

**COST ESTIMATING FOR DECOMMISSIONING OF A PLUTONIUM FACILITY
– LESSONS LEARNED FROM THE ROCKY FLATS BUILDING 771 PROJECT**

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ABSTRACT

The Rocky Flats Closure Site is implementing an aggressive approach in an attempt to complete Site closure by 2006. The replanning effort to meet this goal required that the life-cycle decommissioning effort for the Site and for the major individual facilities be reexamined in detail. As part of the overall effort, the cost estimate for the Building 771 decommissioning project was revised to incorporate both actual cost data from a recently-completed similar project and detailed planning for all activities.

This paper provides a brief overview of the replanning process and the original estimate, and then discusses the modifications to that estimate to reflect new data, methods, and planning rigor. It provides the new work breakdown structure and discusses the reasons for the final arrangement chosen. It follows with the process used to assign scope, cost, and schedule elements within the new structure, and development of the new code of accounts. Finally, it describes the project control methodology used to track the project, and provides lessons learned on cost tracking in the decommissioning environment.

INTRODUCTION

On January 23, 2000, Kaiser-Hill signed a new contract with the Department of Energy to complete the closure of the Rocky Flats Site (Site). This contract delineated the completion criteria, placed significant incentives on achieving cost savings and schedule acceleration, and imposed penalties for poor safety and compliance performance. The contract required greater emphasis on the costs through closure (lifecycle costs), instead of the previous focus on current-year budgets. Kaiser-Hill recognized that a new baseline had to be implemented which included the detail of all the activities that must be completed between that time and site closure. Thus, they created the Closure Project Baseline (Baseline) to establish the cost and schedule baseline for the remaining Site activities. Development began shortly after the contract was signed, and the new baseline was implemented in July 2000. This included restructuring the Closure Project to focus on the decommissioning activities, and aligning the activities and estimates to roll up to the new structure. As a result of this "rebaselining," the Closure Project is subdivided into six "Projects," four of which are principally concerned with the demolition of the four major plutonium facilities.

For the 771 Project, the rebaselining effort focused on the planning, cost estimating, and scheduling of the Project through demolition concurrent with some management restructuring. Overall expectations had been established in the negotiations as to the total 771 Project cost, and exceeding those expectations would invite management scrutiny. Data was available in various forms, in some cases in relatively complete estimates and schedules for near-term activities, with other activities completely unplanned and undefined. Initial activities included identifying and planning required activities previously addressed at a conceptual level, including virtually all of the building decontamination and demolition. The decommissioning work was then integrated, estimated, and scheduled, and finally integrated with the remaining project activities and support. The cost estimate for the decommissioning work was dependent on the information available on the way work would be performed. The conceptual estimates were supported by little detailed planning, and in most cases were done by different people than were responsible to perform the work. As better planning information became available, it was appropriate to revise the estimate and restructure the cost control system to support the project execution.

This paper is structured with a Background section providing general information on the 771 Project and related Site-level systems. Subsequent sections discuss the estimate structure and elements, and the integration of the estimate and the cost control approach. The paper concludes with a discussion of the lessons learned.

BACKGROUND

The 771 Project is one of the Site's four plutonium building Projects. The 771 Project scope is to dismantle the process and support systems, decontaminate the structure, and demolish Buildings 771, 774, and some of the smaller adjacent structures. It is also integrated with the environmental restoration of the soil under and surrounding the building. Building 771 was one of the original facilities at the Rocky Flats Site, constructed in 1952 to handle all of the plutonium purification and weapons fabrication. Building 774 was constructed at the same time to treat the liquid wastes generated in Building 771. The combined footprint of the buildings, including the adjacent structures, is 207,000 square feet. Although weapons fabrication operations were subsequently relocated, the plutonium purification activities remained active until the Site was shut down in 1990. The operations in the Building 771 gloveboxes and tanks used concentrated solutions of plutonium, nitric acid, hydrochloric acid, plutonium fluoride, residue incineration, and other activities dealing with concentrated radionuclides. During the course of operations there was a major fire, numerous spills (within the building) and removal and replacement of numerous pieces of equipment. The ventilation system was upgraded several times to support new safety standards and process requirements. Operations were suspended in 1990.

Building 771, along with other plutonium facilities, contain plutonium processing equipment, gloveboxes, tanks, and piping collectively referred to as the process systems. These process systems are serviced by a ventilation exhaust system that treats the highly contaminated air from the process systems to allow its release to the environment. The process equipment, gloveboxes, and primary exhaust systems represent the principal decommissioning challenge and the majority of the costs for the building decommissioning. In addition, there are the electrical and other utility systems, waste treatment, secondary ventilation, interior finishes, and the overall structure which, while contaminated, are more consistent with the materials decommissioned at other radiologically-contaminated facilities.

The general approach being used to decommission Building 771 is to remove enough lightly-contaminated materials and equipment to have room to work, and then remove and package the process systems. Crews typically remove most or all of the process systems from a given area, and then move to another area as required by the overall project plan. Once the process systems are gone, the remaining less-contaminated materials will be removed by different crews as part of a fixed-price contract. The current baseline for most of the Site Projects is to decontaminate and then survey and release the building structure, and finally take down the building as a clean demolition.

The first building-specific decommissioning estimate for Building 771 was based on a "phased approach to closure" scheme. The principal activity at the time was draining of liquid systems that contained concentrated plutonium solutions, considered hazards reduction or Deactivation, i.e. stabilization of unsafe conditions but not an integral part of Site closure. The phased-approach scheme assumed a continuation of the draining, and an expansion of the Deactivation program to include the removal of these same piping systems which interconnected most of the gloveboxes and tanks in the process areas. In addition to this Deactivation there were five phases of decommissioning: equipment dismantlement (including all gloveboxes, tanks, and Zone 1 HVAC), building decontamination (radioactivity, asbestos), utility system shutdown, building demolition, and site remediation. The Work Breakdown Structure (WBS) of the time was arranged with operating elements and closure elements. Most operating elements were estimated using historical data (number of operators and support staff required for similar work over the previous years). The closure elements were based on media-based estimates, although little effort was placed on the decommissioning because of the regulatory uncertainty and because no next-year execution was funded.

Starting in 1997, the Building 771 Closure Planning Team began developing of the first bottoms-up decommissioning estimate for the building. This generally coincided with better Sitewide definition of the physical and regulatory definition of how decommissioning would be conducted, and the need to support

regulatory document development. The estimate was focused on the equipment dismantlement activities. The equipment was divided into smaller elements of scope called "Sets", which were gloveboxes and tanks, and other process equipment that was either in the same room or portion of a room, or were logically or functionally connected. The team identified 82 Sets. The expanded Deactivation work was divided into 35 Systems of (principally) piping to be removed.

While planning these Sets effectively addressed the equipment dismantlement, there was essentially no estimate for the remaining four phases. In part this was because before the implementation of the plan to close the Site by 2006 there was little effort given to detailed planning for activities that would be done several years out. An additional consideration was that the organization planning the work, Safe Sites of Colorado, LLC, was the organization responsible for operating the Site nuclear facilities. They recognized that they would not be performing the subsequent work, and that such planning would best be done by the organization that would be performing the work. Also, the subsequent work would be done on a subcontracted basis by craft-union labor, not by the Kaiser-Hill Team contractors using plant-union labor. Thus the Building 771 team concentrated on the equipment dismantlement, since this phase had the largest, most immediate decommissioning scope, had to be completed before subsequent phases could begin, and was expected to take several years to execute.

Rocky Flats uses a Sitewide database, the *Basis of Estimate Software Tool* (BEST), to roll up Site estimates for labor, materials, and overall costs into the Site baseline. For some work, BEST may provide all of the detail necessary to support the baseline. For Building 771 estimate, it was decided to create a lower-tier system to develop the estimate and then input the estimate data into the overall BEST system. The Closure Planning Team chose the "POWERTool" estimating system for that purpose. POWERTool was a system originally designed to estimate decommissioning work at the Hanford site, and it was hoped that the factors used there would be applicable to Building 771. As the estimate was defined, it became clear that the scope of the Building 771 and the Hanford dismantlement work were different enough that the Building 771 unit rate factors would have to be uniquely developed, which the developer (Polestar, Inc.) was able to support. The team then began to develop a database containing both the equipment "inventory" that would have to be removed and the unit rate factors that would be applied to that inventory to create the estimate. The details of the estimate form and function are given in a subsequent section.

The development of the unit rate factors that are applied to the equipment inventory was derived from a number of sources. Another plutonium building, Building 779 was being decommissioned in an expedited fashion with the intent that the methods, infrastructure, and expertise in decommissioning it would be transferred to other facilities as Site closure progressed. The Building 771 team discussed a number of the activities with the Building 779 staff, particularly glovebox dismantlement and size reduction, to identify methods, tooling, containment systems, and worker productivity. This data provided significant input into the unit rate factors initially used.

While the Building 771 team was developing the detailed estimate of the Sets, a separate organization was developing an overall decommissioning cost estimate approach, the Facilities Decommissioning Cost Model (FDCM). This model was based on taking the actual costs from previous Site decommissioning projects, including Building 779, and developing a parametric model that could be applied to all of the Site buildings. The parametric units of this model were glovebox volume (for plutonium process equipment), and floor areas of the contaminated and non-contaminated areas of the different Site buildings.

The initial cost estimate for the equipment dismantlement activities in Building 771 was completed in 1999. Also in the summer of 1999 the majority of the Building 779 process work was completed and workers began moving on to the Building 771 work. Finally, the decommissioning regulatory document, the Decommissioning Operations Plan for Building 771, was approved, enabling the project to begin work on the initial dismantlement Sets. Initial physical decommissioning work began in late FY 1999. The FDCM data for decontamination and demolition was incorporated into the 771 Project out-year budget.

After the contract was signed and the work began on the rebaselining, the Building 771 planning team began to identify all of the different elements of scope that would be required to estimate the complete project. This led to the development of the new estimate structures, review and organization of the

estimates already developed, and creation of estimates for those elements of scope not yet estimated in detail.

Facilities Decommissioning Cost Model (FDCM)

Between 1998 and 2000, an effort was undertaken at the Site to improve the basis and accuracy of the out-year decommissioning cost estimates for the closure of the Site. The result of this effort was the FDCM, which generated an order-of-magnitude cost estimate for decommissioning at the Site. The FDCM relied upon actual cost data from past decommissioning of facilities at Rocky Flats, current commercial practices, and Subject Matter Experts (SME) input to develop unit costs for the decommissioning activities. When Rocky Flats decommissioning experience was not available, the model used bottoms up cost assessments, actual cost experience, or input from other government and commercial facilities. The FDCM estimated the costs for the decommissioning of a number of types of facilities including buildings, trailers, tents, cooling towers, tanks, and other facilities using a top-down model based upon empirical data. Because all facilities are atypical in some sense, adjustments were made to incorporate special features or characteristics, e.g., type of construction, assumed levels of contamination, gloveboxes, piping, ducts, and internal tanks. The FDCM was developed to include all direct and indirect costs associated with the decommissioning effort. It did not however include either contingency or escalation and only represents the forecasted life cycle decommissioning costs. As an order-of-magnitude estimate, the FDCM can be expected to predict actual costs within a range of plus 50 percent to minus 30 percent from their estimated values.

The process used to develop the FDCM first established key assumptions, a standard decommissioning WBS and supporting WBS dictionary to organize the estimate into a logical framework, and then classified facilities by types to standardize the estimating process. After these preparatory activities, Site facility information and actual decommissioning costs were collected, analyzed, and normalized for use in the model. Templates were developed for the different facility types incorporating this data based on costs and parameters from previous projects such as total floorspace, building footprint, percentage of floorspace contaminated, and gloveboxes, piping, tank, and duct quantities. Future facility parameters were matched with templates and consolidated to form a Sitewide estimate to support overall planning and contract negotiations. Cost data gaps were filled with detailed bottoms up cost assessments or with actual costs from comparable government or commercial decommissioning projects. The principal benefit of the FDCM was that because it reflected Site actual data, it was able to predict similar work at a building level without trying to quantify the numerous Site- and nuclear-related inefficiencies related to decommissioning work.

A standard WBS was used for decommissioning activities for each of the projects and it provided an organized framework for the estimate. The standard decommissioning WBS developed to organize decommissioning cost estimates is shown in Table I, and described in more detail in Appendix 1.

Table I – Facility Decommissioning Cost Model Work Breakdown Structure

WBS ELEMENT NUMBER	WBS ELEMENT TITLE
1.E.X.D.Y.Y.01	Planning and Engineering
1.E.X.D.Y.Y.02	Characterization
1.E.X.D.Y.Y.03	Final Status Survey and Project Closeout
1.E.X.D.Y.Y.04	Decontamination
1.E.X.D.Y.Y.05	Dismantlement
1.E.X.D.Y.Y.06	Demolition and Disposal
1.E.X.D.Y.Y.07	Project Management
1.E.X.D.Y.Y.08	Support Services

For the non-plutonium buildings, the FDCM formed the basis of estimate for the Closure Project Baseline. The FDCM templates were extended to become the input tool for BEST 2000 for each type of facility. Using this data, BEST 2000 calculated the total cost of the resources for each decommissioning activity for each facility. All activities are entered into the BEST 2000 System by fiscal year, and the Primavera

Project Planner (P3) to produce resource-loaded time-phased cost plans. Escalation may be applied to the total project costs; however, the costs in the FDCM are unescalated constant FY-00 prime dollars.

The plutonium building Projects chose not to utilize the FDCM as their overall project-estimating tool, developing their estimates “bottoms up.” The projects did, however, utilize data for specific activities, such as building demolition, from the FDCM database. The 771 Project had previously utilized POWERTool for the Set scope portion of the project. The Project chose to continue to utilize the estimate detail developed in POWERTool to create a more detailed estimate for the balance of the building. The 771 Project team decided that planning and estimating at that level of detail would allow them to track and control their costs at the working level. This would also give them the benefit of early visibility of estimate unit rate variances in time for corrective action.

Basis of Estimate Software Tool (BEST) 2000

BEST 2000 is a Microsoft Access based system resident on the Site intranet that collects, stores and retrieves various planning information; in particular it stores activity resource estimates. BEST is part of a client/server system and is maintained on a central database that integrates all the projects. The primary purpose of BEST is to collect and maintain a well-documented Site cost estimate. It is intended to make the planning task easier by automating the calculations, collecting data from projects in a standardized way so that the data can be readily transferred to other information systems, and ensuring that the data submitted is consistent and validated to the fullest extent possible. It has links to other site software like People Soft and Primavera and it is the central storage facility of the Site Project Control System.

The Closure Project Baseline and the Basis of Estimate (BOEs) reside within BEST. BEST supports creating, modifying and retrieving cost estimates and related data, using the “activity” as the common work element. Activities are supported by a variable number of line items, which are in turn supported by a variable number of BOEs, all keyed to the activity designator. Costs for each line item are automatically rolled up to the activity. BEST routinely provides current pricing of estimate data based on the latest information.

BEST is not typically the tool of choice for estimate development. At the project level, estimating programs like POWERTool, Excel, and Timberline are used to develop the estimate detail. The quantity and unit rate information that is generated by those programs are then fed into and priced by BEST.

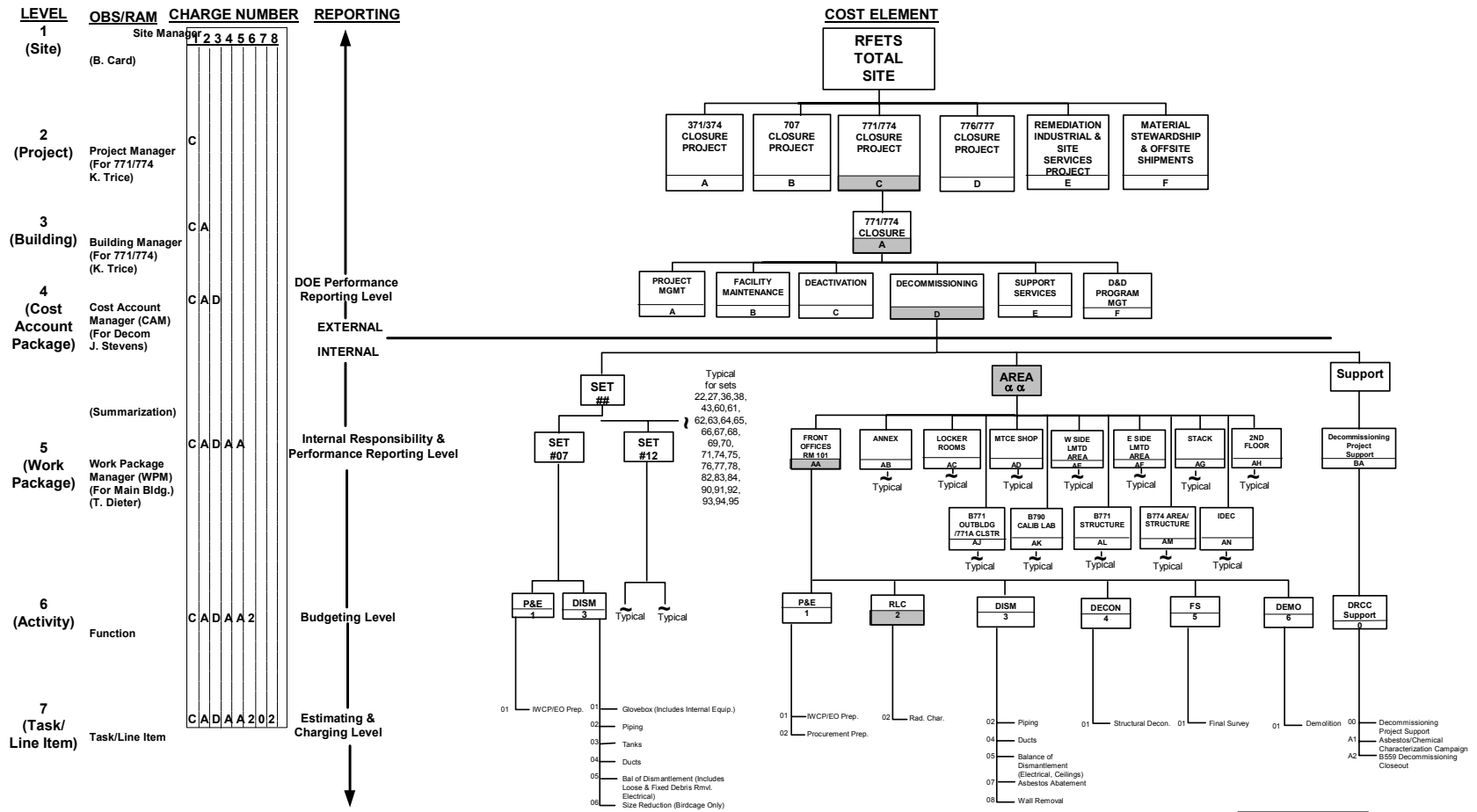
NEW ESTIMATE STRUCTURE

One of the first and most significant changes implemented under the Closure Project Baseline was the reorganization of overall Site WBS. This organization is shown in Figure 1, where the column on the left shows the WBS level. Level 1 is the total Site. Level 2 (or “Project”) identifies the project organizations, with four of the six major projects being the plutonium buildings, a fifth the remaining uranium and support buildings (and certain support functions), and a sixth “operations” such as waste management and security. Level 3 allows separate building groupings to be broken out; however, it was decided on the 771 Project to combine 771 and 774. Level 4 (Cost Account) of the WBS was dictated to the projects and represents groupings covering not only the “Decommissioning” effort but also the ongoing support required by the facility. Level 4 is also the level at which the Kaiser-Hill reports to DOE.

Within Level 5 through Level 7, the project had the ability to define its own specific work breakout. Level 5 or Work Package is the level that the project used to assign responsibility and track performance. Level 6 is used to separate work by “discipline”, e.g. planning (engineers) from dismantlement (craft). Level 7 was envisioned as a “Media-based” level (i.e. glovebox, pipe), at which cost collection could be reconciled with the estimate factors. Current concepts in management strategies and theories for work processes and cost collection were incorporated during this revision along with lessons learned. More detail on the data in Level 5 through Level 7 is given in Table II.

771/774 COST BREAKDOWN STRUCTURE
DECOMMISSIONING

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Tom Dieter/Date

5/23/00

Fig. 1 – 771 Project Work Breakdown Structure

Table II – WBS Description

Project Management	Level 5 to Level 7 only includes the Project Manager's office.
Facility Maintenance (Landlord)	Level 5 and Level 6 includes ongoing operations like "Compliance Surveillance", "Maintenance", "Operations Technical Support", "Operations Management", and "Authorization Basis".
	Level 7 identifies the associated Tasks/Line Items of the estimate.
Deactivation	Levels 5 and Level 6 identify the System.
	At Level 7 no further definition is required.
Decommissioning	Level 5 shows the greatest changes in the reorganized 771 Project WBS: the separation of "Decommissioning" into the Dismantlement "Sets" and Decontamination "Areas". This allows greater flexibility in the work schedule and better tracking between work being done by the Steelworkers and by the Building Trades. The Steelworkers perform dismantlement and equipment removal of materials >2,000dpm within the Sets and the Building Trades remove equipment and material <2,000dpm and decontaminate structural surfaces of the Areas. This resulted in a standardized group of like charge numbers for Systems, Sets and Areas to track actual costs in a logical manner.
	Level 6, the level we detail our planning activities shows a breakout of work consistent with the FDCM WBS organization (see also Appendix 1), i.e. Planning and Engineering, Characterization, Final Status Survey, Decontamination, Dismantlement, and Demolition. Only Planning and Engineering and Dismantlement elements apply to "Sets" while all apply to "Areas". Also specific decommissioning support is collected independently of overall project support.
	Level 7 or Task/Line Item identifies those specific related work activities.
Support Services	Level 5 this is the same and at Level 6 identifies the Activities as Project Support, Security, Waste Operations, Technical Support, and Property Management.
	Level 7 identifies the Task/Line items i.e. for Project Support we have Project Controls.
D&D Programs	(This separate Program is unique and Not Applicable)

The new code of accounts also allowed for a more structured link between the project estimate and the Site estimating system BEST. It has also created a seamless link with the scheduling system Primavera Project Planner (P3) through consistent activity coding and resource loading which made performance measurement a more credible management tool. This new code of accounts has also allowed for easy interaction and understanding with and by the craft supervisors.

ELEMENTS OF THE ESTIMATE

The discussion of the estimate elements is arranged based on the elements of work and how they were estimated. Process Equipment Removal, Building Decommissioning, Demolition, Pre-Demolition Survey, and Deactivation categories are the principal direct execution elements, and are estimated independently. The Waste element requires input from other elements as to the waste quantities to be handled. Additional Factors discusses productivity and other factors and how they were applied. The Project Support section describes those elements of the estimate and their basis. Finally, the Output and Final Estimate Adjustments sections address the procedural and management interfaces necessary to complete the estimate and include it in the Site Closure Project Baseline.

The current Closure Project Baseline cost estimate builds on planning strategies and cost estimates initially conceived in 1997. The work "Set" concept was developed during that timeframe based on previous Westinghouse experience at the Hanford site. The Sets were modified and the work "Area" concept added as part of the ongoing revisions and modifications for the 2006 Plan. The Set concept combined or divided individual rooms and other portions of the building into quantifiable groups (or "sets" of equipment) with similar equipment and components which would require decontamination and decommissioning by the Steelworkers. The Area concept divided the building into segments or "Areas" which would be stripped out

by the Building Trades and basically followed the pattern of the Steelworkers decommissioning activities. When the decommissioning of all of the Sets in a segment of the building was complete, the Area work would begin (in the same building locations) to remove any remaining low level and non-contaminated equipment, components and systems.

The principal reason for development of Areas was to provide a bottoms-up estimate for scope elements previously estimated parametrically. Additionally, the Area approach incorporated the planning necessary to subcontract elements of scope in an attempt to attain additional economy in the decommissioning work. The use of the Set and Area concept also allowed the Steelworker and Building Trades work to be scheduled concurrently for significant acceleration of the project completion date.

Process Equipment Removal (Sets)

The Closure Project Baseline estimate for process equipment removal builds on the original POWERTool work begun in 1998 and 1999. The POWERTool database was created as proprietary software on Microsoft Access (financed by DOE) to estimate work Sets in Building 771 using an activity-based cost estimating method. Thorough field walkdowns were conducted, along with detailed step-by-step analyses of how the actual work would be performed in the field. Based on this information and on discussions with project personnel from the on-going Building 779 decommissioning project, step-by-step work-estimating templates with built-in unit rates were developed which required the insertion of the number of units per activity to complete the cost estimate equation.

The internal structure of POWERTool, which remained unchanged for the Baseline estimate, was set up with the “inventory,” i.e. the materials to be dismantled organized by Set, “subset,” and “work unit;” the work that would be done organized by Tasks and subtasks. The standard subsets are shown in Table III. The “work units” consisted of individual estimate elements, such as removal of linear feet of pipe, erection of a scaffold, or changing a glovebox glove. The standard tasks used for the Building 771 estimate are given in Table IV. Subtasks were defined at the work unit level. Thus the Task/Subtask structure simply provided an alternative way to roll up work unit data. Use of standardized formats, which did not allow the estimate roll-up to vary with the Set inventory, resulted in the work often being concentrated within one Subset, i.e. for glovebox Sets, greater than 80% of the work is in Subset 6, which caused a number of problems in Set reorganization, evaluation of estimate accuracy, and cost control.

Table III – Standard Subsets

Subset Title	Subset Scope
1. Electrical	electrical panels, control panels, electrical boxes, conduit, motors, hoists, lights, cameras, instrumentation, transformers, SAAMs/CAMs, counting equipment, etc.
2. External Low Level Equip	platforms, desks, cabinets, hand rails, framework, valve panels, glove bins, concrete walls, cinderblock walls, eye wash/safety shower, racks, hydraulic systems, debris, manipulators, fire suppression, sumps, sinks, decon showers, chillers, refrigeration units, etc.
3. Internal Glovebox Equip	fulflo filters, glass pipes, metal vessels, evaporators, piping/valves, pumps, columns, flasks, hot plate, scale, chain hoists, debris, etc.
4. External Piping/ TRU Equip	piping, criticality drains, ducts, heat exchangers, chemical pumps, small off-gas piping, vacuum traps, plena, evacuator/pull pump, etc.
5. Tanks/ Raschig Rings	tanks, Raschig rings, sight glasses, tank supports, etc.
6. Glovebox/ Misc. Equipment	gloveboxes, B-boxes, scrubbers, pedestals, pneumatic transfer piping, large off-gas piping, etc.

A third key system element was the Work Unit Library. The work unit library was the “look-up table” that contained all of the factors to transform the inventory data into labor hours by discipline/craft and costs. The work unit included in the library had the capability for 25 labor rates (e.g. Electrician hours/electrical panel), cost elements, or waste values, which represented the potential outputs of the POWERTool system. Once the inventory for a particular activity and the work unit library data had been input, then the program (query) could be run to generate the estimate data. There were a number of standard output formats that

would arrange the labor, cost, and waste data according to Set, subset, task, or labor code. Additional factors were provided to calculate planning, construction, subcontracted materials, labor, and project management costs from Set direct costs. This intermediate output could be used to evaluate the data or examine options. Final output that was generated for inclusion into BEST prior to the 2006 Baseline was stripped of all cost factors, with any additional supporting elements being calculated or input separately from the direct Set data.

Table IV – Standard Tasks

Task A	Initial Characterization
Task B	Additional Technical Support
Task C	Internal Equipment Disassembly
Task D	Internal Decontamination to Stabilize/Reduce Hazards
Task E	Internal Decontamination to Convert Waste Form
Task F	External Equipment Disconnection and Removal
Task G	Size Reduction In-Situ
Task H	Size Reduction Facility
Task I	Waste Packaging

To develop the inventory data, the equipment in a Set was walked down and a number of take-offs of work unit items amenable to direct observation were collected. These included length of pipe, number of glovebox windows and gloves, number of electrical panels, and similar items. After that activity, there were a number of evaluations and calculations performed to determine “derived” work units that were more related to how the craftsmen would perform the work. These included items such as estimating the length and number of cuts each glovebox would require during size reduction, identifying the number of scaffolds necessary for all electrical work, and deciding the number of contamination control enclosures that might be required to size reduce all of the Set’s gloveboxes. As an example, all size reduction of duct, gloveboxes, and tanks was based on inches of cut, which had to be derived for each item, not on a parametric like square foot of glovebox surface, which could be objectively measured.

The development of the Work Unit Library data was key to creating a credible estimate. Original library work units were developed as part of the planning process, including the “derived” work units. Estimates were originally developed based on cutting speeds and typical durations required to perform similar maintenance duties. Detailed estimate "build-up" analyses were conducted for specific activities, in which the work was reduced to and estimated at its most basic elements, and then these elements built up to the work unit level. Building 779 foremen were contacted and provided input on unit rates, crew sizes, and waste quantities for specific activities, although such input was for small samples or durations, and was somewhat anecdotal.

For the development of the Baseline cost estimate, several modifications were made to the process equipment removal estimate. The Sets were modified, with some of the smaller Sets being combined. There were some changes in the ventilation system removal, with some of that work being included with the glovebox Sets that the ventilation supported instead of as a final, building-wide activity. Finally, the factors used for the POWERTool system were reevaluated and changed.

Early in the Building 771 rebaseline process an attempt was made to validate the estimate. A particular Set, Set 36, was identified and estimated using six different methods, including POWERTool, a derivation of the FDCM, and several consultants and foremen. The results of this exercise were factored into the work units to distribute that data across the remaining Sets. Another change made to the POWERTool estimate in the rebaselining process was the transfer of scope from the Sets to the Areas. This required cross-referencing to assure that the scope went to the correct Area, and an interface with the estimate elements used to estimate the Areas. The data that supports this relocation of scope is referred to in the next section as “transferred dismantlement sets.”

The activities necessary to complete the Process Equipment Removal portion of the rebaselined estimate were to include the planning costs and waste costs and quantities. In planning the actual work, each set or area was reviewed for what types of activities would be involved, what levels of contamination were

present and which of the three types of Integrated Work Control Program (IWCP) packages would be required, hot, cold or balance. Hot IWCP packages were required for contaminated equipment/components, cold packages for low level and non-contaminated equipment/components, and balance-of-set packages for miscellaneous ductwork, electrical and mechanical items. Once the appropriate types of packages were identified and scheduled the detailed engineering planning tasks could begin. Waste volumes and costs are discussed under the Waste section. The data output is specifically formatted with the necessary information for direct transfer into the BEST system.

Building Decommissioning (Areas)

The estimate for the Building 771 Decommissioning scope had no detailed counterpart in the earlier estimate. Work done on the FDCM provided some values for decontamination and demolition, among other activities, on a building area basis. Although the FDCM provided input for the costs agreed to in contract negotiations, it only provided an independent checking mechanism for the planning and estimate development of this portion of project scope.

In 1999, TLG Services, Inc. of Connecticut prepared a complete commercial-based cost estimate for Building 771, but not Building 774. TLG Services was supplied with all pertinent engineering drawings available, and prepared a detailed takeoff “inventory” for the structure. Data extracted from this study was used as a partial basis, along with the POWERTool data, for the removal of the lesser-contaminated equipment and structural surfaces or materials to be decontaminated or removed. Surface areas for B774 were separately detailed by drawing takeoff.

The Area estimate was developed on a linked system of Microsoft Excel spreadsheets. It was structured with a core spreadsheet that used the inventory and takeoff data and multiplied it by unit rates, which resulted in basic labor hours and waste volumes by Area. The unit rates, Building Factor (efficiency factor accounting for differences in labor productivity), and additional factors for subcontractor overhead and profit and materials/small tool costs were developed in separate spreadsheet sections, and accessed by the initial section. The data output was formatted as necessary for direct batch transfer into the BEST system.

The core spreadsheet of the estimate applied factors against an inventory of work units to determine the basic labor cost, materials and equipment, other associated costs, and the waste volume. The calculation occurred for each Level 7 WBS element for each of the thirteen Areas, by line item, summing the direct labor for all of the work unit elements under that WBS element (the labor categories became the line items). The total cost included dollars expended for construction subcontractor material and equipment costs, and/or costs expended for subcontract work. It included inventory for the outbuildings as well as Areas in Buildings 771 and 774. A portion of the Area data was based upon a transfer of data from the original POWERTool cost estimate for elements of scope that were moved from the Set to the Area scope.

A separate spreadsheet of the Area estimate provided the build-up for the unit factors to be used as the basis for the calculation of labor resource and waste volumes. The unit factors converted inventory units (e.g. linear feet of pipe) to labor hours by craft, and included Building Factor adjustments. A BOE or reference document/resource used to construct the unit factor was also developed. Costs of material and equipment to perform one work unit, and factors for waste calculation by volume and weight respectively were also developed. Except for the adjustment for the Building Factor, this section functioned as a “lookup” table for other sections to perform calculations.

A final spreadsheet provided the technical support functions for the Areas, providing the required numbers of hours to be expended by labor skill code per day. As such, the technical support was estimated for three types of work expecting differing support functions, i.e. decommissioning Areas, pre-demolition survey, and demolition. Six types of support were estimated: mechanical engineer, electrical engineer, industrial hygienist, radiological engineer, criticality engineer, and nuclear safety engineer. The analysis started with percentages of expected days, and calculates the number of hours per day required based upon the assumption of working 10 hours per day. The number of hours per day was transferred into the BEST program, and was calculated by BEST against schedule durations (from Primavera) to determine the costs associated with technical support.

Demolition

The demolition estimate was reported by Area because of the option to demolish some sections of building 771 and Building 774 independently. Based on ratio of the Area footprint to the total building footprint, the total cost for demolition is broken down by Area. A calculation was also done based on the FDCM to validate and “benchmark” the demolition estimate. Sufficient correlation existed between the two different approaches to validate the demolition cost estimate. The independent demolition cost estimate was then used for the transfer to BEST.

Pre-Demolition Survey (PDS)

The PDS (or Final Survey) costs were estimated based upon the structures surface inventory as detailed by TLG Services. The cost is based upon historical data from the billings by a survey subcontractor used for B779 PDS. The estimate for PDS assumed a production rate of 100 m²/day (vs. 62 m²/day average for Building 779) with a total cost per shift of \$5,700.00, i.e. Building 779 average cost not including “stand-by” time. Since this cost was based on subcontract billing data, overhead and profit (OH&P) costs were not considered for PDS subcontracting work. PDS cost was detailed by decommissioning area, and transferred to BEST as a subcontract cost.

Deactivation

The costs for deactivation were estimated based on actual costs incurred during 1998 and 1999. This data was inputted manually into BEST, with no additional development of BOEs or backup calculations.

Waste

Waste Operations was intentionally broken out as a separate entity due to the difficulty in determining waste costs on a Set-by-Set basis i.e., waste from several different Sets could be processed and packaged at the same time making it unreasonable to collect costs per Set. This activity also includes the costs for waste containers, laundry and drum crusher installation based on the same logic. Estimates were developed using historical data and projected waste quantities for waste operations, waste disposal and laundry. The drum crusher installation was developed using vendor quotes and an activity based cost estimate.

The separate waste rollup spreadsheet was created to extend and manipulate the waste data developed from the inventory data to estimate the labor cost for managing the waste on the project level. Waste volumes, where appropriate, were calculated, and volume was distributed across the waste stream (55gal, LLW, SWB, Cargo vans, and LLWM in 55 gal drums). The waste container data was organized by decommissioning Set/Area and function (dismantlement/decontamination). This spreadsheet also calculated waste container costs by Set/Area and function, and Waste Operations labor resources subcontracted-labor, RCT, and first line supervision based on container inventory by area. The data output was designed to transfer the data directly to BEST.

Additional Factors

Since the Area estimate was based on general market referenced units, an approach was required to adjust these units for appropriate use for specific Site activities. The Building Factors were developed to account for differences in labor productivity due to building contamination levels, building security requirements, building construction, and additional Site requirements and restrictions. The Building Factors were developed in a “Timberline”-type format, and reflected the intended work schedule of 4-10 hour shifts per week, and were designed to be applied to industry standard labor requirements (man-hours) such as R.S. Means, and Richardsons. The specific Building Factors are given below, and factors considered in their development are shown in Table V.

- Outbuildings & Non-Radiological Areas
- Outbuildings & Non-Radiological Areas (full face respiratory protection)
- Radiological Buffer Areas (RBA) Areas
- RBA Areas (full face respiratory protection)
- Contaminated Area (CA) Areas
- CA Areas (full face respiratory protection)
- CA Areas (supplied air respiratory protection)

Table V – Allowances Considered in Building Factors

Degree of Difficulty	Work Factor Constraints	Additional Factors	Monitoring requirements
Height of work	Personal	Personal access	Procedural requirements
Accessibility/obstructions	Delay factors	Building Access	Shower Requirements
Quantity installed	Production efficiency	Building Layout	Clothing change
Quality Assurance	Procedural requirements	Contamination	requirements

In addition to the Building Factors, other OH&P and materials, tools, and equipment (MT&E) factors were developed and applied to the basic estimate elements. Building Trades work was assumed to be accomplished by a fixed-price contractor, who would include OH&P in his bid. In order to calculate OH&P, the labor resources for each task were identified from an initial estimate iteration to develop costs from the labor hours. Overhead and profit was assumed to be equal to OH&P charged by a previous outside subcontractor during the decontamination of Building 779. Cost was calculated for each labor resource, and the OH&P was estimated at 42.81% of this cost. This data was then summed to provide the OH&P by Area. Additionally, an allowance for the cost associated with hand tools and small equipment (MT&E) was estimated to total 2% of the labor cost based on past experience with maintenance-type work. Labor resources were detailed by category and by Area, and labor costs were calculated. MT&E cost was calculated based upon 2% of the total cost of labor resources (for transferred sets) by Area.

Project Support

Project Support elements were activities that were not estimated using the systems identified above for calculating the direct costs and labor. They are included in separate WBS elements and normally managed as level-of-effort activities.

Management Support, including the Project VP, department managers and their administrative staff – Resource requirements were estimated using the existing staffing plan and historical data. These resources were adjusted in the out-years to reflect the craft manpower curve reductions as the Project reached completion.

Landlord Activities, including operations, maintenance and surveillance – These activities are required to meet the Basis for Interim Operations (BIO) for the Project. Resources were derived from historical data from 1998 and 1999. Reductions over the life of the project were calculated based on projected progress of decommissioning activities (i.e., as equipment is removed and rooms/areas are stripped out, a proportional ratio of landlord activities diminish due to reduced BIO requirements).

Support Services, including Project Controls, Special Projects, Security, Waste Operations, Technical Support and Property Management/Equipment/Consumables – Project controls resources were calculated based on historical data along with the existing staffing plan and adjusted to reflect the craft manpower curve reductions as the Project reached completion. Special Projects (e.g., Inner Tent Chamber purchase and construction, Supplied Breathing Air Upgrades, etc.) were developed from vendor quotes and activity based cost estimates on an individual project basis. Waste Operations costs were included under Project Support. The details of waste volume and cost development are discussed under the waste section above.

Security requirements were determined by the Project’s security plan, which was an agreement negotiated between the Project and the Site security contractor. Security requirements were determined based on the Project being within a security “Protected Area,” the need to create a “bubble” in which un-cleared crafts could work, and other special security requirements on an as-needed basis.

Technical Support (includes Training and Non-Productive Time) was based on historical data accumulated from 1998 and 1999. The Non-Productive Time activity was developed for time lost due to unforeseen occurrences which cannot be tied to a specific Project related activity (e.g., work stoppages/shutdowns due to safety concerns). The costs from the Set and Area data fed into this estimate.

Property Management, Equipment, and Consumables estimates were developed using historical data from 1998 and 1999, vendor quotes, and activity-based cost estimates where needed. These activities were separated for reasons similar to Waste Operations, i.e. several Sets/activities could utilize the same piece of equipment over a period of time and the benefits of collecting costs per use was out-weighted as the equipment's use increased. In the past it was found that all costs for multiple-use equipment were charged towards the first Set/activity utilizing the equipment after purchase, even though the equipment was repeatedly utilized for other Sets/activities.

Output

The data output was the interface between the building-specific estimate and the overall Site BEST system. Rebaselining required calculation of man-hours of labor resource for task-activity, waste operations labor resource man-hours, waste container costs and subcontracted support costs such as those for the Reconnaissance Level Characterization, PDS, and demolition. The data was loaded into BEST, which calculated total costs in dollars based on this information. This calculation of labor resources assumed that all man-hours were straight time hours, with BEST programmed to calculate overtime hours at 20% of straight time. BEST absorbed this data, and added current labor rates, fringe benefit rates and corporate adders to produce the official Kaiser-Hill estimate for site cleanup activities.

The section developed to transfer data to BEST packaged the data and assigned activity identification numbers, charge numbers, line item numbers, and quantities. Activity identification numbers and charge numbers are assigned through the WBS. A line item number was designed to be unique to each cost element. Departments, cost elements, and skill codes were assigned to indicate information as used by the BEST program.

Final Estimate Adjustments

Initial 771 Project costs were developed based on the initial input of the Building 771 (mostly labor hour) data into the BEST system. These costs indicated particular elements of scope that seemed inconsistent with other projects of this type. One element was the cost of the demolition. This element was adjusted to bring it in line with expectations. There were other additional factors applied to the estimate to align the project with the negotiated contract. After the alignment of the scope elements, there was a Sitewide effort to identify elements of project risk. The result of this analysis was used to assign project-level contingency.

COST CONTROL

A major consideration during the WBS and cost estimate development was the approach and requirements for project cost control, i.e. the scheduling and project control efforts to ascertain the cost and schedule status of the ongoing project. The 771 Project rebaselining included the estimate discussed in detail above along with concurrent general planning (and in some cases detailed planning – i.e. procedures) and working-level schedules. All of these elements had to be integrated with the cost control approach in order to achieve accurate project control. For the 771 Project, the intended cost control goals were to provide accurate project status to management, while also having a system that was easy to use, integrated with the schedule, and traceable to estimate elements. Additionally, it was expected that by analyzing costs as work was being performed we could project future costs both for the 771 Project and future Site buildings. The charge number structure for the decommissioning work in Building 771 was based on the hierarchy of the WBS, including charge numbers and earned value methodology.

The charge numbers were structured according to Set or Area, with an additional extension that indicated whether the labor or cost charges were for planning, glovebox (in-room), glovebox (size reduction), pipe, duct, tanks, or "balance." The "balance" category contained the electrical and removals of less-contaminated items not covered under one of the other charge numbers. Charge number categories were modified from the POWERTool subtasks. The charge number structure did not distinguish between individual gloveboxes, or different groupings of pipe or duct in a Set or Area, although the schedule and earned value data included that breakout. Charge numbers for Sets contained only labor elements; costs for materials and supplies were collected elsewhere and allocated to the Sets if necessary. This was necessary since there was no centralized method of accounting (i.e. a tool crib) for such items by charge number, which resulted in early Sets incurring a disproportionate share of the tool costs.

A critical improvement included in the modified WBS was the standardization of charge number elements to be consistent with nomenclature of Systems, Sets and Areas. This allowed costs to be grouped by like types of scope to facilitate the tracking of actual costs. The charge numbers mirrored the activity identification number alphanumeric system, allowing for easy interaction with and understanding by the craft supervisors, and a reduced learning curve. Finally, the charge number format allowed for an improved link with the Site's scheduling software and BEST

The basis of the Project earned value system is a schedule of values, created as an Excel "earned value spreadsheet" for each Set, which is linked to the estimate to provide an earned value cost roll-up. The total earned value for a given Set or Area at completion is the same as the value in the Baseline for that Set or Area. The spreadsheet was designed to record percent complete for each item of work, with a level of detail typically including eight to ten items per glovebox for every glovebox in the Set. Non-glovebox items, such as tanks or duct, were given in a similar level of detail. The earned value spreadsheets were developed individually for each Set to reflect the Sets unique characteristics. The earned value spreadsheets were developed in parallel with the schedule, reflecting the schedule breakout of the work. They included cross-referencing to define which detailed elements of the working schedule satisfy which items on the earned value spreadsheet. The spreadsheet items established a lower level of work elements, in most cases below the activities reported in the working schedule.

The spreadsheets support assignment of percent complete values for each item. This allows project control personnel to accurately reflect the initial activity where different parts of room or Set are all being worked simultaneously. The worksheets provide unambiguous cost values to individual pieces of equipment, and are a primary means of communication between the project control personnel and the craft foremen. They provide an objective assessment of the work accomplished and reduce arguments over progress when statused on a weekly basis.

The correlation between the earned value spreadsheets and the estimate was based on the individual work unit data in the estimate. The spreadsheet for a Set was made consistent with the total Set estimate, and then subdivided based on the estimate elements. In some cases the estimate element was sufficient to quantify the estimated cost of the element in the spreadsheet. More often, it was necessary to review the estimate calculation files and/or pro-rate costs based on equipment characteristics to subdivide the element cost (i.e. pro-rate costs for a glovebox activity based on the surface area of the individual gloveboxes).

As the project has progressed there are a number of changes to the charge number and earned value systems. Despite an emphasis on creating a simple charge number system, there have been mistakes in charging. Most errors occurred earlier in the process, before the foremen became familiar with the project control needs. Some decommissioning removals were charged to maintenance accounts. As the project management has become more familiar with the basis of estimate and where things should be charged, such errors have declined. Other methods, such as placing the charge number next to the schedule item on working schedule, and working with decommissioning foremen to prepare for weekly progress meetings where the foremen are required to defended their progress has improved compliance. Discussion during staff training of the benefits of accurate charging for improved project control is expected. While initial efforts focused on getting accurate charging by Sets, more recent efforts to improve charging by media, e.g. by pipe, glovebox, etc. are showing some success.

The earned value system was also modified as the project has progressed. Previously larger estimate items have been subdivided to provide greater resolution for taking earned value. For instance, in the initial portion of Set dismantlement, all electrical components are isolated as a group (i.e. not by individual piece of equipment). Subsequent electrical equipment is removed piecemeal either to allow work on more contaminated items or when time permits. The electrical items on the earned value spreadsheets have now been subdivided to reflect this approach, taking credit for electrical isolations first as a group, and recording the earned value of the other electrical equipment as it is removed.

As the project has progressed, specific types of work have been identified as requiring a greater or lesser actual effort to achieve a given quantity of earned value. The most egregious situations have been

addressed by moving scope and budget between different elements in subsequent Sets. Management selection of work to “accelerate” earned value has been tempered by the reduced earned value received during the later stages of Set work, making the practice somewhat self-correcting. An example of this is that all piping was assigned equal earned value, while some systems have proved easier to remove than others. Future estimates would attempt to segregate piping systems.

CONCLUSIONS AND LESSONS LEARNED

The effort to complete the Building 771 portion of the 2006 Closure Project Baseline was a success in that it provided detailed estimate elements that could support the planning, scheduling, and cost/project control needs of the 771 Project. There are a number of lessons learned, or things that could be done differently in the future.

First, we would have placed more emphasis on the individual pieces of equipment, both in the WBS and in POWERTool, and not used standard Subsets. This would have made the development of the refining of the cost numbers easier and more useful for cost collection and tracking, and would have made the earned value schedule of values track more closely with the estimate. Part of the problem was that the POWERTool estimating system would not allow sufficient levels to be assigned so there was an unnecessary tradeoff between the ways that data could be rolled-up.

A second improvement would have been to assign a consistent numbering system between the WBS, the schedule, and the POWERTool elements. Although changes in the project approach might have made this difficult to maintain, cross-referencing various nomenclatures made the planning more difficult than necessary. Conversely, any system must be flexible, e.g. have additional unused digits that can be defined later, so that it can accommodate project changes. We also should have revisited the Project WBS structure after the initial estimate runs, as there were some Sets that were overly large and some trivially small. Revisiting the structure would have allowed for a better roll-up (instead of a roll-down with unnecessary detail causing unnecessary paperwork).

Finally, in retrospect we should have re-combined the deactivation and decommissioning work. There are cases where the systems work and the Set work are so closely intertwined that separating the work is difficult and causes unnecessary scheduling and charging confusion.

One thing that was done well was to collect a small team early on to do the planning. This ensured that as the changes in approach and organization occurred, the basis of the estimate was maintained and the estimate did not have to be substantially re-done. Although the original estimate did not have a detailed estimate for the future phases of work, the project utilized appropriate parametrics and, when the time came to create the necessary detail, consulted the necessary expertise on a temporary basis to supplement the core team.

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APPENDIX 1 – FACILITY DISPOSITION COST MODEL WBS DESCRIPTIONS

Planning and Engineering

This element addresses all the task specific direct labor, equipment, materials, supplies and subcontract costs for the Planning and Engineering of decommissioning projects. The scope of this element includes activities such as: the preparation of the Decommissioning Operations Plan, Resource Conservation and Recovery Act Unit Closure Plan, Health and Safety Plan, preparation of work plans (i.e. operating procedures), project-specific WBS, readiness assessments, Management Reviews, Waste Management Plan, Training Plan, utility relocation design documents, building demolition design documents, equipment removal design documents, design engineering inspection, and preparation of required procedures.

Characterization

This element addresses all the task specific direct labor, equipment, materials, supplies and subcontract costs for Scoping and Reconnaissance Level Characterization only. This element does not cover the characterization associated with In-Process Characterization during the execution of the Decontamination, Dismantlement, and Demolition and Disposal WBS elements. In-Process Characterization costs would be charged to the aforementioned WBS work element it supports. In addition, this element does not cover the characterization costs associated with Pre-Demolition Survey (PDS) and Project Closeout, Under Building Contamination, Potential Areas of Concern, or Individual Hazardous Substance Site remediation, which are part of ER.

Pre-Demolition Survey and Project Closeout

This element addresses all the task specific direct labor, equipment, materials, supplies and subcontract costs for the PDS. The PDS is the last decommissioning activity to occur prior to the demolition and subsequent disposal of the debris associated with the facility. Also included in this WBS element are costs required for the independent verification, as necessary, of the PDS results and conclusions and costs associated with closeout of the project, i.e., Project Closeout Report.

Decontamination

This element addresses all the task specific direct labor, equipment, materials, supplies and subcontract costs for decontamination of decommissioning projects. The scope of this element includes the decontamination of building interior/exterior surfaces, equipment, drains, etc. In addition, it includes the removal of hazardous and toxic substances; e.g., asbestos abatement, lead/lead-based paint and PCB removals, and any associated In-Process Characterization costs. This element also includes the costs associated with packaging, pre-certification and movement to the nearest pickup point; i.e., building loading dock, etc., of contaminated wastes/materials generated during the overall decontamination effort and any associated In-Process Characterization costs. Any additional movement or treatment, storage and disposal (TSD) of contaminated (hazardous and/or radiological) materials, after they have been packaged and staged at the pickup point, for the types of hazardous and/or toxic wastes generated as a result of the overall decontamination effort are not included in this element.

Dismantlement

This element addresses all the task specific direct labor, equipment, materials, supplies, dismantlement hand tools, and the subcontract costs for dismantlement of decommissioning projects. The scope of this element includes activities such as: site preparation, stripout, removal and size reduction of miscellaneous process equipment, distributed systems (building lighting/power, heating, water, sewer, etc.), and isolation of the building/structure/etc. from the rest of the plant infrastructure. This element also includes the costs associated with In-Process Characterization, packaging, pre-certification and movement to the nearest pickup point, of contaminated wastes/materials generated during the overall dismantlement effort. Any additional movement or treatment, storage and disposal (TSD) of contaminated (hazardous and/or radiological) materials, after they have been packaged and staged at the pickup point, for the types of hazardous and/or toxic wastes generated as a result of the overall dismantlement effort are not included in this element. In addition, the acquisition costs of decommissioning required waste containers; e.g., Standard Waste Boxes (SWBs) will be included under this WBS element.

Demolition and Disposal

This element covers all task specific direct labor, equipment, materials, supplies and subcontract costs for the demolition and disposal of clean construction rubble and debris of decommissioning projects. The scope of this element includes activities such as the demolition and disposal of the roof, non-structural and structural components, floor slabs, foundations, connecting structures (tunnels, breezeways, overhead walkways, etc.) of the building/structure undergoing demolition and any associated In-Process Characterization costs. Additionally, this element could include the excavation of surface contaminated soil, back filling, grading and revegetation. This element also includes the costs associated with packaging, pre-certification and movement to the nearest pickup point, of contaminated wastes/materials generated during the overall demolition and disposal effort. Any additional movement or TSD of contaminated (hazardous and/or radiological) materials, after they have been packaged and staged at the pickup point, for the types of hazardous and/or toxic wastes generated as a result of the overall demolition and disposal effort are not included in this element. In addition, transportation and disposal costs of the demolition rubble at the nearest RFETS approved sanitary landfill are not included.

Project Management

This element covers all the task specific direct labor, equipment, materials, supplies and subcontract costs for the project management of decommissioning projects. The scope of this element includes, but is not limited to, activities such as: project management, construction management, oversight, project engineering, project administration, project controls and reporting, project finance and accounting, project-specific training coordination, project records management and document control, etc.

Support Services

This element addresses all the task specific direct labor, equipment, materials, supplies and subcontract costs for support services for decommissioning projects. The scope of this element includes support services such as: training, procurement and contract administration, security and fire protection, QA/QC, waste inspection and certification, transportation and construction equipment, radiological operations and engineering, Radiation Control Technician (RCT) support coordination and management, medical and health, safety and industrial hygiene, shipping/receiving and warehousing, legal, regulatory interface, laundry, analytical laboratory, toxic and hazardous material handling, utilities, excess property, telecommunications and information resources, finance and administration, planning and integration, and other support services yet to be identified. This element does not cover any direct labor costs, e.g., RCTs, associated with the execution of the decommissioning WBS elements, e.g., Decontamination.