WELDON SPRING SITE REMEDIAL ACTION PROJECT
APPROACH TO BUILDING DISMANTLEMENT AND DEMOLITIONFelix J. Spittler, P.E.¹

1.0 INTRODUCTION

When remediation began at the Weldon Spring Site Remedial Action Project (WSSRAP), there were 41 buildings on site. Twenty-nine of these buildings were ancillary structures and were not used for processing radioactive material. Most of these have been torn down. The remaining 12 buildings were used for uranium and thorium processing or were major support structures, such as the laboratory. Two of the buildings where major processing operations occurred were successfully demolished in February of this year. Demolition of all structures will be complete in September of this year.

To give an understanding of the magnitude of the work, the following is a description of the physical characteristics of the green salt building. This building was used to convert brown oxide (UO₃) to green salt (UF₄), which is the last intermediate step in purifying the mostly yellow cake feed material into uranium metal.

The green salt building had a gross floor area of 69,160 sq ft and a gross volume of 1,286,000 cu ft. It was a five-story building, approximately 90 ft high with a structural steel frame, corrugated asbestos siding, and a flat, poured gypsum roof covered with built-up roofing. Interior walls were concrete block and floors were poured concrete or metal decking. The building was in various stages of structural deterioration, ranging from reasonably sound to structurally unsafe.

Building process components were virtually intact. Equipment included: green salt reactors; carbon and stainless steel tanks; hoppers; compressors, pumps, and valves; and dust collection and exhaust systems.

Radioactive contamination was primarily natural uranium with daughters removed. Reactors were caked with green salt, and dust collectors and piping contained radioactive product. Loose contamination was ubiquitous with typical levels at several tens of thousands dpm/100 cm². Typical foot traffic created airborne levels of approximately 0.1 Derived Air Concentration.

Asbestos containing material (ACM) and man-made mineral fiber (MMMF) material were prevalent. These materials were used for pipe insulation, exterior siding, roofing, floor tiles, gaskets, etc. All ACM and MMMF were radioactively contaminated.

Hazardous chemicals included Polychlorinated Biphenyl, residual amounts of hydrofluoric acid, and ammonium residues.

¹Project Engineer, MK-Ferguson Company

Small amounts of mercury were present in switches and various other equipment. Building sumps were identified as Resource Conservation Recovery Act hazardous due to uranium ores and paint flakes which contained high levels of lead and cadmium. These represented a mixed waste.

2.0 TEAM DEVELOPMENT

Since remediation projects are complex in nature, it is critical to assemble a comprehensive cross-section of professionals to cover all major aspects involved in the remedial design. At a minimum, this Responsibility Area Matrix (RAM) team (Figure 2.0) should include a project engineer and construction engineer and representatives from:

- Regulatory Compliance
- Environmental Safety and Health
- Construction Safety

Depending on the nature of the remedial project, this team might expand to include Quality Assurance/ Quality Control and a contract administrator. The project engineer should serve as the task lead. It is the responsibility of the project engineer to utilize team members, to ask correct questions, and to put information into language appropriate for contract documents.

The first and most important step in the remedial design process is to build a strong team feeling. This is the responsibility of the project engineer. Since all members play an important role in the design process, creating a team feeling can be done in many different ways.

- Keep all members well informed.
- Involve team members by asking questions pertaining to the design.
- Do not ignore team member input.
- Do not overturn a team member's position without first discussing it with the team member. A consensus should be reached.
- Promote an atmosphere in which the team takes responsibility for the design.
- Avoid placing blame on any one team member.

3.0 ESTABLISHING OBJECTIVES

One of the first duties of the team is to outline remedial design objectives. Two of these objectives are:

- Safety and health of workers.
- Minimization of the spread of contaminants.

(The protection of the environment and the public is the reason for the remedial action. Therefore, it is not necessary to include it as an objective for the design.)

When objectives have been established, the team must develop a plan for achieving them. This plan might be as follows:

Safety and health of workers

- 1) Ensure a safe work environment by identifying the hazards through engineering survey.
- 2) Minimize high work.
- 3) Minimize labor-intensive tasks.

Minimization of the spread of contaminants

- 1) Control dust; localized ventilation, and water.
- 2) Control surface water, seal building openings, and install siltation fences.
- 3) Control track out of contaminants, contamination reduction zones, and work zone.

Once the objectives have been defined, the design moves into a data-gathering phase.

4.0 DATA COLLECTION

The success or failure of a remedial design action is heavily dependent on the thoroughness of data collection. Several characterizations should be completed to support a remedial action project. At a minimum, the following characterizations should be developed:

- Physical
- Radiological
- Chemical
- Asbestos

The physical characterization report is the logical starting place. This effort should retrieve all historical information about the facility to include such items as operating procedures, shutdown procedures, as-built drawings, vendor information on equipment, etc. An often overlooked source of information are employees who worked at the facility during its operation. Many times, a retired worker can give valuable information on the uses of certain facilities and can identify areas where debris was buried or where spills may have occurred, etc. These are items which may not have been documented but definitely need to be included in the design. Physical characterization also consists of walking down the facility and verifying as-built drawings. It is very rare that all plant modifications are correctly updated on as-built drawings. The walkdown may reveal areas where new processes, platforms, or storage facilities were installed. Any changes identified in the field should be noted on a master set of as-built drawings. This walkdown provides a great opportunity for the identification of potential safety hazards which should also be noted. These hazards could include weak/collapsed roof areas, floor areas which are open/weak, missing handrails, deteriorated stairways, trip hazards etc. The purpose of the physical characterization then is to:

- Provide an accurate understanding of the prior use of building systems and equipment.
- Identify areas where further characterization

- activities are to be conducted.
- Identify unsafe building conditions.
- Identify building modifications.

The radiological, chemical, and asbestos characterizations can be approached more realistically by understanding the processes which were conducted in the building. Two approaches can be taken for the s/c characterizations. The best approach depends on the final disposition of material generated from the action. For example, if the material will be placed in a disposal facility designed for disposal of mixed wastes, the approach to characterization might be designed to accomplish the following:

- To provide enough data so that proper personal protective equipment can be specified.
- To identify regulated material which requires special clean-up, packaging, and temporary storage requirements.
- To identify areas where a more detailed characterization may be necessary.

If, on the other hand, the material must be cleaned for disposal in an unrestricted landfill or for recycling, a more detailed approach would need to be developed. In addition to the items listed above, the following should also be considered:

- To gather sufficient samples to establish that all contamination has been identified.
- To collect volumetric-type samples to differentiate between surface and volumetric contamination.
- To establish, in the case of radioactivity, the type of radiological contaminant, so that it can be compared to the correct release criteria.
- To minimize costs associated with decontamination, sampling should provide enough information so that quantities of material to be decontaminated are as accurate as possible.
- Workers taking the samples must be able to access all sample locations.

There are pros and cons to each approach. The broad brush approach tends to be more conservative, but could result in the handling of a larger quantity of contaminated material.

The detailed approach defines the contaminant locations more accurately than the more conservative approach but will also result in higher analytical costs. This approach allows more flexibility in choosing sampling locations so as to minimize the number of high-risk (in relation to accessibility) sampling locations.

The detailed plan does not allow the degree of flexibility in choosing sampling locations so safety-related risks to workers collecting samples are increased. Upfront costs also increase because a means of accessing all areas must be provided.

An effective way to decide which sampling approach is best is the value engineering method. This method is designed to look at and compare all alternatives implemented. The results from this type of evaluation will result in a plan to successfully execute the objectives of the task, while minimizing cost and worker exposure.

Figure 4.0 is a fast diagram developed in a value engineering session (VES) for use at the WSSRAP. This VES established most of the criteria to be used in the design of the building removal subcontracts including procedures for handling all material resulting from the removal, to include:

- Cleaning
- Segregating
- Sizing
- Handling
- Packaging
- Storing

When this VES was conducted, the Record of Decision for the WSSRAP was not in place; therefore, this criteria was detailed enough so as not to bias any future disposal options.

Another key element in deciding on a sampling approach is the preparation of site-wide position paper. This position paper develops an approach to be taken by the site on various issues. Issues for position papers can include such items as:

- Demolition of a structure versus dismantlement of the structure.
- Off-site release which covers decontamination and recycle options versus restricted release options.
- Temporary material storage options.

This position paper will enable the site to be consistent in the approach used for various position paper topics. It also makes the site position clear to the client and allows the client to accept this position or suggest modifications. The end result is clear communication and understanding on a site-wide basis.

Results from these efforts will enable the team to make the best decision on the approach to characterization and sampling efforts.

5.0 BUILDING REMOVAL APPROACH

The approach to building removal should cover how the work is expected to be carried out. It creates a framework for the team to

begin developing contract documents. During this process, the team should keep in mind the objectives of the project. Using these objectives, the following work sequence can be established:

- 1) Work zone preparation.
- 2) Site drainage control.
- 3) Temporary construction staging area.
- 4) Roof stabilization.
- 5) Fragmented glass removal and immobilization.
- 6) General housecleaning and sump sealing.
- 7) PCB and mercury cleanup.
- 8) Friable insulation removal.
- 9) Equipment and product process pipe removal.
- 10) Special equipment removal.
- 11) Interior surface dust removal.
- 12) Transite siding removal.
- 13) Structure, deck, and roof demolition.
- 14) Final cleaning and seeding.

The first three steps are considered preliminary preparation. The next three involve removing construction hazards in the building to establish a safe working environment. The removal of the environmental hazards is completed during the next five steps. Once environmental hazards have been removed, demolition of the structure can begin.

5.1 Preliminary Preparation

Work zone preparation consists of establishing a perimeter around the affected work area of a building or buildings, establishing access gates, and setting up shower trailers and surface water controls. Work zone perimeters can be defined by using orange plastic construction fence and by typically surrounding two or more buildings depending on proximity. The area inside the fence can be referred to as the work zone (WZ) (the classical hazardous waste site contamination reduction zone {CRZ}).

A maximum of two entrance points to the WZ should be allowed for vehicles and other equipment. Egress should be allowed only after visible mud and dirt has been removed and a radioactive contamination survey performed. One entrance/egress point through shower trailers should be provided for personnel. The value of the WZ is twofold.

- 1) It provides a physical barrier that prevents access by unqualified personnel (by virtue of training and need to enter) to the work area. Therefore, only the people directly involved in the remedial activity would be exposed to the hazardous conditions.
- 2) It provides an environment in which the remediation contractor can conduct a more efficient operation. The operation is made more efficient by allowing equipment and personnel to move between several buildings with minimal restrictions, rather than requiring the contractor to process the workforce through a full personnel decontamination facility.

The WZ concept could also make use of a CRZ at building exits. A CRZ requires only minimal personnel decontamination, so little time would be expended at contamination check points. This would be acceptable since the WZ area would probably already have been contaminated to some level during original plant processing operations. After completion of all demolition activities within an entire WZ, any "tracked out" or contaminant spread which may have occurred would be cleaned up as a final step.

Water spray for dust control can be used both inside and outside buildings as an effective means to achieve near zero environmental release during remediation. In fact, structure and ground-wetting should be required prior to (this requirement is evaluated on a per building basis) and continuously, over the entire work area during collapse or dropping of portions of buildings. This makes drainage control including run-on and run-off protection and erosion control critical.

Water control inside buildings can be accomplished by covering, plugging, and/or grouting all sumps, trenches, drains, and other floor penetrations. This prevents contaminant spread outside the building via these underground networks. Sumps within the building may be used as collection points for interior run-off water. The sumps should only be used after sealing all cracks or penetrations. Water should be collected inside the building and pumped into holding tanks for testing to determine if any water contains regulated materials i.e., RCRA or Toxic Substance Control Act (TSCA). The holding tank system should be constructed to meet all requirements of 40 CFR 264 for storage of RCRA- contaminated water. After testing for contaminants, the water will be treated or released.

Exterior water control is achieved through the use of filter fences, straw bales, and/or sand bags. These controls are placed around drainage structures or in drainage ditches to filter-out solids carried in the water.

5.2 Removal of Construction Hazards

Roof stabilization is critical for worker safety. All buildings should be inspected and unsafe conditions corrected. Roof integrity may be questionable on structures that haven't been maintained. Concrete roofs pose the highest risk with varying degrees of deterioration from cracks and holes. These areas must be stabilized before work can safely be conducted inside the building. This stabilization can be safely achieved by sounding the roof from below using a long metal rod of sufficient length to maintain a safe distance. Manlifts can be effectively used to provide access to roof areas. Weak areas should be marked and then either removed or shored. In areas where removal has taken place, temporary roof covers can be used to minimize the infiltration of rainwater and to minimize the number of building openings. Minimizing building openings is critical to remove pathways for airborne particulates to leave the structure.

Broken or cracked windows also pose potential safety hazards. These hazards can be addressed by removing the glass or stabilizing it with duct tape. Covers can be placed over the openings where windows have been removed to avoid rainwater infiltration and to minimize the number of building openings which could be pathways for airborne particulates to leave the structure.

Potential construction safety hazards such as slips, trips, and falls should also be addressed. All platforms, stairways, and handrails should be inspected for structural integrity, and unsafe conditions should be corrected or the area barricaded to prevent personnel access. General housecleaning will remove most slip and trip hazards by removing such items as miscellaneous debris and small equipment. HEPA vacuuming, scraping, and shoveling will remove built-up dust from floors which will minimize contaminate tracking during execution of work.

Many buildings contain large equipment sumps, pits, or trenches. Since these areas pose a number of safety hazards it is important to properly barricade or cover them. A considerable amount of standing water may be present in the sumps, trenches and pits. The sump should be drained and the water tested. The equipment, debris, and sludges should be removed and the sump washed down and drained a final time. They should then be covered and sealed to prevent entry of and contamination by water from demolition activities. The contractor may elect to leave one or more of the sumps open to collect washdown water, but prior to allowing this, the sump must be inspected for cracks and penetrations. All cracks and penetrations should be sealed to prevent release and spread of contamination.

5.3 Removal of Environmental Hazards

When regulated materials such as PCBs, lead, mercury, etc., are present in buildings, they should be addressed after the structure is made safe for workers. These contaminants are generally localized and are related to the specific operations which took place in that area of the building. These contaminated areas should be isolated by constructing a barricade to minimize tracking and worker exposure. The clean-up of these areas must be completed in a manner consistent with State and Federal regulations. Workers should enter and exit these areas through a CRZ.

Friable insulation is a hazard found in most buildings. Several industry standards exist for removal. When large quantities must be removed, a negative air enclosure can be constructed. When such an enclosure is impractical, cut and wrap or glove bag techniques can be used.

Contaminants such as oils and radioactive products can be containerized and kept in an appropriate storage facility. Oils should be drained from all equipment and collected in 55-gal drums. Oil Dry or other absorbent material can be packed into drained equipment to absorb any residual liquids. Radioactive product, dust from High Efficiency Particulate Air (HEPA) vacuums, and floor sweepings can be drummed separately.

To minimize material which must be removed prior to building demolition, a special material group may be established. Equipment and process pipe which contain, or may have contained radiological contaminants should be identified. Then, whether this material is inside or attached to the outside of the building, it must be removed prior to final cleaning of the building. Systems which might fall into this category are:

- Dust collection systems.
- Chemical feed lines(material conveyors).
- Heating and ventilation systems.
- Radioactive material feed lines.

Items which can remain in the building during demolition include:

- Steam lines.
- Potable waterlines .
- Plant air lines.
- Electrical lines (provided ACM is not present).

When overhead runs of product process pipe are present, controlled lowering methods are required. Due to the pyrophoric potential of the product material, torch cutting should not be allowed unless the lines have been inspected and no visible residues are detected. It is important to note that airborne releases of both chemical and radiological contaminants during torch cutting activities can be quite high. Additional engineering controls such as localized exhaust ventilation equipped with HEPA filtration should be required.

Sometimes a combination of both construction safety and environmental hazards exist in one item. These hazards should be identified as special handling items. Examples of these types of materials are:

- Reactor furnaces.
- Azeotrope distillation columns.
- Rotary kiln.
- Reduction furnace.

Specific plans should be submitted which outline the removal and dismantlement approach for special handling items. The specific engineering controls which can be required for dismantlement include sealing the immediate building area or staging in a separate controlled area within the buildings. The area used for this operation should have a forced air system with HEPA filtration to reduce levels of airborne contaminants.

All material should be cleaned prior to removal from the building. After exterior surfaces are washed to remove loose contamination, fixed contamination will still be present. Cleaning can be done using HEPA vacuums, wet wiping, scraping, and/or high-pressure water sprayers. Cleaning operations should be set up where water can be collected and then transported to the water holding area for testing. The cleaned materials can then be transferred to an outside storage area with run-on and run-off protection, pending final disposal.

After removal of these items, the building interior should be completely cleaned. All surfaces within the structure can be HEPA vacuumed, wet wiped, and scraped or washed with high-pressure water. If high-pressure water is used, all building openings should be sealed. The water from this operation should be collected and sent to the water storage area for testing. After the interior has been cleaned, surfaces should be inspected to ensure that all loose contamination has been removed. After inspection, structural demolition can begin.

5.4 Removal of the Structure

Many structures have transite siding which is a non-friable ACM. A removal method must be used which will not make this material friable. In many cases, window caulking will also be a non-friable ACM, and the method used to remove it cannot make it friable. Therefore, prior to demolition of the structure, all window frames and transite siding should be removed in a manner which would not create a friable condition. The removal method will generally be a piece-by-piece operation and these panels can be stacked for outdoor storage. Window glass can be removed before or after frame removal. If the glass is removed prior to the frame being removed, the glass must be broken out in a controlled manner and collected. If the frame comes down with the glass still intact, removal of the glass will be completed on the ground and collected. Any loose ACM should be removed and handled as friable. The window frame should be encapsulated, stacked, banded, and placed in the designated storage area.

Actual demolition of the structure can now begin. Demolition should follow detailed plans developed by a competent person which identify the procedures for the entire demolition. (Occupational Safety and Health Administration calls for a competent person, but provides no qualifications for the position. For this type of work, the competent person might be required to be a registered professional engineer.) Although this plan should not be changed in the field, changes may be made as demolition progresses, provided the changes have been reviewed and approved by the competent person.

One of the most critical steps in demolition will be the sufficient wetting of the structure. Although the building will have been thoroughly washed down, there will still be potential for release of radioactive contaminants from connection areas of the structure. Therefore, it is necessary to require wetting of the structure prior to and during demolition by placing soaker hoses and sprinklers on the structure, as well as by spraying water with hoses.

Depending on segregation requirements, the concrete roof material may need to be segregated from the structural steel. In this case, contractors might elect to remove the roof separately, prior to demolition of the structural steel. It is important to test built-up roofing material for potential ACM. If ACM is found, it will most likely be locked in a tar matrix and therefore, will not likely become friable during demolition, so no special ACM requirements will be required. Monitoring for ACM should be

conducted during removal to confirm this assumption. Removal of the roof can be completed by using a clam shell or wrecking ball attached to a crane. During roof removal, manlifts can be used to get workers close enough to the structure so that effective wetting can take place. The wetting is necessary to prevent airborne releases.

Demolition will vary from structure to structure depending on configuration, size, and height. Techniques for demolition include:

- Excavator-mounted shear attachment.
- Selective member cutting to bring a portion of the structure down.
- Collapse demolition.

When the structure is safely on the ground, sizing can be completed. One of the most effective means of sizing is an excavator-mounted shear. When the structure has been sized and sorted, the remaining slab should be cleaned. Any disturbed soil areas around the slab should be graded and seeded. The demolition subcontractor can then be demobilized.

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◆ FROM

Spittler, Felix

◆ TO

Rone, Walker

◆ DATE

3/16/94

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DUE DATE

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ENGINEERS
AND
CONSTRUCTORS

-46802 -41030
-46803 -41031

MORRISON KNUDSEN CORPORATION

MK-FERGUSON GROUP

WELDON SPRING SITE REMEDIAL ACTION PROJECT
7295 HIGHWAY 94 SOUTH
ST. CHARLES, MISSOURI 63304
PHONE: (314) 441-8086

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May 16, 1994

U. S. Department of Energy
Weldon Spring Site
Remedial Action Project
ATTN: Mr. Walker K. Love
Contracting Officer
7295 Highway 94 South
St. Charles, MO 63304

SUBJECT: Contract No. DE-AC05-86OR21548
SPEAKER FOR ASME D&D AND ENVIRONMENTAL RESTORATION SHORT
COURSE - MAY 1994

Dear Mr. Love:

At the request of Jerry Van Fossen, the PMC is sending Felix Spittler to represent the site as a speaker at the ASME D&D and Environmental Restoration Short Course, to be conducted in Cincinnati the week of May 23, 1994.

The attached paper is submitted for your review. Please indicate your concurrence by signing below and returning the original of this letter to me by May 16, 1994.

If you have any questions, please contact Felix Spittler at ext. 2922.

Sincerely,

James R. Powers
Project Director

JRP/fs/mac

cc: Stephen H. McCracken

Attachment: As stated

Approved By: Walker K. Love
Walker K. Love
Contracting Officer

Date: 5/22/94

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