal impacts to soils are expected from dust control, the falling structure and vehicular traffic. No soil contamination is expected as these are not contaminated facilities. • No impacts to wildlife are expected. Efforts will be taken to cordon off the area to wildlife. • This method may generate additional incidental waste during demolition due to the duration. It is expected to take approximately a week and a half. • Resource use is increased by this method due to the demolition duration.	This method has medium environmental impacts. • Impacts to air quality: fugitive dust will be controlled by an operator wetting the structure with a fire hose. This will result in little or no dust generation during the demolition process. Vehicle and equipment emissions are a potential issue. • Minimal impacts to water quality may occur such as runoff generated during and after dust control. • Minimal impacts to soils are expected from dust control, the falling structure and vehicular traffic. No soil contamination is expected as these are not contaminated facilities. • No impacts to wildlife are expected. Efforts will be taken to cordon off the area to wildlife. • This method may generate additional incidental waste during demolition due to the duration. It is expected to take approximately a week and a half. • Resource use is increased by this method as the demolition duration is expected to be approximately four weeks.

Table 1. Demolition Evaluation

	Explosives	Mechanical Means	
		Crane with a clamshell and sleeve	**Diamond Wire Cutting**
Structural[3]	The objective of the detonation will be to compromise the stack and allow gravity to pull it straight down. The use of explosives will negate the concern of stack concrete strength.	The crane with a clamshell and sleeve would remove demolish the stack from the top down through pulverizing the concrete and steel.	The cutter would remove portions of the stack a piece at a time. Due to the construction, several types of attachments may be required during debris removal including concrete pulverizers, shears, grapples, and rams.
Economic[4]	The cost for demolition is $63,000.	The cost for demolition is $75,000.	The cost for demolition is $130,000.

[3] The structural evaluation is based on the description in Section 1
[4] The economic evaluation only considered demolition costs