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A Successful Waste Stream Analysis on a Large Construction Project in a Radiologically Controlled Facility

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Introduction

The Los Alamos National Laboratory (the Laboratory) Chemistry and Metallurgy Research (CMR) Facility, constructed in 1952, is currently under going a major, multi-year demolition and construction project. Many of the operations required under this project (i.e., design, demolition, decontamination, construction, and waste management) mimic the processes required of a large scale decontamination and decommissioning (D&D) job and are identical to the requirements of any of several upgrades projects anticipated for the Laboratory and other Department of Energy (DOE) sites. For these reasons the CMR Upgrades Project is seen as an ideal model facility - to test the application and measure the success of waste minimization techniques which could be implemented for any similar projects. The purpose of this paper will be to discuss the successful completion of a waste stream analysis. The analyses performed was to measure the potential impact of waste generation, in terms of volume and costs, for a reconfiguration option being considered to change the approach and execution of the original project.

Reconfiguration

The original intent of the project was to improve the facility infrastructure by replacing or upgrading individual subsystems throughout the entire building. The proposed recommendation to reconfigure would move offices out of the first floor of three wings which currently contain analytical laboratories in radiologically controlled areas, and offices in non-controlled spaces. By moving offices out of the wings and reconfiguring functions on the main floor, analytical chemistry functions can be combined into two wings, rather than the current configuration of three wings, allowing the third wing to become available for future programmatic initiatives. Overall, this approach will provide an increased ability to manage health and safety risks, costs, and schedules during the construction of the upgrades, and make management of the upgraded facility easier. The reconfiguration will involve the demolition and removal of most of the equipment, including gloveboxes; walls and doors; electrical services, supply and exhaust ductwork; fire suppression system, gas and water lines; and all other items within the outside walls of the first floor of each wing. The Upgrades Project Team had previously submitted an Environmental Assessment (E/A) which limites the amount of wastes regulated as radioactive to 4000 m^3. Any additional waste generated from the reconfiguration, which would cause the overall project to exceed 4000 m^3, could require a modification to the EA. The remainder of this paper will discuss the performance and results of the waste stream analysis conducted as a planning exercise while considering the reconfiguration option.

Approach

The first step in conducting the waste stream analysis was to assemble the proper team. Three engineers, including one mechanical, electrical, and chemical, were joined by a health physics technician to conduct the analysis. The team was led by the project waste minimization coordinator and was assisted in data processing by a systems engineer. All team members had extensive Waste Minimization/Pollution Prevention experience in both DOE and the nuclear power industry. The analysis began with a complete historical data review. Relevant data was entered into a data base, as the baseline for other information gathered. Next, during a two week period a physical inventory was taken of all items between the outside walls of each wing involved. While conducting the inventory, engineers performing the measurement were instructed to evaluate each item for potential reduction opportunities. The outside dimensions of all visible items were measured and entered on data collection sheets for each room. Items with geometry easily converted to volumes (i.e., gloveboxes, shelves, tables) were entered directly from the data sheets into a data base, which converted outside dimensions to volumes.

All pipe, conduit, and tubing was measured or estimated and entered in the database in terms of outside diameter and length. This information was accumulated and totaled. The totals were processed against a conversion table which calculated buried volumes from linear feet of the various piping diameters.

A common item to almost every laboratory is the lab bench. Attached to the top and rear of each lab bench is a back panel. The back panels contain large quantities of pipe, tubing, and conduit which are not visible from the exterior. An assumption was made that each back panel contained a uniform volume of materials. In order to accurately estimate the amount of waste associated with each pack panel, access was gained to one not currently in use. An educated judgment was made which assumed quantities of various materials per each back panel. Calculations were then used to convert the linear feet of the measured back panel to an actual buried volume of waste. It also illustrated the calculations used to estimate linear feet of various pipe found within each back panel, which was later converted to a buried volume of pipe.

One of each of the following items were e measured and used as a standard: a glovebox High Efficiency Particular Air (HEPA) filter, faucet, gas cock, glovebox light, fluorescent ceiling light, incandescent light, junction box, wall cabinet and a countertop. The total numbers of each item were entered into a table, which converted number of items to buried volumes. The table also calculated reduced volumes based on reduction techniques identified for each item.

A calculation of the disposed volume of all walls and doors was made using measurements of standard doors, wall panels, hallway dimensions and dividing walls. The channels which hold the wall panels in place were also calculated for disposal volume and reduction possibilities.

The exhaust ductwork from the gloveboxes to the main exhaust header in the basement of each wing was calculated by direct measurement and physical inventory of spool pieces. Other spool pieces which did not meet this standard description were inventoried and measured separately.

The amount of waste associated with the replacement of the fire suppression system was estimated through a detailed inspection of the system installed in the halls, offices, and laboratories. The supply header from the basement and flow monitors were not included. Secondary waste, a byproduct of handling primary waste, was estimated by multiplying the primary waste stream by a multiplier of 1.5.

Results

After all calculations and estimates were completed, three scenarios were developed to evaluate the impact of various waste minimization approaches.

> Scenario A "Worst Case" - This "rip and ship" scenario describes the resulting wastes streams when all materials in the demolition are assumed to be disposed of as radioactive waste and standard demolition waste handling and packaging practices are used with very little waste minimization effort applied. Waste projections under these assumptions exceed 14,000 m^3. Critical budgetary impacts

and noncompliance with the EA limits would result if this scenario were implemented.

Scenario B - "Minimal Reduction" - When minimal amounts of low cost, simple, waste reduction techniques are applied, the total radioactive waste volume is reduced to approximately 7000 m^3. Techniques considered included simple/size reduction (i.e., removal of glovebox legs), increasing waste packaging efficiencies, sorting and segregating radioactive from noncontaminated materials for free release, recycle, reuse, or disposal as non-radioactive waste. This scenario assumes some effort is applied to mitigating secondary waste generation, lowering the multiplier to 1.2 times the primary waste stream. While this scenario leaves the project with unacceptable waste management costs for the remaining waste streams. In addition, the EA limit still exceeded in this scenario.

Scenario C "4000m^3 -This scenario assumes the minimal effort of Scenario B is applied, but also presumes an aggressive waste minimization approach which includes additional techniques such as decontamination, advance size reduction and secondary waste avoidance. Although aggressive mitigation of the secondary waste streams is required in this scenario the application of decontamination and size reduction in itself will generate some secondary waste. A multiplier of 1.6 was used to estimate secondary waste under this scenario. Implication costs for this scenario are currently being investigated. However they are very low when relative to overall waste management cost savings ($100m). In addition, this is the only scenario which allow the project to remain within the EA limit.

<u>Added Benefits</u>

The most obvious benefit of this project was the accurate projection of waste streams. However, several additional benefits were gained during the pursuit of this objective. The development of estimating tools was a requirement for this project in order to accurately predict buried volumes, packaging efficiencies, and quantities of materials anticipated when physical measurements could not be performed (i.e., pipes in the walls). The database and estimating tools will be very useful on projects requiring accurate waste estimates. The analysis also gained project management recognition of the potential impact of waste generation on overall project accomplishment. Waste management and minimization impacts are currently being considered as project drives. The benefit to gaining support for waste minimization activities in this type of environment is obvious. The final added benefit to performing this analysis was the synergistic impact on other. Involvement in conducting waste stream analyses for at least two other construction projects is anticipated. Commitment to considering waste in the early stages of project design has been greatly enhanced by the successful completion of this analysis.

Conclusion

Based on the results of this analysis, the CMR Upgrades Project is currently completing a Waste Management capability requirements document. This document will be used to provide justification for funding waste minimization activities as part of the projects baseline funding request. Concurrently, investigation and development of implementation plans for mitigating the waste streams has begun. The successful completion of the waste stream analysis provided the impetus to move forward with these activities. Waste minimization is integrated as a project priority. This accomplishments is the true measure of the success of this analysis.