A MANAGED APPROACH TO ACHIEVE A SAFE, COST EFFECTIVE, AND ENVIRONMENTALLY SOUND DEMOLITION OF A PLUTONIUM-238 CONTAMINATED BUILDING

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ABSTRACT

DOE's Mound Plant has the problem of demolishing a former plutonium-238 processing facility, the Special Metallurigical (SM) Building. The building is located within 200 feet of a major public road and golf course. Previous removal efforts on appendages to the building used the technique of tenting small segments and used labor intensive segment-by-segment removal with expendable hand tools. This approach was very slow and costly, but offered good environmental control of radioactive contamination. It was realized that this method, when applied to the entire structure of the building, would not only be very costly, but would also be of high risk to worker safety and worker exposure to contamination.

The new approach to overcome these problems is to dismantle the building structure using a rotating grapple to hold sections of the building structure while a portable rotating shear cuts the steel beams into appropriate lengths for loading directly into large waste containers. By the former method, the cut jagged steel would be size reduced with hand tools and loaded into waste containers manually. The additional handling has a high probability of producing minor, yet potentially contaminated, skin lacerations. The shear and grapple method eliminates this hazard.

To apply this safer and more cost effective technology, Mound had to assure that the method would be environmentally sound and that neither onsite workers or the general public would be exposed to radioactivity.

The Annex was decontaminated to as low as reasonably possible and the contaminated interior painted. However, there were numerous areas where contamination could be trapped. Mound conducted a formal sampling of these areas and had the results modeled for potential release during demolition. The results of this sampling and modeling effort showed that the building could be dismantled using this technology without producing a harmful effect on the environment.

Application of this managed approach to the removal of Mound's Special Metallurgical Building Annex resulted in a savings of over $100K. Also, the project was completed six months ahead of schedule with no measurable release of radioactivity and no safety problems.

Further application of this technology to the remainder of the building is expected to yield proportionality greater savings.

INTRODUCTION

The problem addressed in this report is the complete demolition of a former plutonium-238 processing building. The building including structural members, walls, ceilings, and roof were contaminated with plutonium-238. The building is located within 200 feet of a major public road and municipal golf course. Between the building and the road is a company cafeteria.

This paper addresses the complete demolition of a 46 ft x 115 ft annex to the Special Metallurgical Building at DOE's Mound Plant. The Annex was a steel superstructure with concrete block walls. The roof consisted of metal decking attached to the superstructure. Prior to the work described herein, the concrete floor of the building had been removed. The contaminated soil below the floor was removed to a level of < 10 nCi/gm plutonium-238, or a depth of about 5 ft below grade. The interior walls were removed. The exterior concrete block wall was removed and replaced with sheet metal. All exposed interior areas and ceiling (underside of roof decking) was painted to hold loose contamination.

Previous removal efforts on appendages to the building, and the removal of the concrete block wall (Fig. 1.), used the technique of tenting segments and used labor intensive segment-by-segment removal with expendable hand tools. This approach was very slow and costly, but offered good environmental control. The cost to enclose (tent) the whole building was estimated to be about $3.3 million. This approach not only would be very costly, it would present a high risk to worker safety and worker exposure to contamination. The handling of cut jagged steel provides a high probability of producing potentially contaminated skin lacerations.

NEW APPROACH

Mound wanted to overcome the cost and safety hazards of the old methods by utilizing a shear and grapple technique. The new method uses a rotating grapple to hold sections of the building while a large portable rotating shear cuts the steel beams into appropriate lengths for loading into large waste containers.

There was a concern that using this heavy duty equipment approach would result in release of plutonium-238 contamination. Although all efforts were made to remove or stabilize contamination on exposed surfaces, a potential for trapped contamination would exist between the sheet metal roof decking and the structural steel (Fig. 2.). Because data was not available on the entrapped contamination in this area, a sampling plan was initiated.

SAMPLING PLAN

Knowledge of the former operations in the building was used to develop a sampling scheme (Fig. 3.). Each area of the annex was assigned an expected risk level according to the type of work that was performed. Areas that were used for

Fig. 1. Shows enclosure method used for removing contaminated block wall and replacing with sheet metal wall.

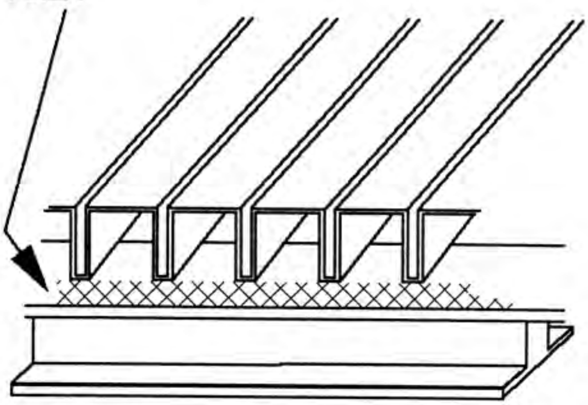

Fig. 2. A potential for trapped contamination existed between the sheet metal roof decking and the structural steel.

handling fine particles had high risk levels; and therefore, a total of eight samples were assigned to each. Some areas were in the cold, nonradioactive, side of the building. Thus, only two samples were taken from these low risk areas. The remaining areas were used for handling liquids. They were expected to be of moderate risk so at least three samples were taken. Also, a FIDLER (Field Instrument for Detection of Low Energy Radiation) survey of the entire roof was conducted. Any spot showing a level of greater than 500 cpm was marked for sampling. Each sample was 8" x 12" and from an area directly over a roof beam.

Swipes taken from the sampled areas ranged from less than 20 dpm/100 cm^2 to 4000 dpm/cm^2. The average was 670 dpm/100 cm^2.

ENVIRONMENTAL ANALYSIS

For the environmental analysis it was assumed that the entire area between the roof and structural beams was contaminated to the level of the highest sample result. Two cases were then analyzed. Case 1 assumed that the operation went as planned. There were seven exposed beam cuts in a section (The SM Annex contained ten 23 ft x 23 ft sections). There were also two cuts to be made on the ground. Case 2 assumed that all the beams fall away from the roof leaving the total lengths of the beams exposed. Both cases assume that the receptor is standing at the fence line 200 feet away for the length of the project. Under these conditions for Case 1, the receptor would receive an estimated total of 1 mrem bone surface dose. For Case 2, where all sections have the maximum contamination and all beams fall completely away from the roof immediately exposing their entire length, an estimated total of 80 mrem bone surface dose would be received by the receptor. EPA 40 CFR61 subpart H lists a standard of 75 mrem organ dose. Thus, considering the assumption used in the analysis, it was decided that the risk was very reasonable.

However, to be extra safe, it was decided to proceed by removal of only one section and determine whether the beams would fall away from the roof. Also, continuous air monitors were strategically placed (Fig. 4.) to measure any release of contamination.

The first section was removed (Fig. 5.). The beams did not fall from the roof upon cutting with the shear. Also, no

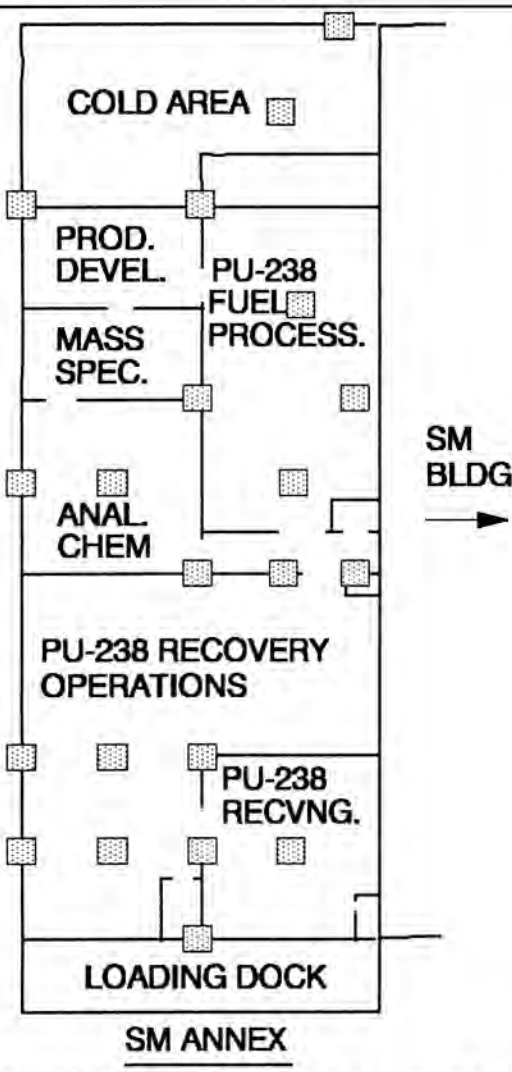

Fig. 3. Knowledge of former building operations was used to develop sampling scheme.

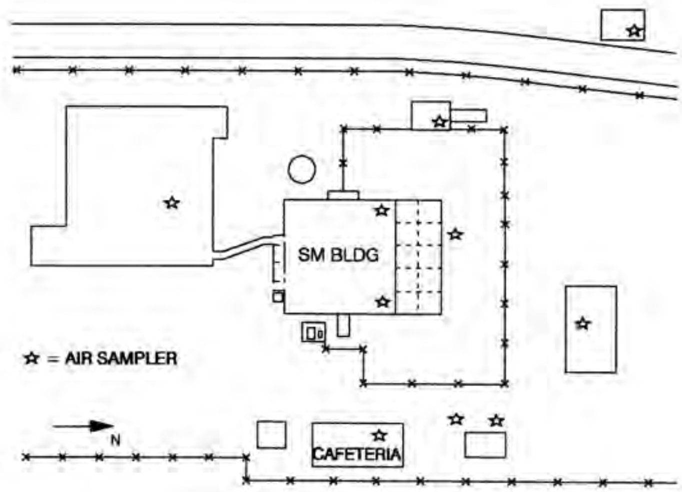

Fig. 4. Air sampling stations (*) were set up to monitor the project.

TABLE I

Savings Analysis And Implementation Costs of Applying Shear and Grapple Technique For the Demolition of the Special Metallurgical Building Annex

	Old Method $ x 1000	New Method $ x 1000
Labor	206	54
Material	139	151
Total	345	205

airborne contamination was measured on the continuous air monitors.

RESULTS

The project proceeded to remove the remainder of the annex without incident. There were no safety problems or environmental releases. The results of the shear and grapple technique verses the older labor intensive hand tool method are shown in Table I. Taking the time to carefully conduct the sampling plan and analyze the possible environmental results yielded an overall savings of $140,000 (40%) and improved the schedule by over six months. This method will result in even greater savings when applied to the demolition of the main building's structure.

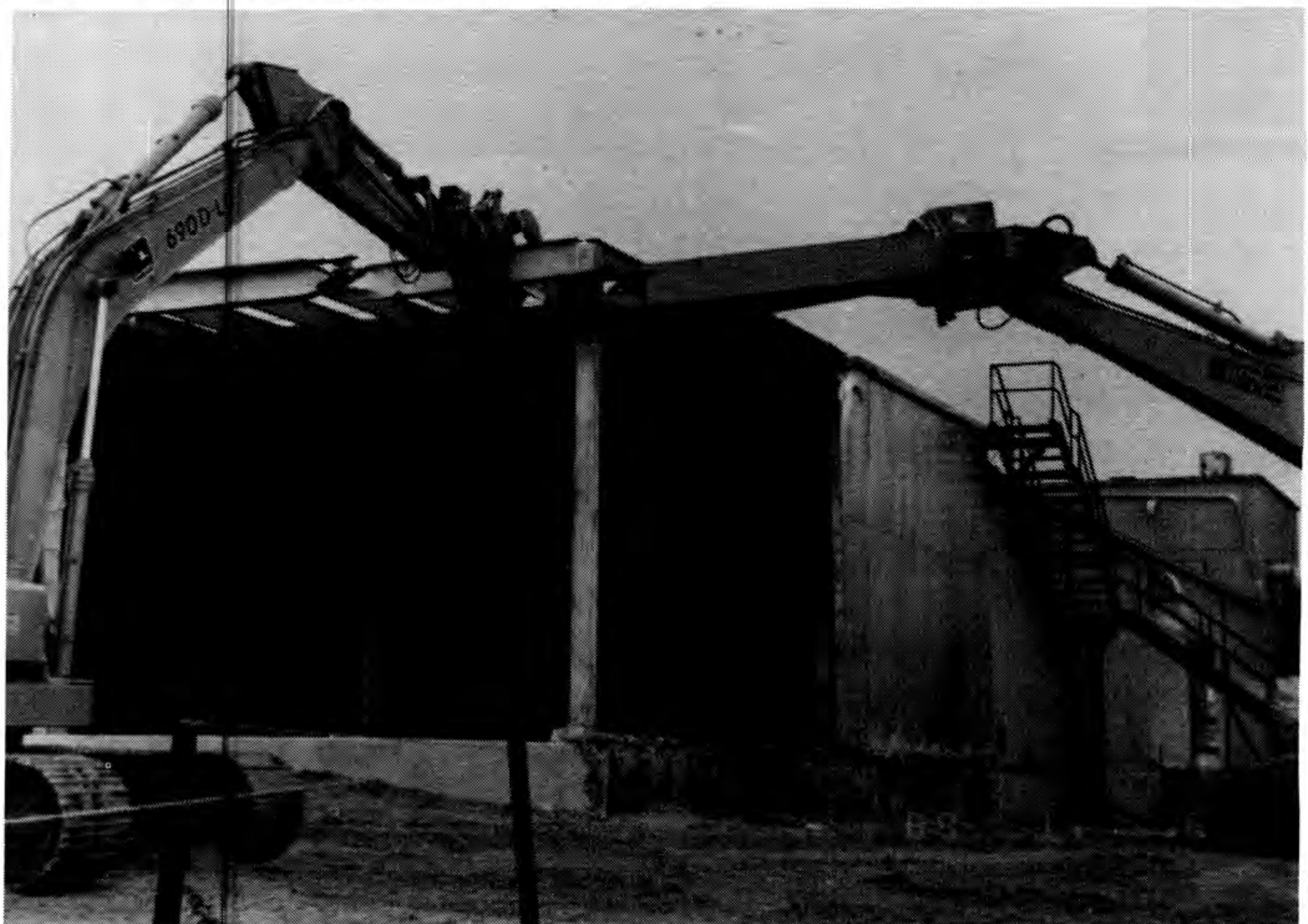

Fig. 5. Grapple holds structural steel while shear cuts first corner of building.