ACCELERATING D&D AT FERNALD:
THE FAST TRACK REMEDIATION DESIGN/BID PACKAGE

BY

Steven M. Houser, FERMCO*
Mark F. Albertin, FERMCO*
Terry D. Borgman, FERMCO*
William A. Zebick, FERMCO*

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FERMCO*
Fernald Environmental Management Project
P.O. Box 398704
Cincinnati, OH 45239-8704

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Steven M. Houser, Project Director, Operable Unit 3, FERMCO
Mark F. Albertin, Vice President, Construction, FERMCO
Terry D. Borgman, Construction Contract Manager, FERMCO
William A. Zebick, Construction Manager, FERMCO

ABSTRACT

The Fernald Environmental Management Project is a Department Of Energy (DOE) facility near Cincinnati, Ohio which provided high purity uranium metal products to support United States defense programs. Production operations were halted in 1989 to focus available resources on environmental restoration activities at the facility.

Operable Unit 3 (OU3) is the designation given to the production area and production-associated facilities and equipment, including, but not limited to, all above and below ground structures, equipment, and utilities.

In late spring of 1994, two decisions were made that established the long range strategy on how remedial designs (RD) and the bidding of remedial actions (RA) are approached for the decontamination and decommissioning (D&D) of the Fernald facilities. The first was to fast track the remediation design and bidding process for the first three D&D packages; and the second was to use standard performance specifications to streamline the decontamination and decommissioning process.

This paper describes these strategies, identifies the key elements involved, and discusses the lessons learned that were associated with the approaches. A brief synopsis of these elements is as follows:

• A facility complex which groups facilities into blocks of work was used for the bid packages.

• A task force approach involving the required functional organizations was used to fast track the design and bidding process.

• Standard Performance Specifications have been developed for each task to establish minimum acceptable criteria and yet provide the subcontractor flexibility to be creative within these boundaries. This approach also dramatically decreases costs for future D&D packages.

• A key feature of value engineering has been the use of construction methods and techniques to drive the D&D cost significantly lower.

• The bid package was structured around a modified IFB approach. This provides the successful bidder the opportunity to incorporate innovative ideas within the performance
specification guidelines. In addition, several innovative concepts such as prequalifications of bidders, preparation of a task based bid package, and use of video and still shots were used to create a comprehensive bid package.

- The D&D approach was structured to decrease safety risks by emphasizing mechanical methods over manual methods.

This paper will present the lessons learned in these strategies and illustrate how the various concepts described above were translated into a four month fast track design bid process, how the overall project costs were significantly reduced, and how safety risks were significantly mitigated.

INTRODUCTION

In Spring 1994, an opportunity was seized to establish the long range strategy on how remedial designs (RD) and the bidding of remedial actions (RA) are approached for the decontamination and decommissioning (D&D) of the Fernald facilities. Several key concepts contributed directly to this opportunity:

First, the CERCLA process provides for an Interim Record of Decision (IROD) in situations where RA can be performed that mitigates potential threat to public health or the environment, yet doesn’t prevent regulatory and public participation in the ultimate remedy selection. Such is the case with building demolition at Fernald. Second, it was observed that the typical bidding process was too long, and that significant schedule gains could be made by fast-tracking the design and bid process. Lastly, it was concluded that we could successfully employ standard performance specifications to streamline the overall engineering design process, instead of specific procedures for each facility.

This paper describes these approaches, identifies the key elements, and discusses the lessons learned that were associated with these efforts.

FACILITY COMPLEX APPROACH

Initially various methodologies were created to prioritize the sequence of D&D of the 232 structures/facilities at Fernald. These included ranking and weighing of each facility with factors such as contamination levels, use, location, D&D difficulty, etc. However, these approaches ultimately resulted in using a simple approach based on three criteria: 1) Group the facilities into blocks of adjacent facilities which have obvious geographic boundaries. 2) Schedule those blocks that are available first. 3) Schedule the blocks to achieve the early start of a sub-surface cleanup taking into account site drainage and underground utility feeds.

This resulted in the grouping of above-ground facilities into approximately 24 (3 underground) project packages called complexes.

COMPLEX DESCRIPTIONS
The initial complexes included in this approach are the Pilot Plant (12 Structures), Plant 4 (1 Structure) and Plant 1 (11 structures). The Pilot Plant has two large concrete framed structures and 10 steel framed structures. Plant 4 is a very large steel framed structure with asbestos transite panels. Plant 1 is composed of a large steel framed structure with asbestos transite panels, 1 masonry block structure and 9 smaller structures. Each of the complexes requires remediation activities for dismantlement of pipe, ductwork, electrical removal (1400 components); interior and exterior transite siding and exterior features (doors/windows): structural steel/concrete framing removal including interior/exterior concrete slabs and walls and masonry walls and built up roofing systems.

**TASK FORCE APPROACH**

To accomplish a fast track design and bid process, a remediation task force was established to ensure that engineering, design, construction, safety, quality, regulatory, waste management, environmental, procurement, DOE input, schedule and budget aspects were considered in each remediation design package. The team was commissioned to participate in all aspects of the project, including but not limited to the inception of the design, Certification for Construction, contract award, execution of the remedial action, completion of the contract and the final verification report.

**DEC (Design, Engineering, Construction) Team**

Members of the CERCLA RCRA Unit 3 staff participated using representatives from functional groups to formulate an aggressive design package which included scope definition of the engineering, construction, and waste disposition aspects of a specific project. A work plan of construction tasks was prepared and brainstorm sessions including lessons learned from past and ongoing projects were incorporated into the approach to the work. Value engineering and constructability studies were performed and shared with the design engineer. Particular emphasis was placed on performing the remediation work in a safe, quickest and least cost method.

**Fast Track Schedule**

The work plan formed a basis for design specifications; a design/construction/waste management preliminary schedule; a task based safety matrix; waste stream characterization and documentation; quality plan and labor determination. A fast track schedule for the development of the Certified for Construction Package (CFC) was determined to be approximately ten (10) weeks. This period is combined with an additional two weeks for final preparation of the bid package; a four week bid period, a three week bid evaluation period and a two week DOE bid evaluation period. These are the components of the fast track schedule to award a contract for the remediation of the complexes in five to six months.

**Integration of Environmental and Permitting Requirements**

As the work plan described above was prepared, representatives from environmental, regulatory and safety and health divisions provided comments in parallel to the development of the design
specifications. This ensured that regulatory requirements for construction plans were incorporated during the design process.

USE OF STANDARD PERFORMANCE SPECIFICATIONS

Generic performance, procurement specifications and project scope drawings were created to form a Certified for Construction design package to be issued for bids. The task force developed work planning packages based on the D&D work tasks. The design engineer then used these work planning packages to create specifications related to specific Decontamination and Dismantling construction tasks. Major standard specifications included dismantling actions such as asbestos, asbestos transite, piping, electrical components, ductwork, process equipment, concrete, and structural steel. Other specifications included methods and special requirements for rigging, mobilization, decontamination, site preparation, demobilization and waste handling.

A key decision to the fast track remediation design process was to develop a set of standard performance specifications. The foundation for standard performance specifications is built around two basic concepts:

1) Establish the minimum acceptable boundaries (performance standards) in which a task is to be accomplished.

2) Allow the performing subcontractor the flexibility to exercise creativity within these boundaries.

The objective is accomplished by breaking the project into discrete, homogeneous tasks. For each task category, a set of criteria is set forth in the form of standard performance specification that establishes the baseline requirements for accomplishing the respective category of work. The specification sets the requirements to accomplish the task in a manner that protects the individual and the environment, and also meets the site operating criteria. An example of the former would be dust control methods for removing concrete, and of the latter would be size reduction requirements for steel and associated appenditures to meet packaging criteria for shipping boxes.

The use of a standard specification eliminates the requirements to redesign the specification for each facility. For example, once a specification is developed for removing process piping, transite siding, and structural steel, it applies wherever that task is performed. A specification for a facility demolition then only requires the assembly of those specs that apply and the preparation of specifications for which a standard specification does not exist.

VALUE ENGINEERING AND D&D CONSTRUCTION METHODS

A key aspect of value engineering for D&D remediation projects is in the use of cost saving construction methods. There is a fundamental difference in the approach to design of a new facility versus the design for D&D of the same facility. New design requires specific calculation of loads, flows, stresses, etc. to establish size and configuration of equipment and facilities. This process results in a detailed set of drawings and specifications to describe these
requirements. There is almost always no description of the construction methods that will be used to build the facility.

However, in de-construction, the process is almost totally based on the construction methods that will be used to dismantle the equipment and the facility. The emphasis both from a safety and from a cost standpoint needs to focus on the construction methods and equipment to be used. Construction experts need to be involved in the early phase of the remedial design process to bring in the construction expertise that is required for a safe, successful, and low cost project.

BID APPROACH

Prequalification

In parallel to the design specification activities, prequalification of bidders was conducted. This consisted of preparing a Notice of Prequalification published in the Commerce Business Daily which included the key criteria to evaluate bidders in light of the type of work included in the three complexes to be bid. These criteria included performing government work (experience with government contracts); demolition experience (asbestos and regular); rigging experience; radiation experience (worker safety issues); safety experience (EMR rating in the industry) and verifiable proof of self performing 45% of the past qualified work. Prequalifications were evaluated and bidders were notified accordingly.

Modified Invitation for Bid (IFB)

A modified IFB consisted of the preparation of a bid package using performance specifications. The IFB package consists of commercial bid and award terms, general terms and conditions, special terms and conditions, the project agreement, the statement of work (including the work scope, performance criteria), drawings, specifications, photographs, videos, safety program (including the safety matrix), and the quality plan criteria. The successful bidder is required to incorporate innovative ideas within the guidelines of the performance specification to form a bid. While the award is made to the lowest, responsible, responsive bidder, the bidder must meet all the criteria specified in the performance specifications. After the award, the successful subcontractor submits detailed work plans for approval which incorporate the contractor’s unique approach to meeting the performance guidelines.

Task Based

The entire construction process is built around discrete tasks of like work (i.e., ventilation, duct dismantling, transite siding removal, process equipment removal). The bid package as well as the management systems used to support the work are all structured to support the task concept. As was discussed previously, a standard performance specification is developed for each discrete task category. The estimate and schedule are developed to uniquely depict each of these tasks. This does not preclude greater detail than at the task level; however, the detail must uniquely roll up into the specific task. For example, the task may be transite siding removal, and the contractor may prepare a more detailed schedule that shows siding removal on all four sides of the building. The contractor’s individual pay items are also established at the task level. In
addition, safety and quality matrixes are developed at the task level to specify the safety and quality requirements that are required for the performance of each task.

**Video and Picture Book**

The use of videos and picture books greatly facilitate fast track remediation bidding. Typically, bid packages have reference drawings that the bidders use for a bid take off. The cost involvement in updating these reference drawings to present as-built conditions is costly and time consuming. A detailed videotape which shows inside and outside of the structures, miscellaneous outside structures, utilities, side photography, and construction boundaries is sent out with each bid package. A photo book showing a panoramic overview of each floor of the structure and outside of the structure is also sent out with each bid package. The use of videos and a picture book does the following: 1) reduces cost of engineering and drafting; 2) reduces bidder clarification questions; 3) reduces number of tour visits by the bidders; and 4) is used as a tool on claims and changes.

**Bottoms Up Estimating**

During the work plan development in the design phase, the estimate is based on D&D quantities and the associated construction methods, techniques and materials. This type of D&D work is approximately 70-80% craft labor; therefore, the duration to perform the tasks is based on the methods and manpower required to perform the tasks. Materials, construction equipment, indirect costs, overhead and profit were estimated based on a task based preliminary schedule. This schedule formed the basis of the contractor pay items.

By focusing all the management systems on the specific tasks, the bid package establishes the framework for success during the actual de-construction phase. The probability of success on a project is significantly enhanced if it is well planned and the management systems are "pulling in the same direction" as the work to be performed.

Finally, prior to the performance of a specific task, the subcontractor is required to submit a detailed work plan which embodies how the work is to be performed and how safety and quality issues are to be addressed.

**EMPHASIS ON SAFETY APPROACH**

**Mechanical vs. Manual**

D&D construction activities have one of the highest recordable incident rates in any industry. In order to cope with this reality, owners, construction managers, and engineering must find ways to reduce this liability and still get the job done. In reviewing the type of accident that occurs during D&D activities, most are caused by material and equipment removal and handling. Some accidents which occur during the activities include: slips, falls, pinch points, scrapes, bruises, burns, etc. These are all inherent with manual D&D tasks. A good safety program along with a good work plan reduces these dangers.
By emphasizing mechanical material handling methods, further reductions are achievable. Some mechanical methods that can reduce the manual labor in D&D tasks are:

1. Mechanically tripping of the structure can be accomplished by making strategic cuts on the structure, connecting cables to it and pulling the structure down using heavy equipment.

2. Shaped charges can also be utilized to use gravity to trip the structure. Shaped charges strategically placed on structural columns, beams, X-bracing, etc. can remove selective structural members so that the building will fall to the ground in a safe, controlled manner.

3. Large mechanical shears mounted on large track hoes can cut structural steel in almost any size and configuration vs. manual torch cutting.

4. Inside the structure smaller mechanical shears can remove piping, ducting, electrical conduit, etc.

5. Small "bob-cats" outfitted with grapples can eliminate manual handling and loading of debris.

By utilizing mechanical construction methods in removal and handling activities, the project cost and safety requirements are greatly enhanced.

Multiple Work Area - Fast Track Work

Radiological D&D work must be accomplished in a safe, controlled manner. The outer shell (siding and roofing) is used for primary containment. The sequencing of work tasks is somewhat straightforward: safe shutdown of the structure (utility disconnect, removal of holdup/hazardous waste material, etc.), asbestos abatement, construction debris removal (piping, equipment, conduit, ducting, etc.), interior wall panels, final decontamination of the outer shell (transite paneling, brick, block, sheeting), and finally structural steel.

Some of these activities can be accomplished concurrently to expedite the schedule. On multi-story structures, asbestos abatement can proceed on one floor while construction debris removal is ongoing on another floor. On a one story structure, this asbestos abatement work area can be sealed off and other D&D work performed on the same floor as long as two different entrances and exits are established. The same goes with debris removal in one area while removing interior transite wall panels in another. It is important that work plans are comprehensive, integrated into the construction D&D schedule, reviewed by appropriate personnel, and that the work plan is followed. This allows simultaneous performance of multiple work tasks in a safe, productive manner.

LESSONS LEARNED
**Keep it Simple**

D&D work is not highly technical work. Use of basic demolition techniques with appropriate environmental controls will enhance wherever possible. Our experience shows that elaborate approaches have been unsuccessful, are costly, and create increased safety risk for the worker.

**Involve Construction from the Beginning**

Early involvement of Construction input will result in an integrated approach to a final product which meets the DOE, FERMCO (contractor) and stakeholders’ requirements.

**Involve Outside Expertise**

When developing the scope of work for a D&D package, all construction methods must be evaluated, and the best one chosen. Even though you have a qualified construction staff, it is sometimes necessary to bring in outside expertise on a specific field (e.g., use of shape charges). This expert can help evaluate specific construction methods, review work plans, review specifications, evaluate safety concerns, and specify dust control measures. By bringing in outside expertise early on in the planning stage, you can evaluate each D&D method and select the appropriate technical approaches for the bid documents.

**Key is Construction Techniques**

The key to de-construction lies in the construction techniques. While a new facility requires great emphasis on analysis of loads, process flows, process control, etc., the emphasis for de-construction is on construction equipment and methods. Therefore, it is important to have construction expertise play a key role from the beginning of the remedial design process.

**Bid Multiple Facilities**

Grouping individual buildings into complexes by geographic area is an efficient and low cost way of performing D&D work. This is based on the following factors:

1) From a logistics standpoint, peripheral buildings and facilities must be removed prior to the removal of the main building.

2) Many main facilities are structurally connected, which requires a specific dismantling sequence.

3) The design and bidding costs for small, medium, and large contaminated structures is almost the same. By grouping facilities, the bid and design costs are significantly reduced.

4) Management and support costs are significantly lower for a complex of facilities than for the same set of facilities sequenced for D&D on an individual basis.
SUMMARY

Accelerating decommissioning projects can mean different things to different people. In the context of our demonstrated successful work at Fernald, accelerating decommissioning work means delivering projects to our clients safer, faster and for lower cost.

Our approach has yielded the following key results:

- Improved safety performance. Employing this process on our recently completed Plant 7 dismantling project resulted in zero lost-time accidents, as compared to a nationwide incident rate for the construction industry of 6.5 lost time accidents per 200,000 hours worked;

- The task force approach has yielded a structured design, engineering, and construction (DEC) team concept that has been formalized at Fernald by a standard operating procedure. The involvement of on-site internal stakeholder participation in the planning process greatly facilitates a smooth project flow;

- Fast-track schedules can be achieved with this approach within the CERCLA and DOE arenas. Shorter project durations result in lower overall project costs. Our recently completed Plant 7 project was completed approximately $5M and 1 year ahead of its baseline estimate;

- The specific task, performance specification approach yields improved change control. Subcontract change orders for the Plant 7 project (pending resolution) are near 5% of the subcontract value, a goal of the project at the outset.

Accelerating decommissioning activities can be achieved. To date, our experience with this approach leads to the conclusion that applying these identified concepts can result in a win-win situation for all.