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DECOMMISSIONING CHALLENGES AT THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

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ABSTRACT

This paper presents a discussion of the demolition of the Building 788 cluster at the Rocky Flats Environmental Technology Site (RFETS) in Golden, Colorado. The Building 788 Cluster was a Resource Conservation and Recovery Act (RCRA) permitted storage facilities and ancillary structures. Topics covered include the methods employed for Project Planning, Regulatory Compliance, Waste Management, Hazard Identification, Radiological Controls, Risk Management, Field Implementation, and Cost $ Schedule control, and Lessons Learned and Project Closeout.

INTRODUCTION

This paper presents a discussion of the demolition and site remediation of the Building 788 Facility Group at the Rocky Flats Environmental Technology Site (RFETS) in Golden, Colorado. The Building 788 Cluster was a Resource Conservation and Recovery Act (RCRA) permitted container storage facility with supporting structures. Building 788 was an approximately 5600 square foot, single story, and steel-frame structure on a concrete slab. This RCRA unit was constructed to support operations at the Solar Evaporation Ponds (SEP) in the Protected Area of RFETS. In addition to storage capabilities, B788 also served as the support facility for a RCRA treatment unit that was installed to treat the sludges removed from the ponds. These sludges were the by-product of the passive evaporation process of wastewater from several nuclear production facilities at RFETS. The sludges contained low-level radioactive constituents and RCRA listed contamination. The treatment unit consists of a clarifier tank (sludge thickener tank) and cementation equipment. Several other support facilities and ancillary equipment was also removed as part of this project.

The RFETS' tank management plan was modified to include the removal of the clarifier tank at the Solar Evaporation Ponds. Inspections of the site by Project Management Personnel revealed that access to the tank was limited by the processing equipment and the Building 788 structure. In order to utilize available resources efficiently, the decision was made to remove the entire Building cluster. As part of a Compliance Order between the Department of Energy (DOE) and the Colorado Department of Public Health and Environment (CDPHE), completion of the Building 788 D&D project supports the mission of removing all identified facilities not needed to support site closure at Rocky Flats.

Preliminary schedules indicated that the typical D&D regulatory approach would not allow for the completion of the project by the consent order date. Decontamination and Demolition (D&D) projects for DOE at RFETS are primarily performed under the guidance of the Rocky Flats Cleanup Agreement (RFCA), a multi-agency agreement between DOE, CDPHE, and the Environmental Protection Agency (EPA). Due to the unique project boundaries as defined by RCRA permitted areas, closure through RFCA was not required. The building structure and surrounding treatment equipment were RCRA permitted units, therefore the project proceeded as a RCRA closure rather than a Comprehensive Environmental Response Cleanup and Liability Act (CERCLA) closure. With this approach, standard D&D regulatory activities, as defined by RFCA, were not implemented. Project personnel maintained an open line of communication with all oversight agencies since this approach had not been attempted prior to this project. This

allowed the project team to utilize closure documents that were developed as a part of the RCRA part B permit for the site rather than producing a new CERCLA Closure Decision Document subject to public comment. Several issues surrounding this approach were raised and required multiple rounds of negotiations with the regulators before all the stakeholders were in agreement.

By deviating from the typical RFCA closure activities and schedule logic, the Project Management team was accepting a tangible risk. This paper discusses the methods employed for Cost and Schedule Control, Regulatory Compliance, Waste Management, Hazard Identification, Lessons Learned, and Risk Management in successfully completing this project.

COST AND SCHEDULE

Schedules for demolition projects at RFETS are developed under the guidance set forth in RFCA. Activities and logic flow for projects, which fall under RFCA, are presented in detail in the Kaiser-Hill Decommissioning Program Plan (DPP), for the site. This programmatic document draws on past D&D experiences at RFETS, and reflects the regulatory agreements and deliverables set forth in RFCA.

Preliminary schedules developed under guidance of the DPP indicated that completion by the date listed in the Consent Agreement with the CDPHE was not feasible. Specifically, it was the development, review and approval of a Proposed Action Memorandum (PAM), the RFCA term for the CERCLA decision document as defined by the DPP, which drove the completion date beyond the Consent Order date of completion.

In reaction to the preliminary completion dates, project team members began re-evaluating the approach they were taking. Negotiations began immediately with the regulators to pursue closure under the auspices of RCRA rather than CERCLA or RFCA. Utilizing existing RCRA closure plans eliminated a considerable deliverable which drove the critical path.

Primavera software was utilized in the development of resource loaded project schedules. The project team developed new schedules representing the unique regulatory approach, however they still faced the task of resource loading a schedule that had not been field-tested. The unique approach to this D&D project called for significant input from the usual support organizations. Each organization historically involved in D&D projects was contacted and provided with a logic driven schedule. Each group was given the opportunity to add or delete activities, indicate resource requirements for each activity and to define the scope of work they would perform on the project. The project team used this information to build a logic driven, resource loaded, critical path schedule that satisfied the Site's regulatory commitments, finished on time, and provided the Project Management team with a valuable tool for monitoring progress.

The Primavera schedule was developed in accordance with the RFETS site Work Breakdown Structure (WBS). In order to maintain historical consistency with respect to actual project costs, the site WBS applies to all D&D projects at RFETS. To ensure satisfactory cost data at the completion of this project, all subcontracts were developed with a schedule of values that fit the site WBS.

Project costs were collected manually at the activity level on a weekly basis and entered into Primavera. Costs are also collected by the RFETS Information Technology system, People Soft. Updated monthly, this system provides official budget information drawn from the site accounting system. By utilizing the Primavera schedule, Project Management was able to access real time data on Budgeted Cost of Work Performed (BCWP), monitor Actual Cost of Work Performed (ACWP), and track each to the Budgeted Cost of Work Scheduled (BCWS). This activity level data allowed for better evaluation of project status and issues, and helped the project management team maintain tight controls on a previously untried project approach.

REGULATORY COMPLIANCE

As discussed earlier, Demolition at RFETS is performed under the requirements of RFCA. Detailed activities and logic are represented in the site DPP. D&D at Rocky Flats are performed as a CERCLA closure activity. Development of the preliminary project schedules indicated that performance of this project under RFCA/CERCLA guidelines would not allow for completion by the required date.

Since Building 788 was a permitted Hazardous Waste Storage area (RCRA Unit 21) and the clarifier tank was part of a Hazardous Waste Treatment Unit (RCRA Interim Status Unit 48), the project team decided to pursue closure of the entire cluster as a RCRA action. Following interesting negotiations with the CDPHE and EPA, it was determined that this project could proceed as a RCRA closure.

The site's RCRA Part B Permit includes closure plans for all RCRA units that fall under the permit. These closure plans were submitted along with the Part B permit, and were subject to public review as part of the permit process. By utilizing these plans, the project team deleted the need to generate new documents and the requirement to solicit public review.

The closure plans contained in the Part B Permit provided the project team with guidelines for closure. To validate the process, a Closure Description Document (CDD) was prepared to establish the specific methods employed for closure. This document dictated how the project would proceed to ensure compliance with the approved Closure Plan.

The CDD was developed prior to solicitation for proposals. Since the project was pursuing a Firm Fixed Price contract, the team wanted to offer as much flexibility as possible in the CDD. It was written with several options on how closure would be achieved. The CDD presented several closure options, and required the approval of CDPHE. Upon approval of the CDD, a Sampling and Analysis Plan (SAP) was developed to ensure that all sampling activities used to demonstrate closure met the required Data Quality Objectives.

The closure option selected involved dismantlement and packaging of the physical structures while still regulated under RCRA. Those portions of the facility which remain in place, i.e. building and tank slabs, were to be scrubbed, rinsed, and sampled to demonstrate decontamination of the permitted slabs to levels below Drinking Water Standards. The remainder of the RCRA units and all ancillary equipment were packaged as either Low Level Mixed (LLM) Waste, steel for recycling, or Low Level Waste (LLW).

WASTE MANAGEMENT

The Building 788 D&D project dealt with four major categories of waste; Low Level Waste (LLW), Low Level Mixed Waste (LLMW), Sanitary Waste, and Recyclable Steel. Table I presents a preliminary summary of the waste generated by this project.

Table I. Project Waste Types and Quantities

Type	LLMW	LLW	Sanitary	Recycle
Quantity	11 Full Size Wooden Waste Boxes	59 Full Size Wooden Waste Boxes and 1-20 foot Cargo	80 Cubic Yards	160,000 lbs. in 13-20 foot Cargo

The project approached this site and all ancillary equipment, building materials, and facilities as having low level radioactive contamination. Those components which were either part of the permitted units or were exposed to wastewater and/or sludges were considered RCRA waste. The only anticipated significant amount of sanitary waste was the building insulation that had been protected from the elements and therefore assumed to be free of contamination.

The bulk of the waste streams consisted of the steel structural components of the building and the steel equipment that made up the treatment unit. Over 80 tons of steel was anticipated to be removed as a part of this project. While this steel could have been decontaminated for both radioactive and RCRA contaminants, a Cost Benefit Analysis was prepared to determine the optimal disposition path for the steel. The project team evaluated the utilization of the GTS Duratek facility, in Oak Ridge Tennessee, to recycle the steel. Investigations by site legal and compliance officers revealed that this method of recycle offered an exemption from the RCRA debris treatment standards for the steel. This eliminated the need to demonstrate that much of the building and treatment equipment was free of contaminants significantly reducing sampling and analysis activity costs and durations. The ability to recycle steel with low level radiological contamination coupled with the RCRA Debris Treatment exemption resulted in a the elimination of costly size reduction activities. All steel related to the project was considered for recycle. To comply with GTS Duratek's acceptance criteria, all non-ferrous materials were removed from the steel components. The steel that could not be inspected for gross amounts of RCRA contaminants was packaged as LLMW. The non-ferrous materials that were removed from the steel were packaged as Surface Contaminated Object (SCO) waste or LLMW depending on specific location in the Treatment/Storage area.

The radiological profile of all the project's wastes and recycle materials was developed using the site's procedure for SCO, and Low Specific Activity (LSA) waste. By utilizing this survey procedure, the waste coordinator and radiological engineer could statistically calculate the gross radiological contamination of each container leaving the site. The project team ensured that all waste or recycle materials had been adequately characterized regardless of their final disposition.

Any steel that could not be verified as free from gross amounts of RCRA contamination (e.g. process piping, cement mixer full of concrete, pug mill auger screw, etc.) was handled a LLMW. These materials were size reduced and packaged in standard full size wooden waste crates. In order to satisfy receiver site Waste Acceptance Criteria (WAC), waste profiles from the unconditioned sludge, that was handled and stored in RCRA units 21 and 48, was applied to the contents of the LLM crates. The project waste coordinators applied this profile to the waste materials by visual inspection of all LLMW. All porous materials possibly exposed to RCRA liquids were handled as LLMW.

The Low Level Waste stream consisted of those materials not suitable for recycle that were not suspected of having come into contact with the RCRA contaminants of concern. As discussed earlier, this waste was characterized as SCO waste and surveyed accordingly.

This waste was primarily disposed of in full size wooden waste boxes; however, one SCO SEALAND container was utilized to prevent unnecessary size reduction of the Treatment Process's cement surge tank. The surge tank was full of partially set cement and therefore represented a significant amount of unacceptable material for metal melt. The tank was removed whole and placed in the SCO container rather than going to metal recycle.

The decision to default the majority of the project's waste to Low Level was based on previous experiences with similar structures in the vicinity. Due to Building 788's proximity to the SEPs, any material that was not protected from the elements could not be free-released based on historical knowledge. Cost Benefit Analyses indicated that the additional size reduction and work controls required to package and dispose of the entire project as Low Level (Waste or Recycle), were economically competitive with the option of decontamination and free-release. The free-release option would have involved much more extensive radiological surveying as well possible decontamination and re-surveying. The economic analysis indicated that each option would cost about the same, however, the extensive activities, duration's, and risks involved in the free-release option swayed the project to treat all materials as Low Level Contaminated. This decision supported the site's waste minimization goals since the bulk of the materials were going to be recycled.

CHARACTERIZATION

"The greatest antidote to worry, whether you're getting ready for space flight or facing a problem of daily life, is preparation…the more you try to envision what might happen and what your best response and options are, the more you are able to allay your fears about the future." Senator John Glenn's words sum up the driver behind characterization of a demolition site. Characterization of a demolition project is arguably the most important element of D&D. Thorough characterization provides a project team with all the information they need to develop project plans and contract documents.

Unfortunately, there is a misconception about what characterization means. Historically, characterization plans and reports have been primarily aimed at common hazardous building materials and preliminary radiological surveys. The Building 788 D&D project team made great strides to expand the information developed during characterization.

The Building 788 project site was characterized early in the planning process to ensure that responsive bidders were given all the information they needed. The ability to provide complete and accurate information during the bid process reduces project risk significantly. The Building 788 project team approached the characterization comprehensively. The scope of the characterization included everything from files in desks to unmarked containers of Granular Activated Carbon. Sample teams collected and analyzed samples from suspect building materials. Construction personnel poured over the building and its contents. Radiological Control Technicians (RCTs) performed SCO surveys. As-Built drawings were reviewed and incorporated into the bid documents. Compliance personnel researched existing data on the materials processed and stored in the RCRA units. Every element of the characterization activity contributed significantly to the success of this project.

This extensive effort produced information that could be used in several areas of the project plans. The sampling team collected information on building materials that presented a hazard to workers or required special handling. These materials included but are not limited to asbestos roofing material, creosote utility poles, and lead paint. This data was used in two major ways. Project waste coordinators used the data to produce a waste management plan. This plan contained information on waste disposition paths, packaging requirements, waste classification, and preliminary quantity projections. The data collected also allowed project health and safety representatives to evaluate the hazards posed to workers during the demolition of these materials. This evaluation ensured that all workers were provided with the proper Personal Protective Equipment (PPE) for every task they performed.

Construction personnel spent several days walking the job down. The information they gathered was also used in several ways. The construction managers were able to create a detailed scope of work. This scope of work accounted for any anomalies found at the work site. Construction personnel also provided basic information to be used in the D&D process. By opening lockers, desks, cabinets, and safes, these personnel were able to determine how excess equipment; documents, chemicals, and other operations property would be dispositioned. Looking in, under, and behind objects helped locate "hidden" problems like staining from a possible spill in the area, or sensitive documents that may have slipped under a desk. This all sounds so simple, however, absence of this information when fieldwork begins inevitably leads to many problems.

Radiological Control Technicians (RCTs) performed SCO surveys on the entire site and associated debris and equipment. The site was divided into survey cells and data was collected over several weeks. This data was used to develop radiological boundaries, areas of concern, PPE requirements, Radiological Work Permits, As Low As Reasonably Achievable (ALARA) job reviews, waste categorization, and specific activity levels.

The project engineering team researched as-built drawings of the site. These drawings were used to develop the engineering order and Integrated Work Control Package (IWCP). They also supplemented the scope of work document. The drawings provided essential information to project personnel on every level. The waste coordinator was able to calculate waste quantities. Construction personnel determined where utilities could be isolated most effectively and efficiently. Field personnel were able to decipher piping configurations. Compliance personnel confirmed permitted area boundaries. The availability of as-built drawings was key to the success of many aspects of the B788 D&D project.

Compliance personnel researched all available data on the sludges that were treated and stored in and around Building 788. This data provided a basis for the CDD and the Data Quality Objectives of the Sampling and Analysis Plan. The information was used to determine PPE and monitoring requirements for field workers, and allowed for waste classification and disposition paths. Ultimately, this data was a driver for many of the work controls and compliance issues that project team members faced.

This characterization effort did not consist of a single plan and report. It was an integrated effort that involved every key team member and organization. Project Management personnel received input from all the sources and ensured that any and all information provided was passed along to the rest of the team. The project managers were responsible for incorporating all available data, qualitative and quantitative, into project schedules, compliance documents, and contract documents. Providing as much information as possible to regulators, management, and prospective bidders allowed the project to proceed smoothly. The project team reduced significant "surprises", and realized significant control over change orders, minimized Health and Safety issues, and confirmed understanding and agreement amongst the stakeholders.

RISK MANAGEMENT

Performance of any large-scale project involves risk. These risks may be physical, financial, or schedule based. Early recognition of these risks allowed the Building 788 D&D project team the ability to adjust project priorities in a manner that minimized the detrimental effects, and maximized efficiency.

Many physical risks are inherent to demolition work. These risks and their subsequent controls are generally well documented through Lessons Learned on previous projects, Occupational Safety and Health Administration regulations, Radiological Control Procedures, and Integrated Safety Management (ISM). Risks to worker safety and health leave no room for compromise. These risks are addressed and mitigated to the lowest failure rate achievable. By implementing the principles of ISM, the project team ensured that input was received from all levels, including craft performing the tasks, to management personnel planning and scheduling the work.

Activity Hazard Analyses (AHAs) were prepared for each individual demolition activity. The preparation of these documents occurred just prior to performance of the specified tasks. Performing craft, in conjunction with Health and Safety personnel, discussed and identified all hazards presented by a given task. The performing group then documented the PPE, work methods, and hold points that would maintain the safest work environment possible. These were not calculated risks, but risks that were addressed and dealt with appropriately.

Throughout the planning process of the Building 788 D&D project, there were many cases where the project management assumed risk. By doing so, they exposed the project to possible financial liability. By weighing the benefits of assumed risk, the project team was able to accelerate the schedule.

Most documents prepared during the planning phase of the project involved several steps. First, they were prepared in draft form. These drafts were distributed to the internal team members, reviewed, commented on, and re-drafted.

They were then distributed site wide to the appropriate organizations, reviewed, commented on, and composed in final form. These documents then became official project documents and dictated the commitments made by the project.

When a document was the predecessor to another activity, that activity was on hold while the document went through the lengthy review and approval process. In order to accelerate the schedule to an acceptable completion date, the project team assumed a tangible and significant risk. Critical path documents were utilized, in draft form, so that critical successor activities could begin. The time saved outweighed the possibility of major changes that may have been necessary following the comment period. Solicitation for proposals began while many documents were still in the review cycle. This exposed the project team to the possibility of major changes and subsequent cost overruns. None of these problems came to fruition and the project team successfully accelerated the schedule. The accelerated schedule resulted in significant cost savings, and a reduction of project overhead expenses.

LESSONS LEARNED

The Building 788 Closure Project was completed without serious personal injuries or environmental impact. The project experienced several unknown site conditions, which impacted the budget and schedule.

1. The safety performance throughout the project was well managed. Attention to detail and communication between project personnel decreased near the completion of the field activities.

   Personnel were reassigned prior to completion of the project. In some cases, this extended field activities and created communication problems due to lack of key personnel.

   Lesson Learned:

   Safety awareness and communication must be given highest priority from the start of the project through the completion of all field activities. This must be reinforced at the Plan of the Day (POD) and Toolbox meetings.

2. During the strip-out and demolition phases of the Building 788 Cluster, several delays were incurred due to acquiring proper notification of facilities and appropriate signatures/reviews prior to work beginning. Ample time to acquire signoffs and reviews should be included in project schedule and budget. Concurrence signatures should be coordinated in a timely manner so that downtime and delays are limited and do not impact schedule or contractors abilities to start work. For D&D projects, the emphasis is primarily for utility terminations (Lockout/Tagout LO/TO) and/or modifications that affect other buildings.

   Lesson Learned:

   Appropriate time is needed to acquire signatures and reviews prior to beginning work. It should be noted that additional costs are incurred when supporting organizations are needed for LO/TO and/or contractors are delayed when signatures are not acquired on time.

3. Building 788 Demolition and Closure was completed several weeks early. There were significant delays accrued to the oversight contractor by the subcontractor due to lack of supervision, prolonged pre-evolutions (i.e., discussions not within project scope and new time card procedures) and improper safety coverage during the course of the project.

   Lesson Learned:

   It is prudent to keep the focus of the pre-evolutions in direct relation to the scope of the project and having the appropriate assigned personnel available to support evolutions. This will enable the subcontractor to be more efficient and ensure all workers are properly supervised.

4. During the planning phase, characterization of Building 788 for the Site Hazard Assessment Report (SHAR) was delayed due to lack of coordination between supporting groups. Once sampling was completed, the results for the

samples were delayed by the lab's inability to meet schedules. Turn-around delays and the additional sampling that was required throughout the project impacted the schedule and caused several revisions to the SHAR.

Lesson Learned:

Coordination between the Characterization Group, Sampling Team, Project Planners, and the Labs ability to process samples must be demonstrated early in the planning phase in order to keep impacts on budget and schedule to a minimum.

5. Another incident involving process pipe removal within a Contaminated Area (CA) resulted in a Radiological Improvement Report. A spill of less than one pint of process liquids, occurred as a result of the use of improper glove-bags and tape by the subcontractor. The spill was cleaned up and it was determined by Radiological Operations that no contamination to the environment had occurred. A fact-finding meeting was held. Discussions ensued regarding the method of bag-cut, type of glove-bag and tape for glove-bags. This was not in the subcontractors approved plan for cut and removal. The subcontractor was in violation and instructed to acquire the appropriate glove-bags and rated tape to comply with approved plans.

   Lessons Learned:

   Procedural Compliance is to be followed at all times with no exceptions at RFETS, and must be demonstrated for every evolution.

6. The Site Hazard Assessment Plan (SHAP) did not include characterization for Beryllium (Be). The SHAR did not have any information regarding Be as a hazard for this project. When the Subcontractor raised the concern of potential Be contamination, results from a routine survey of the Contamination Control Room were above allowable limits. Reviewing existing characterization of the SEP sludge found potential Be contamination in Building 788 and the Clarifier piping. Building 788 and the SEP were included on the site list of facilities with potential Be contamination. If existing characterization data had been reviewed during the planning phase, delays and subcontractor claims would have been avoided.

   Lessons Learned:

   All potential hazards need to be evaluated during characterization. The project team needs to be thorough when filling out the Job Hazards Analysis Checklist, which has a specific question regarding Be.

CONCLUSION

We feel that the Building 788 D&D project was an overall success. Through thorough planning and aggressive management of cost and schedule, the project team was able to mine success from a seemingly impossible situation. The key to their success was proactive leadership. By thinking out of the box, the project team leaders set the tone for future D&D work at Rocky Flats. The D&D process has become more refined and fluid as a result of this project's ability to adapt standing site procedures and regulations to the uniqueness presented by individual structures. Understanding that there is no cookbook for these types of projects is the only recipe for success.

- Involve Lead Regulatory Agency in the planning of the project.
- Use Out-of-the-Box thinking and progressive approaches in conducting D&D.
- Conduct Plan of the Week Meetings
- Utilize proactive project leadership skills.
- Conduct end of the workweek debriefing sessions with the project team.

REFERENCES

1. DOE/EM-0142P, The Decommissioning Handbook.
2. DOE/EM-0246, The Decommissioning Resource Manual.

3. DOE Order 5400.5, Radiation Protection of the Public and the Environment.
4. Final Rocky Flats Cleanup Agreement, Rocky Flats Environmental Technology Site, Golden, CO.