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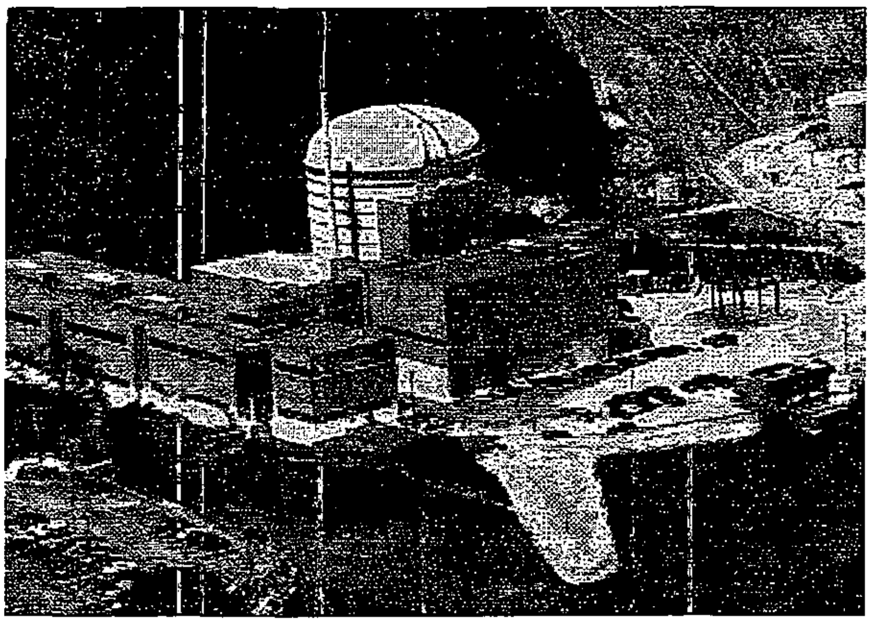
Exhibit TLG-4

# DECOMMISSIONING COST STUDY
# for
# PEACH BOTTOM ATOMIC POWER STATION
# UNIT 1



*prepared for*

**PECO Energy Company**

**June 1996**

*prepared by*

**TLG Services, Inc.**

Bridgewater, Connecticut

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# EXECUTIVE SUMMARY

This study, prepared for PECO Energy Company (PECO) by TLG Services, Inc., addresses the cost to decommission the Peach Bottom Atomic Power Station, Unit 1 (PB1). The projected costs to decommission the station are estimated at approximately $62.937 million for the activities associated with the termination of the license and restoration of the site. Cost and schedule summaries are reported in Table 4.1 and Figure 5.1, respectively. Detailed cost, waste volume and man-hour schedules are provided in Appendix C. Costs are reported in 1995 dollars and exclude any costs currently incurred in maintaining the unit in safe-storage.

## Alternatives and Regulations

The Nuclear Regulatory Commission (NRC) provided general decommissioning guidance in the rule "General Requirements for Decommissioning Nuclear Facilities" published and adopted on June 27, 1988. In the rule the NRC set forth technical and financial criteria for decommissioning licensed nuclear facilities. The regulations addressed decommissioning planning needs, timing, funding methods, and environmental review requirements. The rule also defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR and ENTOMB.

> DECON was defined as "the alternative in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations."
>
> SAFSTOR was defined as "the alternative in which the nuclear facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use."
>
> ENTOMB was defined as "the alternative in which radioactive contaminants are encased in a structurally long-lived material, such as concrete; the entombed structure is appropriately maintained and continued surveillance is carried out until the radioactive material decays to a level permitting unrestricted release of the property."

In 1995 the NRC proposed revisions to the general requirements for decommissioning nuclear power plants to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. The proposed amendments would allow for greater public participation and better define the transition process from operations to decommissioning. The costs and schedules presented in this estimate follow the general guidance and sequence proposed in the amended regulations.

Methodology

The methodology used to develop the decommissioning cost estimate for PB1 follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates." This reference describes a unit cost factor method for estimating decommissioning activity costs. The unit cost factors used in this study reflect site-specific costs as well as the latest available information about worker productivity in decommissioning. The information obtained from the Shippingport Station Decommissioning Project, completed in 1989 as well as from TLG's involvement in the decommissioning planning and engineering for the Shoreham, Yankee Rowe, Trojan, Rancho Seco, Pathfinder and Cintichem reactor facilities is reflected within this estimate.

An activity duration critical path is used to determine the total decommissioning program schedule needed in calculating the carrying costs associated with program management, administration, field engineering, equipment rental, quality assurance and security. This systematic approach in assembling decommissioning estimates, has been shown to provide a high degree of confidence in the reliability of the resulting costs.

Contingency

Contingencies are applied to the decontamination and dismantling costs developed as "specific provision for unforeseeable elements of cost within the defined project scope, particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this estimate are based upon ideal conditions; therefore, the types of unforeseeable events that are likely to occur in decommissioning, based upon industry experience, are addressed through a percentage contingency applied on a line item basis. It should be noted that contingency, as used in this estimate, does not account for price escalation and inflation in the cost of decommissioning over the remaining safe-storage period.

There is a general misconception on the use and role of contingency within decommissioning estimates, sometimes viewed as a "safety factor". Safety factors provide additional security and address situations that may never occur.

Contingency funds are expected to be fully expended throughout the program. They also provide assurance that sufficient funding is available to accomplish the intended tasks.

Low-Level Radioactive Waste Disposal

The contaminated and activated material generated in the decontamination and dismantling of a commercial nuclear reactor is classified as low-level radioactive waste, although not all of the material is suitable for "shallow-land" disposal. With the passage of the Low-Level Radioactive Disposal Act in 1980 and Amendments of 1985, the States became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders. Consequently, low-level radioactive waste generated in the decontamination and dismantling of PECO's nuclear generating units is destined for the future Appalachian Compact disposal site in Pennsylvania (designated as host state). The process of selecting and developing a suitable site is in the early stages with work progressing on siting and selection criteria. Opening of a low-level radioactive waste disposal facility in Pennsylvania is not anticipated until sometime after the year 2000, at the earliest.

For purposes of constructing the decommissioning cost estimate, disposal charges were calculated on published schedules from the operating Barnwell Low-Level Radioactive Waste Management Facility, as a proxy.

Site Restoration

The efficient removal of the contaminated materials and verification that residual radionuclide concentrations are below the NRC limits will result in substantial damage to many of the site structures. Blasting, coring, drilling, scarification (surface removal), and the other decontamination activities will substantially damage power block structures and potentially weaken footings and structural supports. Prompt demolition is clearly the most appropriate and cost-effective option. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures with a workforce already mobilized on-site is more efficient and less costly than if the process is deferred. Experience at shutdown generating stations has shown that plant facilities quickly degrade without continual maintenance, adding additional expense and creating potential hazards to the public as well as to the demolition work force.

Removal of site structures to a nominal depth of three feet below grade allows for the cover to be placed over the exposed rebar mats, embedded conduit and piping and structural steel resulting from the controlled demolition process. Excavation also allows for the placement of gravel for drainage as well as for sufficient topsoil so that vegetation can be established for erosion control.

Recommendations

Continual deferral in decommissioning PB1 will not dramatically alter the cleanup requirements, i.e., the quantities of waste to be remediated is not expected to vary significantly with time. Although the radiation levels within the plant have decreased over time, the presence of long-lived radioisotopes will control the removal and disposal techniques used in the decontamination and dismantling of plant systems and facilities. While TLG has not performed a present-value analysis, it appears that the cost savings in postponing decommissioning are relatively small, while the risk that regulatory and waste disposal requirements will become more restrictive are relatively high.

In most situations, the immediate remediation would be the preferred mode of decommissioning. The alternative is favored because it eliminates a potential long-term safety hazard. More importantly, the individuals familiar with the operation of the nuclear facility are available to support the dismantling effort, plant systems and services are fully functional, structural integrity is intact, and the licensee has a comprehensive management organization available to oversee/conduct the orderly decontamination and dismantling of the facility and site. However, given the current status of the PB1 facility and the absence of a dedicated staff, financial risk becomes the deciding factor.

# 1. SUMMARY

Peach Bottom Atomic Power Station, Unit 1 (PB1) was the first prototypical high-temperature, gas-cooled reactor (HTGR) to operate in the United States. The plant is located about 80 miles southwest of Philadelphia on the west shore of the Susquehanna River and shares the site with two adjacent 1165 MWe Boiling Water Reactors. In addition to developing a cost to decontaminate and dismantle PB1, this study also provides activity schedule(s), waste generation and disposition volumes, and an estimate of potential occupational exposure. PB1 has been placed in safe-storage after an abbreviated decommissioning program that included partial system disassembly and facility decontamination. This study focuses on the activities required to complete the decommissioning of the plant, resulting in the release of the facilities for conventional dismantling and the land for unrestricted use.

The scenario evaluated for PB1 is most consistent with the deferred phases of SAFSTOR as defined by the Nuclear Regulatory Commission (NRC). SAFSTOR is defined by the NRC as "the alternative in which the nuclear facility is placed and maintained in a condition that allows the facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use." Deferred remediation addresses the removal of radioactive fission and corrosion products, and all other radioactive materials present in excess of the limits allowed by law. The facility operator would then have unrestricted use of the site with no further requirement for a NRC license.

The costs in this study are reported in 1995 dollars. The total cost of deferred decommissioning is relatively insensitive to its period of performance as long as certain support services from Units 2 and 3 (in either an operations or decommissioning mode) are available. This is a result of the period of radionuclide decay which has already occurred, and will continue to occur prior to the earliest commencement of decommissioning activities, minimizing the benefits of any extended storage period (assuming stable waste disposal costs and regulatory criteria). While the costs to currently maintain the PB1 property and facilities are not addressed in this analysis, the maintenance and caretaking requirements will tend to increase with age and should be considered in evaluating long-term risks, liability and in assessing the timing for ultimately decommissioning PB1.

The ultimate cost for any alternative and the advantages and disadvantages of deferring the decommissioning of PB1 are highly dependent on future economic factors such as inflation and escalation of cost, and on future policy factors resulting from regulatory changes in the nuclear and environmental arenas, and on waste policy decisions and actions.

This study provides an estimate for decommissioning PB1 under current requirements, based upon present-day costs and available technology. Cost and schedule estimates presented herein assume the complete removal of all components and structures within the property lines, as the station is presently configured, except as noted within the body of this report. The estimated cost to decontaminate and dismantle PB1 is estimated at approximately $62.937 million. A summary of annual expenditures is provided in Table 4.1 following a schedule and sequence of decommissioning activities identified in Section 5. A detailed cost report is provided in Appendix C.

# 2. INTRODUCTION

This analysis is designed to provide PECO Energy Company (PECO) with sufficient information to prepare financial planning documents required by the U.S. Nuclear Regulatory Commission (NRC or Commission), the Pennsylvania Public Utility Commission, and/or other regulatory bodies. It is not a detailed engineering document, but a cost estimate prepared in advance of the detailed engineering preparations which will be necessary to carry out the decommissioning of Peach Bottom Atomic Power Station, Unit 1 (PB1).

## 2.1 OBJECTIVE OF STUDY

The objective of this study is to prepare an estimate of the cost, schedule, occupational exposure and waste volume generated to decommission PB1, currently in safe-storage. The study assumes that Units 2 and 3 are either operational or under active decommissioning at the time of PB1 decommissioning and that site personnel and services will be available to support PB1 activities.

PB1 operated from March 3, 1966, until October 1, 1974, at which time the plant was permanently shut down. The unit was placed in safe-storage after an abbreviated decontamination and dismantling campaign. For estimating purposes, decommissioning of PB1 is scheduled to commence concurrent with the final cessation of Unit 2 operations, although a more accelerated or prolonged schedule would also be feasible and equally cost-effective while the Unit 2/3 site is active (all other factors unchanged).

## 2.2 SITE DESCRIPTION

PB1 was the first prototype high-temperature, gas-cooled reactor (HTRG) built in the United States. It is located about 80 miles southwest of Philadelphia on the west shore of the Susquehanna River. A layout of the site is shown in Figure 2.1. The 40-MW(e) plant generated a total of 1,385,919 gross electrical megawatt hours with a gross plant capacity factor of 74% for a lifetime of 1349 equivalent full power days.

The heart of the nuclear steam supply system was a helium-cooled, graphite-moderated 115 MWt reactor core operating at high temperature on a thorium-uranium fuel cycle. The reactor core contained 804 fuel elements, each containing 30 graphite fuel compacts. The fuel cycle concept was based on continuous operation of the reactor until core depletion, at which time the spent fuel would be replaced with a new core. An isometric view of the reactor vessel is shown in Figure 2.2. The PB1 steam generation system consisted of two helium coolant loops that transferred heat from the reactor core to two shell and tube steam generators. Gross thermal efficiency at design operating conditions was 39%. Figure 2.3 is an isometric view of the primary coolant system.

The primary helium system contained a purge system for the fuel elements that trapped fission products before they were released into the primary system. Components included a trap in each fuel element, a condensibles trap, water-cooled delay beds, dust removal filter, low temperature delay beds, and a second dust removal filter. Purified helium system components included oil removal filters, liquid nitrogen traps for $^{85}$Kr removal, tanks, valves and manifolds. The components of the purge system are unique to PB1 and are not found in later HTGR designs.

The decision to shutdown PB1 was based on a study of the benefits to be derived from further operation beyond the last core, relative to the investment necessary to satisfy the Atomic Energy Commission's requirements for a full-term license. The study indicated that any gains from continued operation of this small plant were not sufficient to justify the large expenses that would be incurred in satisfying changes needed for a permanent license. With results of the study, PECO determined that safe-storage was the preferred alternative.

The reactor was completely defueled. Safe-storage preparations included limited decommissioning operations including decontamination of the fuel pool, removal of the radwaste system, and other minor clean-up work.

## 2.3 REGULATORY GUIDANCE

The NRC provided decommissioning guidance in the rule "General Requirements for Decommissioning Nuclear Facilities" (Ref. 1), published and adopted on June 27, 1988. In the rule, the NRC amended its regulations to set forth technical and financial criteria for decommissioning licensed nuclear facilities. The amended regulations address decommissioning planning needs, timing, funding methods, and environmental review requirements. The intent of the amendments was to assure that decommissioning would be accomplished in a safe and timely manner and that adequate licensee funds would be available for this purpose. Subsequent to the rule, the NRC issued Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors", (Ref. 2), providing guidance to the licensees of nuclear facilities on methods acceptable to the NRC staff for complying with the requirements of the amended rule. The regulatory guide addressed the funding requirements as well as guidance on the content and form of the financial assurance mechanisms indicated in the rule amendments.

The rule defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR and ENTOMB.

DECON was defined by the NRC as "the alternative in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations."

SAFSTOR was defined as "the alternative in which the nuclear facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use."

ENTOMB was defined as "the alternative in which radioactive contaminants are encased in a structurally long-lived material, such as concrete; the entombed structure is appropriately maintained and continued surveillance is carried out until the radioactive material decays to a level permitting unrestricted release of the property."

Prior to this rule, no endpoint was identified for either the SAFSTOR or ENTOMB process, i.e., a facility could remain in either state indefinitely. This is no longer the case as the rule places limits on the time allowed to complete the decommissioning process. For SAFSTOR, the process is restricted in overall duration to 60 years unless it can be shown that a longer duration is necessary to protect public health and safety. The guidelines for ENTOMB are similar, providing the Commission with both sufficient leverage and flexibility to ensure that these deferred options are only used in situations where it is reasonable and consistent with the definition of decommissioning. Consequently, with the new restrictions, the SAFSTOR and ENTOMB options are no longer decommissioning alternatives in themselves, as neither terminates the license for the site. At the conclusion of a 60-year dormancy period, the site would still require significant remediation to meet the definition of unrestricted release and license termination.

In 1995 the NRC proposed revisions to the general requirements for decommissioning nuclear power plants (Ref. 3). When the decommissioning regulations were adopted in 1988, it was assumed that the majority of licensees would decommission at the end of the operating license. Since that time several licensees have permanently and prematurely ceased operations without having submitted a decommissioning plan. In addition, these licensees have requested exemptions from certain operating requirements as being unnecessary once the reactor is defueled. Each case has been handled individually without clearly defined generic requirements. The Commission has proposed to amend the decommissioning regulations to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. The proposed amendments would allow for greater public participation and better define the transition process from operations to decommissioning.

Under the proposed regulations, the licensee would submit an application to terminate the license, along with a termination plan, at least two years prior to the intended termination date. The termination plan would contain a detailed site characterization, i.e., location, type and amount of radioactivity, a description of any remaining dismantling activities to be accomplished, detailed plans for a final survey and the planned end use of the site. An updated cost to complete the decommissioning (and terminate the license), would be required along with the reporting of any new or altered environmental consequences.

The NRC would notice receipt of the plan as a license amendment and conduct a public meeting in the vicinity of the site. Following approval of the plan, the licensee would then execute the plan. Once accomplished and verified by the NRC, the Commission would terminate the license.

Congress passed the Low-Level Radioactive Disposal Act in 1980, declaring the States as being ultimately responsible for the disposition of their own low-level radioactive waste. The federal law encouraged the formation of regional groups or compacts to implement this objective safely, efficiently and economically and set a target date of 1986. With little progress, the Amendments Act of 1985 (Ref. 4), extended the target with specific milestones and stiff sanctions. However, now more than 10 years later, no new sites have been developed and even the most progressive program is far behind schedule.

Low-level radioactive waste generated in the decontamination and dismantling of PECO's nuclear generating units is destined for the Appalachian Compact's future disposal site (Pennsylvania has been designated as the host state). The process of selecting and developing a suitable site is in the early stages with work progressing on siting and selection criteria. Opening of a low-level radioactive waste disposal facility in Pennsylvania is not anticipated until sometime after the year 2000.

For purposes of constructing the decommissioning cost estimate, a unit base burial rate of $298.20 per cubic foot was used for the disposal of low-level radioactive waste. The value is based upon the schedule of rates in effect at the operating Barnwell Low-Level Radioactive Waste Management Facility, as a proxy.

**FIGURE 2.1**

**GENERAL LAYOUT OF THE SITE**

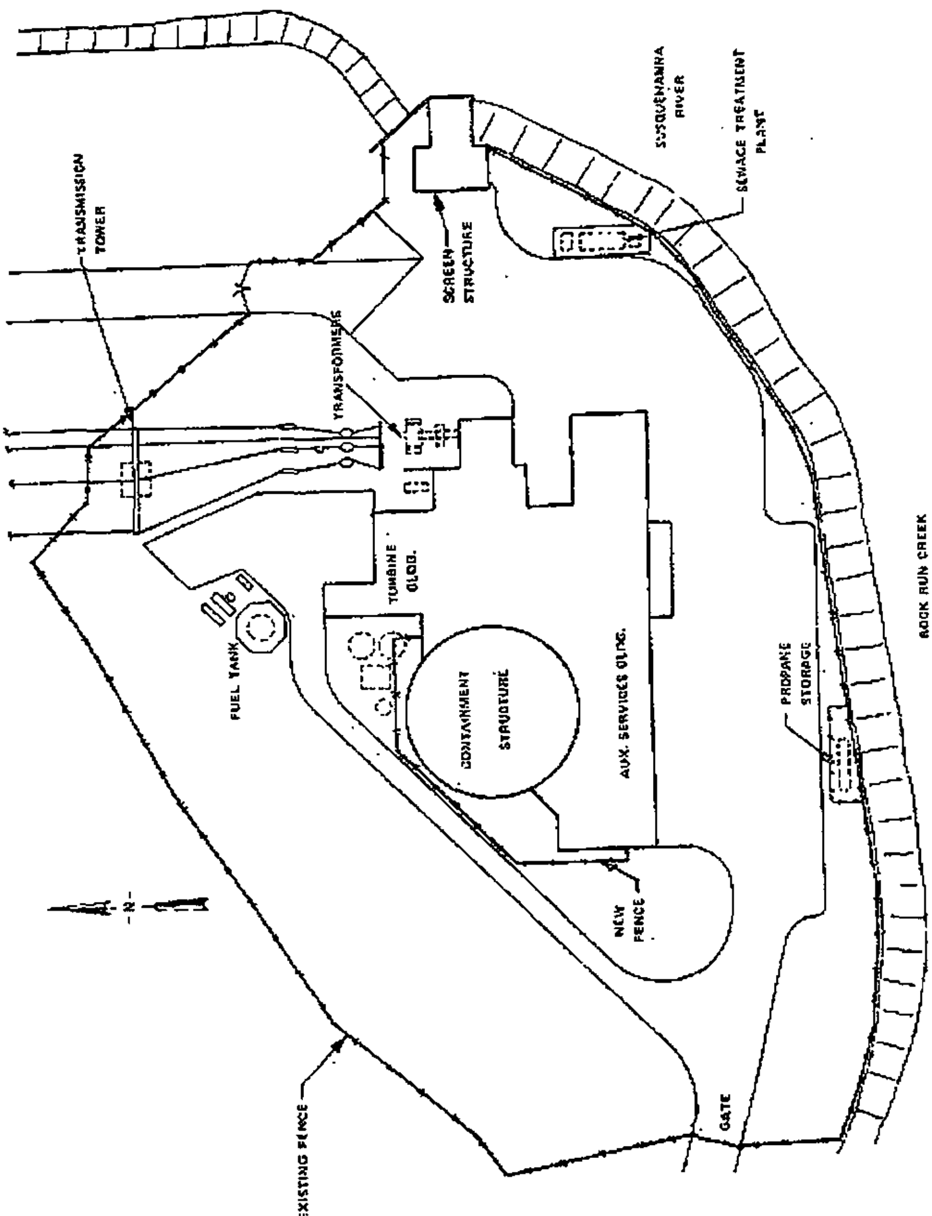
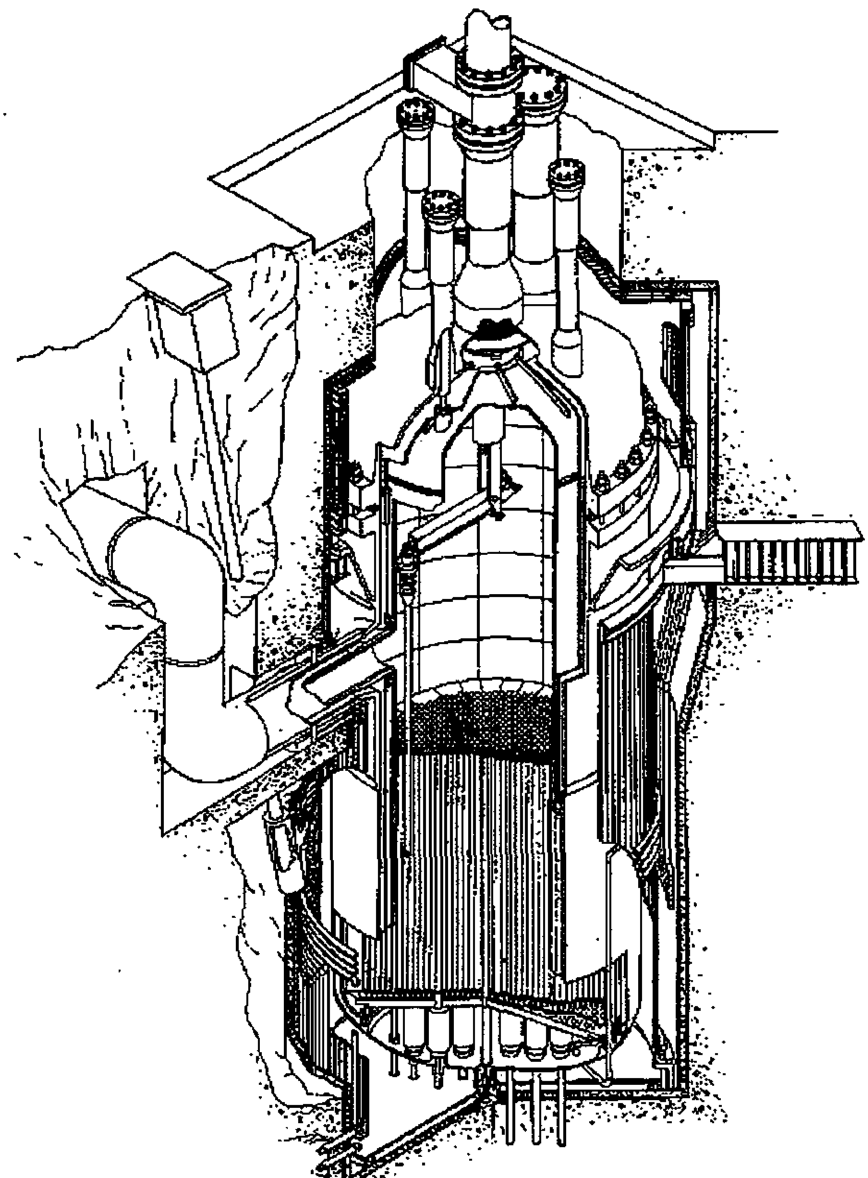


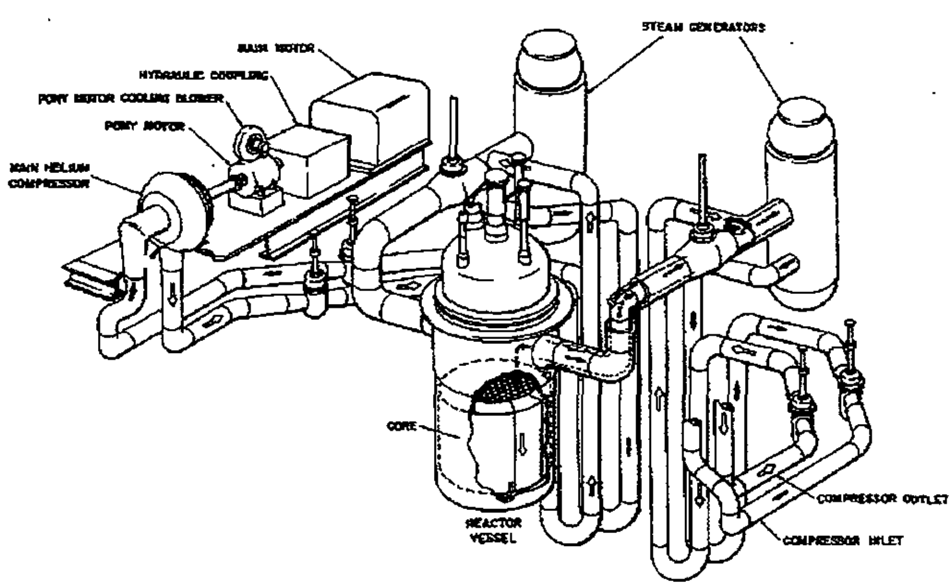
**FIGURE 2.2**

**ISOMETRIC VIEW OF THE REACTOR VESSEL**



## FIGURE 2.3

## ISOMETRIC VIEW OF THE PRIMARY COOLANT SYSTEM



# 3. DEFERRED DECOMMISSIONING

The PB1 nuclear unit was placed into safe-storage following an eight-year operating life and abbreviated decontamination and dismantling. This cost study addresses those activities required to complete the decommissioning process and release the site for unrestricted use. While this study does not address the current expense to maintain the facility, such costs are a factor in the long-term planning as they increase with plant age.

The following sections describe the basic activities associated with decommissioning PB1. Although detailed procedures for each activity identified are not provided, and the actual sequence of work may vary, these activity descriptions provide a basis not only for estimating but also for the expected scope of work, i.e., engineering and planning at the time of decommissioning.

The conceptual approach that the Nuclear Regulatory Commission (NRC or Commission) has chosen in their proposed amended regulations is to divide decommissioning into three phases. The initial phase commences with the effective date of permanent cessation of operations and involves the transition of both plant and licensee from reactor operations, i.e., power production, to facility de-activation and closure. The second phase addresses licensed activities during a storage period, applicable to the dormancy phases of the deferred decommissioning alternatives and Phase III pertains to the activities involved in license termination. The submittal of an application to terminate the license, along with a termination plan, marks the commencement of this phase. The termination plan would contain a detailed site characterization, i.e., location, type and amount of radioactivity, a description of any remaining dismantling activities to be accomplished, detailed plans for a final survey and the planned end use of the site. An updated cost to complete would be required along with the reporting of any new or altered environmental consequences.

Since PB1 is already in a safe-storage/dormancy state, the activities envisioned for completing the decommissioning process could be considered analogous to Phase III, license termination planning and execution.

## 3.1 PERIOD 3 - PREPARATIONS

Following the cessation of plant operations, PB1 was defueled and limited decontamination and decommissioning operations performed. Although certain components, systems and facilities were decontaminated, it is assumed that such items that remain in the controlled area were not decontaminated to levels that would allow them to be free-released. Consequently this inventory is included for additional remediation along with the any residual radioactive material present at the site. This study further assumes the dismantling of the PB1 structures, permitting release of the area for alternative use.

Prior to the commencement of future decommissioning operations, detailed preparations are undertaken to re-activate the facility. The organization required to manage the intended activities is assembled from available Unit 2/3 plant staff and outside resources, as required. Preparations include the preparation of a license termination plan. Under the proposed regulations, plan submittal is required at least two years prior to the intended license termination date. With an abbreviated schedule for a facility of this size, preparation of the plan would need to be required prior to re-activating the site. The license termination plan must include a site characterization, description of the remaining dismantling activities, plans for site remediation, procedures for the final radiation survey, designation of the end use of the site, an updated cost estimate to complete, and any associated environmental concerns. The NRC will notice the receipt of the plan and make the plan available for public comment. A local hearing will also be scheduled. Plan approval will be subject to any conditions and limitations as deemed appropriate by the Commission.

Much of the work in preparing the license termination plan is also relevant to the development of the detailed engineering plans and procedures. This work includes:

- Site preparation plans for the proposed decommissioning activities;
- Detailed procedures and sequences for removal of systems and components;
- Evaluation of the disposition alternatives for the reactor vessel and its internals;
- Plans for decontamination of structures and systems;
- Design/procurement and testing of tooling and equipment;
- Identification/selection of specialty contractors;
- Procedures for removal and disposal of radioactive materials; and

- Sequential planning of activities to minimize conflicts with simultaneous tasks.

Prior to initiating site decommissioning activities, the following preparations are undertaken. Asbestos and any other hazardous materials are also remediated during this preparations phase.

- Prepare site support and storage facilities, as required.
- Procure and install temporary facilities for the decommissioning operations.
- Clean all plant areas of loose contamination.
- Conduct radiation surveys of work areas; major components (including the reactor vessel); sample internal piping contamination levels.
- Correlate and normalize survey data for development of packaging and transportation procedures.
- Determine transport and disposal requirements for the reactor vessel and steam generators, including shielding and stabilization.
- Develop procedures for occupational exposure control, control and release of liquid and gaseous effluent, processing of radwaste including DAW, resins, filter media, metallic and non-metallic components generated in decommissioning, site security and emergency programs, and industrial safety.
- Design, analyze and submit an application for reactor vessel and steam generator package approval.
- Design and fabricate closures to permanently seal reactor vessel and steam generator openings for transportation and disposal.
- Design and fabricate vessel transportation cradle and vessel and cradle tiedown assembly compatible with the transporter and railcar.
- Design and fabricate shielding for packaging of reactor vessel and steam generators.

## 3.2 PERIOD 4 - D&D OPERATIONS & LICENSE TERMINATION

The activities envisioned in the remediation of the PB1 facility include:

- Construct temporary facilities and modify existing storage facilities to support the dismantling activities. These may include: additional changing rooms and contaminated laundry facilities for increased work force, establishment of laydown areas to facilitate equipment removal and preparation for off-site transfer, upgrading roads to facilitate hauling and transportation, and modifications to the Reactor Building to facilitate access of large/heavy equipment.

- Design and fabricate shielding in support of removal and transportation activities, contamination control envelopes, specify/procure specialty tooling and remotely operated equipment. Prepare rigging for extraction of heavy components, including the reactor vessel and steam generators.

- Procure required shipping canisters, cask liners, and Low Specific Activity (LSA) containers from suppliers.

- Contract with specialty contractors for extracting and grouting reactor vessel and steam generators.

- Remove contaminated equipment and material from the site structures. Remediate until radiation surveys indicate that the structure can be released for unrestricted access and conventional demolition.

- Conduct decontamination of components and piping systems as required to control (minimize) worker exposure. Remove, package and dispose of piping and components in all structures except for the main coolant system.

- Remove activated concrete biological shield and accessible contaminated concrete. If dictated by the reactor vessel and steam generator removal scenarios, remove those portions of the associated cubicles necessary for access and component extraction.

- Extract the reactor vessel and steam generators for shipment and controlled disposal. Decontaminate exterior surfaces, as required, and seal-weld openings (nozzles, inspection hatches and other penetrations). These components can serve as their own burial containers provided that all penetrations are properly sealed and the internal contaminants are stabilized.

- Pump low-density cellular concrete (LDCC) into each vessel to control movement of loose contamination during transport. A cylindrical spacer is assumed to be placed in the reactor vessel to create an internal void during grouting to reduce the overall weight of the package. Additional steel shielding may be added to meet transportation regulations.

- Restore the weather integrity of the containment by sealing the extraction hatch (temporary).

- Decontaminate remaining site buildings and facilities, removing residual contaminants. Package, and dispose of all remaining low-level radioactive waste along with any remaining hazardous and toxic materials.

- Remove the Main Coolant System and any other remaining plant systems and associated components.

- Material removed in the decontamination and dismantling of the nuclear units will be routed to a central processing area. Material certified to be free of contamination will be released for unrestricted disposition, e.g., as scrap, recycle or general disposal. Contaminated material will be characterized and segregated for additional on-site decontamination, off-site processing (disassembly, chemical cleaning, volume reduction, waste treatment, etc.), and/or packaged for controlled disposal at the regional low-level radioactive waste disposal facility.

- Conduct final radiation survey to ensure that radioactive materials, in excess of permissible residual levels, have been remediated. This survey may coincide with final NRC site inspection.

The Commission will terminate the license if it determines that site remediation has been performed in accordance with the license termination plan and the terminal radiation survey and associated documentation demonstrates that the facility is suitable for release. Once the requirements are satisfied, the NRC can terminate the license.

## 3.3 PERIOD 5 - SITE RESTORATION

Following completion of decommissioning operations, site-restoration activities may begin. Efficient removal of the contaminated materials and verification that residual radionuclide concentrations are below the NRC limits will result in substantial damage to many of the structures. Blasting, coring, drilling, scarification (surface removal), and the other decontamination activities will substantially damage power block structures. Verifying that subsurface radionuclide concentrations meet NRC site release requirements may require removal of grade slabs and lower floors, potentially weakening footings and structural supports. This will be necessary for those facilities and plant areas where historical records indicate the potential of radionuclides having been present in the soil, where system failures have been recorded, or where it is required to confirm that subsurface process and drain lines were not breached over the operating life of the unit.

Prompt dismantling of site structures is clearly the most appropriate and cost-effective option. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures, with a workforce already mobilized on-site, is more efficient and less costly than if the process is deferred. Site facilities quickly degrade without continual maintenance, adding additional expense and creating potential hazards to the public as well as to future workers. Abandonment creates a breeding ground for vermin infestation as well as other biological hazards.

This cost study presumes that structures non-essential to the adjacent operating units and site facilities will be dismantled as a continuation of the decommissioning activity. Foundations and exterior walls are assumed to be removed to a nominal depth of three feet below grade. This depth of removal allows for clearance of the exposed rebar mats, embedded conduit and piping and structural steel produced in demolition. The three-foot depth also allows for the placement of gravel for drainage as well as for sufficient topsoil so that vegetation can be established for erosion control. Site areas affected by the dismantling activities are cleaned and the plant area graded as required to prevent ponding and inhibit the refloating of subsurface materials. Activities include:

- Demolition of the remaining portions of the primary containment structure and interior portions of the Reactor Building. Concrete rubble and clean fill produced by demolition activities may be used to backfill below-grade voids. Suitable materials can be used on site for fill; otherwise the rubble is trucked off site for reuse elsewhere.

- Remaining buildings, including the Auxiliary, Turbine, and Screenwell and Discharge buildings, and other site structures are removed using conventional demolition techniques.

# 4. COST ESTIMATE

A site-specific cost estimate was prepared for decommissioning PB1, accounting for the unique features of the site including the NSSS, electric power generation systems, site buildings and structures. The basis of the estimate (including the source of information), methodology, site-specific considerations, assumptions and total costs, are described in this section.

## 4.1 BASIS OF ESTIMATE

The site-specific cost estimate for PB1 was developed using plant drawings and inventory documents provided by PECO. These drawings and design documents were used to analyze the general arrangement of the facility and to determine estimates of building concrete volumes, steel quantities, numbers and sizes of major components, and areas of the site to be addressed in the decommissioning.

Decommissioning is a labor-intensive effort. Representative labor rates for each craft and salaried worker are essential for the development of a meaningful, site-specific decommissioning cost estimate. Consequently, PECO provided the information on the local cost of labor.

Disposition of radioactive waste is also a major contributor to the cost of decommissioning. The availability of burial sites is of national concern, with regional compacts formed to provide adequate burial space for current and future generators. With the Appalachian Compact still in the early siting stage, a proxy was required for developing a disposal cost for low-level radioactive waste. For estimating purposes, a unit disposal rate of $298.20 per cubic foot was used as a proxy for regional disposal costs. The value, along with any associated special handling surcharges, were based upon the rate schedule in effect at the Barnwell Low-Level Radioactive Waste Management Facility, (as of July 1, 1995).

## 4.2 METHODOLOGY

The methodology used to develop the cost estimate for PB1 follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates" (Ref. 5) and the US DOE "Decommissioning Handbook" (Ref. 6). These references utilize a unit cost factor method for estimating decommissioning activity costs to simplify the estimating calculations. Unit cost factors for concrete removal ($/cubic yard), steel removal ($/ton) and cutting costs ($/in) were developed from the labor cost information provided by PECO. With the item quantity (cubic yards, tons, inches, etc.) developed from plant drawings and inventory documents, the activity-dependent costs are estimated.

The unit cost factors used in this study reflect the latest available information about worker productivity in decommissioning, including the Shippingport Station Decommissioning Project, completed in 1989 as well as from TLG's involvement in the decommissioning planning and engineering for other nuclear facilities such as Shoreham, Rancho Seco, Trojan and Yankee Rowe.

The activity duration critical path was used to determine the total decommissioning program schedule. The program schedule is used to determine the period-dependent costs for program management, administration, field engineering, equipment rental, quality assurance and security. PECO provided typical salary and hourly rates for personnel associated with period-dependent costs. The costs for conventional demolition of non-radioactive structures, materials, backfill, landscaping and equipment rental were obtained from the "Building Construction Cost Data" published by R. S. Means (Ref. 7). Examples of unit cost factor development are presented in the AIF/NESP-036 study (Ref. 5). Appendix A presents the detailed development of a typical site-specific unit cost factor. Appendix B summarizes one of the sets of specific factors developed for the PB1 analysis.

The unit cost factor method provides a demonstrable basis for establishing reliable cost estimates. The detail of activities provided in the unit cost factors for activity duration, labor costs (by craft), and equipment and consumable costs, provides assurance that cost elements have not been omitted. These detailed unit cost factors, coupled with the plant-specific inventory of piping, components and structures, provide a high degree of confidence in the reliability of the cost estimates.

## 4.3 CONTINGENCY

The activity- and period-dependent costs are combined to develop the total decommissioning costs. A contingency is then applied. "Contingencies" are defined in the American Association of Cost Engineers' Cost Engineers' Handbook (Ref. 8) as "specific provision for unforeseeable elements of cost within the defined project scope; particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this estimate are based upon ideal conditions; therefore, a contingency factor has been applied. In the AIF/NESP-036 study (Ref. 5), the types of unforeseeable events that are likely to occur in decommissioning are discussed and guidelines are provided for percentage contingency in each category. Application of contingency is assigned on a line item basis for this estimate. It should be noted that contingency, as used in this estimate, does not account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the unit.

There is a general misconception on the use and role of contingency within decommissioning cost estimates, sometimes viewed as a "safety factor". Safety factors provide additional security and address situations which may never occur. Contingency funds are expected to be fully expended throughout the program, providing assurance that sufficient funding is available to accomplish the intended tasks. Some of the rationale for, and need to incorporate, contingency within any estimate is offered in the following discussion. An estimate without contingency, or from which contingency has been removed, can disrupt the orderly progression of events and jeopardize the financial success of the project.

The following listing is a composite of some of the activities, assembled from past decommissioning programs, in which contingency dollars were spent to respond to, compensate for, and/or provide adequate funding of decontamination and dismantling tasks:

*Incomplete or Changed Conditions:*

- Unavailable/incomplete operational history which led to a re-contamination of a work area, as a sealed cubicle incorrectly identified as being non-contaminated, was breached without controls;
- Surface coatings covering contamination which, due to an incomplete characterization, required additional cost and time to remediate;
- Additional decontamination, controlled removal and disposition of previously undetected (although at some sites, suspected) contamination due to enhanced access of formerly inaccessible areas and components;

- Unrecorded construction modifications, facility upgrades, maintenance, enhancements, etc., which precipitated scheduling delays, more costly removal scenarios, additional costs (e.g., for re-engineering, shoring, structural modifications), and compromised worker safety;

*Adverse Working Conditions:*

- Lower than expected productivity due to heat exhaustion in underground vaults, resulting in a change in the working hours (shifting to cooler periods of the day) and additional manpower;

- Confined space, low-oxygen environments where supplied air was necessary and additional safety precautions prolonged the time required to perform required tasks;

*Maintenance, Repairs and Modifications*

- Facility refurbishment required to support site operations, including those needed to provide new site services as well as to maintain the integrity of existing structures;

- Damage control, repair and maintenance from bird nesting and fouling of equipment and controls;

- Building modification, i.e., re-supporting of floors to enhance loading capacity for heavily shielded casks;

- Roadway upgrades on site to handle heavier and wider loads; roadway rerouting, excavation and reconstruction;

- Requests for additional safety margins by a vendor;

- Requests to analyze accident scenarios beyond those defined by the removal scenario (requested by the NRC to comply with "total scope of regulation");

- Additional collection of site run-off and processing of such due to disturbance of natural site contours and drainage;

- Concrete coring for removal of embedments and internal conduit, piping and other potentially contaminated material not originally identified;
- Modifications required to respond to higher than expected worker exposure, water clarity, water disassociation and hydrogen generation from high temperature cutting operations;
- Additional waste containers needed to accommodate cutting particulates (fines), inefficient waste geometry's and excess material;

*Labor*

- Turnover of personnel, e.g. , craft and health physics. Replacement of labor is costly, involving additional training, badging, medical exams, and associated processing procedures. Recruitment costs are incurred for more experienced personnel and can include relocation and living expense compensation;
- Additional personnel required to comply with NRC mandates and requests;
- Replacement of personnel due to non-qualification and/or incomplete certification (e.g., welders);

*Schedule*

- Schedule slippage due to a conflict in required resources, i.e., the licensee was forced into a delay until prior (non-licensee) commitments of outside resources were resolved;
- Weather-related delays in the construction of facilities required to support site operations (with compensation for delayed mobilization made to vendor);
- Rejection of materials, requiring refabrication and causing program delays in activities required to be completed prior to initiating decommissioning operations;

*Weather*

- Frozen crane hydraulics prior to a major lift; and
- Destruction of an exterior asbestos containment enclosure due to violent winds.

Not included within the application of contingency, but equally probable to impact the cost and performance of the decommissioning program are:

- Added cost for worker separation packages throughout the decommissioning program, state mandated retraining and retention incentives for key personnel;
- Delays in approval of the license termination plan due to intervention, public participation in local advisory committees, state and local hearings, etc.;
- Regulatory changes, e.g., affecting worker health and safety, site release criteria, waste transportation, and disposal; and
- Policy decisions altering federal and state commitments, e.g., in the ability to accommodate certain waste forms for disposition, or in the timetable for such.

These concerns (with the exception of the first which can be quantified), are typically addressed in a Risk and Uncertainty analysis against which probabilities are assigned and, confidence traded against cost. Other areas addressed in such an analysis would include the probabilities associated with the uncertainties in predicting the costs of goods and services prior to their actual purchase, scope omission and error, escalation, schedule, scope growth, and "Acts of God".

## 4.4 SITE-SPECIFIC CONSIDERATIONS

There are a number of site-specific considerations that affect the method for dismantling and removal of equipment from the site and the degree of restoration required. The cost impact of the considerations identified below is included in this cost study.

### 4.4.1 Status of Retired Plant

Defueling of the reactor commenced immediately following the cessation of operations at PB1. All 804 fuel elements were removed and shipped off site, i.e., the reactor and site are considered to be 100% defueled. Following the defueling an abbreviated decontamination and dismantling program was pursued, including decommissioning of the fuel pool and radwaste system. A general area decontamination followed before the facility was placed in safe-storage.

The following component, system and plant conditions are assumed as a basis for estimating the cost to complete the decommissioning of PB1. Facility status is based upon the information provided in the Final Decommissioning Report, dated July 1978. (Ref. 9).

- All flammable materials were removed from the systems, including all charcoal traps from the helium purification system, as well as all oils and other flammable liquids and solids, all potentially radioactive liquids were also removed. Refrigerants and cooling water were drained.
- The fuel pool was drained and the fuel racks cut and disposed of as radioactive waste.
- The liquid waste area has been decommissioned by removing all equipment except some sections of embedded piping. (10 % of the total piping is considered embedded for this estimate)
- The exhaust filters and oil filter were removed from the fuel handling purge system.
- The tritium holding tank and associated piping were removed and disposed of as radioactive waste.
- Containment sump pumps were removed and disposed of as radioactive waste.
- The main coolant bypass filters and their associated dust collectors were removed and disposed of as radioactive waste.
- The water-cooled delay bed system was removed.

- The temperature delay bed system was removed
- Charcoal cartridges from the oil removal filters were removed from the Purified Helium Handling System.
- The steam generator plateout absorber and the oil absorber were removed from the Non-purified Helium Handling System
- The head tank and support steel were removed from the Fuel Building Sump Pit.
- Spent fuel cooling water pipes and sluice pipe were removed
- The Spent fuel heat exchanger, spent fuel cooling water pumps, spent fuel cooling water booster pump, and filter tanks were removed.
- The Shield Cooling Water System was removed.
- The Radiation Monitoring System was removed

While some areas of the plant were decontaminated before the facility was placed in safe-storage, it is assumed that additional decontamination would be required to release the facility for unrestricted use.

### 4.4.2 Reactor Vessel and Steam Generators

The reactor vessel including associated internal components is assumed to be removed intact, grouted, and prepared for transport and disposal as its own package. The package would be transported by a combination of overland multi-wheeled vehicle and rail to the regional low-level radioactive disposal facility. The steam generators will also be removed and disposed of intact. The weight and size of the reactor vessel and the steam generators, as well as their configuration in the Reactor Building and limited access in the Reactor Building itself, places constraints on the intact removal of these components. Modifications to the Reactor Building are necessary for component extraction, as no large access to the building currently exists. Consequently, for purposes of this estimate, extraction of the vessel and steam generators is assumed to be through an opening created in the top of the containment structure.

Creating an opening in the containment dome will provide the needed room for extraction of the components and the rigging equipment required for their removal. Steam generator extraction will require the additional removal of portions of the steam generator cubicle walls, adjoining floor slabs and grating so as to allow the generators to be maneuvered to the opening.

The lift will be made with a large mobile crane, e.g., a Manitowoc. Once the building is opened, the reactor vessel is rigged for removal first, having already been disconnected from the surrounding piping and supports. The reactor vessel will be placed onto the temporary cradles where the nozzles and other penetrations will be welded closed. The vessel will then be filled with a low-density cellular concrete (LDCC) for stabilization of the internal contamination. Due to weight considerations, a cylindrical spacer will be placed in the upper portion of the vessel. Sized to allow the grout to completely seal the annulus, the spacer will serve to displace a significant volume of interior void, which would only add additional weight to the package. Steel shielding may be required to be added to the outside of the package to meet transportation regulations.

With preparation completed, the reactor vessel will be moved by multi-wheeled transporter to an on-site stage area to await transport to the disposal facility. The steam generators will be extracted and prepared in a similar manner. With removal of the large components complete, the opening in containment will be made weather-tight.

The components are assumed to be transported to the regional low-level radioactive waste disposal facility by rail. The components will be moved to and from the rail sidings by multi-wheeled transporters.

The size and weight of the component packages was a concern in evaluating transportation alternatives. As such, discussions were held with the Lampson, Inc. (rigging), on the handling of large components, as well as Conrail on rail shipping. Lampson has had experience moving large nuclear components, and was able to supply pricing based on the specific vessel dimensions and weight. TLG was also able to apply its experience gained in the planning of the disposition of the steam generators at the Trojan site, where Lampson was a subcontractor.

### 4.4.3 Transportation Methods

For the purposes of the cost estimate, it was assumed that the low-level radioactive waste produced in the decontamination and dismantling of the nuclear unit will be moved overland by truck, rail, shielded van, and/or multi-wheeled transporter to the regional burial facility. Transport costs were derived assuming a common destination within the Appalachian Compact.

### 4.4.4 Low-Level Radioactive Waste Disposal

Disposal costs for low-level radioactive waste were derived using a unit disposal charge of $298.20 per cubic foot. This value was based upon published rate schedule in effect at the Barnwell Low-Level Radioactive Waste Management Facility (Barnwell), located in Barnwell, South Carolina. Disposal charges at Barnwell were deemed by PECO as a reasonable proxy for those anticipated at a regional site. Surcharges for high-curie and high-weight packages were also calculated using the published 1995 schedule at the Barnwell facility (Ref. 10).

To the greatest extent practical, non-compactible, low-level radioactive waste was assumed to be recycled as a means of reducing the total volume of radioactive material requiring controlled disposal. The recycled waste that met radioactive material release limits was assumed to be released as clean scrap, requiring no further cost consideration. Recycled material that did not meet release limits will be packaged and routed for controlled disposal as low-level radioactive waste. This recycling activity is performed off site by a licensed vendor at an approximate cost of $100 per cubic foot.

Compactible Dry Active Waste (DAW), such as booties, glove liners, respirator filter cartridges, shipping containers, radiological controls survey materials, etc. was assumed to be drummed and compacted to 10% of the original volume.

### 4.4.5 Site Conditions at Facility Close Out

It is assumed that the site is restored by regrading to conform to the adjacent landscape. Gravel is placed over the rubble-filled excavations to allow drainage and a soil cap is placed for the establishment of native vegetation. The intake structure will be demolished and removed, the circulating water piping sealed and abandoned in place.

## 4.5 ASSUMPTIONS

The following assumptions were made in the development of the cost estimates for decommissioning PB1.

1. Costs are calculated using 1995 dollars. The estimate excludes escalation. No present-value economic analysis is included.

2. PB1 is currently in safe-storage. This study addresses only those costs incurred once the planning for license termination is initiated. This study further assumes that decontamination and dismantling of the PB1 facility will be concurrent with Unit 2/3 site operations such that certain administrative and technical support services are available to the project.

3. There are no site property taxes and insurance costs specifically allocated to PB1, i.e., such costs for the site are carried by Units 2/3.

4. PB1 drawings, equipment and structural specifications, including construction details, were provided by PECO for consideration within the cost estimate.

5. Employee salary and craft labor rates for site administration, operations, construction and maintenance personnel were provided by PECO for positions identified by TLG.

6. PECO provides for the electrical power required to demolish the plant to be brought on site. These costs are reflected in the energy expenditures identified in the cost study.

7. Material and equipment costs for conventional demolition and/or construction activities were based upon data provided by R.S. Means Construction Cost Data. (Ref. 7)

8. Contaminated piping, components and structures other than the reactor vessel are assumed to meet DOT limits for Low Specific Activity (LSA) material. A regional burial facility, for cost estimating purposes, is assumed to be located within 350 miles of the plant site. Transportation costs were estimated from tariffs published by Tri-State Motor Transit for this type of cargo. (Ref. 11)

9. The curie content of the vessel at the time of removal was derived from the results of an activation analysis presented in the Decommissioning Plan and Safety Analysis Report for the Peach Bottom Atomic Power Station, Unit 1, dated July 1974 (Ref. 12). For purposes of this study, the activity presented in the July 1974 document was decayed to the time periods identified in this report for vessel disposition.

10. The reactor vessel including associated internal components is assumed to be removed intact, grouted, and prepared as its own package for

disposal. Transport of the vessel as well as the steam generators was assumed to be by rail.

11. Scrap generated during decommissioning is not included as a salvage credit line item in this study for two reasons: (1) the scrap value merely offsets the associated site removal and scrap processing costs, and (2) a relatively low value of scrap exists in the market. Scrap processing and site removal costs are not included in the estimate.

12. Decommissioning will take place sufficiently far in the future that all equipment will be non-functional, obsolete and suitable for scrap as deadweight quantities only. No equipment is salvageable as used equipment.

13. The cost study assumes that PECO will serve as the Decommissioning Operations Contractor (DOC) for the decommissioning project. As such, PECO will provide sufficient staff to perform the preparatory demolition planning and scheduling, and manage the demolition efforts. Site security, radiological controls, quality assurance and overall site administration during decommissioning and demolition will also be provided by PECO. The demolition work is performed by PECO, or a demolition subcontractor who will provide adequate staff, labor, equipment, materials and overhead to complete the demolition.

14. It is assumed that if the decommissioning of Peach Bottom Units 2 and 3 is deferred, e.g., SAFSTOR, PECO's resources will require augmentation in executing termination of the site license(s). This study assumes that this augmented site staff can continue to support PB-1 activities.

15. Engineering services for such items as writing activity specifications, detailed procedures, detailed activation analyses, structural modifications, etc. are assumed to be performed by specialty contractors hired by PECO.

16. PECO will remove all items of furniture, tools, mobile equipment such as forklifts, trucks, bulldozers, other similar mobile equipment and other such items of personal property owned by PECO that will be easily removed without the use of special equipment.

17. The decommissioning activities will be performed in accordance with the current regulations which are assumed to be in place at the time of decommissioning.

18. This study follows the principles of ALARA through the use of work duration adjustment factors which incorporate such items as radiological protection instruction, mock-up training, the use of respiratory protection and personnel protective clothing. These items lengthen a task's duration, which increases the costs and lengthens the schedule. ALARA planning is considered in the costs for engineering and planning, and in the development of activity specifications and detailed procedures.

19. This study was performed in accordance with the published study from the Atomic Industrial Forum/National Environmental Studies Project report AIF/NESP-036, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates" (Ref. 5). The contents of those guidelines were prepared under the review of a task force consisting of representatives from utilities, state regulatory commissions, architect/engineering firms, the Federal Energy Regulatory Commission, the NRC, and the National Association of Regulatory Utility Commissioners.

20. This study includes the Containment Structure, Auxiliary Building (including spent fuel area), Turbine Building (including new construction), and the Screenwell and discharge structures at PB-1.

21. The perimeter fence and in-plant security barriers will be moved as appropriate to conform with the Site Security Plan in force at the various stages in the project.

22. Underground concrete pipe will be collapsed and backfilled where accessible. Underground steel pipe will be removed completely, surveyed for contamination, removed from the site and disposed of as clean scrap at no cost or credit to the project. Piping greater than ten feet below grade will be sealed and abandoned in place, e.g., the Circulating Water Piping. Electrical manholes are backfilled with suitable earthen material and abandoned.

23. Structures are assumed to be removed to a nominal depth of three feet below grade level with the non-contaminated subgrade foundations remaining in place. The foundation mats will be penetrated so as to

allow the free flow of groundwater and to enhance drainage of the subgrade structures. Building foundations will be backfilled with clean demolition debris, and the site will be graded and landscaped. Gravel and soil will be placed over the backfilled foundation for re-seeding.

## 4.6 COST ESTIMATE SUMMARY

A summary of the decommissioning costs with annual expenditures is provided in Table 4.1. The costs were extracted from the detailed table of expenditures provided in Appendix C. Additional information is provided in Table 8.1 including a reporting of the decommissioning costs into the components of decontamination, removal, packaging, transportation, waste disposal, project management (staffing) and other cost components.

The detailed cost tables (Appendix C) list the major activities for the decommissioning option. The following should be considered when reviewing Appendix C:

- "Decon" as used in the headings of these tables, refers to decontamination.
- "Total" as used in the headings of these tables, is the sum of Decon, Remove, Pack, Ship, Bury, and Contingency as well as other miscellaneous items not listed (such as engineering and preparations).
- The subtotal for the major cost categories such as Decon, Remove, Bury, etc. does not include contingency, which is a separate column.
- "Other" includes different types of costs, and the types of cost vary by the associated line item. For instance, in systems removal and structures decontamination, the "Other" cost consists of the off-site recycling costs for low-level radioactive waste. In most of the engineering preparatory activities the "Other" costs is strictly engineering labor hour costs. Other also includes the utility staffing, plant energy budgets, and regulatory fees.
- "License Termination" includes all costs that contribute to termination of the 10 CFR §50 "Possession-Only" license. The "Clean" costs are all of the other costs involved which do not directly contribute to termination of the 10 CFR §50 license, but are incurred as a result of the decommissioning process. "Clean" costs include the removal of those systems which are not safety-related and the costs to restore the site after license termination. These are also referred to as "radiological" and "non-radiological" costs, respectively.

**TABLE 4.1**

**ANNUAL DECOMMISSIONING EXPENDITURES**
**(Thousand of 1995 Dollars)**

| Year | Period 3 Planning | Period 4 Decommissioning | Period 5 Site Restoration | Totals |
|---|---|---|---|---|
| 1 | $13,263 | | | $13,263 |
| 2 | $6,668 | $14,670 | | $21,338 |
| 3 | | $22,481 | $2,474 | $24,955 |
| 4 | | | $3,381 | $3,381 |
| | $19,931 | $37,151 | $5,855 | $62,937 |

# 5. SCHEDULE ESTIMATE

The schedule for the decommissioning scenario considered in this study follows the sequence presented in the AIF/NESP-036 study (Ref. 5) with minor changes to reflect recent experience and site-specific constraints.

Figure 5.1 presents a schedule for the deferred decommissioning alternative; the assumptions supporting this schedule are listed in Section 5.1. The key activities listed in the schedule do not reflect a one-to-one correspondence with those activities in the Appendix C cost tables, but reflect dividing some activities for clarity and combining others for convenience. A legend defining the schedule nomenclature and depictions is also included. The schedule was prepared using the "Microsoft Project" computer software (Ref. 13).

## 5.1 SCHEDULE ESTIMATE ASSUMPTIONS

The schedule estimate reflects the results of a precedence network developed for the site decommissioning activities, i.e., a PERT (Program Evaluation and Review Technique) network. The durations used in the precedence network reflect the actual man-hour estimates from the cost tables in Appendix C, adjusted by stretching certain activities over their slack range and shifting the start and end dates of others. The following assumptions were made in the development of the decommissioning schedule.

- All work except vessel and internals removal activities is performed during an 8-hour workday, 5 days per week with no overtime. There are eleven paid holidays per year.

- The timing of the schedule for this study is set to correlate with the shutdown of Unit 2; however, the schedule to decommission PB1 is relatively insensitive and could occur at any time prior to this point with little impact to the overall cost (in 1995 dollars).

- Multiple crews work parallel activities to the maximum extent possible consistent with optimum efficiency, adequate access for cutting, removal and laydown space, and with the stringent safety measures necessary during demolition of heavy components and structures.

- For plant systems removal, the systems with the longest removal durations in areas on the critical path are considered to determine the duration of the activity.

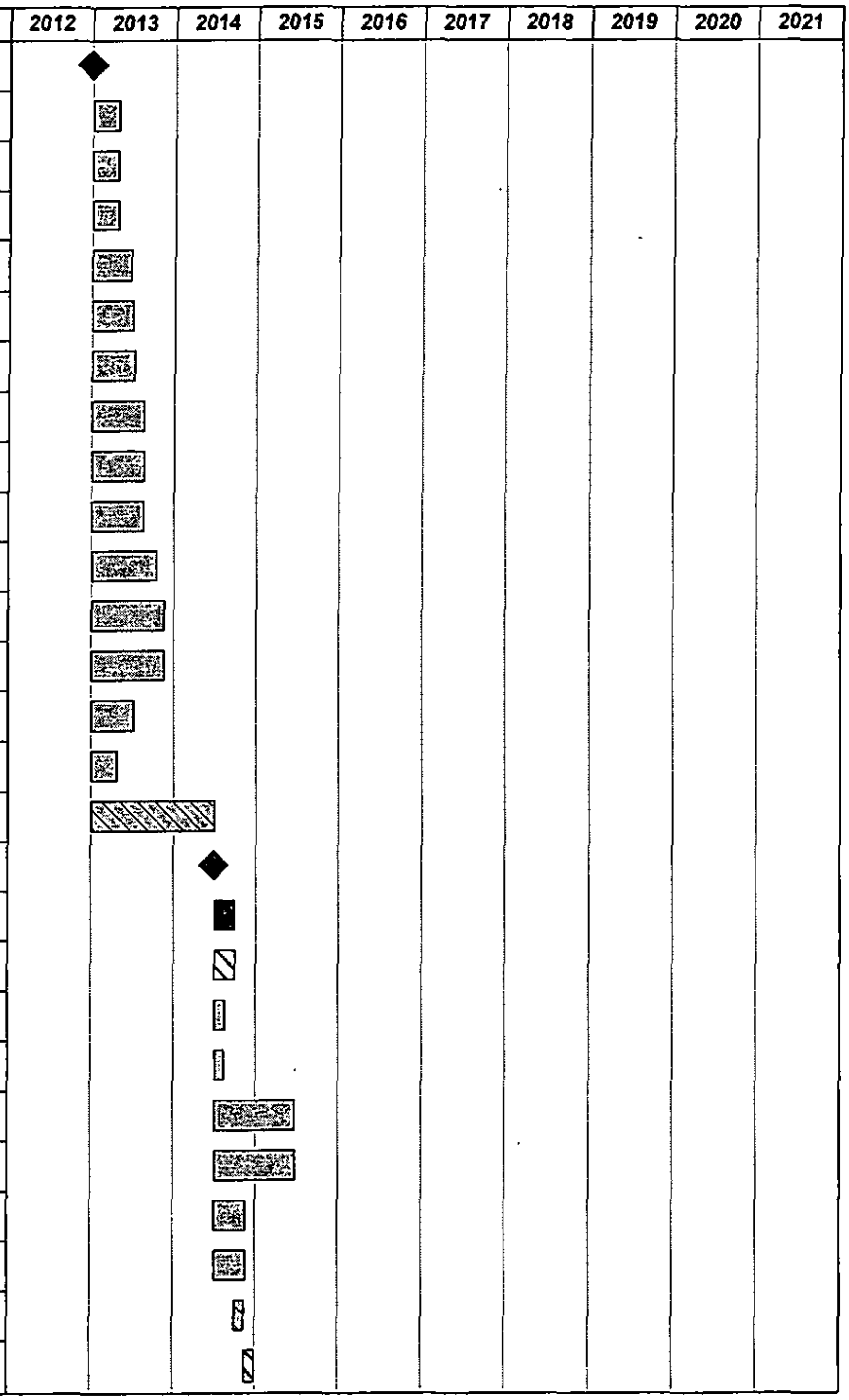
## 5.2 PROJECT SCHEDULE

The period-dependent costs presented in the cost table in Appendix C are based upon the durations developed in the schedule for the selected decommissioning alternative. Durations are established between several milestones in each project period; these durations are used to establish a critical path for the entire project. In turn, the critical path duration for each period is used as the basis for determining the total costs for these period-dependent items.

A project timeline for the deferred decommissioning alternative is included in this section as Figure 5.2.

## FIGURE 5.1
## DECOMMISSIONING ACTIVITY SCHEDULE

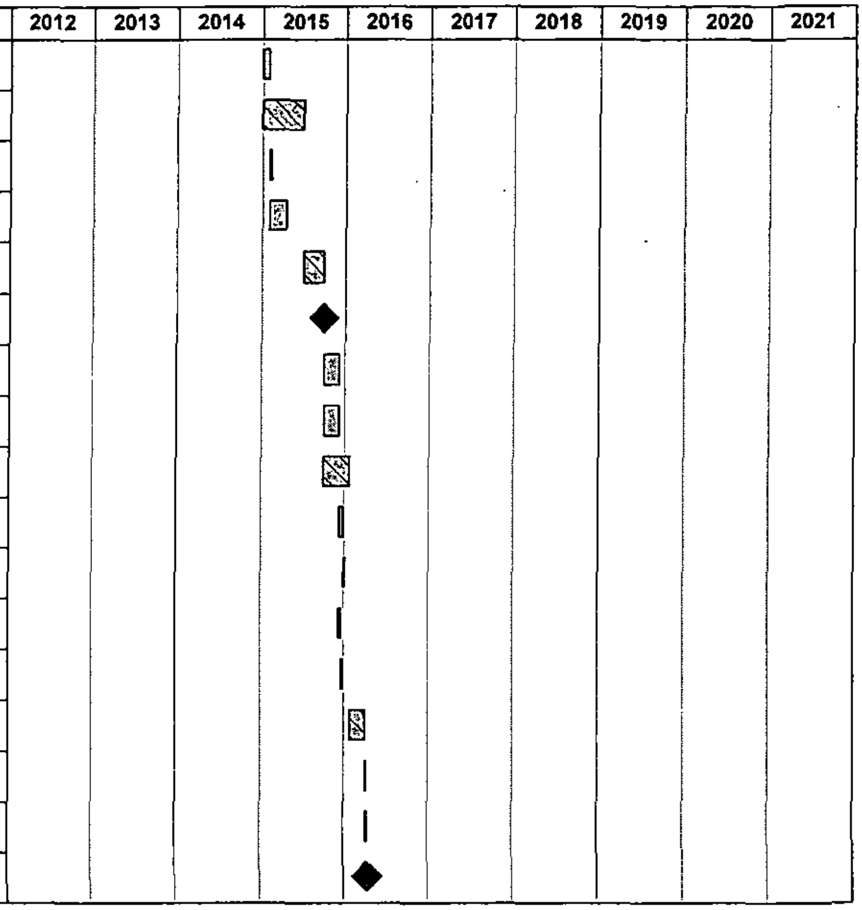
| ID | Task Name |
|---|---|
| 1 | **Start Period 1** |
| 2 | Prepare Dismantling Sequence |
| 3 | Detailed Radiation Survey |
| 4 | Define Major Work Sequence |
| 5 | *Detailed Procedures* |
| 6 | Prepare Activity Specs |
| 7 | Detailed By Product Inventory |
| 8 | Special Equipment |
| 9 | Procure Casks & Liners |
| 10 | Plant Preparation |
| 11 | Review Plant Drawings |
| 12 | *Engineering Preparations* |
| 13 | Period 1 Waste |
| 14 | Establish By-product Inventory |
| 15 | End Product Description |
| 16 | **Period 1 Licensing** |
| 17 | **End Period 1 Unit 1** |
| 18 | **RPV Prep** |
| 19 | **Systems Removal RB** |
| 20 | Systems Removal TB |
| 21 | Systems Removal AB |
| 22 | Period 2 Waste |
| 23 | Period 2 Licensing |
| 24 | Remove Turbine |
| 25 | Remove Condenser |
| 26 | **Remove RPV** |
| 27 | **Steam Generator Removal** |




Task | Critical Task | Milestone

## FIGURE 5.1
## DECOMMISSIONING ACTIVITY SCHEDULE
(Continued)

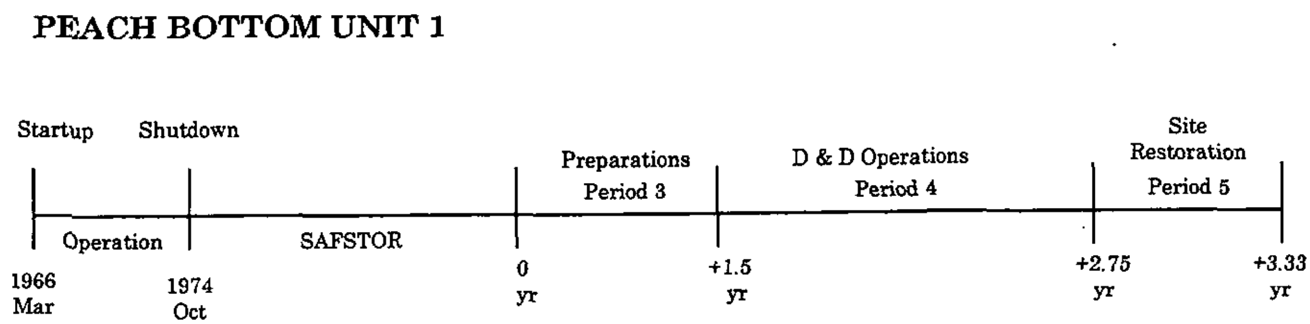
| ID | Task Name |
|---|---|
| 28 | Main Coolant Syst Removal - RB |
| 29 | **Decon Aux Bldg** |
| 30 | Decon Turbine Building |
| 31 | Decon Reactor Building |
| 32 | **Survey** |
| 33 | **End Period 2 Unit 1** |
| 34 | Auxiliary Building Interior Demolition |
| 35 | Turbine Building Interior Demolition |
| 36 | **Reactor Building Interior Demolition** |
| 37 | Turbine Building Exterior Demolition |
| 38 | Turbine Builidng Backfill |
| 39 | Auxiliary Building Exterior Demolition |
| 40 | Auxiliary Building Backfill |
| 41 | **Reactor Building Exterior Demolition** |
| 42 | **Reactor Building Backfill** |
| 43 | **Landscape Site** |
| 44 | **End** |




Task | Critical Task | Milestone

## FIGURE 5.2

## DECOMMISSIONING TIMELINE



## 6. RADIOACTIVE WASTES

The ultimate goal of the decommissioning program is the removal of all radioactive material from the site which would restrict its future use. This currently requires the remediation of all radioactive material at the site, in excess of applicable legal limits.

Under the Atomic Energy Act, the NRC is responsible for protecting the public from sources of ionizing radiation. Title 10 of the Code of Federal Regulations delineates the production, utilization and disposal of radioactive materials and processes. In particular, §71 defines low-level radioactive material and §61 controls the disposal of such material.

The radioactive waste volumes generated in the various decommissioning activities at the site are shown by line activity in the cost table provided in Appendix C. Waste volume summaries, shown in Table 6.1, are quantified consistent with §61 classifications. The volumes are calculated based on the gross container dimensions or, for components serving as their own waste container, the volume is calculated based upon the displaced volume of the component, i.e., reactor vessel or steam generators.

Most of the materials being transported for controlled burial are categorized as LSA material containing Type A quantities, as defined in 49 CFR §173-178 (Ref. 14). For this study, commercially available steel containers are presumed to be used for the disposal of piping, small components and concrete. Larger components can serve as their own container with proper closure of all openings, accessways, penetrations, etc.

The reactor vessel and steam generators are presumed to be shipped intact for disposal. The components are assumed to be grouted with low-density cellular concrete for stabilization of the internal contaminants. While the grout will also provide some shielding, additional steel may be necessary to meet transportation criteria. Preliminary calculations indicate that the reactor vessel contains types and quantities of radioactive material such that it must be transported as a Type B quantity of radioactive material, but will meet the "Exemption for LSA packages", 10 CFR §71.73, "Hypothetical accident conditions". The basis for this assumption should be validated, e.g., through a more detailed §61-based reactor vessel activation analysis.

Plant systems that are presently radioactive are assumed to be radioactive at the time decommissioning activities are initiated, i.e., decay alone will not provide for the unrestricted release of currently contaminated material. While the radionuclide inventory and associated contributing dose rates will decrease with time, long-lived radionuclides are assumed to control the disposition.

The waste volume generated in the decontamination and dismantling of the nuclear units is primarily generated during Period 4. Contaminated and activated material will be characterized on site with a significant volume routed for additional processing. Components with low levels of removable surface contamination will be decontaminated on site, to the maximum extent possible. Components with low levels of internal contamination will be shipped to a waste recycling center for disassembly, decontamination, volume reduction and/or repackaging. Heavily contaminated components and activated materials are generally routed for controlled disposal after on-site volume reduction.

Low-level radioactive waste is destined for final disposal at the future Appalachian Compact facility to be located in Pennsylvania. For cost estimating purposes, this facility was assumed to be located within 350 miles of the site. Disposal costs at this facility were calculated with a base burial fee of approximately $298.20 per cubic foot, as a proxy. This value is based upon the current schedule of rates (1995), in effect at the Barnwell Low-Level Radioactive Waste Management Facility in operation in South Carolina (Ref. 10).

Non-compactable (metallic) radioactive waste generated from removal of the plant equipment is assumed to be sent to an off-site vendor for recycling as a means of reducing the ultimate disposal volume. Considering typical plant conditions and industry experience, the inventory of contaminated material at PB1 was segregated based on the likelihood of volume reduction and decontamination for radiological free release. The burial volumes reported in Table 6.1 reflect the savings resulting from reprocessing and recycling. Off-site processing of non-compactable metallic waste was estimated to cost approximately $100 per cubic foot based upon industry experience and appears as an "other" cost in the detailed decommissioning cost tables in Appendix C.

**TABLE 6.1**

**DECOMMISSIONING RADIOACTIVE WASTE BURIAL VOLUMES**

| | Waste Class[1] | Volume[2] (Cubic feet) |
|---|---|---|
| | A | 14,337 |
| | B | 10,063 |
| | C | 0[3] |
| | >C | 0[3] |
| **Total** | | **24,400** |

1 Waste is classified according to the requirements as delineated in Title 10 of the Code of Federal Regulations, Part 61.55

2 Columns may not add due to rounding.

3 Without a detailed activation analysis to consider certain 10 CFR §61 isotopes of concern, e.g., $^{94}$Nb and $^{99}$Tc, no classification of the activated material within the reactor vessel was attempted. It is possible that some portions of the reactor internals could exceed Class B, and perhaps Class C, if such an analysis was performed.

# 7. OCCUPATIONAL EXPOSURE

Estimates of occupational radiation exposure were developed by TLG from the hours expended removing contaminated components and in the decontamination of site structures. These estimates are scoping in nature and are performed to provide an upper bound to the exposure limits for comparison with NRC maximum dose limitations.

Worker dose is calculated as the product of the direct personnel hours expended in radiation field and the average area dose rate estimated for each decommissioning task. The calculation assumes that:

- Only those personnel directly involved in the decontamination, removal and packaging activities, as well as associated health physics personnel, are considered in the exposure calculation. Casual exposures to the supervisory and plant staff are not included in the estimate.

- Personnel exposure to radiation is minimized by utilizing shielding and remote handling techniques and avoiding higher radiation fields when personnel presence is not necessary.

- Locally high exposure rates near items such as tanks and pipes are reduced by chemical decontamination or the installation of temporary shielding prior to work in that area.

- Careful prompt accounting of accumulated radiation exposure is maintained to rapidly identify tasks causing excessive dose accumulation by workers so that corrective action can be taken.

- Cobalt-60 is the primary contributor to radiation exposure.

It should be noted that the assumed working area radiation levels used to calculate the occupational exposures shown in Appendix C are based on optimum conditions. Future maintenance and caretaking activities at the site could cause the expected exposure rates at the time of decommissioning for individual activities to vary.

# 8. RESULTS

Decommissioning technology is well established and the tools and equipment necessary to completely dismantle PB1 are available and have been demonstrated. The projected costs to decommission the station, commencing with the preparations for a deferred alternative, is estimated to be approximately $62.937 million in 1995 dollars. The costs reflect the site-specific features of PB1, the local cost of labor, and a projected cost for low-level radioactive waste disposal at the regional compact site. Analysis of the major activities contributing to the total cost is provided in Table 8.1.

Staffing, including management, security and health physics combine with the removal labor cost to represent the majority of the cost to decommission a nuclear station. This is a direct result of the labor-intensive nature of the decommissioning process as well as the management controls required to ensure a safe and successful program. Low-level radioactive waste disposal (Burial) represents the next largest cost component. These costs are indicative of the expense incurred in siting, developing and licensing new disposal facilities. Packaging and transportation costs are most sensitive to the waste volume generated in the decontamination and dismantling process, the volume reduction achieved, transport regulations for low-level radioactive waste, as well as the final destination (i.e., distance to the disposal site). "Other" costs include engineering costs, insurance, fees, as well as energy costs and health physics supplies.

This study evaluates the decommissioning costs following the conclusion of safe-storage. The estimate is relatively time-insensitive as long as certain administrative and technical resources are available from Units 2/3. While this study does not reflect the current cost to maintain PB1 in safe-storage, this cost should be considered along with changing regulations, escalating disposal costs, and the availability of radioactive waste disposal sites, in any long-term evaluation of decommissioning alternatives for PB1.

This study provides an estimate for decommissioning the site under current requirements based on present-day costs and available technology. Individual costs associated with decommissioning activities have historically increased at rates greater than general inflation. For example, there has been significant volatility in the issues and policies surrounding waste disposal, i.e., the access to and the cost of low-level radioactive waste disposal has been both unpredictable and escalated at rates historically greater than inflation (over the past ten years). Waste disposal has become the primary driver in the escalation of decommissioning costs. It is therefore appropriate that this cost estimate be reviewed periodically.

## TABLE 8.1

## SUMMARY OF DECOMMISSIONING COST CONTRIBUTORS

| Work Category | Costs 95$ (thousands)[1] | Percent of Total Costs[1] |
|---|---|---|
| Decontamination | 1,781 | 2.83 |
| Removal | 12,891 | 20.48 |
| Packaging | 737 | 1.17 |
| Shipping | 653 | 1.04 |
| Burial (off-site) | 7,769 | 12.34 |
| LLRW Recycling | 2,744 | 4.36 |
| Decommissioning Staffs | 8,921 | 14.17 |
| Other[2] | 15,660 | 24.88 |
| Contingency | 11,781 | 18.72 |
| **Total** | **62,937** | **100.00** |

1 Columns may not add due to rounding.
2 Other includes: engineering & preparations, and undistributed costs.

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3. U.S. Code of Federal Regulations, Title 10, Parts 2, 50 and 51, Proposal Rule "Decommissioning of Nuclear Power Reactors", Nuclear Regulatory Commission, Federal Register Volume 60, p 37374+, July 20, 1995.

4. "Low-Level Radioactive Waste Policy Amendments Act of 1985", Public Law 99-240, January 15, 1986.

5. T.S. LaGuardia et al., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates", AIF/NESP-036, May 1986.

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7. "Building Construction Cost Data 1995", Robert Snow Means Company, Inc., Kingston, Massachusetts.

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12. "Decommissioning Plan and Safety Analysis Report, Peach Bottom Atomic Power Station Unit 1, July 1974.

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*Document No. P03-1246-002*

Exhibit TLG-5

# DISMANTLING COST STUDY
## for the
## EDDYSTONE, CROMBY, SCHUYLKILL, DELAWARE, KEYSTONE AND CONEMAUGH STATIONS

*prepared for*

**PECO Energy, Inc.**

*prepared by*


**TLG Services, Inc.**

Bridgewater, Connecticut


**March 1997**

# APPROVALS

| | | |
|---|---|---|
| **Project Manager** | Edmond DeFlorio<br>**Edmond DeFlorio** | 3/21/97<br>**Date** |
| **Technical Manager** | William A. Cloutier<br>**William A. Cloutier** | 3/21/97<br>**Date** |
| **Quality Assurance Manager** | Carolyn A. Palmer<br>**Carolyn A. Palmer** | 3/21/97<br>**Date** |

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# REVISION LOG

| Rev. No. | CRA No. | Date | Item Revised | Reason for Revision |
|---|---|---|---|---|
| 0 | | 3/21/97 | | Original Issue |

## EXECUTIVE SUMMARY

This report presents a summary of the estimated costs for the complete dismantling of the Eddystone, Cromby, Schuylkill, Delaware, Keystone and Conemaugh Stations. Most stations are wholly owned and operated by PECO Energy, Inc. (PECO); Keystone and Conemaugh Stations are partially owned by PECO and operated by other utility companies.

The dismantling estimate includes the cost of removing the turbine generators, fuel handling systems, and all plant equipment and structures, except for the transformer yard. At the conclusion of the dismantling process the area surrounding the transformer yards will be available for alternative, non-restricted use.

This study provides the estimated cost associated with the total dismantling of site structures and facilities (except where noted). Partial dismantling is not recommended since it tends to make the overall remediation process more costly. However, partial dismantling could be used where compliance involves only minimal environmental and safety requirements. Complete and prompt dismantling is recommended because it relieves the owner of the liabilities associated with leaving behind partially dismantled, potentially unsafe structures. Leaving unsafe structures in place would also be a violation of Uniform Building Code, Section 102.

Deferred dismantling (for several years after the cessation of plant operations), can significantly increase the total cost as the owner continues to incur the cost of manning and maintaining the site in protective storage. In addition, at the end of the dormancy period the station must reactivate those systems necessary to support dismantling operations and/or procure replacement services. Refurbishment activities could involve re-qualifying the cranes and other lifting devices, and reactivating electrical, lighting, air handling and other service systems.

A major disadvantage to delayed dismantling is the unavailability of the station operations personnel at the time of final dismantling. The knowledge of the current operating staff is invaluable in the planning for, and assisting in, plant dismantling activities. Without personnel familiar with station operations, the dismantling program may incur additional costs as it compensates for engineering and planning developed from an incomplete data base. Consequently, dismantling shortly after the permanent cessation of plant operations is not only the basis for the costs presented within this study, but also the action recommended.

# 1. INTRODUCTION

## 1.1 OBJECTIVE OF STUDY

The objective of TLG's dismantling cost study is to present an estimate of the manpower, schedule and cost to completely dismantle the Eddystone, Cromby, Schuylkill, Delaware, Keystone, and Conemaugh Stations at the end of their useful generating lives. This study is not a detailed engineering document, but a cost estimate prepared in advance of the detailed engineering preparations which will be necessary to carry out the dismantling activities. The costs presented in this study should be considered in light of this qualification.

## 1.2 STATION DESCRIPTIONS

Eddystone Station is a four unit station located in Eddystone, PA (vicinity of Chester, PA). Station capacity is approximately 1,397 Mw. The cooling water source is the Delaware River. Units 1 & 2 are coal-fired, and Units 3 & 4 are oil-fired. Eddystone is scheduled to begin dismantling in the year 2025.

Cromby Station is a two (2) unit station located in Phoenixville, PA. Station capacity is approximately 348 Mw. The cooling water source is the Schuylkill River. All units are coal-fired. Cromby is scheduled to begin dismantling in the year 2010.

Schuylkill Station is a multi-unit station located in Philadelphia, PA. This report only includes dismantling costs for the removal of the power block, combustion turbines, and the diesel-generator for Schuylkill Unit 1. Other facilities at Schuylkill are owned and operated by other companies and are not included. Schuylkill 1 is oil-fired. Total station capacity is approximately 197 Mw. The cooling water source is the Schuylkill River. Schuylkill 1 is scheduled to begin dismantling in the year 1999.

Delaware Station is a multi-unit station located in Philadelphia, PA. This report includes the dismantling costs for the removal of Units 7 & 8 and their supporting facilities, the combustion turbines, and the diesel-generator. Other previously retired facilities at Delaware are not included in this study. Delaware 7 & 8 were originally designed as coal-fired units but were converted to oil-fired. Total capacity is approximately 281 Mw. The cooling water source is the Delaware River. Delaware 7 & 8 are scheduled to begin dismantling in the year 1999.

Keystone Station is a two unit station located in Shelocta, PA. Station capacity is approximately 1,700 Mw. The cooling water sources are natural draft cooling towers. Both units are coal-fired. Keystone is scheduled to begin dismantling in the year 2008.

Conemaugh Station is a two (2) unit station located in New Florence, PA. Station capacity is approximately 1,700 Mw. The cooling water source is from natural draft cooling towers. Both units are coal-fired. Conemaugh is scheduled to begin dismantling in year 2011.

## 1.3 GENERAL APPROACH

This cost estimate is prepared on an item-by-item basis using unit factors developed for each cost item from prior dismantling experience or similar related experience. The costs for project management, equipment and consumables, and other collateral costs are estimated on a period-dependent basis (i.e., the magnitude of the expense depends, in part, on the duration of the project). While equipment salvage is not considered, the potential value of scrap from materials generated in dismantling the boilers, plant components, and building structural steel is included as an offset to the dismantling cost. Contingency is provided within the estimate to account for unpredictable project events.

This estimate includes the costs to remove all non-essential structures on the site to a nominal level of three feet below grade. The costs reflect demolition by controlled/engineered dismantling. Concerns for worker safety reinforce the need for a controlled approach. Accordingly, all large components are assumed to be lowered to grade for additional disassembly. The boilers are dismantled from the bottom upward. The steel support structures and other site building structures are dismantled from the top. All plant equipment and their supporting mechanical and electrical systems are removed by disassembly and segmentation where necessary.

Limited site landscaping includes seeding for drainage control. At the end of dismantling activities, the plant site will be in a condition such that the land will be available for alternative use.

## 1.4 REGULATORY GUIDELINES AND CRITERIA

The Eddystone, Cromby, Schuylkill, and Delaware stations use cooling water taken from adjacent rivers. The U.S. Army Corps of Engineers (ACE) regulations will apply to any changes in the intake (and discharge) structures located at the river. To comply with ACE requirements, the concrete structures must be completely removed, and the riverbank returned to its natural state.

On-site ponds must be closed by PECO in accordance with an approved closure plan (approved by Pennsylvania State agencies). After pond closure, PECO is assumed to implement an environmental monitoring plan for a duration of 30 years.

For purposes of the study, it was assumed that asbestos-containing materials (ACM) will be removed prior to the initiation of physical dismantling activities. Removal of inaccessible ACM will be conducted as dismantling activities progress. This will require the use of environmental controls throughout the dismantling process, not only for asbestos, but for other hazards, e.g., lead paint.

## 1.5 DISMANTLING COSTS AND SCHEDULE

Tables 1.1 through 1.6 summarize the estimated cost and schedule to dismantle each of the stations. Definitions of "Periods" and the line-item costs are provided in Section 2 of this report.

**TABLE 1.1a**

**EDDYSTONE STATION UNITS 1 AND 2**
**DISMANTLING COST AND SCHEDULE SUMMARY**[1]
(Thousands of 1997 Dollars)

| | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Activity Cost | $2,724 | $21,301 | Note 2 |
| Period-Dependent Cost | $1,056 | $7,675 | $17 |
| Subtotal | $3,780 | $28,976 | $17 |
| Contingency | $773 | $4,346 | $2 |
| Dismantling Cost Subtotal | $4,553 | $33,324 | $19 |
| Duration (months) | 4.0 | 21.7 | 0.5 |
| Total Dismantling Cost | | | $37,896 |
| Scrap Credit | | | ($6,931) |
| **Total Station Cost** | | | **$30,965** |

Note 1: Columns may not add due to rounding; Period 3 duration does not include the 30-year post-demolition environmental monitoring of the site.

Note 2 Costs assigned to Eddystone 3 and 4.

**TABLE 1.1b**

**EDDYSTONE STATION UNITS 3 AND 4**
**DISMANTLING COST AND SCHEDULE SUMMARY**[1]
(Thousands of 1997 Dollars)

| | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Activity Cost | $667 | $18,330 | $276 |
| Period-Dependent Cost | $1,056 | $6,475 | $18 |
| Subtotal | $1,723 | $24,805 | $294 |
| Contingency | $258 | $3,721 | $43 |
| Dismantling Cost Subtotal | $1,982 | $28,524 | $336 |
| Duration (months) | 4.0 | 18.1 | 0.5 |
| Total Dismantling Cost | | | $30,842 |
| Scrap Credit | | | ($6,655) |
| **Total Station Cost** | | | **$24,186** |

Note 1: Columns may not add due to rounding; Period 3 duration does not include the 30-year post-demolition environmental monitoring of the site.

**TABLE 1.2a**

**CROMBY STATION UNIT 1**
**DISMANTLING COST AND SCHEDULE SUMMARY**[1]
(Thousands of 1997 Dollars)

| | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Activity Cost | Note 2 | $4,023 | Note 2 |
| Period-Dependent Cost | Note 2 | $5,983 | $19 |
| Subtotal | Note 2 | $10,006 | $19 |
| Contingency | Note 2 | $1,500 | $2 |
| Dismantling Cost Subtotal | Note 2 | $11,507 | $20 |
| Duration (months) | 3.0 | 23.7 | 0.5 |
| Total Dismantling Cost | | | $11,527 |
| Scrap Credit | | | ($2,211) |
| **Total Station Cost** | | | **$9,316** |

Note 1: Columns may not add due to rounding; Period 3 duration does not include the 30-year post-demolition environmental monitoring of the site.

Note 2: Costs assigned to Cromby Unit 2.

**TABLE 1.2b**

**CROMBY STATION UNIT 2**
**DISMANTLING COST AND SCHEDULE SUMMARY[1]**
(Thousands of 1997 Dollars)

| | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Activity Cost | $1,530 | $6,182 | $104 |
| Period-Dependent Cost | $567 | $5,998 | $18 |
| Subtotal | $2,097 | $12,180 | $122 |
| Contingency | $401 | $1,826 | $18 |
| Dismantling Cost Subtotal | $2,498 | $14,008 | $139 |
| Duration (months) | 3.0 | 23.7 | 0.5 |

| | |
|---|---|
| Total Dismantling Cost | $16,646 |
| Scrap Credit | ($1,908) |
| **Total Station Cost** | **$14,738** |

Note 1: Columns may not add due to rounding; Period 3 duration does not include the 30-year post-demolition environmental monitoring of the site.

## TABLE 1.3

## SCHUYLKILL STATION UNIT 1
## DISMANTLING COST AND SCHEDULE SUMMARY[1]
(Thousands of 1997 Dollars)

| | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Activity Cost | $1,162 | $3,505 | $23 |
| Period-Dependent Cost | $534 | $4,451 | $18 |
| Subtotal | $1,696 | $7,956 | $41 |
| Contingency | $304 | $1,193 | $6 |
| Dismantling Cost Subtotal | $2,001 | $9,150 | $47 |
| Duration (months) | 3.0 | 18.8 | 0.5 |
| Total Dismantling Cost | | | $11,197 |
| Scrap Credit | | | ($1,520) |
| **Total Station Cost** | | | **$9,677** |

Note 1: Columns may not add due to rounding; Period 3 duration does not include the 30-year post-demolition environmental monitoring of the site.

## TABLE 1.4

## DELAWARE STATION UNITS 7 AND 8
## DISMANTLING COST AND SCHEDULE SUMMARY[1]
(Thousands of 1997 Dollars)

| | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Activity Cost | $1,589 | $8,637 | $25 |
| Period-Dependent Cost | $486 | $2,996 | $17 |
| Subtotal | $2,075 | $11,633 | $42 |
| Contingency | $403 | $1,745 | $6 |
| Dismantling Cost Subtotal | $2,478 | $13,377 | $48 |
| Duration (months) | 3.0 | 12.9 | 0.5 |
| Total Dismantling Cost | | | $15,905 |
| Scrap Credit | | | ($2,952) |
| **Total Station Cost** | | | **$12,953** |

Note 1: Columns may not add due to rounding; Period 3 duration does not include the 30-year post-demolition environmental monitoring of the site.

## TABLE 1.5a

## KEYSTONE STATION UNIT 1
## DISMANTLING COST AND SCHEDULE SUMMARY[1]
(Thousands of 1997 Dollars)

| | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Activity Cost | Note 2 | $22,725 | Note 2 |
| Period-Dependent Cost | Note 2 | $19,255 | $1,305 |
| Subtotal | Note 2 | $41,980 | $1,305 |
| Contingency | Note 2 | $6,297 | $195 |
| Dismantling Cost Subtotal | Note 2 | $48,279 | $1,501 |
| Duration (months) | 6.0 | 54.7 | 0.5 |
| Total Dismantling Cost | | | $49,778 |
| Scrap Credit | | | ($7,494) |
| **Total Station Cost** | | | **$42,284** |

Note 1: Columns may not add due to rounding; Period 3 duration does not include the 30-year post-demolition environmental monitoring of the site.

Note 2: Costs assigned to Keystone Unit 2.

## TABLE 1.5b

## KEYSTONE STATION UNIT 2
## DISMANTLING COST AND SCHEDULE SUMMARY[1]
(Thousands of 1997 Dollars)

| | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Activity Cost | $4,980 | $30,696 | $1,408 |
| Period-Dependent Cost | $1,680 | $19,313 | $1,305 |
| Subtotal | $6,659 | $50,009 | $2,713 |
| Contingency | $1,430 | $7,502 | $406 |
| Dismantling Cost Subtotal | $8,089 | $57,511 | $3,120 |
| Duration (months) | 6.0 | 54.7 | 0.5 |

| | |
|---|---|
| Total Dismantling Cost | $68,720 |
| Scrap Credit | ($7,434) |
| **Total Station Cost** | **$61,286** |

Note 1: Columns may not add due to rounding; Period 3 duration does not include the 30-year post-demolition environmental monitoring of the site.

**TABLE 1.6a**

**CONEMAUGH STATION UNIT 1
DISMANTLING COST AND SCHEDULE SUMMARY[1]**
(Thousands of 1997 Dollars)

| | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Activity Cost | Note 2 | $24,363 | Note 2 |
| Period-Dependent Cost | Note 2 | $19,245 | $1,313 |
| Subtotal | Note 2 | $43,608 | $1,313 |
| Contingency | Note 2 | $6,541 | $197 |
| Dismantling Cost Subtotal | Note 2 | $50,147 | $1,510 |
| Duration (months) | 6.0 | 54.6 | 0.5 |
| Total Dismantling Cost | | | $51,659 |
| Scrap Credit | | | ($9,519) |
| **Total Station Cost** | | | **$42,140** |

Note 1: Columns may not add due to rounding; Period 3 duration does not include the 30-year post-demolition environmental monitoring of the site.

Note 2: Costs assigned to Conemaugh Unit 2.

## TABLE 1.6b

## CONEMAUGH STATION UNIT 2
## DISMANTLING COST AND SCHEDULE SUMMARY[1]
(Thousands of 1997 Dollars)

| | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Activity Cost | $6,076 | $30,722 | $451 |
| Period-Dependent Cost | $1,735 | $19,314 | $1,313 |
| Subtotal | $7,811 | $50,036 | $1,764 |
| Contingency | $1,712 | $7,505 | $265 |
| Dismantling Cost Subtotal | $9,523 | $57,539 | $2,029 |
| Duration (months) | 6.0 | 54.6 | 0.5 |
| Total Dismantling Cost | | | $69,094 |
| Scrap Credit | | | ($9,805) |
| **Total Station Cost** | | | **$59,288** |

Note 1: Columns may not add due to rounding; Period 3 duration does not include the 30-year post-demolition environmental monitoring of the site.

# 2.0 DISMANTLING OPERATIONS

The estimate for dismantling Eddystone, Cromby, Schuylkill, Delaware, Keystone, and Conemaugh Stations is based on the complete removal of the structures and facilities at the site (except where noted). The following sections describe the project organization, basic activities, and special equipment necessary for accomplishing the dismantling operation.

## 2.1 PROJECT ORGANIZATION

For the purposes of this study the dismantling project is assumed to be managed by the owner, who would have the primary authority for dismantling the station. A Dismantling Contractor, experienced in dismantling similar facilities, would be hired as the prime contractor for the removal of plant components and site facilities. The Contractor's Project Manager would supervise the day-to-day dismantling activities of the station and be responsible for completing the work in an expeditious and safe manner. Contractor personnel would manage and direct the labor force in accordance with approved procedures and under the supervision of the owner's health and safety organization. The owner's staff maintain and/or provide the engineering resources, environmental expertise, operations and maintenance support, and security services necessary to support dismantling operations. Figures 2.1 through 2.4 identify typical organizations for the plant/utility staff and the associated contractor personnel.

## 2.2 PRELIMINARY PLANNING/PREPARATION

Plant closure planning is initiated once the decision is made to discontinue plant operations. Several activities should be initiated prior to cessation of operations, to provide a smooth transition to site dismantling. Since these activities are typically performed during the final year(s) of operations, the associated cost is not specifically reflected within the subsequent dismantling expenditures.

Plant closure support activities could include:

- the removal from the site of non-essential structures, personal and surplus property;
- consumption of residual fuel (including oil/coal) in active or inactive storage areas;
- installation of supplemental environmental monitoring equipment;

- application of appropriate permits for off-site disposal of hazardous and toxic materials;
- identification and selection of a qualified Dismantling Contractor;
- removal of acids and caustics, flushing and cleaning of inactive storage tanks;
- cleaning of fly-ash handling equipment, e.g., filters and holding tanks; and
- disposition of surplus bulk chemicals and gas storage containers.

## 2.3 DISMANTLING PROGRAM

A dismantling program is characterized by three distinct periods: Period 1 - Engineering and Planning; Period 2 - Dismantling Operations; and Period 3 - Site Restoration. This section summarizes the activities performed under each phase of the program.

Although detailed procedures for each activity required are not provided, and actual sequences of work may differ from those presented herein, these activity descriptions provide a basis for the detailed engineering, planning, and scheduling at the time of dismantling.

### 2.3.1 Period 1- Engineering and Planning

Detailed engineering and planning activities are initiated once the Dismantling Contractor has been selected. Period 1 includes preparation of activity specifications which identify and describe the major work activities to be performed. Detailed work procedures to provide the step-by-step instructions for the work crews are also prepared during this period.

The Dismantling Contractor proceeds with dismantling engineering and planning by performing the following activities:

- reviewing plant drawings and specifications;
- establishing the final site configuration and identifying the processes to achieve that configuration;
- identifying the major work sequence;

- categorizing plant systems and component inventory, and their associated disposition;
- preparing dismantling activity specifications and work orders/forms;
- preparing detailed dismantling procedures;
- performing required safety analyses;
- preparing a dismantling plan for utility review and approval;
- preparing permit application(s) for plant demolition;
- mobilizing site staff; securing temporary services/facilities to support dismantling operations; procuring specialty services, e.g., asbestos remediation; arranging for heavy lift and dismantling equipment, rigging and tooling; and
- hiring and training the labor force.

2.3.2 Period 2 - Dismantling Operations

The Dismantling Contractor will initiate plant dismantling activities during this period, including:

- sealing circulating water lines;
- removing coal yard equipment, including unloading structures, conveyors, transfer towers, and reclaim systems;
- removing systems and/or components that are non-essential to the dismantling effort (these systems are referred to as "A Systems"), including steam piping, generator auxiliary equipment, feedwater and condensate systems, various water systems, main condenser, etc.;
- removing the screenhouse and other structures located at the riverbank;
- removing non-essential "B Systems" (identified in Appendix A) equipment that must be removed prior to start of boiler structure removal, including fly-ash handling, coal handling, burner fuel supply, scrubbers, air and flue gas ducts, etc.;

- removing electrostatic precipitator by cutting collection electrodes, casing, and connecting gas ducts;

- removing the stacks and top of the boiler enclosure to allow access to the platens;

- removing the boilers:

  The boiler waterwall will be removed from the bottom upward using scaffolding to lower sections to grade. Steel beams will be placed across the top of the upper steel structure for rigging and hoist attachment. Platens will be rigged from these beams and lowered to grade. Headers will also be rigged for removal and lowered to grade.

- removing steam drum and deaerator by severing all connections and lowering to grade;

- disassembling the turbine/generator and condenser;

- removing boiler structural steel from the top, placing small pieces in transfer containers; larger pieces are lowered to grade for additional processing;

- removing the turbine building superstructure and intermediary floors;

- removing ancillary site structures and non-essential facilities;

- blasting/dismantling the monolithic concrete turbine-generator pedestal(s);

- removing the mechanical and electrostatic precipitators;

- removing the concrete stack; and

- removing all essential "C Systems" (identified in Appendix A) such as fire protection, compressed air, and power.

### 2.3.3 Period 3 - Site Restoration

Following completion of the dismantling operations, site restoration activities are initiated. Coal storage areas are covered with clay and topsoil. Ponds are remediated according to a pre-approved closure plan. Original contour of the site is not restored; landscaping is limited to grading and seeding as necessary for site drainage and erosion control. A final dismantling report is issued upon completion of the program.

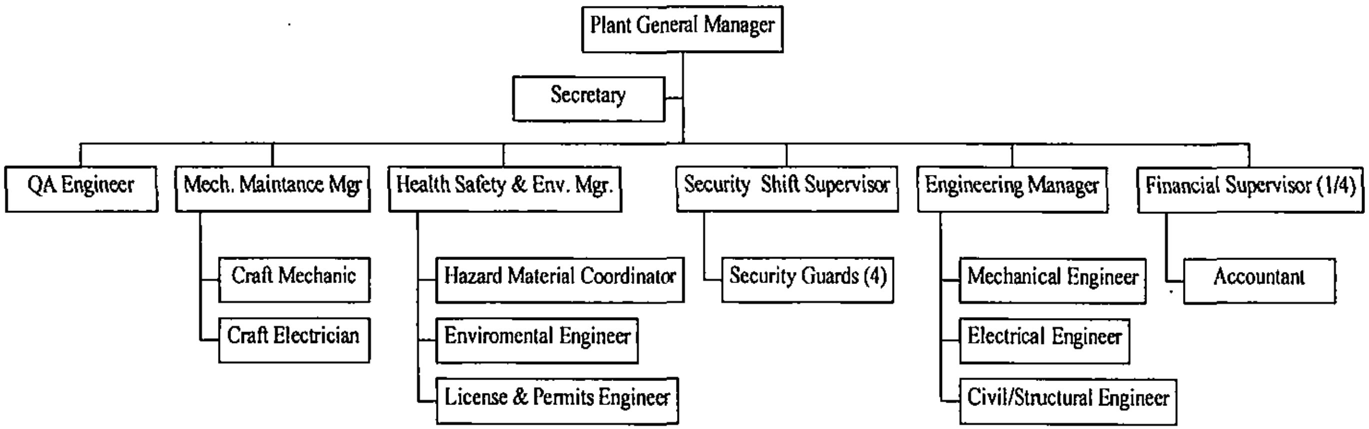
## 2.4 SPECIAL EQUIPMENT

A track-mounted cutting torch is used to segment boiler drums and waterwall headers. The track is magnetically attached to the item to be cut, and the cutting torch is advanced along the track to make the cut. This technique allows greater output than manual cutting, particularly for extremely thick sections.

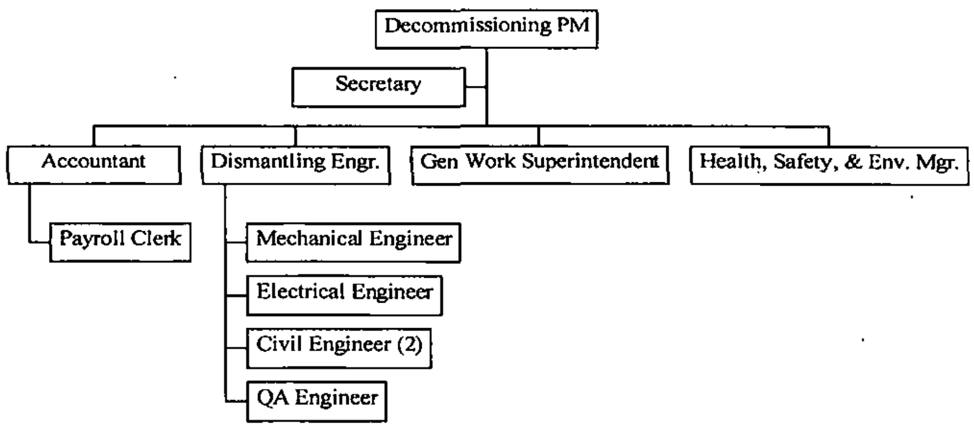
A front-end loader with a demolition bucket is also used during the dismantling operations. The bucket has two movable jaws which allow it to pick up scrap and place it on a transfer vehicle for removal. Other equipment used in the dismantling process includes forklifts, cutting torches, wheeled backhoes and mobile cranes, all of which are readily available from rental equipment yards. To the maximum extent possible, existing plant equipment (such as the turbine-hall crane) will be used during the demolition activities.

**FIGURE 2.1a**

## EDDYSTONE
## UTILITY DISMANTLING PROJECT ORGANIZATION - PERIOD 1




## DISMANTLING CONTRACTOR PROJECT ORGANIZATION - PERIOD 1



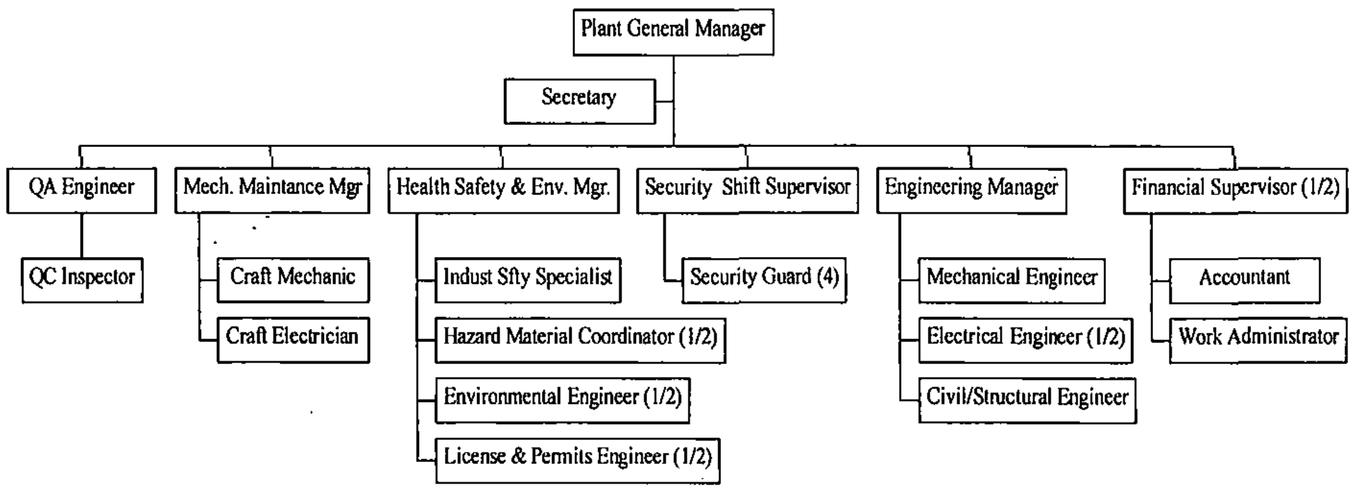

2 - 380 MW (Oil)

1 - 279 MW (Coal)

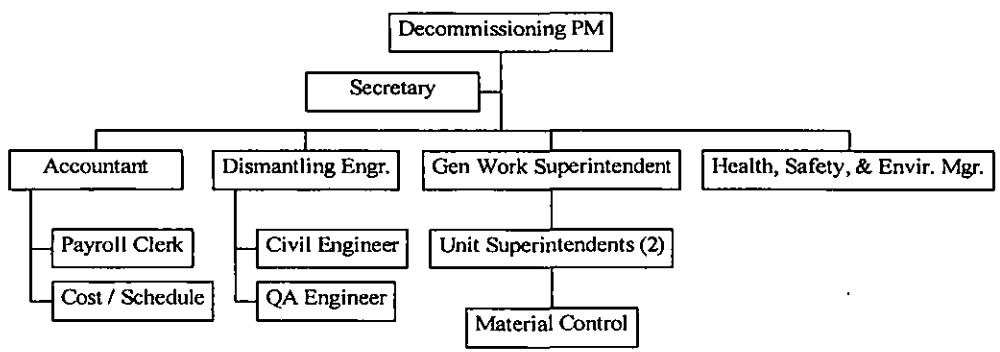
1 - 302 MW (Coal)

# FIGURE 2.1b

## EDDYSTONE
## UTILITY DISMANTLING PROJECT ORGANIZATION - PERIOD 2




## DISMANTLING CONTRACTOR PROJECT ORGANIZATION - PERIOD 2



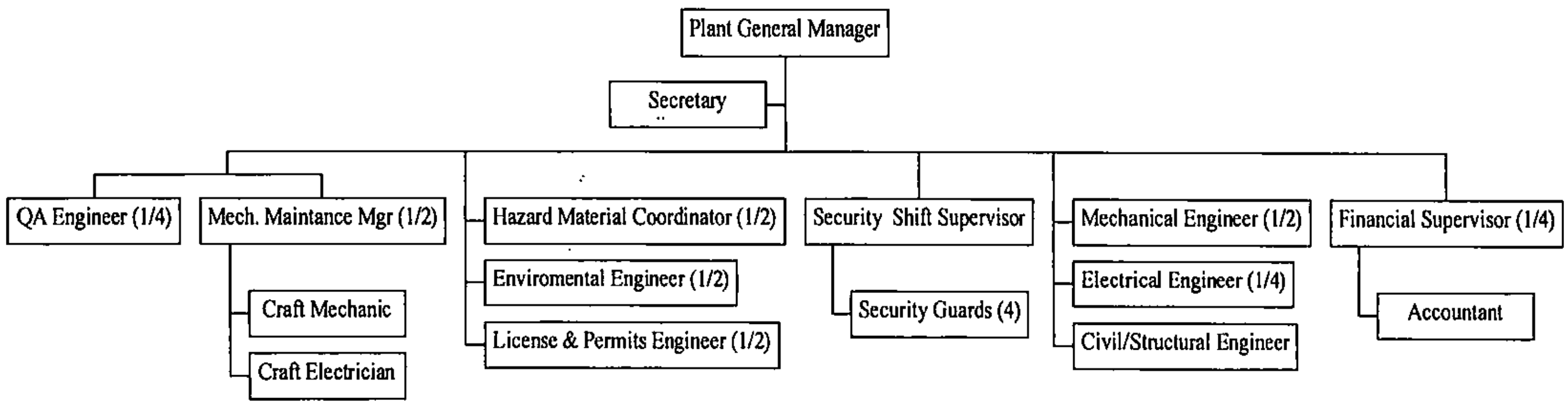

2 - 380 MW (Oil)

1 - 279 MW (Coal)

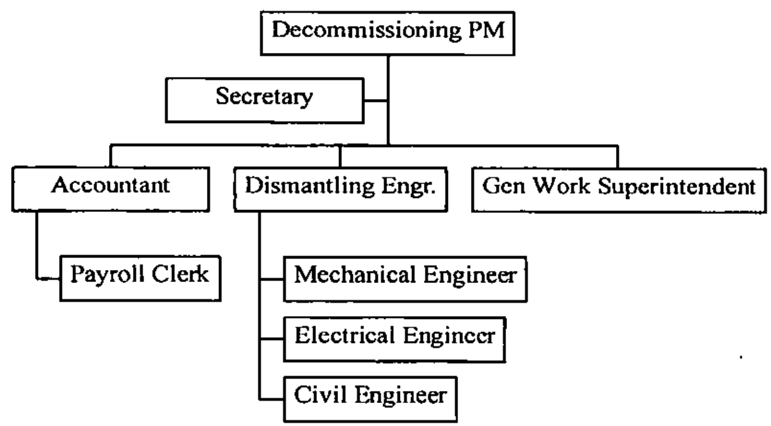
1 - 302 MW (Coal)

# FIGURE 2.2a

## CROMBY
## UTILITY DISMANTLING PROJECT ORGANIZATION - PERIOD 1




## DISMANTLING CONTRACTOR PROJECT ORGANIZATION - PERIOD 1

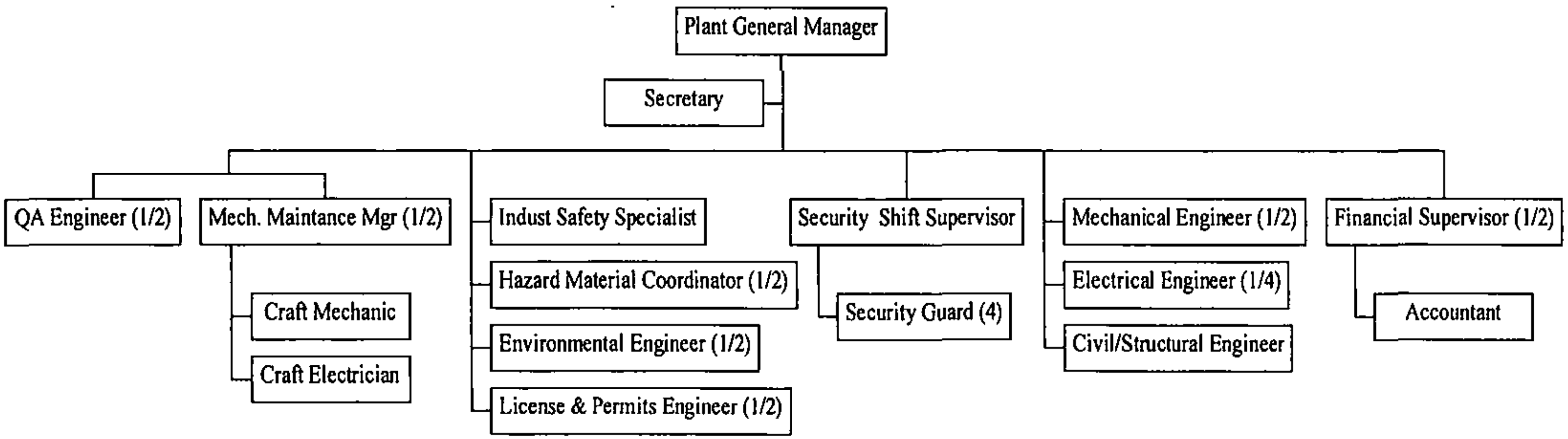



1 - 144 MW (Coal & Oil)

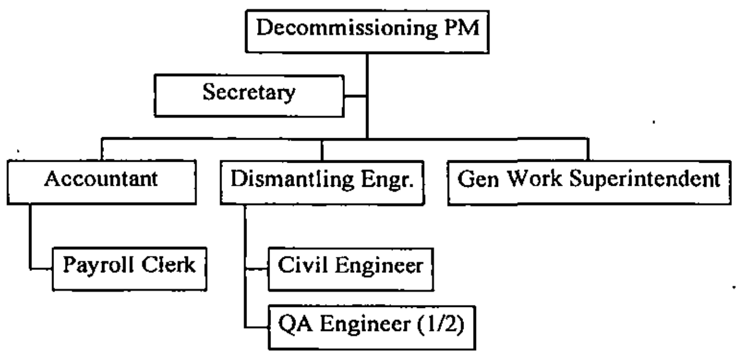
1 - 201 MW (Coal & Oil)

# FIGURE 2.2b

## CROMBY
## UTILITY DISMANTLING PROJECT ORGANIZATION - PERIOD 2




## DISMANTLING CONTRACTOR PROJECT ORGANIZATION - PERIOD 2

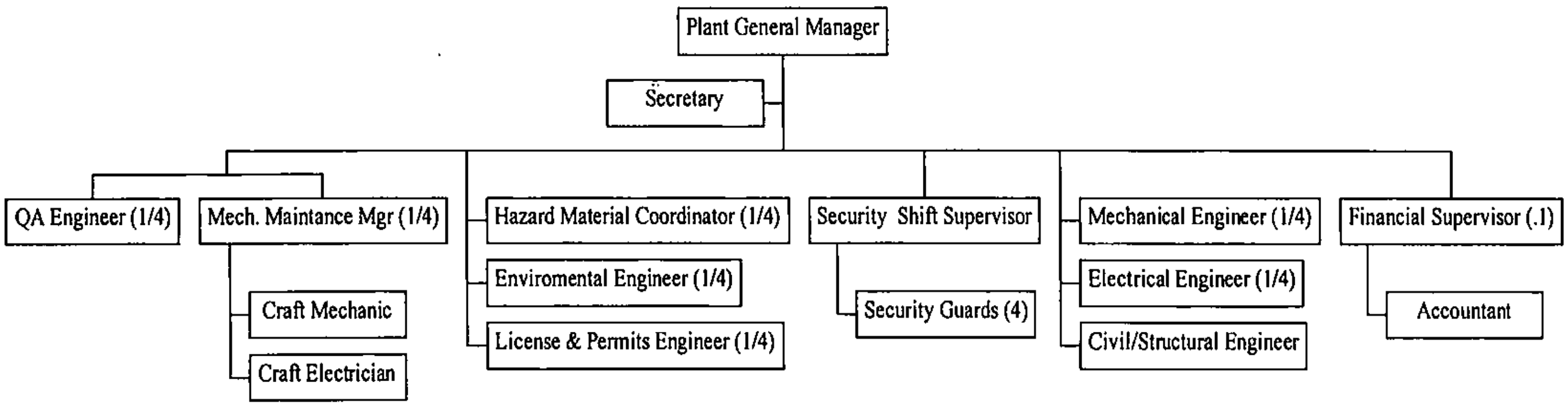



1 - 144 MW (Coal & Oil)

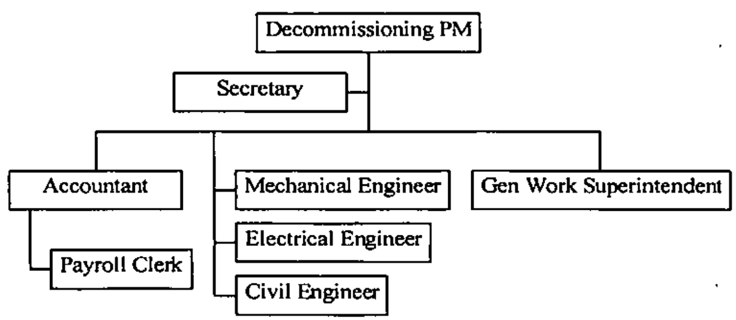
1 - 201 MW (Coal & Oil)

## FIGURE 2.3a

## DELAWARE / SCHUYLKILL
## UTILITY DISMANTLING PROJECT ORGANIZATION - PERIOD 1




## DISMANTLING CONTRACTOR PROJECT ORGANIZATION - PERIOD 1

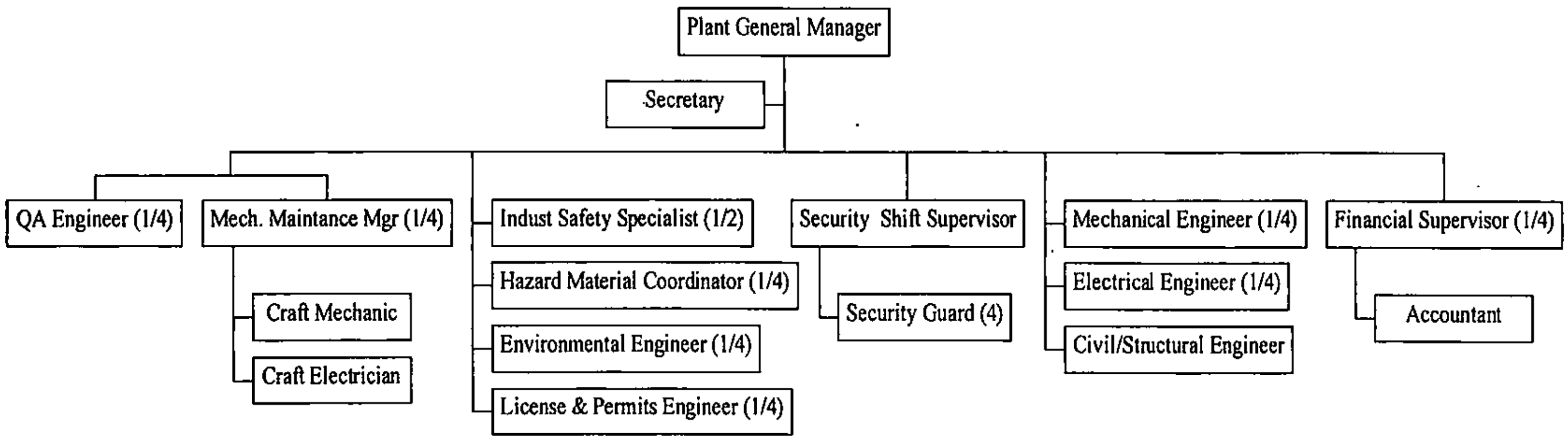



Delaware: 2 - 125 MW (Oil)

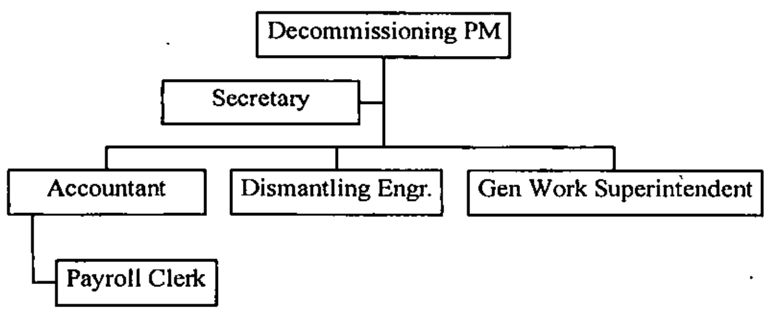
Schuylkill: 1 - 160 MW (Oil)

# FIGURE 2.3b

## DELAWARE / SCHUYLKILL
## UTILITY DISMANTLING PROJECT ORGANIZATION - PERIOD 2



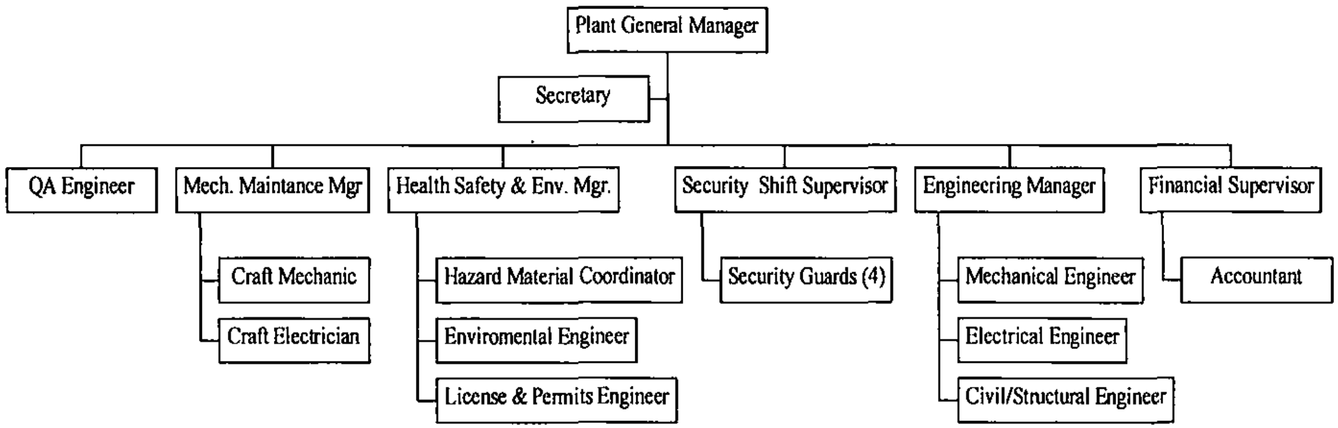

## DISMANTLING CONTRACTOR PROJECT ORGANIZATION - PERIOD 2



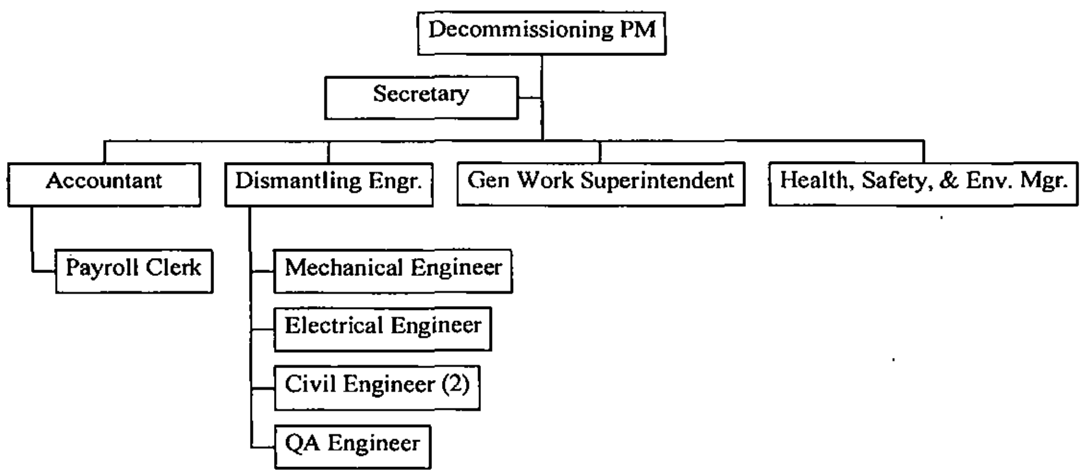

Delaware: 2 - 125 MW (Oil)    Schuylkill: 1 - 160 MW (Oil)

## FIGURE 2.4a

## CONEMAUGH / KEYSTONE
## UTILITY DISMANTLING PROJECT ORGANIZATION - PERIOD 1



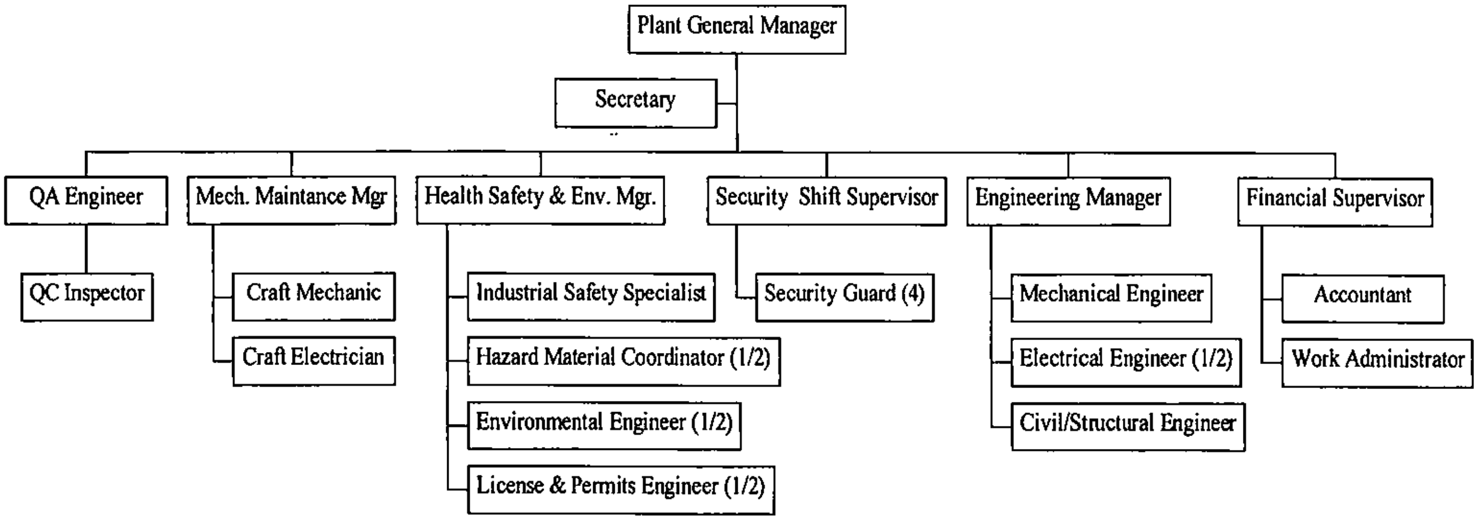

## DISMANTLING CONTRACTOR PROJECT ORGANIZATION - PERIOD 1



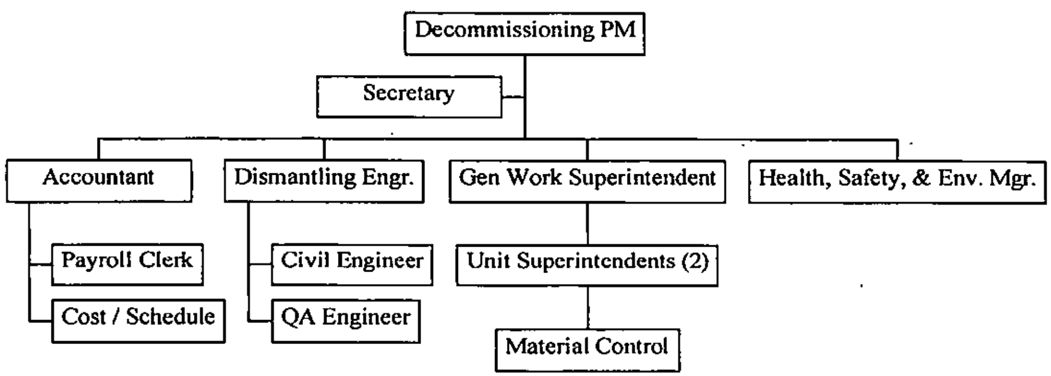

2 - 850 MW (Coal)

# FIGURE 2.4b

## CONEMAUGH / KEYSTONE
## UTILITY DISMANTLING PROJECT ORGANIZATION - PERIOD 2




## DISMANTLING CONTRACTOR PROJECT ORGANIZATION - PERIOD 2




2 - 850 MW (Coal)

# 3.0 COST ESTIMATE

A site-specific cost estimate was prepared for dismantling the Eddystone, Cromby, Schuylkill, Delaware, Keystone, and Conemaugh Stations. The basis, methodology, assumptions, and associated costs are described in the following sections.

## 3.1 BASIS OF ESTIMATE

The cost estimate was developed using drawings and cost information provided by PECO. Information extrapolated from TLG's existing database for plants of similar size and type was used to develop estimates of building concrete volumes, steel quantities, and component inventories for each station.

The cost estimate is based on averages, such that the total costs shown for the project are a reasonable approximation of what is expected to occur. Individual cost elements could vary from the estimated values. Accordingly, this estimate is not a substitute for the detailed engineering and planning that is performed in preparation for the dismantling of the units.

## 3.2 METHODOLOGY

The methodology used to develop the cost estimate follows the basic approach presented in the AIF/NESP-036 "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates" (Ref. 1) and the US DOE "Decommissioning Handbook" (Ref. 2). These publications utilize a unit factor method for estimating decommissioning activity costs to simplify the estimating calculations. Unit cost factors for concrete removal ($/cubic yard) steel removal ($/ton) and cutting costs ($/in) are developed from the labor cost information from R. S. Means (Ref. 3). With the item quantity (cubic yards, tons, inches, etc.) developed from plant drawings and inventory documents, the activity-dependent costs are estimated. The unit factors used in this study reflect the latest available information on worker productivity in plant dismantling.

An activity duration critical path is developed to determine the total dismantling program schedule. This program schedule is then used to determine the period-dependent costs for program management, administration, field engineering, equipment rental, quality assurance, and security. PECO provided typical salary and hourly rates for personnel associated with period-dependent costs. The costs for conventional demolition of structures, materials, backfill, landscaping, and equipment rental are obtained from R.S. Means. Examples of such unit factor development are presented in AIF/NESP-036.

The unit cost factor method provides a demonstrable basis for establishing reliable cost estimates. The detail of activities for labor costs, equipment and consumables costs provide assurance that cost elements have not been omitted. Detailed unit cost factors, coupled with the site-specific inventory of piping, components and structures, provide a high degree of confidence in the cost estimates.

The activity-dependent and period-dependent costs are combined with applicable collateral costs to yield the direct decommissioning cost. A contingency is then applied. "Contingencies" are defined in the American Association of Cost Engineers' Cost Engineers' Notebook (Ref. 4) as "specific provision for unforeseeable elements of cost within the defined project scope; particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this estimate are based on ideal conditions; therefore, a contingency factor has been applied.

Examples of items that could occur but have not otherwise been accounted for in this estimate include: labor work stoppages; bad weather delays; equipment/tool breakage; and changes in the anticipated plant shutdown conditions, etc. These types of unforeseeable events are discussed in the AIF/NESP-036 study. Guidelines are also provided for applying contingency in each area. Application of contingency is assigned on a line-item basis in this estimate.

## 3.3 ASSUMPTIONS

The following assumptions were used in developing the dismantling estimate.

1. Estimated costs are stated in 1997 dollars. Escalation/inflation of the costs over the remaining operating life are not included.

2. The arrangement of the facilities is based on drawings provided by PECO, except as modified by mutual agreement.

3. The dismantling process will be an engineered process rather than wrecking ball demolition.

4. The demolition will be performed by a Dismantling Contractor who will provide adequate staff and equipment to complete the dismantling.

5. Office trailers will be used to house PECO and Dismantling Contractor personnel.

6. Site security will be provided by PECO.

7. Environmental regulations effective in 1997 are assumed to be in force during the dismantling effort.

8. Structural steel, piping, electrical cable, etc., will be credited for scrap value. Plant equipment is assumed to have no value as salvage.

9. The estimate to dismantle the stations does not address the value of the land.

10. On-site fuel inventories will be used and/or removed prior to start of dismantling.

11. Silos, precipitators, scrubbers, hoppers, tanks, etc., will be emptied prior to start of dismantling.

12. Acids and caustics will be removed. Ion exchangers and filters will also be emptied in preparation for dismantling.

13. Stores, spare parts, bulk chemical supplies, gas storage containers, laboratory equipment, office furniture, etc., will be removed by the owner in preparation for dismantling.

14. Station transformer oil is assumed to be PCB-free.

15. Asbestos will be removed prior to the start of dismantling.

16. Essential systems (air, water, electrical, fire water, etc.), required to support dismantling operations, will remain in service throughout the project until replaced by temporary services.

17. Turbine hall cranes, miscellaneous hoists, and trolleys will remain in service to support dismantling, until no longer needed.

18. Boiler platens and waterwalls will be cut from their supports, lowered to grade level, and sectioned into 8' x 8' pieces.

19. Conveyors will be rigged, connections severed and lowered to grade. When on-grade the conveyors will be torch-cut into 10' long sections.

20. Valves 2" and smaller will be removed intact with the piping. Valves 2-1/2" and larger will be removed from the piping.

21. Structures and foundations will be removed to a depth of three feet below grade, with any resulting voids back-filled to grade level.

22. Turbine pedestals and powerhouse building foundations will be removed by controlled blasting and back-filled to grade.

23. Stand-alone chimney stacks will be blasted to the ground and broken into rubble. The rubble will be used as clean fill.

24. Holes will be drilled in all subsurface, abandoned foundations prior to being back-filled.

25. Screenhouse and other river water structures will be removed back to the riverbank. Underground circulating water piping will be sealed and abandoned in place. Small underground yard piping located near the surface will be collapsed and backfilled.

26. The estimate assumes that the dismantling of the electrical equipment terminates at the switchyard. The switchyard itself is left intact.

27. The site will be graded; however, no effort will be made to restore the original contour of the land. Ground cover will be established for erosion control. Soil required for fill is assumed to be available on site.

28. Roads, parking lots, etc., are removed after the facility is dismantled (with the exception of the immediate area around the switchyard). The site boundary fence is left intact.

29. Solid, non-combustible, non-hazardous, non-toxic rubble generated during dismantling will be used as fill where needed.

30. Ash ponds will be dewatered, backfilled and covered with topsoil.

31. The study assumes that dismantling of the site will not occur until all units are retired. Costs for security and maintenance on any of the units retired prematurely are not included in the study. Such costs are assumed to be recovered through the station's operating budget.

32. For Delaware Station, the estimate includes costs to dismantle Units 7 & 8, the gas turbines, diesel-generator, and associated site facilities. Estimate does not include costs to dismantle any other units.

33. For Schuylkill Station, the estimate includes costs to dismantle Unit 1, the gas turbines, and diesel-generator. Estimate does not include costs to dismantle other units which are not owned by PECO, or any site facilities.

# 4.0 SCHEDULE ESTIMATE

Using information presented in the AIF/NESP-036 study and recent industry experience, a dismantling project schedule was developed for the Eddystone, Cromby, Schuylkill, Delaware, Keystone, and Conemaugh Stations. Activities listed in the schedule do not reflect a one-to-one correspondence with the activities listed in the Appendix C cost table. Some activities have been divided for clarity, while others have been combined for convenience. The schedule was prepared using the "Microsoft Project" (Ref. 5) scheduling software.

## 4.1 SCHEDULE ESTIMATE ASSUMPTIONS

The schedule reflects the results of a precedence network developed for the dismantling activities, i.e., a PERT (Programmed Evaluation and Review Technique). The durations used in the precedence network reflect the actual man-hour estimates from the detailed cost table in Appendix C. The schedule outputs were adjusted by stretching certain activities over their slack period ranges and by "pushing" other activities to the end of their slack periods.

Both the project schedule and the manpower estimate account for the limitations of personnel workspace and maximum worker safety and protection.

The following limitations and assumptions are reflected in the development of the dismantling schedule.

1. All work is performed during an 8-hour workday, 5 days per week, with no overtime. There are eleven paid holidays per year.

2. Multiple crews work parallel activities to the maximum extent possible, consistent with optimum efficiency (adequate access for cutting, removal, and laydown space) and with the stringent safety measures necessary during demolition of heavy components and structures.

3. It is assumed that four crews safely work on boiler waterwall removal at one time. Since the work is in a confined area, additional crews would increase the probability of injury from materials dropping from above.

4. Demolition of concrete stack structures is by controlled blasting. Blast fragments have the potential to cause injury to personnel and ground vibrations could collapse other structures or trailers. In order to limit risk of injury or damage, demolition of the stack is delayed until the number of on-site personnel is reduced.

5. Scheduling was calculated without constraints on availability of labor, equipment and materials, or regulatory inspection schedules.

## 4.2 PROJECT SCHEDULES

The period-dependent costs presented in the cost table in Appendix C are based on the durations developed in the schedule. Durations were established between several milestones in each project period; these durations were used to establish a critical path for the project. In turn, the critical path durations for each period were used as the basis for determining the total costs for these items.

Table 4.1 through 4.6 provide a project GANTT chart schedule for each station's dismantling activities.

# FIGURE 4.1a
# EDDYSTONE STATION UNITS 1 AND 2
# DISMANTLING ACTIVITY SCHEDULE

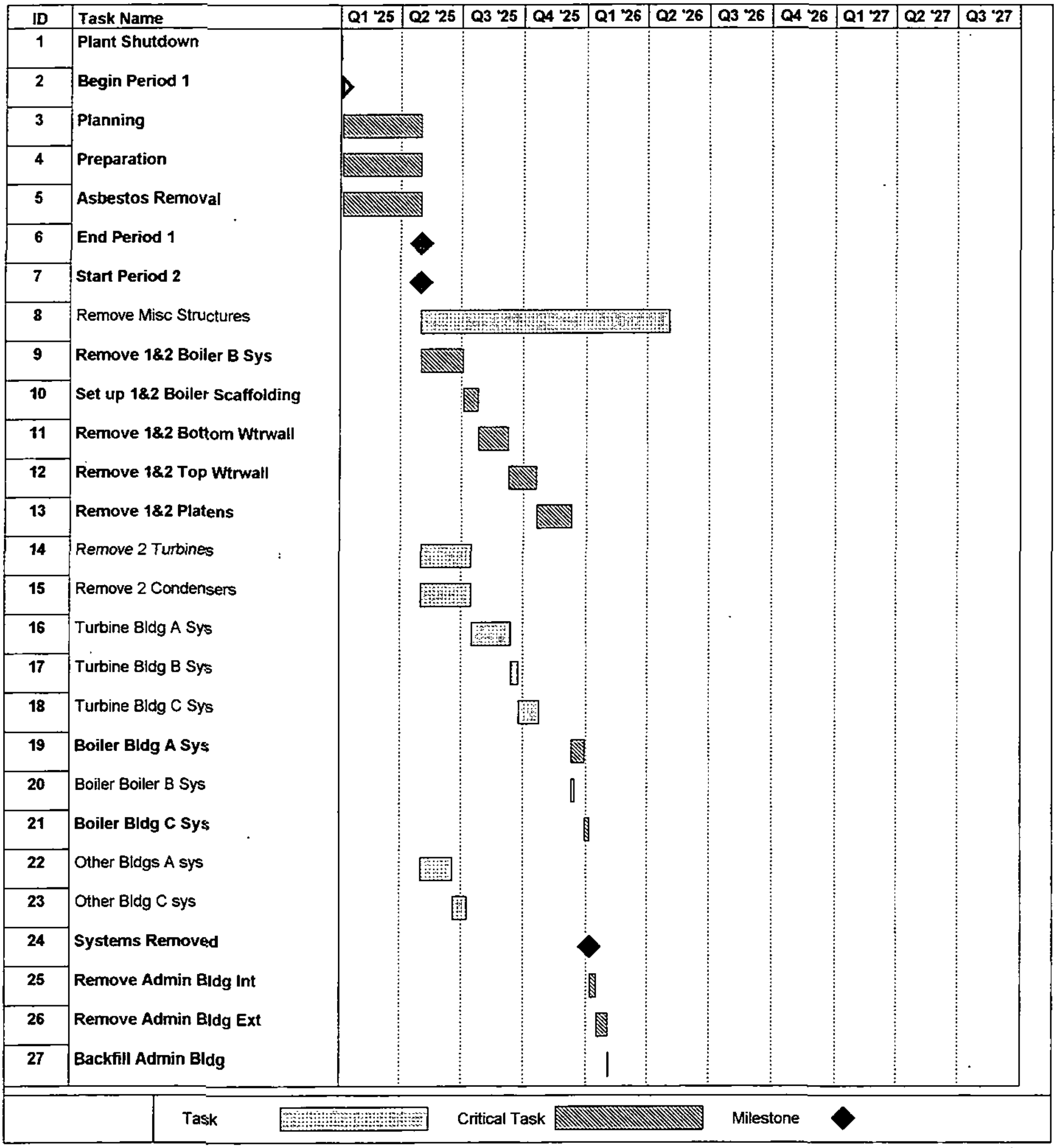
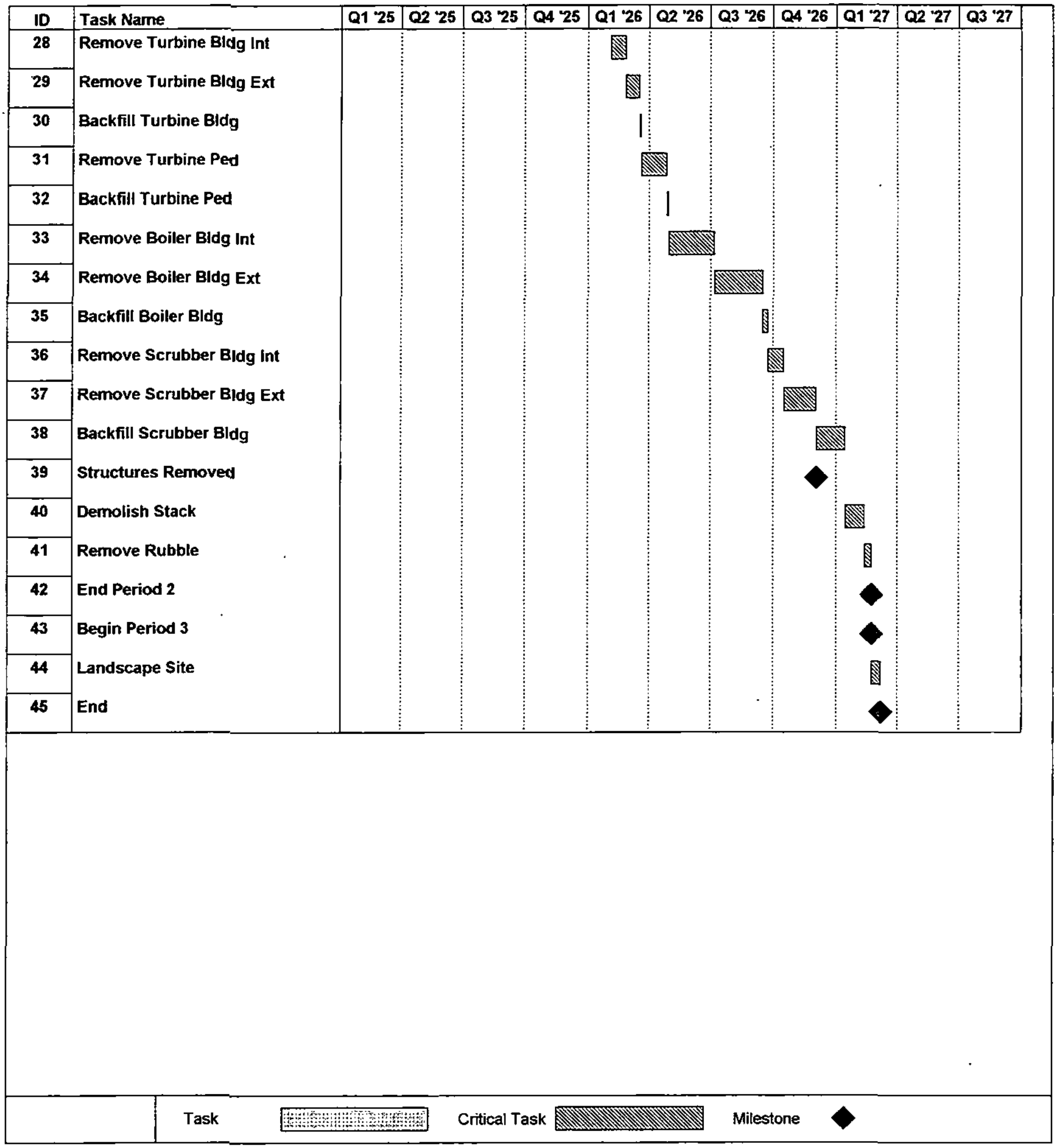
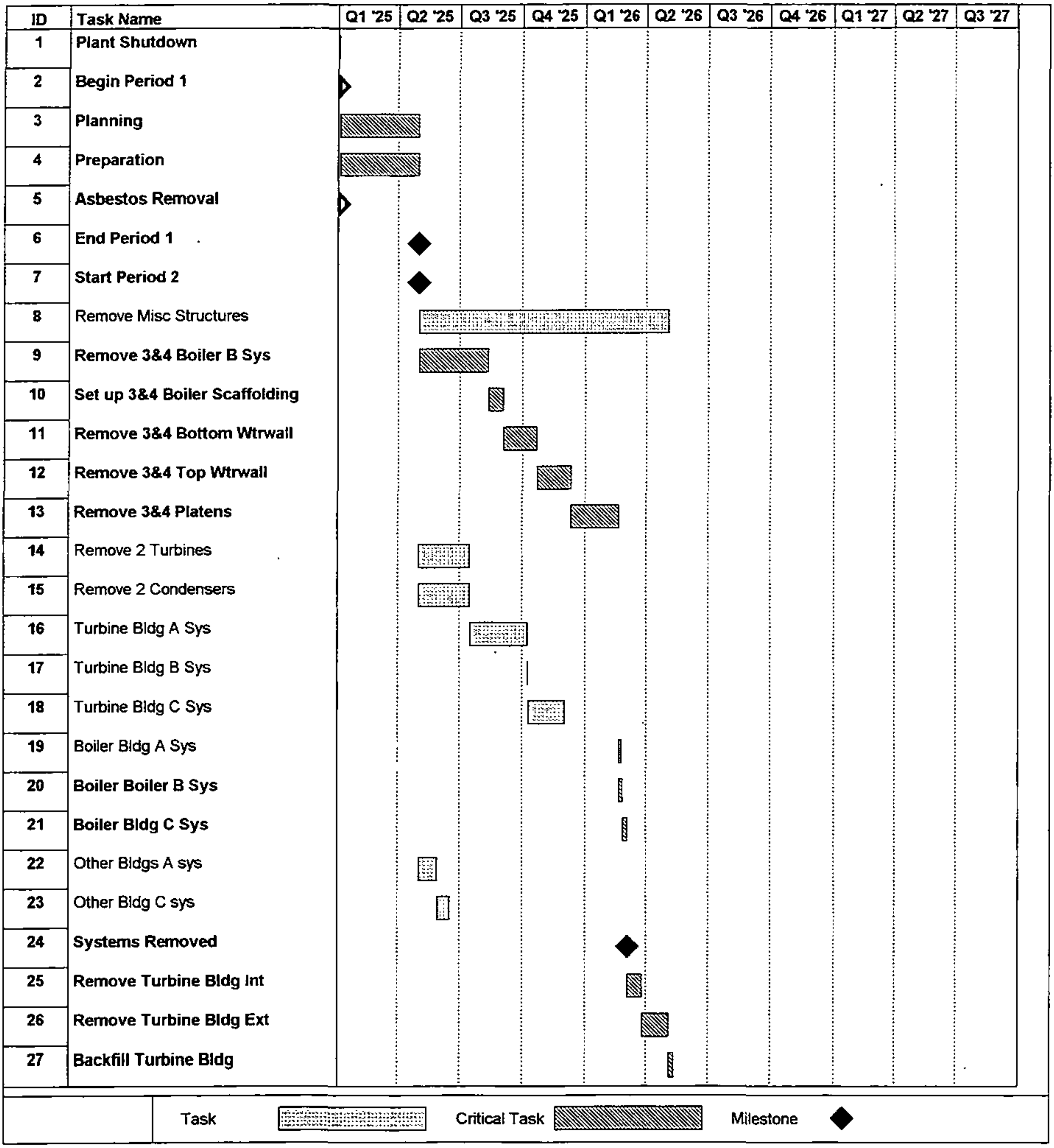


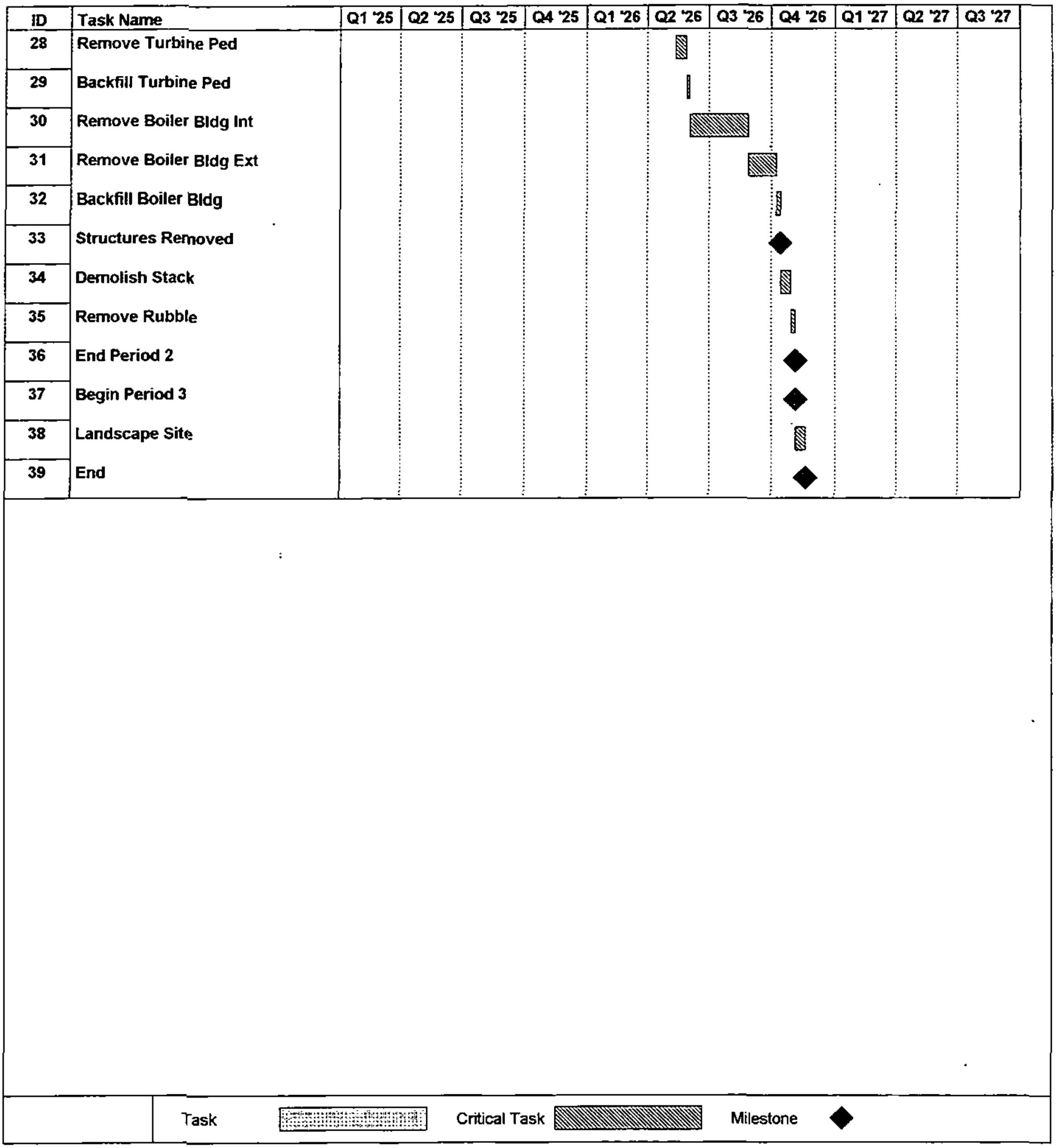
**FIGURE 4.1a**
**EDDYSTONE STATION UNITS 1 AND 2**
**DISMANTLING ACTIVITY SCHEDULE**
**(continued)**



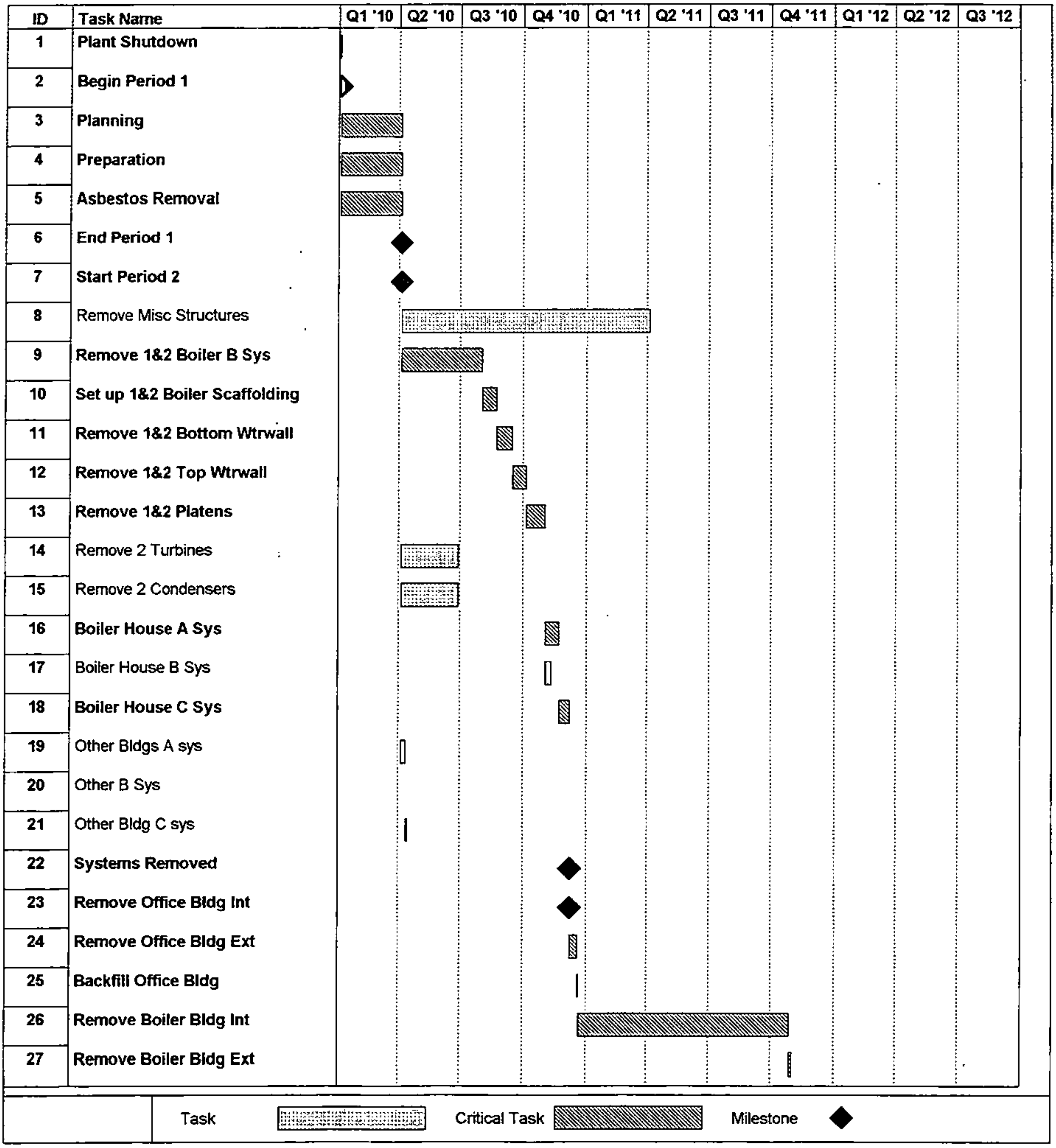
# FIGURE 4.1b
# EDDYSTONE STATION UNITS 3 AND 4
# DISMANTLING ACTIVITY SCHEDULE



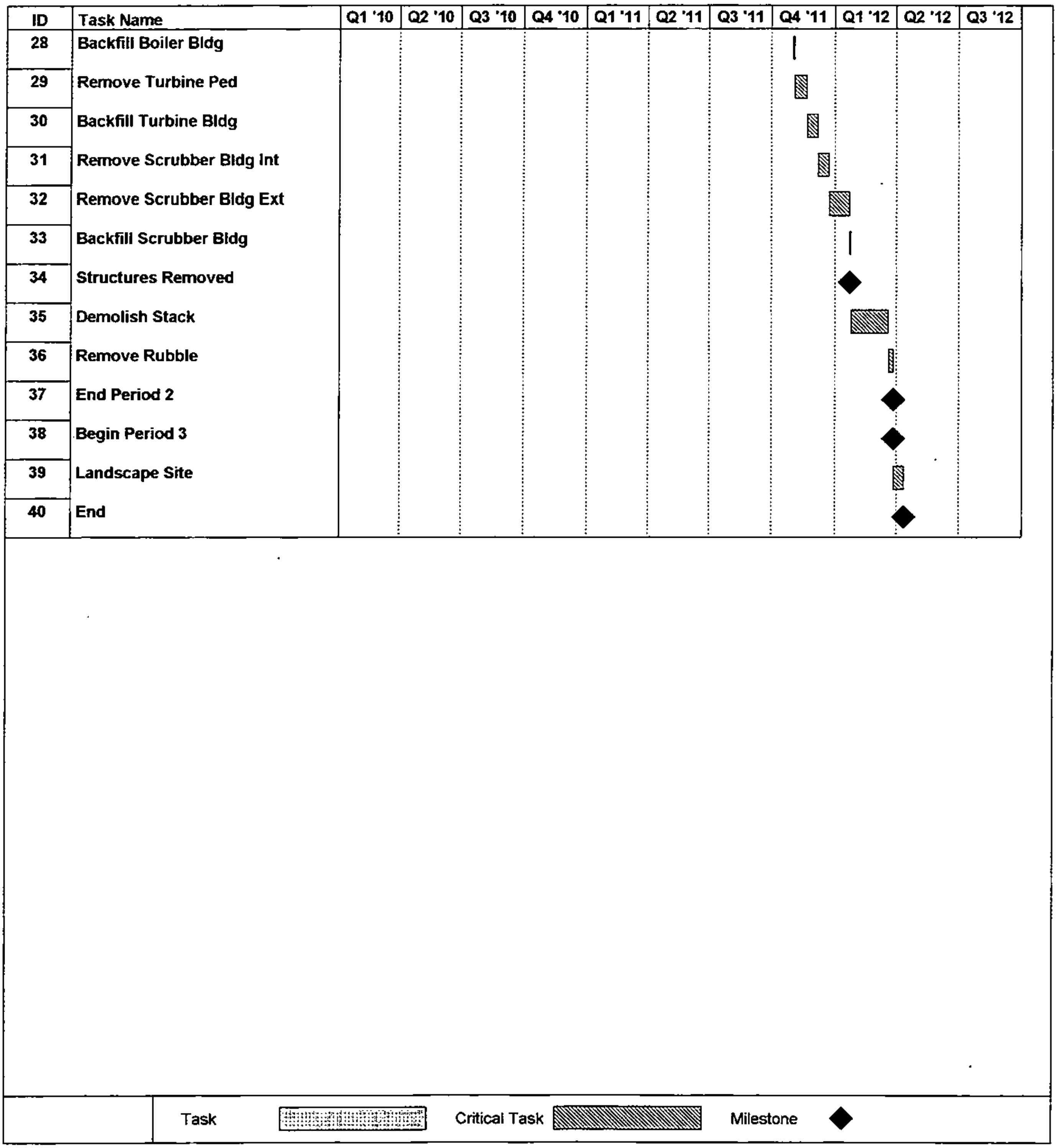
# FIGURE 4.1b
# EDDYSTONE STATION UNITS 3 AND 4 DISMANTLING ACTIVITY SCHEDULE
# (continued)



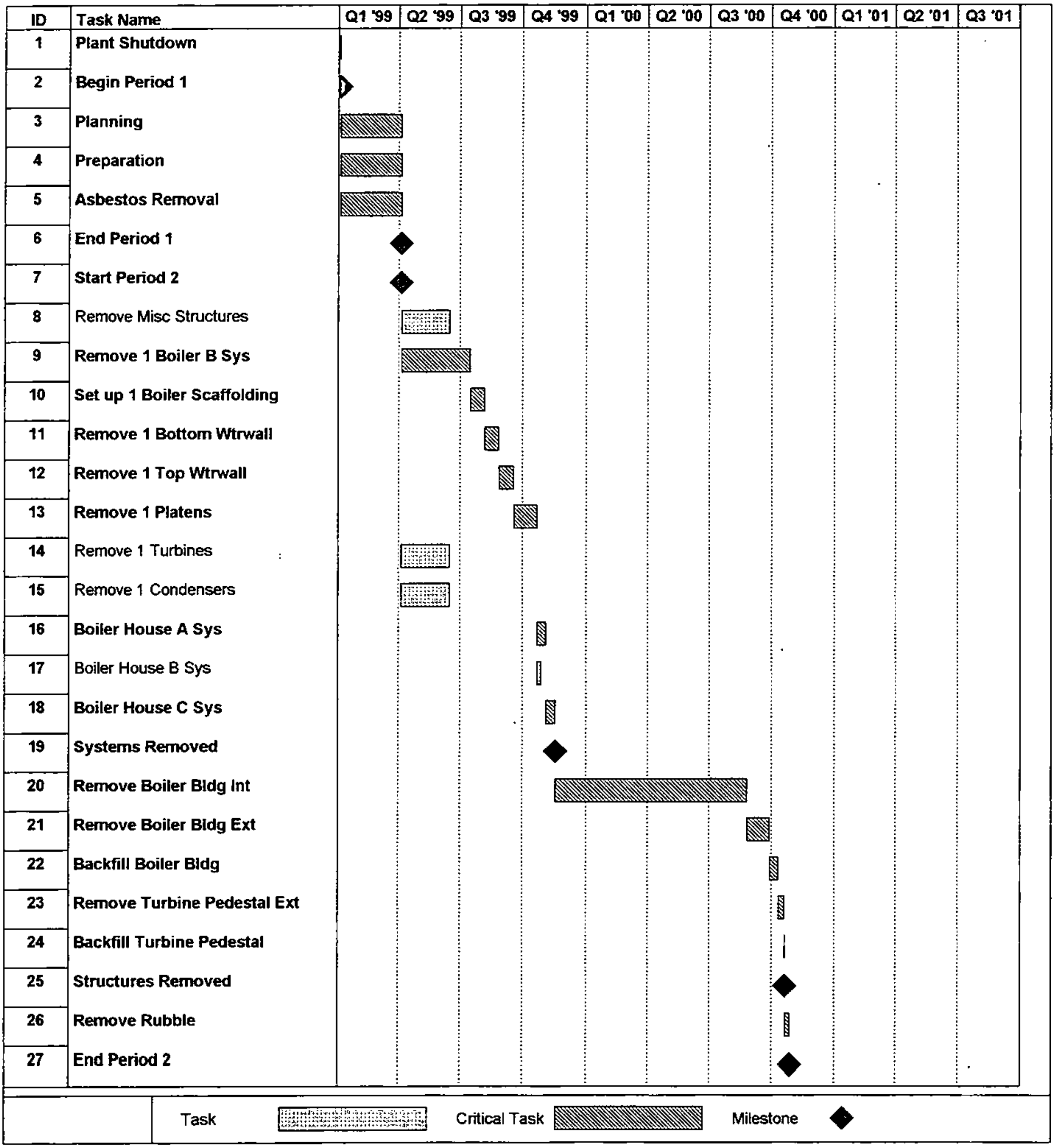
# FIGURE 4.2
# CROMBY STATION
# DISMANTLING ACTIVITY SCHEDULE



# FIGURE 4.2
# CROMBY STATION
# DISMANTLING ACTIVITY SCHEDULE
# (continued)



# FIGURE 4.3
# SCHUYLKILL STATION
# DISMANTLING ACTIVITY SCHEDULE



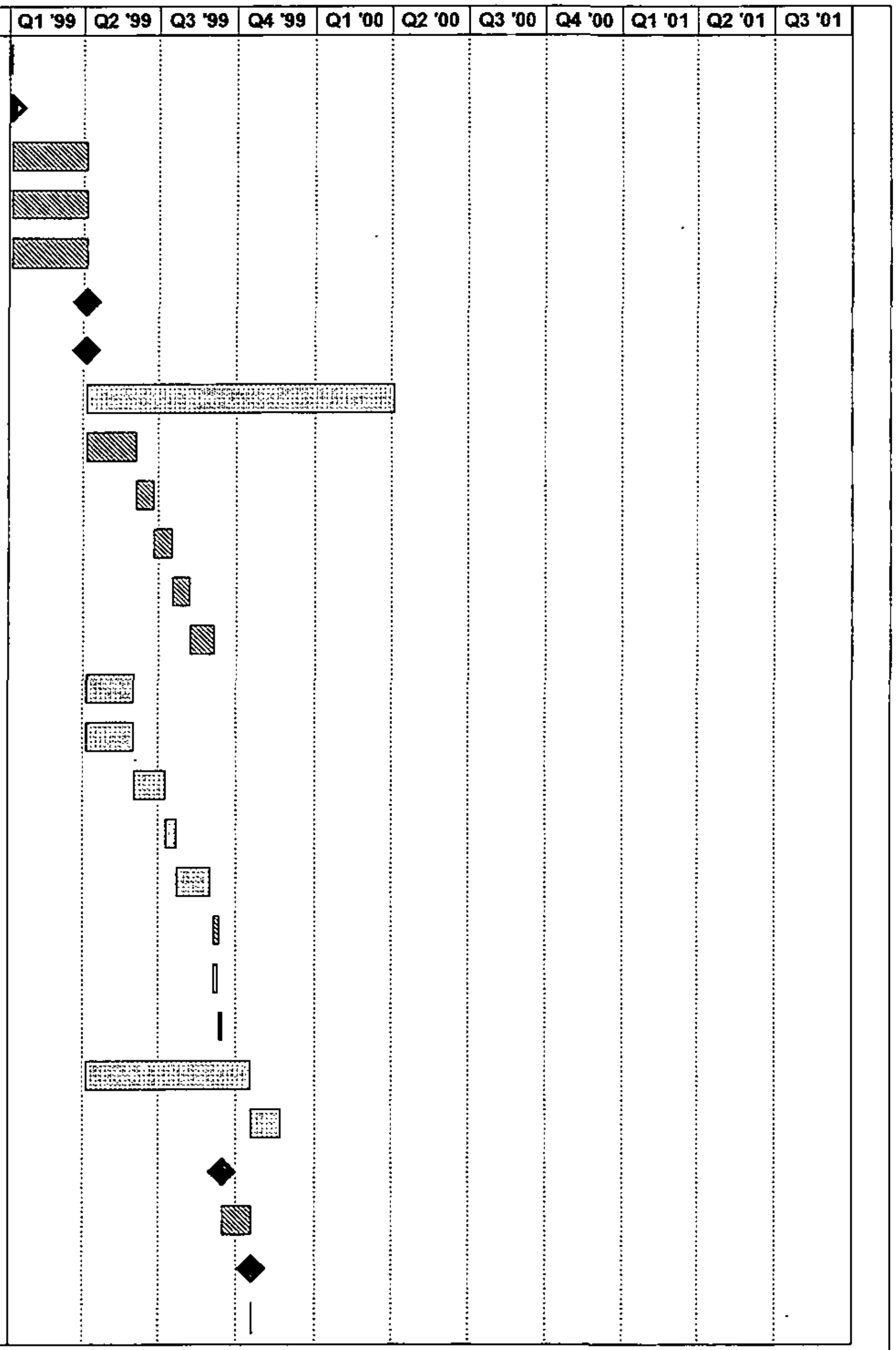
# FIGURE 4.3
# SCHUYLKILL STATION
# DISMANTLING ACTIVITY SCHEDULE
# (continued)

| ID | Task Name | Q1 '99 | Q2 '99 | Q3 '99 | Q4 '99 | Q1 '00 | Q2 '00 | Q3 '00 | Q4 '00 | Q1 '01 | Q2 '01 | Q3 '01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | Begin Period 3 | | | | | | | | ◆ | | | |
| 29 | Landscape Site | | | | | | | | ▒ | | | |
| 30 | End | | | | | | | | ◆ | | | |

Task | Critical Task | Milestone ◆

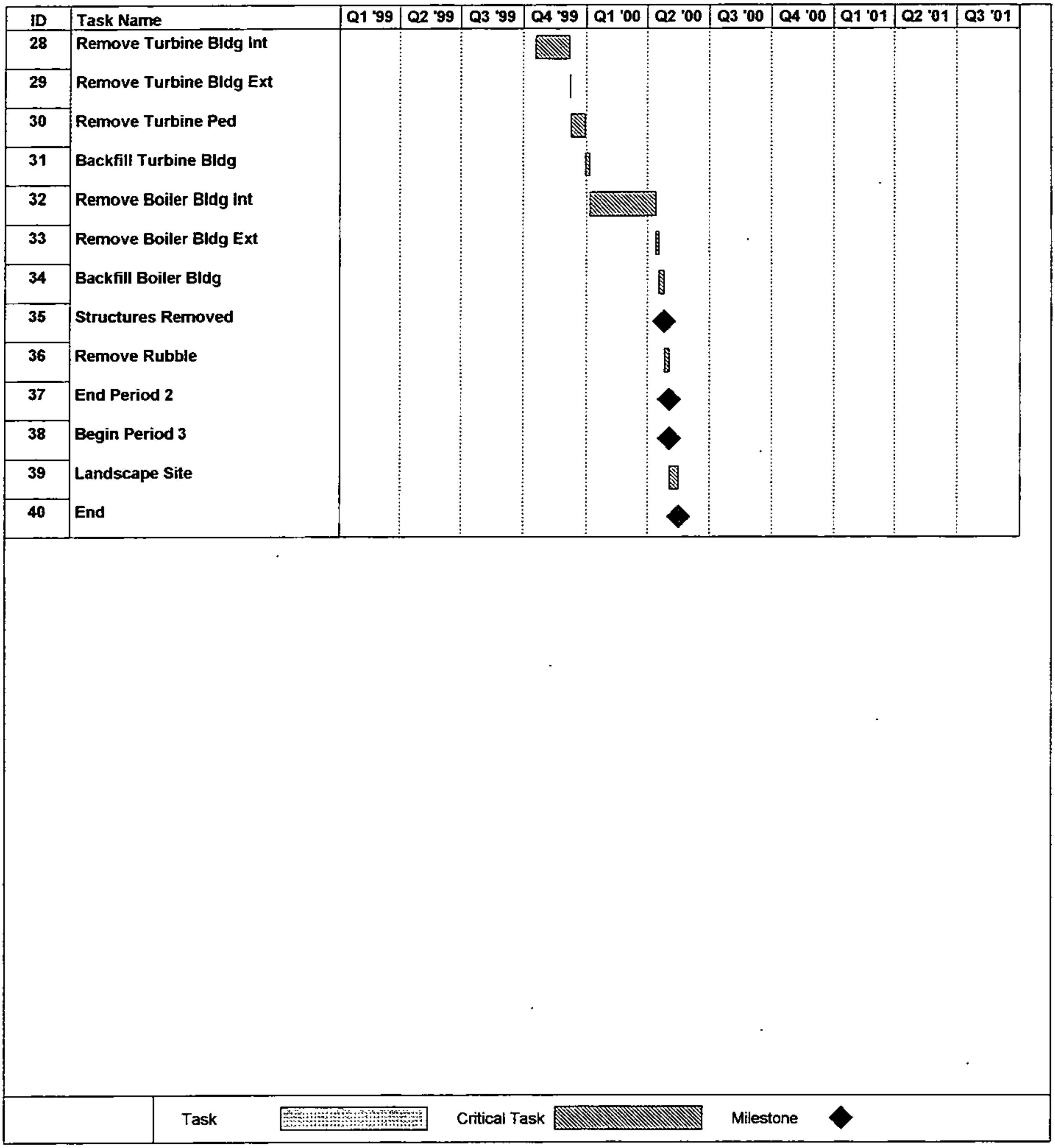
# FIGURE 4.4
# DELAWARE STATION
# DISMANTLING ACTIVITY SCHEDULE

| ID | Task Name |
|---|---|
| 1 | Plant Shutdown |
| 2 | Begin Period 1 |
| 3 | Planning |
| 4 | Preparation |
| 5 | Asbestos Removal |
| 6 | End Period 1 |
| 7 | Start Period 2 |
| 8 | Remove Misc Structures |
| 9 | Remove 7&8 Boiler B Sys |
| 10 | Set up 7&8 Boiler Scaffolding |
| 11 | Remove 7&8 Bottom Wtrwall |
| 12 | Remove 7&8 Top Wtrwall |
| 13 | Remove 7&8 Platens |
| 14 | Remove 2 Turbines |
| 15 | Remove 2 Condensers |
| 16 | Turbine Bldg A Sys |
| 17 | Turbine Bldg B Sys |
| 18 | Turbine Bldg C Sys |
| 19 | Boiler Bldg A Sys |
| 20 | Boiler Bldg B Sys |
| 21 | Boiler Bldg C Sys |
| 22 | Other Bldgs A sys |
| 23 | Other Bldg C sys |
| 24 | Systems Removed |
| 25 | Remove Service Bldg Int |
| 26 | Remove Office Bldg Ext |
| 27 | Backfill Office Bldg |

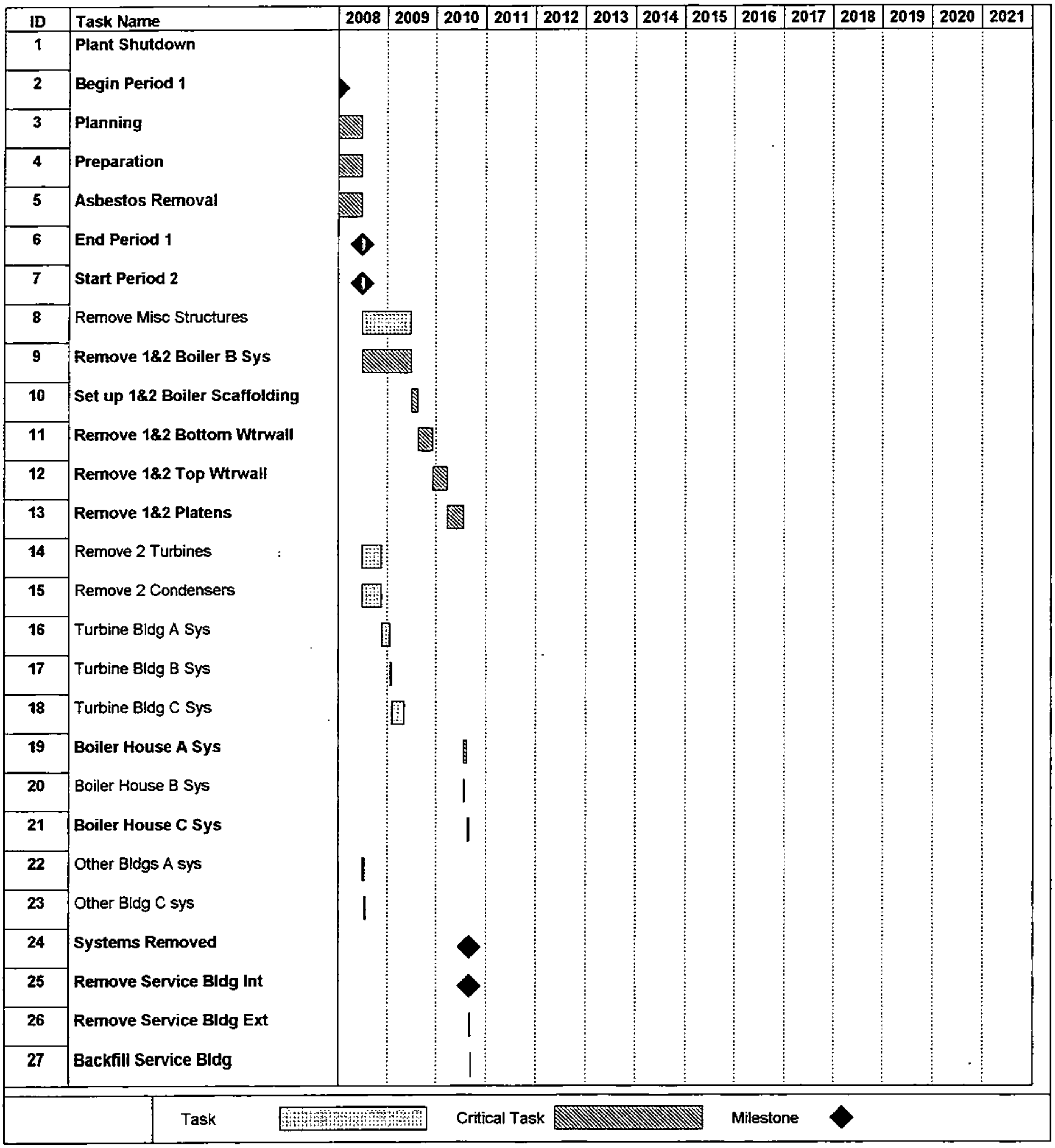



Task | Critical Task | Milestone

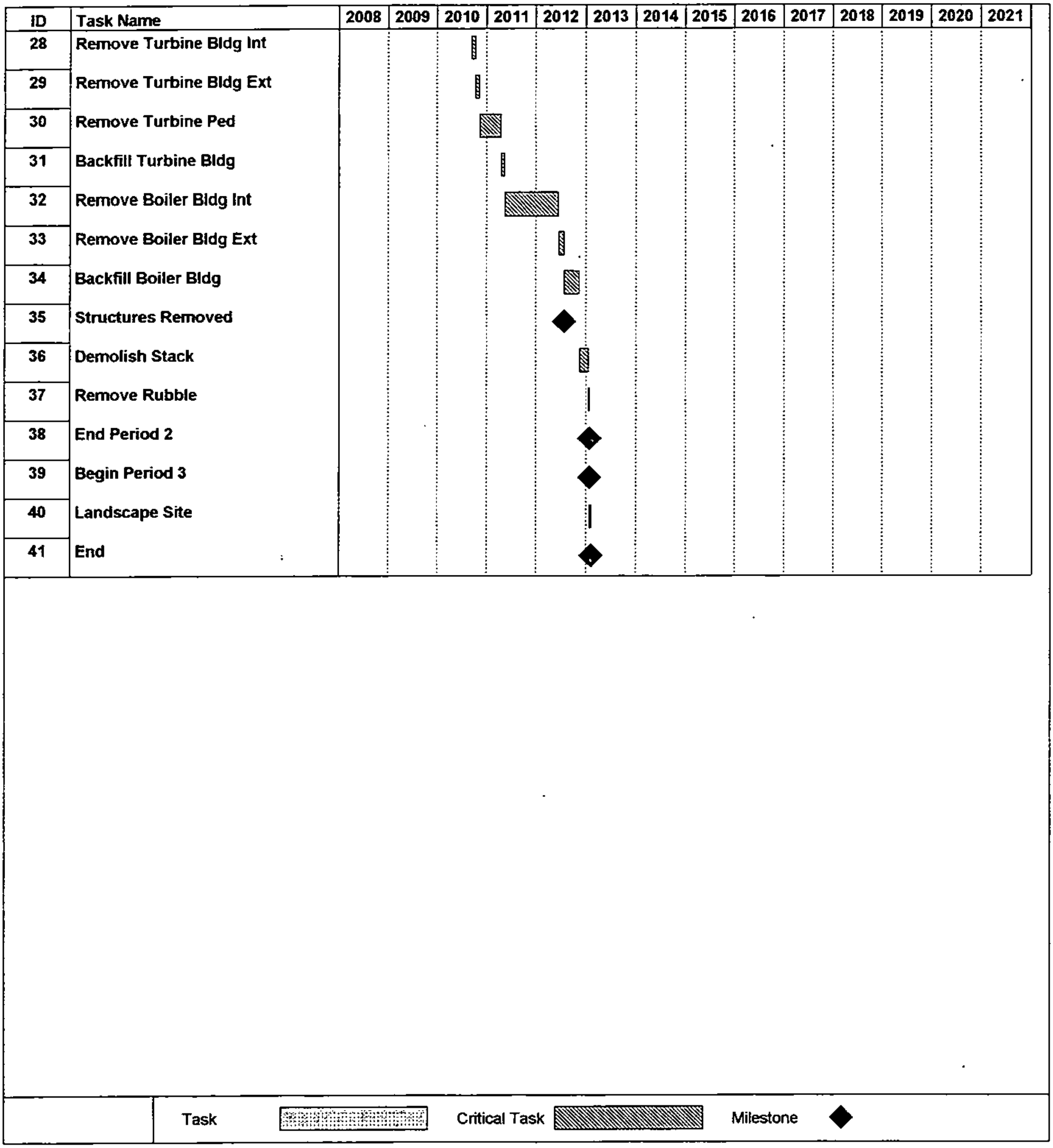
# FIGURE 4.4
# DELAWARE STATION
# DISMANTLING ACTIVITY SCHEDULE
# (continued)



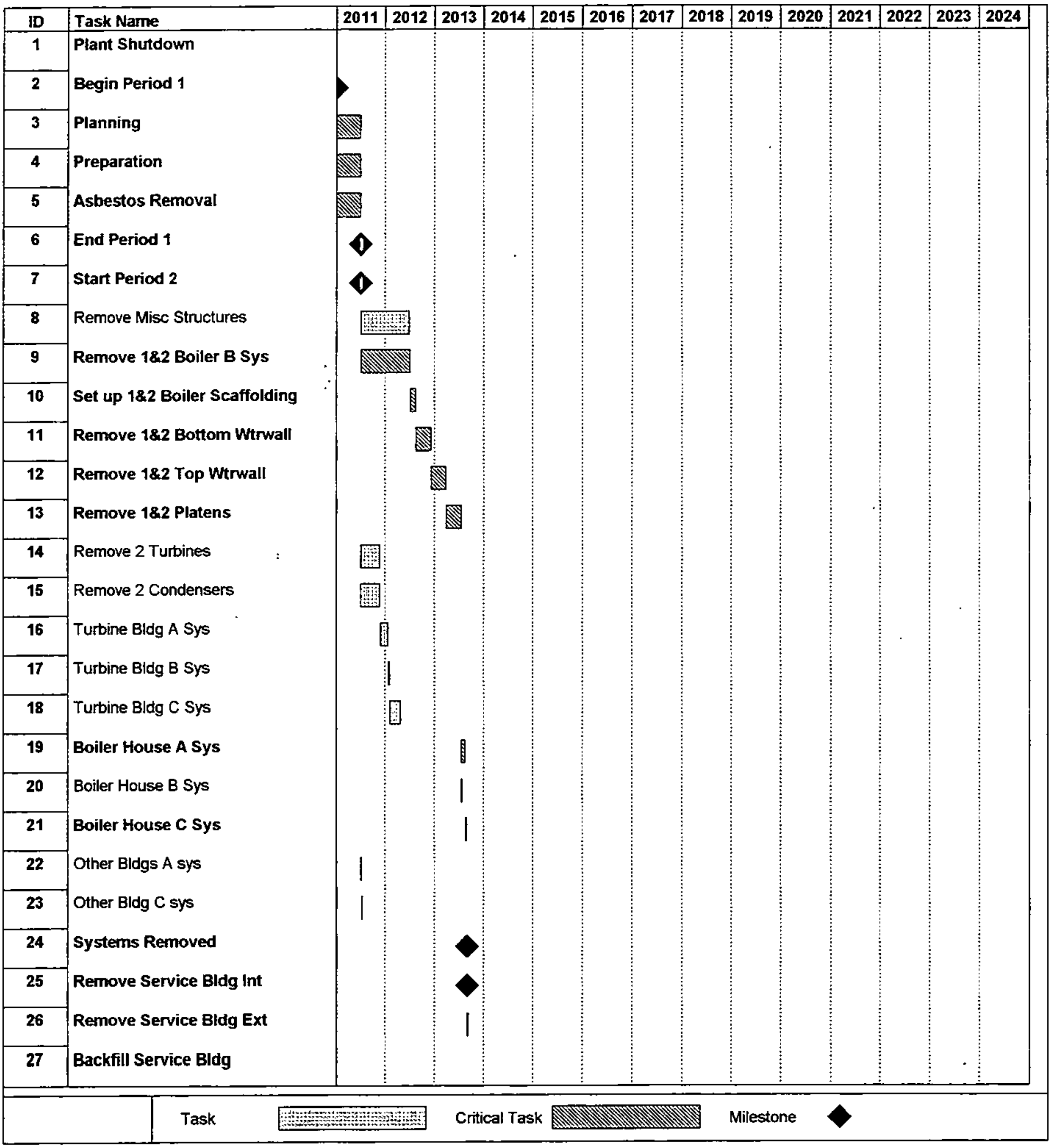
# FIGURE 4.5
# KEYSTONE STATION
# DISMANTLING ACTIVITY SCHEDULE



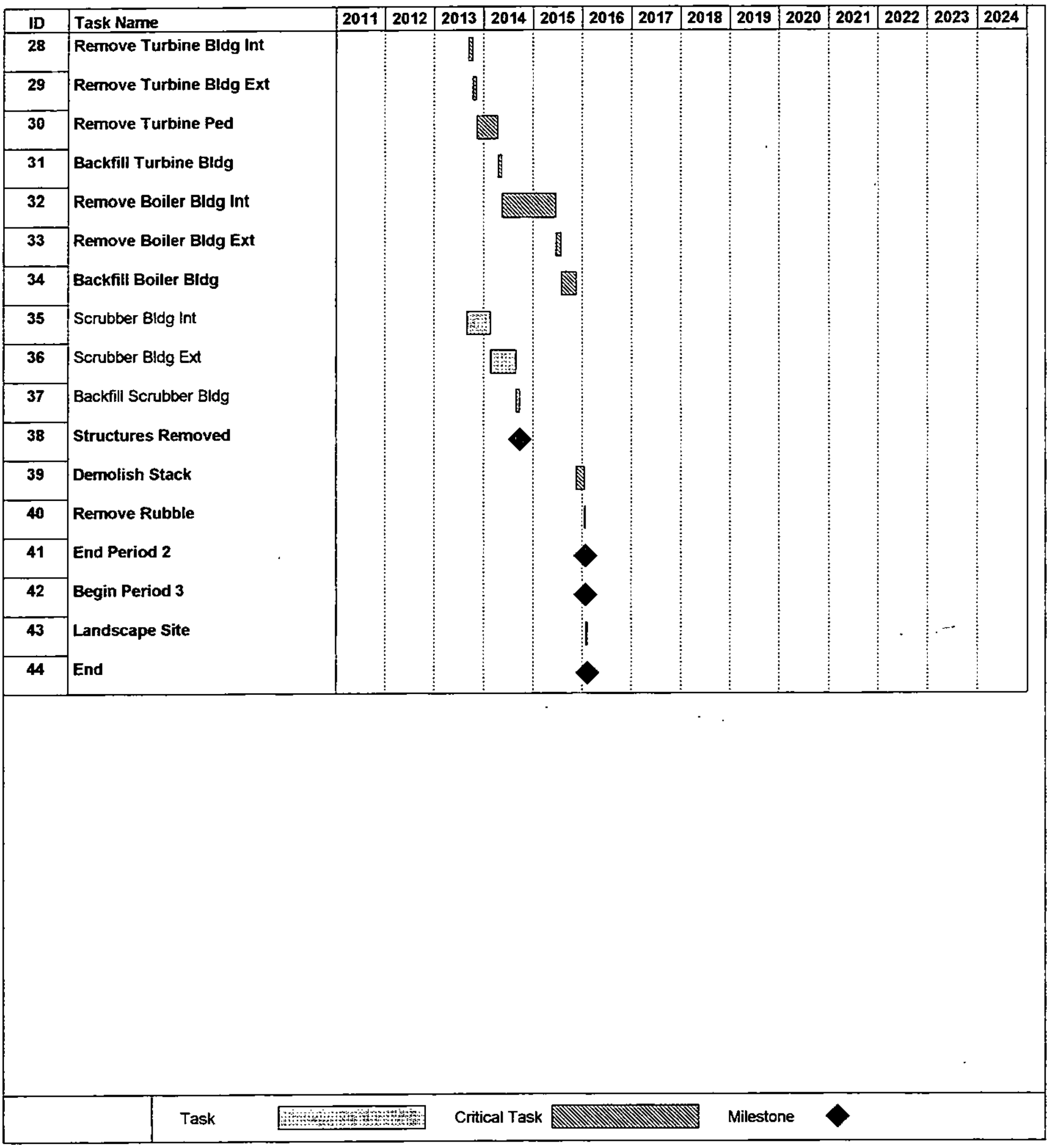
# FIGURE 4.5
# KEYSTONE STATION
# DISMANTLING ACTIVITY SCHEDULE
# (continued)



# FIGURE 4.6
# CONEMAUGH STATION
# DISMANTLING ACTIVITY SCHEDULE



# FIGURE 4.6
# CONEMAUGH STATION
# DISMANTLING ACTIVITY SCHEDULE
# (continued)



# 5.0 WASTE MANAGEMENT

Several types of hazardous and non-hazardous wastes are located on the plant site. These include asbestos insulation and non-PCB equipment oil. If additional hazardous wastes are discovered during dismantling operations or if environmental regulations change, then appropriate measures will then be taken by PECO and the Dismantling Contractor. Any residual oil obtained from the draining of plant equipment will be collected and removed for proper disposal by a waste hauler. Asbestos-containing insulation and building materials will be removed by qualified personnel and disposed of in a licensed landfill.

The non-hazardous wastes will be disposed of in a safe and reasonable manner. Non-asbestos calcium silicate insulation will be buried in the voids of the plant; it is of mineral composition and should not present an environmental hazard.

# 6.0 SCRAP VALUE

Dismantling is assumed to occur after a 40-50 year plant operating life. Process equipment is assumed to be worn, obsolete and suitable for scrap only. No equipment is assumed salvageable as used equipment.

The value of scrap was estimated from information on the current market value. In general, scrap materials were assumed to be removed from their installed location and placed on a loading dock or laydown area on site for a scrap dealer to remove.

The value of the scrap was estimated using an adjusted (for a non-prepared condition), market value of $100 per ton for carbon steel, $550 per ton for stainless steel and $1,200 per ton for copper. The estimated scrap amounts for each station are summarized in Table 6.1 below.

## TABLE 6.1

## ESTIMATED SCRAP QUANTITIES

| Station | Carbon Steel (tons) | Copper (tons) | Stainless Steel (tons) |
|---|---|---|---|
| Eddystone | 96,377 | 2,612 | 1,480 |
| Cromby | 25,726 | 947 | 746 |
| Schuylkill 1 | 11,338 | 322 | - |
| Delaware 7 & 8 | 21,008 | 709 | - |
| Keystone | 108,209 | 3,423 | - |
| Conemaugh | 114,081 | 3,566 | 6,612 |

# 7.0 RESULTS

Several fossil-fired electrical generating stations have been dismantled to date. The techniques, tools, and equipment necessary to remove the large components and remediate the hazardous and toxic materials found at these stations are available and have been successfully demonstrated.

The Dismantling Contractor, utility staff, and craft labor combine to represent the majority of the costs to dismantle the station. This is a direct result of the labor-intensive nature of the dismantling process. A breakdown of the major cost categories is provided in Tables 7.1 through 7.6. Detailed costs, by activity, are reported in Appendix C.

This study provides an estimate for dismantling under current requirements, based on present-day costs and available technology. As additional dismantling experience becomes available, cost estimates should be modified to reflect this experience.

## TABLE 7.1a
## EDDYSTONE STATION UNITS 1 AND 2
## SUMMARY OF ACTIVITY COSTS[1]
(Thousands of 1997 Dollars)

| Activity | Total Cost | Total Percent |
|---|---|---|
| Asbestos Removal | $2,571 | 6.8% |
| Systems Removal | $14,693 | 38.8% |
| Structures Demolition | $9,802 | 25.8% |
| Landscaping & Reclamation | Note 2 | - |
| Utility Staffing | $4,090 | 10.8% |
| Dismantling Contractor Staffing | $3,448 | 9.1% |
| Plant Energy | $230 | 0.6% |
| Tools & Equipment | $3,060 | 8.1% |
| **Total Dismantling Costs** | **$37,896** | **100.0%** |
| Scrap Credit | ( $6,931) | |
| **Total Project Cost** | **$30,965** | |

Note 1: Columns may not add due to rounding

Note 2: Costs assigned to Eddystone Units 3 and 4

**TABLE 7.1b**
**EDDYSTONE STATION UNITS 3 AND 4**
**SUMMARY OF ACTIVITY COSTS[1]**
(Thousands of 1997 Dollars)

| Activity | Total Cost | Percent |
|---|---|---|
| Asbestos Removal | - | - |
| Systems Removal | $13,794 | 44.7% |
| Structures Demolition | $7,282 | 23.7% |
| Landscaping & Reclamation | $317 | 1.0% |
| Utility Staffing | $3,515 | 11.4% |
| Dismantling Contractor Staffing | $2,969 | 9.6% |
| Plant Energy | $200 | 0.6% |
| Tools & Equipment | $2,763 | 9.0% |
| **Total Dismantling Costs** | **$30,842** | **100.0%** |
| Scrap Credit | ($6,655) | |
| **Total Project Cost** | **$24,186** | |

Note 1: Columns may not add due to rounding

**TABLE 7.2a**
**CROMBY STATION UNIT 1**
**SUMMARY OF ACTIVITY COSTS[1]**
(Thousands of 1997 Dollars)

| Activity | Total Cost | Total Percent |
|---|---|---|
| Asbestos Removal | Note 2 | - |
| Systems Removal | $2,545 | 22.1% |
| Structures Demolition | $2,082 | 18.0% |
| Landscaping & Reclamation | Note 2 | - |
| Utility Staffing | $2,409 | 20.9% |
| Dismantling Contractor Staffing | $1,994 | 17.3% |
| Plant Energy | $286 | 2.5% |
| Tools & Equipment | $2,212 | 19.2% |
| **Total Dismantling Costs** | **$11,527** | **100.0%** |
| Scrap Credit | ( $2,211) | |
| **Total Project Cost** | **$9,316** | |

Note 1: Columns may not add due to rounding

Note 2: Costs assigned to Cromby Unit 2

**TABLE 7.2b
CROMBY STATION UNIT 2
SUMMARY OF ACTIVITY COSTS[1]**
(Thousands of 1997 Dollars)

| Activity | Total Cost | Total Percent |
|---|---|---|
| Asbestos Removal | $1,079 | 6.5% |
| Systems Removal | $2,704 | 16.2% |
| Structures Demolition | $4,406 | 26.5% |
| Landscaping & Reclamation | $119 | 0.7% |
| Utility Staffing | $2,677 | 16.1% |
| Dismantling Contractor Staffing | $2,300 | 13.8% |
| Plant Energy | $329 | 2.0% |
| Tools & Equipment | $3,033 | 18.2% |
| **Total Dismantling Costs** | **$16,646** | **100.0%** |
| Scrap Credit | ( $1,908) | |
| **Total Project Cost** | **$14,738** | |

Note 1: Columns may not add due to rounding

**TABLE 7.3**
**SCHUYLKILL STATION UNIT 1**
**SUMMARY OF ACTIVITY COSTS**[1]
(Thousands of 1997 Dollars)

| Activity | Total Cost | Percent |
|---|---|---|
| Asbestos Removal | $619 | 5.5% |
| Systems Removal | $2,330 | 20.9% |
| Structures Demolition | $1,699 | 15.2% |
| Landscaping & Reclamation | $27 | 0.2% |
| Utility Staffing | $1,805 | 16.1% |
| Dismantling Contractor Staffing | $1,648 | 14.7% |
| Plant Energy | $473 | 4.2% |
| Tools & Equipment | $2,594 | 23.2% |
| **Total Dismantling Costs** | **$11,197** | **100.0%** |
| Scrap Credit | ( $1,520) | |
| **Total Project Cost** | **$9,677** | |

Note 1: Columns may not add due to rounding

**TABLE 7.4**
**DELAWARE STATION UNITS 7 AND 8**
**SUMMARY OF ACTIVITY COSTS[1]**
(Thousands of 1997 Dollars)

| Activity | Total Cost | Percent |
|---|---|---|
| Asbestos Removal | $1,153 | 7.2% |
| Systems Removal | $4,985 | 31.4% |
| Structures Demolition | $4,946 | 31.1% |
| Landscaping & Reclamation | $29 | 0.2% |
| Utility Staffing | $1,317 | 8.3% |
| Dismantling Contractor Staffing | $1,169 | 7.3% |
| Plant Energy | $126 | 0.8% |
| Tools & Equipment | $2,177 | 13.7% |
| **Total Dismantling Costs** | **$15,905** | **100.0%** |
| Scrap Credit | ( $2,952) | |
| **Total Project Cost** | **$12,953** | |

Note 1: Columns may not add due to rounding

**TABLE 7.5a**
**KEYSTONE STATION UNIT 1**
**SUMMARY OF ACTIVITY COSTS[1]**
(Thousands of 1997 Dollars)

| Activity | Total Cost | Percent |
|---|---|---|
| Asbestos Removal | Note 2 | - |
| Systems Removal | $12,317 | 24.7% |
| Structures Demolition | $13,818 | 27.8% |
| Landscaping & Reclamation | Note 2 | - |
| Utility Staffing | $10,578 | 21.2% |
| Dismantling Contractor Staffing | $7,421 | 14.9% |
| Plant Energy | $586 | 1.2% |
| Tools & Equipment | $5,060 | 10.2% |
| **Total Dismantling Costs** | **$49,778** | **100.0%** |
| Scrap Credit | ( $7,494) | |
| **Total Project Cost** | **$42,284** | |

Note 1: Columns may not add due to rounding

Note 2: Costs assigned to Keystone Unit 2

**TABLE 7.5b**
**KEYSTONE STATION UNIT 2**
**SUMMARY OF ACTIVITY COSTS[1]**
(Thousands of 1997 Dollars)

| Activity | Total Cost | Total Percent |
|---|---|---|
| Asbestos Removal | $5,391 | 7.8% |
| Systems Removal | $12,502 | 18.2% |
| Structures Demolition | $22,799 | 33.1% |
| Landscaping & Reclamation | $1,619 | 2.4% |
| Utility Staffing | $11,533 | 16.8% |
| Dismantling Contractor Staffing | $8,247 | 12.0% |
| Plant Energy | $664 | 1.0% |
| Tools & Equipment | $5,965 | 8.7% |
| **Total Dismantling Costs** | **$68,720** | **100.0%** |
| Scrap Credit | ( $7,434) | |
| **Total Project Cost** | **$61,286** | |

Note 1: Columns may not add due to rounding

**TABLE 7.6a**
**CONEMAUGH STATION UNIT 1**
**SUMMARY OF ACTIVITY COSTS[1]**
(Thousands of 1997 Dollars)

| Activity | Total Cost | Percent |
|---|---|---|
| Asbestos Removal | Note 2 | - |
| Systems Removal | $14,407 | 27.9% |
| Structures Demolition | $13,611 | 26.4% |
| Landscaping & Reclamation | Note 2 | - |
| Utility Staffing | $10,554 | 20.4% |
| Dismantling Contractor Staffing | $7,403 | 14.3% |
| Plant Energy | $584 | 1.1% |
| Tools & Equipment | $5,099 | 9.9% |
| **Total Dismantling Costs** | **$51,659** | **100.0%** |
| Scrap Credit | ( $9,519) | |
| **Total Project Cost** | **$42,140** | |

Note 1: Columns may not add due to rounding

Note 2: Costs assigned to Conemaugh Unit 2

**TABLE 7.6b**
**CONEMAUGH STATION UNIT 2**
**SUMMARY OF ACTIVITY COSTS[1]**
(Thousands of 1997 Dollars)

| Activity | Total Cost | Percent |
|---|---|---|
| Asbestos Removal | $6,761 | 9.8% |
| Systems Removal | $14,558 | 21.0% |
| Structures Demolition | $20,772 | 30.1% |
| Landscaping & Reclamation | $519 | 0.8% |
| Utility Staffing | $11,541 | 16.7% |
| Dismantling Contractor Staffing | $8,256 | 11.9% |
| Plant Energy | $664 | 1.0% |
| Tools & Equipment | $6,020 | 8.7% |
| **Total Dismantling Costs** | **$69,094** | **100.0%** |
| Scrap Credit | ( $9,805) | |
| **Total Project Cost** | **$59,288** | |

Note 1: Columns may not add due to rounding

## 8.0 REFERENCES

1. T.S. LaGuardia, et al, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

2. W.J. Manion and T.S. LaGuardia, "Decommissioning Handbook," U.S. Department of Energy, DOE/EV/10128-1, November 1980.

3. "Building Construction Cost Data, 1997," Robert Snow Means Company, Inc., Kingston, MA.

4. Cost Engineers Notebook: American Association of Cost Engineers, AA-4.000, p. 3 of 22, Rev. 2 (January 1978) (Updated periodically).

5. "Microsoft Project for Windows," Version 3.0, Microsoft Corporation, Redmond, WA, 1993.

# APPENDIX A

## SYSTEM DESIGNATIONS

## APPENDIX A

## SYSTEM DESIGNATIONS

In general, those systems classified as "B Systems" are those which are involved in the generation of steam at the plants, or which are connected to the boiler and would limit accessibility to it at the time of removal. Examples of such systems include:

Ash Disposal
Boiler
Boiler Feed System
Fly-ash Disposal
Main Steam
Combustion Air & Flue Gas

Those systems classified as "C Systems" are those which are essential in the dismantling effort prior to demolition of the buildings. These systems are the last to be removed from the plant.

Building Services (Elevators)
Electrical
Heating & Ventilating (HVAC)
Potable Water
Station Air
Fire System

Those systems which are not included in the above listings are generally classified as "A Systems". These systems are not essential to the overall dismantling effort and can be removed at any time in the dismantling period.

# APPENDIX B

## UNIT COST FACTOR DEVELOPMENT

## APPENDIX B

## UNIT COST FACTOR DEVELOPMENT

Example: Unit Factor for Removal of Heat Exchanger < 3,000 pounds

### 1. SCOPE

Heat exchangers weighing < 3,000 lb. will be removed in one piece using a crane or small hoist. They will be disconnected from the inlet and outlet piping. The heat exchanger will be sent to the laydown area.

### 2. CALCULATIONS

| Act ID | Activity Description | Activity Duration | Critical Duration |
|---|---|---|---|
| a | Remove insulation | 20 | (b) |
| b | Mount pipe cutters | 60 | 60 |
| c | Disconnect inlet and outlet lines | 60 | 60 |
| d | Rig for removal | 30 | 30 |
| e | Unbolt from mounts | 30 | 30 |
| f | Remove, send to packing area | 60 | 60 |
| | Totals (Activity/Critical) | 260 | 240 |

Duration adjustment(s):

| | |
|---|---|
| + Work break adjustment (8.33 % of productive duration) | 20 |
| Total work duration (minutes) | 260 |

***** Total duration = 4.333 hr *****

## 3. LABOR REQUIRED

| Crew | Number | Duration (hr) | Rate ($/hr) | Cost |
|---|---|---|---|---|
| Laborers | 3.0 | 4.333 | $23.89 | $310.55 |
| Craftsmen | 2.0 | 4.333 | $29.16 | $252.70 |
| Foreman | 1.0 | 4.333 | $35.65 | $154.47 |
| General Foreman | 0.25 | 4.333 | $37.18 | $ 40.28 |
| Fire Watch | 0.05 | 4.333 | $23.89 | $ 5.18 |
| Total labor cost | | | | $763.18 |

## 4. EQUIPMENT & CONSUMABLES COSTS

| | |
|---|---|
| Equipment Costs | none |
| Consumables/Materials Costs | |
| Gas torch consumables 1 @ $7.09/hr x 1 hr {1} | 7.09 |
| Subtotal cost of equipment and materials | 7.09 |
| Overhead & profit on equipment and materials @ 16.0% | 1.13 |
| Total costs, equipment & material | $8.22 |
| **TOTAL COST Removal of heat exchanger <3000 pound:** | **$771.40** |
| Total labor cost: | $763.18 |
| Total equipment/material costs: | $8.22 |
| Total craft labor man-hours required per unit: | 27.298 |

## 5. NOTES AND REFERENCES

1. Durations are shown in minutes. The integrated duration accounts for those activities that can be performed in conjunction with other activities, indicated by the alpha designator of the concurrent activity. This results in an overall decrease in the sequenced duration.

2. Work difficulty factors were developed in conjunction with the AIF program to standardize decommissioning cost studies and are delineated in the "Guidelines" study (Reference 2, Vol. 1, Chapter 5)

3. References:

1. R.S. Means (1997) Division 016 Section 420-6360, page 22

# APPENDIX C

# DETAILED COST TABLES

TABLE C-1
EDDYSTONE STATION UNITS 1 & 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 1** | | | | | | | | | | |
| 1. Review plant dwgs & specs. | | | | | | | | | | |
| 2. End product description | | | | | | | | | | |
| 3. Define major work sequence | | | | | | | | | | |
| 4. Perform SER and EA | | | | | | | | | | |
| 5. Perform Site-Specific Cost Study | | | | | | | | | | |
| **Activity Specifications** | | | | | | | | | | |
| 6.1 Plant & temporary facilities | | | | | | | | | | |
| 6.2 Plant systems | | | | | | | | | | |
| 6.3 Boiler removal | | | | | | | | | | |
| 6.4 Reinforced concrete | | | | | | | | | | |
| 6.5 Turbine & condenser | | | | | | | | | | |
| 6.6 Plant structures & buildings | | | | | | | | | | |
| 6.7 Waste management | | | | | | | | | | |
| 6.8 Facility & site closeout | | | | | | | | | | |
| 6. Total | | | | | | | | | | |
| **Planning & Site Preparations** | | | | | | | | | | |
| 7. Prepare dismantling sequence | | | | | | | | | | |
| 8. Plant prep. & temp. svces | | | 361 | 54 | 415 | | | | | |
| 9. Rigging/CCEs/tooling/etc. | | | 306 | 46 | 351 | | | | | |
| **Detailed Work Procedures** | | | | | | | | | | |
| 10.1 Plant systems | | | | | | | | | | |
| 10.2 Remaining buildings | | | | | | | | | | |
| 10.3 Boiler | | | | | | | | | | |
| 10.4 Facility closeout | | | | | | | | | | |
| 10.5 Reinforced concrete | | | | | | | | | | |
| 10.6 Turbine & condensers | | | | | | | | | | |
| 10. Total | | | | | | | | | | |

TABLE C-1
EDDYSTONE STATION UNITS 1 & 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Period 1 Additional Costs** | | | | | | | | | | |
| 11. Asbestos Remediation Project | 1868 | 189 | | 514 | 2571 | | | | | |
| Subtotal Period 1 Activity Costs | 1868 | 189 | 667 | 614 | 3338 | | | | | |
| **Period 1 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 41 | | | 6 | 47 | | | | | |
| Plant energy budget | | | 36 | 5 | 42 | | | | | |
| Subtotal Undistributed Costs Period 1 | 41 | | 36 | 12 | 89 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 464 | 70 | 534 | | | | | |
| Utility Staff Cost | | | 515 | 77 | 593 | | | | | |
| **TOTAL PERIOD 1 COST** | **1909** | **189** | **1682** | **773** | **4553** | | | | | |
| **PERIOD 2** | | | | | | | | | | |
| **Disposal of Plant Systems** | | | | | | | | | | |
| **Fuel Systems** | | | | | | | | | | |
| 12. Totals | 3934 | | | 590 | 4522 | 23907 | 1480 | 404 | 18 | 140532 |
| **Power Systems** | | | | | | | | | | |
| 13. Totals | 2663 | | | 400 | 3061 | 5520 | | 897 | 22 | 96070 |
| **Support Systems** | | | | | | | | | | |
| 14. Totals | 688 | | | 103 | 791 | 1195 | | 92 | 8 | 24402 |
| 15. Erect scaffolding for systems removal | 5128 | | | 769 | 5897 | 3901 | | | | 43143 |
| **Removal of Major Equipment** | | | | | | | | | | |
| 16. Main Turbine/Generator | 109 | | | 16 | 126 | 3246 | | | | 3831 |
| 17. Main Condensers | 257 | | | 39 | 296 | 912 | | | | 8705 |

TABLE C-1
EDDYSTONE STATION UNITS 1 & 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Demolition of Remaining Site Buildings** | | | | | | | | | | |
| 18.1 Administation Building | 408 | | | 61 | 470 | 125 | | | | 6986 |
| 18.2 Boiler Room - Unit 1 | 1535 | | | 230 | 1765 | 1836 | | | | 35552 |
| 18.3 Boiler Room - Unit 2 | 1582 | | | 237 | 1819 | 1949 | | | | 36908 |
| 18.4 Car Dumper | 12 | | | 2 | 14 | <1 | | | | 269 |
| 18.5 Crusher House - Unit 2 | 190 | | | 29 | 219 | 224 | | | | 4309 |
| 18.6 MgO, MgSO Silos | 1901 | | | 285 | 2186 | 28 | | | | 27130 |
| 18.7 Screen and Pump House | 314 | | | 47 | 361 | 111 | | | | 5313 |
| 18.8 Scrubber Building | 1053 | | | 158 | 1210 | 329 | | | | 25213 |
| 18.9 Stacks | 82 | | | 12 | 94 | | | | | 1969 |
| 18.10 Turbine Building | 958 | | | 144 | 1102 | 1096 | | | | 22727 |
| 18.11 Turbine Pedestal | 489 | | | 73 | 562 | | | | | 7890 |
| 18. Totals | 8524 | | | 1279 | 9802 | 5698 | | | | 174267 |
| Subtotal Period 2 Activity Costs | 21301 | | | 3195 | 24497 | 44379 | 1480 | 1399 | 52 | 490949 |
| **Period 2 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 1587 | | | 238 | 1825 | | | | | |
| Small tool allowance | 224 | | | 34 | 258 | | | | | |
| Pipe cutting equipment | 143 | | | 21 | 164 | | | | | |
| Plant energy budget | | | 163 | 24 | 188 | | | | | |
| Subtotal Undistributed Costs Period 2 | 1954 | | 163 | 317 | 2435 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 2525 | 379 | 2904 | | | | | |
| Utility Staff Cost | | | 3033 | 455 | 3488 | | | | | |
| **TOTAL PERIOD 2** | **23255** | | **5721** | **4346** | **33324** | **44379** | **1480** | **1399** | **52** | **490949** |
| **PERIOD 3** | | | | | | | | | | |
| **Site Closeout Activities** | | | | | | | | | | |
| 19. Grade & landscape site | | | | | | | | | | |

TABLE C-1
EDDYSTONE STATION UNITS 1 & 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 9 | 1 | 10 | | | | | |
| Utility Staff Cost | | | 8 | 1 | 9 | | | | | |
| **TOTAL PERIOD 3** | | | **17** | **2** | **19** | | | | | |
| **TOTAL COST TO DECOMMISSION** | **25164** | **189** | **7420** | **5121** | **37896** | **44379** | **1480** | **1399** | **52** | **490949** |

**TOTAL COST TO DECOMMISSION WITH 15.63% CONTINGENCY:** **$37,895,836**

**TOTAL SCRAP METAL REMOVED:**

| | | | |
|---|---|---|---|
| Carbon Steel | 44,379 | TONS |
| Stainless Steel | 1,480 | TONS |
| Copper | 1,399 | TONS |
| Total | 47,258 | TONS |

**SCRAP CREDIT:**

| | |
|---|---|
| Carbon Steel | $4,437,900 |
| Stainless Steel | $814,000 |
| Copper | $1,678,800 |
| Total | $6,930,700 |

**ADJUSTED COST TO DISMANTLE:** **$30,965,136**

**TOTAL CRAFT LABOR REQUIREMENTS:** **490,949 MAN-HRS**

TABLE C-2
EDDYSTONE STATION UNITS 3 & 4
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 1** | | | | | | | | | | |
| 1. Review plant dwgs & specs. | | | | | | | | | | |
| 2. End product description | | | | | | | | | | |
| 3. Define major work sequence | | | | | | | | | | |
| 4. Perform SER and EA | | | | | | | | | | |
| 5. Perform Site-Specific Cost Study | | | | | | | | | | |
| **Activity Specifications** | | | | | | | | | | |
| 6.1 Plant & temporary facilities | | | | | | | | | | |
| 6.2 Plant systems | | | | | | | | | | |
| 6.3 Boiler removal | | | | | | | | | | |
| 6.4 Reinforced concrete | | | | | | | | | | |
| 6.5 Turbine & condenser | | | | | | | | | | |
| 6.6 Plant structures & buildings | | | | | | | | | | |
| 6.7 Waste management | | | | | | | | | | |
| 6.8 Facility & site closeout | | | | | | | | | | |
| 6. Total | | | | | | | | | | |
| **Planning & Site Preparations** | | | | | | | | | | |
| 7. Prepare dismantling sequence | | | | | | | | | | |
| 8. Plant prep. & temp. svces | | | 361 | 54 | 415 | | | | | |
| 9. Rigging/CCEs/tooling/etc. | | | 306 | 46 | 351 | | | | | |
| **Detailed Work Procedures** | | | | | | | | | | |
| 10.1 Plant systems | | | | | | | | | | |
| 10.2 Remaining buildings | | | | | | | | | | |
| 10.3 Boiler | | | | | | | | | | |
| 10.4 Facility closeout | | | | | | | | | | |
| 10.5 Reinforced concrete | | | | | | | | | | |
| 10.6 Turbine & condensers | | | | | | | | | | |
| 10. Total | | | | | | | | | | |

TABLE C-2
EDDYSTONE STATION UNITS 3 & 4
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| Subtotal Period 1 Activity Costs | | | 667 | 100 | 767 | | | | | |
| **Period 1 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 41 | | | 6 | 47 | | | | | |
| Plant energy budget | | | 36 | 5 | 42 | | | | | |
| Subtotal Undistributed Costs Period 1 | 41 | | 36 | 12 | 89 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 464 | 70 | 534 | | | | | |
| Utility Staff Cost | | | 515 | 77 | 593 | | | | | |
| **TOTAL PERIOD 1 COST** | **41** | | **1682** | **258** | **1982** | | | | | |
| **PERIOD 2** | | | | | | | | | | |
| **Disposal of Plant Systems** | | | | | | | | | | |
| **Fuel Systems** | | | | | | | | | | |
| 11. Totals | 4076 | | | 611 | 4688 | 28907 | | 44 | | 145548 |
| **Power Systems** | | | | | | | | | | |
| 12. Totals | 3582 | | | 537 | 4117 | 7058 | | 1065 | 30 | 129398 |
| **Support Systems** | | | | | | | | | | |
| 13. Totals | 902 | | | 134 | 1038 | 1436 | | 99 | 11 | 32117 |
| 14. Erect scaffolding for systems removal | 3058 | | | 459 | 3516 | 2326 | | | | 25725 |

TABLE C-2
EDDYSTONE STATION UNITS 3 & 4
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Removal of Major Equipment** | | | | | | | | | | |
| 15. Main Turbine/Generator | 130 | | | 20 | 150 | 3873 | | | | 4571 |
| 16. Main Condensers | 248 | | | 37 | 285 | 877 | | | | 8373 |
| **Demolition of Remaining Site Buildings** | | | | | | | | | | |
| 17.1 Boiler Area | 2616 | | | 392 | 3008 | 4290 | | | | 66992 |
| 17.2 Miscellaneous Structures | 267 | | | 40 | 307 | 281 | | | | 6925 |
| 17.3 Miscellaneous Yard | 1277 | | | 192 | 1468 | 916 | | | | 17574 |
| 17.4 Screen Facility | 580 | | | 87 | 667 | 135 | | | | 10107 |
| 17.5 Service and Aux Boiler Building | 208 | | | 31 | 239 | 141 | | | | 4751 |
| 17.6 Stack | 41 | | | 6 | 47 | | | | | 980 |
| 17.7 Turbine Building | 1099 | | | 165 | 1264 | 1757 | | | | 26851 |
| 17.8 Turbine Pedestal | 244 | | | 37 | 281 | | | | | 3947 |
| 17. Totals | 6333 | | | 950 | 7282 | 7518 | | | | 138127 |
| Subtotal Period 2 Activity Costs | 18330 | | | 2750 | 21078 | 51998 | | 1213 | 46 | 483858 |
| **Period 2 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 1331 | | | 200 | 1531 | | | | | |
| Small tool allowance | 222 | | | 34 | 255 | | | | | |
| Pipe cutting equipment | 143 | | | 21 | 164 | | | | | |
| Plant energy budget | | | 137 | 20 | 158 | | | | | |
| Subtotal Undistributed Costs Period 2 | 1696 | | 137 | 275 | 2108 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 2109 | 316 | 2425 | | | | | |
| Utility Staff Cost | | | 2533 | 380 | 2913 | | | | | |
| **TOTAL PERIOD 2** | **20026** | | **4779** | **3721** | **28524** | **51998** | | **1213** | **46** | **483858** |
| **PERIOD 3** | | | | | | | | | | |
| **Site Closeout Activities** | | | | | | | | | | |
| 18. Grade & landscape site | 276 | | | 41 | 317 | | | | | 4332 |

TABLE C-2
EDDYSTONE STATION UNITS 3 & 4
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 9 | 1 | 10 | | | | | |
| Utility Staff Cost | | | 8 | 1 | 9 | | | | | |
| **TOTAL PERIOD 3** | 276 | | 18 | 43 | 336 | | | | | 4332 |
| **TOTAL COST TO DECOMMISSION** | 20342 | | 6477 | 4023 | 30842 | 51998 | | 1213 | 46 | 488188 |

| | | | |
|---|---|---|---|
| **TOTAL COST TO DECOMMISSION WITH 15% CONTINGENCY:** | | $30,841,624 | |
| **TOTAL SCRAP METAL REMOVED:** | Carbon Steel | 51,998 | TONS |
| | Copper | 1,213 | TONS |
| | Total | 53,211 | TONS |
| **SCRAP CREDIT:** | Carbon Steel | $5,199,800 | |
| | Copper | $1,455,600 | |
| | Total | $6,655,400 | |
| **ADJUSTED COST TO DISMANTLE:** | | $24,186,224 | |
| **TOTAL CRAFT LABOR REQUIREMENTS:** | | 488,188 | MAN-HRS |

TABLE C-3
CROMBY STATION UNIT 1
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 1** | | | | | | | | | | |
| **Period 1 cost assigned to Cromby Unit 2.** | | | | | | | | | | |
| **PERIOD 2** | | | | | | | | | | |
| **Disposal of Plant Systems** | | | | | | | | | | |
| **Fuel Systems** | | | | | | | | | | |
| 1. Totals | 971 | | | 146 | 1117 | 6523 | 746 | 225 | 3 | 34307 |
| **Power Systems** | | | | | | | | | | |
| 2. Totals | 489 | | | 75 | 563 | 1063 | | 331 | | 17565 |
| **Support Systems** | | | | | | | | | | |
| 3. Totals | 74 | | | 11 | 84 | 137 | | 3 | | 2615 |
| 4. Erect scaffolding for systems removal | 589 | | | 88 | 677 | 448 | | | | 4955 |
| **Removal of Major Equipment** | | | | | | | | | | |
| 5. Main Turbine/Generator | 29 | | | 4 | 33 | 907 | | | | 1013 |
| 6. Main Condensers | 62 | | | 9 | 71 | 438 | | | | 2089 |
| **Demolition of Remaining Site Buildings** | | | | | | | | | | |
| 7.1 Boiler and Turbine Building | 975 | | | 146 | 1122 | 1342 | | | | 25778 |
| 7.2 Car Dumper | 12 | | | 2 | 14 | <1 | | | | 269 |
| 7.3 Crusher Building | 122 | | | 18 | 141 | 62 | | | | 2280 |
| 7.4 Intake Structure | 221 | | | 33 | 255 | 22 | | | | 3403 |
| 7.5 Scrubber Area | 288 | | | 43 | 332 | 324 | | | | 8295 |
| 7.6 Stack | 70 | | | 10 | 80 | | | | | 1667 |
| 7.7 Turbine Pedestal | 121 | | | 18 | 140 | | | | | 1970 |
| 7. Totals | 1810 | | | 272 | 2082 | 1750 | | | | 43662 |
| Subtotal Period 2 Activity Costs | 4023 | | | 603 | 4626 | 11266 | 746 | 562 | 9 | 106205 |

TABLE C-3
CROMBY STATION UNIT 1
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Period 2 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 1732 | | | 260 | 1993 | | | | | |
| Small tool allowance | 48 | | | 7 | 55 | | | | | |
| Pipe cutting equipment | 143 | | | 21 | 164 | | | | | |
| Plant energy budget | | | 249 | 37 | 286 | | | | | |
| Subtotal Undistributed Costs Period 2 | 1923 | | 249 | 325 | 2498 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 1724 | 259 | 1983 | | | | | |
| Utility Staff Cost | | | 2087 | 313 | 2400 | | | | | |
| TOTAL PERIOD 2 | 5946 | | 4060 | 1500 | 11507 | 11266 | 746 | 562 | 9 | 106205 |
| PERIOD 3 | | | | | | | | | | |
| **Site Closeout Activities** | | | | | | | | | | |
| 8. Grade & landscape site | | | | | | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 10 | 1 | 11 | | | | | |
| Utility Staff Cost | | | 8 | 1 | 9 | | | | | |
| TOTAL PERIOD 3 | | | 19 | 2 | 20 | | | | | |
| TOTAL COST TO DECOMMISSION | 5947 | | 4077 | 1504 | 11527 | 11266 | 746 | 562 | 10 | 106206 |

| | | | |
|---|---|---|---|
| TOTAL COST TO DECOMMISSION WITH 15% CONTINGENCY: | | $11,527,385 | |
| TOTAL SCRAP METAL REMOVED: | Carbon Steel | 11,266 | TONS |
| | Stainless Steel | 746 | TONS |
| | Copper | 562 | TONS |
| | Total | 12,574 | TONS |
| SCRAP CREDIT: | Carbon Steel | $1,126,600 | |
| | Stainless Steel | $410,300 | |
| | Copper | $674,400 | |
| | Total | $2,211,300 | |
| ADJUSTED COST TO DISMANTLE: | | $9,316,085 | |
| TOTAL CRAFT LABOR REQUIREMENTS: | | 106,206 | MAN-HRS |

TABLE C-4
CROMBY STATION UNIT 2
DISMANTLING COST ESTIMATE

| Activity | Remove (*$000's*) | Bury (*$000's*) | Other (*$000's*) | Cntgcy (*$000's*) | Total (*$000's*) | Carbon Steel (*Tons*) | Stainless Steel (*Tons*) | Copper (*Tons*) | Other (*Tons*) | Craft Labor (*Man-Hrs*) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 1** | | | | | | | | | | |
| 1. Review plant dwgs & specs. | | | | | | | | | | |
| 2. End product description | | | | | | | | | | |
| 3. Define major work sequence | | | | | | | | | | |
| 4. Perform SER and EA | | | | | | | | | | |
| 5. Perform Site-Specific Cost Study | | | | | | | | | | |
| **Activity Specifications** | | | | | | | | | | |
| 6.1 *Plant & temporary facilities* | | | | | | | | | | |
| 6.2 Plant systems | | | | | | | | | | |
| 6.3 Boiler removal | | | | | | | | | | |
| 6.4 Reinforced concrete | | | | | | | | | | |
| 6.5 *Turbine & condenser* | | | | | | | | | | |
| 6.6 Plant structures & buildings | | | | | | | | | | |
| 6.7 Waste management | | | | | | | | | | |
| 6.8 Facility & site closeout | | | | | | | | | | |
| 6. Total | | | | | | | | | | |
| **Planning & Site Preparations** | | | | | | | | | | |
| 7. Prepare dismantling sequence | | | | | | | | | | |
| 8. Plant prep. & temp. svces | | | 361 | 54 | 415 | | | | | |
| 9. Rigging/CCEs/tooling/etc. | | | 306 | 46 | 351 | | | | | |
| **Detailed Work Procedures** | | | | | | | | | | |
| 10.1 Plant systems | | | | | | | | | | |
| 10.2 Remaining buildings | | | | | | | | | | |
| 10.3 Boiler | | | | | | | | | | |
| 10.4 Facility closeout | | | | | | | | | | |
| 10.5 Reinforced concrete | | | | | | | | | | |
| 10.6 Turbine & condensers | | | | | | | | | | |
| 10. Total | | | | | | | | | | |

**TABLE C-4**
**CROMBY STATION UNIT 2**
**DISMANTLING COST ESTIMATE**

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Period 1 Additional Costs** | | | | | | | | | | |
| 11. Asbestos Remediation Project | 777 | 86 | | 216 | 1079 | | | | | |
| Subtotal Period 1 Activity Costs | 777 | 86 | 667 | 316 | 1845 | | | | | |
| **Period 1 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 31 | | | 5 | 36 | | | | | |
| Plant energy budget | | | 37 | 6 | 43 | | | | | |
| Subtotal Undistributed Costs Period 1 | 31 | | 37 | 10 | 79 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 266 | 40 | 306 | | | | | |
| Utility Staff Cost | | | 233 | 35 | 268 | | | | | |
| **TOTAL PERIOD 1 COST** | **808** | **86** | **1203** | **401** | **2498** | | | | | |
| **PERIOD 2** | | | | | | | | | | |
| **Disposal of Plant Systems** | | | | | | | | | | |
| **Fuel Systems** | | | | | | | | | | |
| 12. Totals | 923 | | | 139 | 1062 | 8917 | | 19 | 2 | 32552 |
| **Power Systems** | | | | | | | | | | |
| 13. Totals | 648 | | | 98 | 747 | 1294 | | 361 | 2 | 23295 |
| **Support Systems** | | | | | | | | | | |
| 14. Totals | 94 | | | 13 | 110 | 180 | | 3 | 0 | 3409 |
| 15. Erect scaffolding for systems removal | 589 | | | 88 | 677 | 448 | | | | 4955 |

TABLE C-4
CROMBY STATION UNIT 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Removal of Major Equipment** | | | | | | | | | | |
| 16. Main Turbine/Generator | 32 | | | 5 | 37 | 1013 | | | | 1131 |
| 17. Main Condensers | 62 | | | 9 | 71 | 438 | | | | 2089 |
| **Demolition of Remaining Site Buildings** | | | | | | | | | | |
| 18.1 Boiler and Turbine Building | 1184 | | | 178 | 1361 | 1838 | | | | 31730 |
| 18.2 Intake Structure | 230 | | | 35 | 265 | 43 | | | | 3655 |
| 18.3 Miscelaneous Yard | 307 | | | 46 | 353 | 87 | | | | 5418 |
| 18.4 Miscellaneous Structures | 141 | | | 21 | 162 | 117 | | | | 3602 |
| 18.5 Office Building | 529 | | | 79 | 608 | 66 | | | | 8063 |
| 18.6 Stack | 70 | | | 10 | 80 | | | | | 1667 |
| 18.7 Storage Silos | 1250 | | | 188 | 1438 | 19 | | | | 14405 |
| 18.8 Turbine Pedestal | 121 | | | 18 | 140 | | | | | 1970 |
| 18. Totals | 3832 | | | 575 | 4406 | 2170 | | | | 70510 |
| Subtotal Period 2 Activity Costs | 6182 | | | 927 | 7108 | 14460 | | 385 | 8 | 137940 |
| **Period 2 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 1732 | | | 260 | 1993 | | | | | |
| Small tool allowance | 63 | | | 9 | 74 | | | | | |
| Pipe cutting equipment | 143 | | | 21 | 164 | | | | | |
| Plant energy budget | | | 249 | 37 | 286 | | | | | |
| Subtotal Undistributed Costs Period 2 | 1938 | | 249 | 327 | 2517 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 1724 | 259 | 1983 | | | | | |
| Utility Staff Cost | | | 2087 | 313 | 2400 | | | | | |
| **TOTAL PERIOD 2** | 8120 | | 4060 | 1826 | 14008 | 14460 | | 385 | 8 | 137940 |
| **PERIOD 3** | | | | | | | | | | |
| **Site Closeout Activities** | | | | | | | | | | |
| 19. Grade & landscape site | 104 | | | 16 | 119 | | | | | 1773 |

TABLE C-4
CROMBY STATION UNIT 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 10 | 1 | 11 | | | | | |
| Utility Staff Cost | | | 8 | 1 | 9 | | | | | |
| TOTAL PERIOD 3 | 104 | | 18 | 18 | 139 | | | | | 1773 |
| TOTAL COST TO DECOMMISSION | 9032 | 86 | 5281 | 2246 | 16646 | 14460 | | 385 | | 139713 |

| | | | |
|---|---|---|---|
| TOTAL COST TO DECOMMISSION WITH 15.6% CONTINGENCY: | | $16,645,543 | |
| TOTAL SCRAP METAL REMOVED: | Carbon Steel | 14,460 | TONS |
| | Copper | 385 | TONS |
| | Total | 14,845 | TONS |
| SCRAP CREDIT: | Carbon Steel | $1,446,000 | |
| | Copper | $462,000 | |
| | Total | $1,908,000 | |
| ADJUSTED COST TO DISMANTLE: | | $14,737,543 | |
| TOTAL CRAFT LABOR REQUIREMENTS: | | 139,714 | MAN-HRS |

TABLE C-5
SCHUYLKILL STATION UNIT 1
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 1** | | | | | | | | | | |
| 1. Review plant dwgs & specs. | | | | | | | | | | |
| 2. End product description | | | | | | | | | | |
| 3. Define major work sequence | | | | | | | | | | |
| 4. Perform SER and EA | | | | | | | | | | |
| 5. Perform Site-Specific Cost Study | | | | | | | | | | |
| **Activity Specifications** | | | | | | | | | | |
| 6.1 Plant & temporary facilities | | | | | | | | | | |
| 6.2 Plant systems | | | | | | | | | | |
| 6.3 Boiler removal | | | | | | | | | | |
| 6.4 Reinforced concrete | | | | | | | | | | |
| 6.5 Turbine & condenser | | | | | | | | | | |
| 6.6 Plant structures & buildings | | | | | | | | | | |
| 6.7 Waste management | | | | | | | | | | |
| 6.8 Facility & site closeout | | | | | | | | | | |
| 6. Total | | | | | | | | | | |
| **Planning & Site Preparations** | | | | | | | | | | |
| 7. Prepare dismantling sequence | | | | | | | | | | |
| 8. Plant prep. & temp. svces | | | 361 | 54 | 415 | | | | | |
| 9. Rigging/CCEs/tooling/etc. | | | 306 | 46 | 351 | | | | | |
| **Detailed Work Procedures** | | | | | | | | | | |
| 10.1 Plant systems | | | | | | | | | | |
| 10.2 Remaining buildings | | | | | | | | | | |
| 10.3 Boiler | | | | | | | | | | |
| 10.4 Facility closeout | | | | | | | | | | |
| 10.5 Reinforced concrete | | | | | | | | | | |
| 10.6 Turbine & condensers | | | | | | | | | | |
| 10. Total | | | | | | | | | | |
| **Period 1 Additional Costs** | | | | | | | | | | |
| 11. Asbestos Remediation Project | 446 | 49 | | 124 | 619 | | | | | |
| Subtotal Period 1 Activity Costs | 446 | 49 | 667 | 224 | 1385 | | | | | |

TABLE C-5
SCHUYLKILL STATION UNIT 1
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Period 1 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 31 | | | 5 | 36 | | | | | |
| Plant energy budget | | | 64 | 10 | 74 | | | | | |
| Subtotal Undistributed Costs Period 1 | 31 | | 64 | 14 | 110 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 239 | 36 | 275 | | | | | |
| Utility Staff Cost | | | 200 | 30 | 230 | | | | | |
| **TOTAL PERIOD 1 COST** | **477** | **49** | **1170** | **304** | **2001** | | | | | |
| **PERIOD 2** | | | | | | | | | | |
| **Disposal of Plant Systems** | | | | | | | | | | |
| **Fuel Systems** | | | | | | | | | | |
| 12. Totals | 651 | | | 98 | 748 | 6292 | | 12 | | 22942 |
| **Power Systems** | | | | | | | | | | |
| 13. Totals | 532 | | | 79 | 611 | 1013 | | 306 | | 19025 |
| **Support Systems** | | | | | | | | | | |
| 14. Totals | 80 | | | 12 | 92 | 153 | | 3 | | 2890 |
| 15. Erect scaffolding for systems removal | 664 | | | 100 | 763 | 505 | | | | 5585 |
| **Removal of Major Equipment** | | | | | | | | | | |
| 16. Main Turbine/Generator | 18 | | | 3 | 21 | 610 | | | | 635 |
| 17. Main Condensers | 83 | | | 12 | 95 | 586 | | | | 2799 |

TABLE C-5
SCHUYLKILL STATION UNIT 1
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Demolition of Remaining Site Buildings** | | | | | | | | | | |
| 18.1 Boiler Area | 924 | | | 139 | 1062 | 1334 | | | | 22637 |
| 18.2 Turbine Area | 432 | | | 65 | 497 | 844 | | | | 10649 |
| 18.3 Turbine Pedestal | 121 | | | 18 | 140 | | | | | 1970 |
| 18. Totals | 1477 | | | 222 | 1699 | 2179 | | | | 35256 |
| Subtotal Period 2 Activity Costs | 3505 | | | 526 | 4030 | 11338 | | 322 | 5 | 89132 |
| **Period 2 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 1375 | | | 206 | 1582 | | | | | |
| Small tool allowance | 41 | | | 6 | 47 | | | | | |
| Pipe cutting equipment | 143 | | | 21 | 164 | | | | | |
| Plant energy budget | | | 346 | 52 | 399 | | | | | |
| Subtotal Undistributed Costs Period 2 | 1559 | | 346 | 285 | 2192 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 1184 | 178 | 1362 | | | | | |
| Utility Staff Cost | | | 1362 | 204 | 1566 | | | | | |
| **TOTAL PERIOD 2** | **5064** | | **2892** | **1193** | **9150** | **11338** | | **322** | **5** | **89132** |
| **PERIOD 3** | | | | | | | | | | |
| **Site Closeout Activities** | | | | | | | | | | |
| 19. Grade & landscape site | 23 | | | 4 | 27 | | | | | 134 |

TABLE C-5
SCHUYLKILL STATION UNIT 1
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 10 | 1 | 11 | | | | | |
| Utility Staff Cost | | | 8 | 1 | 9 | | | | | |
| TOTAL PERIOD 3 | 23 | | 18 | 6 | 47 | | | | | 134 |
| TOTAL COST TO DECOMMISSION | 5564 | 49 | 4080 | 1504 | 11197 | 11338 | | 322 | 5 | 89265 |

| | | | |
|---|---|---|---|
| TOTAL COST TO DECOMMISSION WITH 15.51% CONTINGENCY: | | $11,197,207 | |
| TOTAL SCRAP METAL REMOVED: | Carbon Steel | 11,338 | TONS |
| | Copper | 322 | TONS |
| | Total | 11,660 | TONS |
| SCRAP CREDIT: | Carbon Steel | $1,133,800 | |
| | Copper | $386,400 | |
| | Total | $1,520,200 | |
| ADJUSTED COST TO DISMANTLE: | | $9,677,007 | |
| TOTAL CRAFT LABOR REQUIREMENTS: | | 89,265 | MAN-HRS |

TABLE C-6
DELAWARE STATION UNITS 7 & 8
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 1** | | | | | | | | | | |
| 1. Review plant dwgs & specs. | | | | | | | | | | |
| 2. End product description | | | | | | | | | | |
| 3. Define major work sequence | | | | | | | | | | |
| 4. Perform SER and EA | | | | | | | | | | |
| 5. Perform Site-Specific Cost Study | | | | | | | | | | |
| **Activity Specifications** | | | | | | | | | | |
| 6.1 Plant & temporary facilities | | | | | | | | | | |
| 6.2 Plant systems | | | | | | | | | | |
| 6.3 Boiler removal | | | | | | | | | | |
| 6.4 Reinforced concrete | | | | | | | | | | |
| 6.5 Turbine & condenser | | | | | | | | | | |
| 6.6 Plant structures & buildings | | | | | | | | | | |
| 6.7 Waste management | | | | | | | | | | |
| 6.8 Facility & site closeout | | | | | | | | | | |
| 6. Total | | | | | | | | | | |
| **Planning & Site Preparations** | | | | | | | | | | |
| 7. Prepare dismantling sequence | | | | | | | | | | |
| 8. Plant prep. & temp. svces | | | 361 | 54 | 415 | | | | | |
| 9. Rigging/CCEs/tooling/etc. | | | 306 | 46 | 351 | | | | | |
| **Detailed Work Procedures** | | | | | | | | | | |
| 10.1 Plant systems | | | | | | | | | | |
| 10.2 Remaining buildings | | | | | | | | | | |
| 10.3 Boiler | | | | | | | | | | |
| 10.4 Facility closeout | | | | | | | | | | |
| 10.5 Reinforced concrete | | | | | | | | | | |
| 10.6 Turbine & condensers | | | | | | | | | | |
| 10. Total | | | | | | | | | | |
| **Period 1 Additional Costs** | | | | | | | | | | |
| 11. Asbestos Remediation Project | 830 | 92 | | 231 | 1153 | | | | | |
| Subtotal Period 1 Activity Costs | 830 | 92 | 667 | 330 | 1919 | | | | | |

TABLE C-6
DELAWARE STATION UNITS 7 & 8
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Period 1 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 31 | | | 5 | 36 | | | | | |
| Plant energy budget | | | 24 | 4 | 28 | | | | | |
| Subtotal Undistributed Costs Period 1 | 31 | | 24 | 8 | 63 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 231 | 35 | 265 | | | | | |
| Utility Staff Cost | | | 200 | 30 | 230 | | | | | |
| **TOTAL PERIOD 1 COST** | 861 | 92 | 1122 | 403 | 2478 | | | | | |
| **PERIOD 2** | | | | | | | | | | |
| **Disposal of Plant Systems** | | | | | | | | | | |
| **Fuel Systems** | | | | | | | | | | |
| 12. Totals | 1564 | | | 233 | 1798 | 12631 | | 30 | 4 | 55084 |
| **Power Systems** | | | | | | | | | | |
| 13. Totals | 913 | | | 137 | 1048 | 2170 | | 667 | 5 | 32652 |
| **Support Systems** | | | | | | | | | | |
| 14. Totals | 152 | | | 23 | 173 | 291 | | 8 | 1 | 5459 |
| 15. Erect scaffolding for systems removal | 1565 | | | 235 | 1800 | 1191 | | | | 13170 |
| **Removal of Major Equipment** | | | | | | | | | | |
| 16. Main Turbine/Generator | 42 | | | 6 | 48 | 1300 | | | | 1478 |
| 17. Main Condensers | 103 | | | 15 | 118 | 364 | | | | 3477 |

**TABLE C-6**
**DELAWARE STATION UNITS 7 & 8**
**DISMANTLING COST ESTIMATE**

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Demolition of Remaining Site Buildings** | | | | | | | | | | |
| 18.1 Boiler Room | 1441 | | | 216 | 1658 | 2022 | | | | 33509 |
| 18.2 Circulating Water Intake Tunnels | 2 | | | <1 | 3 | | | | | 20 |
| 18.3 Miscellaneous Structures - Unit 8 | 62 | | | 9 | 71 | 115 | | | | 1702 |
| 18.4 Miscellaneous Yard - Unit 8 | 1612 | | | 242 | 1854 | 75 | | | | 36988 |
| 18.5 Office Building | 115 | | | 17 | 132 | 58 | | | | 1979 |
| 18.6 Pump and Screen House | 226 | | | 34 | 260 | 54 | | | | 3716 |
| 18.7 Turbine Pedestal | 243 | | | 36 | 279 | | | | | 3940 |
| 18.8 Turbine Room | 600 | | | 90 | 690 | 737 | | | | 14531 |
| 18. Totals | 4301 | | | 645 | 4946 | 3061 | | | | 96386 |
| Subtotal Period 2 Activity Costs | 8637 | | | 1295 | 9932 | 21008 | | 709 | 11 | 207706 |
| **Period 2 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 957 | | | 144 | 1100 | | | | | |
| Small tool allowance | 96 | | | 14 | 111 | | | | | |
| Pipe cutting equipment | 143 | | | 21 | 164 | | | | | |
| Plant energy budget | | | 85 | 13 | 98 | | | | | |
| Subtotal Undistributed Costs Period 2 | 1196 | | 85 | 192 | 1473 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 778 | 117 | 894 | | | | | |
| Utility Staff Cost | | | 937 | 141 | 1078 | | | | | |
| **TOTAL PERIOD 2** | 9833 | | 1800 | 1745 | 13377 | 21008 | | 709 | 11 | 207706 |
| **PERIOD 3** | | | | | | | | | | |
| **Site Closeout Activities** | | | | | | | | | | |
| 19. Grade & landscape site | 25 | | | 4 | 29 | | | | | 307 |

TABLE C-6
DELAWARE STATION UNITS 7 & 8
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 9 | 1 | 10 | | | | | |
| Utility Staff Cost | | | 8 | 1 | 9 | | | | | |
| **TOTAL PERIOD 3** | 25 | | 17 | 6 | 48 | | | | | 307 |
| **TOTAL COST TO DECOMMISSION** | 10720 | 92 | 2938 | 2155 | 15905 | 21008 | | 709 | 11 | 208013 |

| | | | |
|---|---|---|---|
| **TOTAL COST TO DECOMMISSION WITH 15.67% CONTINGENCY:** | | $15,904,844 | |
| **TOTAL SCRAP METAL REMOVED:** | Carbon Steel | 21,008 | TONS |
| | Copper | 709 | TONS |
| | Total | 21,717 | TONS |
| **SCRAP CREDIT:** | Carbon Steel | $2,100,800 | |
| | Copper | $850,800 | |
| | Total | $2,951,600 | |
| **ADJUSTED COST TO DISMANTLE:** | | $12,953,244 | |
| **TOTAL CRAFT LABOR REQUIREMENTS:** | | 208,013 | MAN-HRS |

TABLE C-7
KEYSTONE STATION UNIT 1
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 1** | | | | | | | | | | |
| **Period 1 cost assigned to Keystone Unit 2.** | | | | | | | | | | |
| **PERIOD 2** | | | | | | | | | | |
| **Disposal of Plant Systems** | | | | | | | | | | |
| **Fuel Systems** | | | | | | | | | | |
| 1. Totals | 6279 | | | 942 | 7221 | 29077 | | 182 | 20 | 225834 |
| **Power Systems** | | | | | | | | | | |
| 2. Totals | 2846 | | | 427 | 3271 | 6137 | | 1390 | 9 | 102869 |
| **Support Systems** | | | | | | | | | | |
| 3. Totals | 511 | | | 75 | 586 | 863 | | 95 | 7 | 18624 |
| 4. Erect scaffolding for systems removal | 779 | | | 117 | 896 | 593 | | | | 6554 |
| **Removal of Major Equipment** | | | | | | | | | | |
| 5. Main Turbine/Generator | 84 | | | 13 | 97 | 2609 | | | | 2966 |
| 6. Main Condensers | 214 | | | 32 | 246 | 758 | | | | 7232 |
| **Demolition of Remaining Site Buildings** | | | | | | | | | | |
| 7.1 Boiler Building-Unit 1 | 5489 | | | 823 | 6313 | 6943 | | | | 142136 |
| 7.2 Circulating Water Pump Building-Unit 1 | 84 | | | 13 | 97 | 17 | | | | 1307 |
| 7.3 Cooling Tower-Unit 1 | 1735 | | | 260 | 1996 | 751 | | | | 36751 |
| 7.4 Stack-Unit 1 | 1402 | | | 210 | 1613 | 4860 | | | | 45498 |
| 7.5 Turbine Building-Unit 1 | 2245 | | | 337 | 2582 | 2281 | | | | 56386 |
| 7.6 Turbine Pedestal-Unit 1 | 1059 | | | 159 | 1218 | | | | | 16928 |
| 7. Totals | 12015 | | | 1802 | 13818 | 14852 | | | | 299007 |
| Subtotal Period 2 Activity Costs | 22725 | | | 3409 | 26135 | 54892 | | 1671 | 39 | 663085 |

TABLE C-7
KEYSTONE STATION UNIT 1
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Period 2 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 3950 | | | 593 | 4543 | | | | | |
| Small tool allowance | 307 | | | 46 | 353 | | | | | |
| Pipe cutting equipment | 143 | | | 21 | 164 | | | | | |
| Plant energy budget | | | 509 | 76 | 586 | | | | | |
| Subtotal Undistributed Costs Period 2 | 4400 | | 509 | 736 | 5646 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 6444 | 967 | 7411 | | | | | |
| Utility Staff Cost | | | 7902 | 1185 | 9087 | | | | | |
| **TOTAL PERIOD 2** | **27125** | | **14855** | **6297** | **48279** | **54892** | | **1671** | **39** | **663085** |
| **PERIOD 3** | | | | | | | | | | |
| **Site Closeout Activities** | | | | | | | | | | |
| 8. Grade & landscape site | | | | | | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 9 | 1 | 10 | | | | | |
| Utility Staff Cost | | | 1296 | 194 | 1491 | | | | | |
| **TOTAL PERIOD 3** | | | **1305** | **195** | **1501** | | | | | |
| **TOTAL COST TO DECOMMISSION** | **27126** | | **16160** | **6493** | **49778** | **54892** | | **1671** | **39** | **663084** |

**TOTAL COST TO DECOMMISSION WITH 15% CONTINGENCY:** **$49,778,384**

| | | | |
|---|---|---|---|
| **TOTAL SCRAP METAL REMOVED:** | Carbon Steel | 54,892 | TONS |
| | Copper | 1,671 | TONS |
| | Total | 56,563 | TONS |
| **SCRAP CREDIT:** | Carbon Steel | $5,489,200 | |
| | Copper | $2,005,200 | |
| | Total | $7,494,400 | |

**ADJUSTED COST TO DISMANTLE:** **$42,283,984**

**TOTAL CRAFT LABOR REQUIREMENTS:** **663,084** MAN-HRS

TABLE C-8
KEYSTONE STATION UNIT 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 1** | | | | | | | | | | |
| 1. Review plant dwgs & specs. | | | | | | | | | | |
| 2. End product description | | | | | | | | | | |
| 3. Define major work sequence | | | | | | | | | | |
| 4. Perform SER and EA | | | | | | | | | | |
| 5. Perform Site-Specific Cost Study | | | | | | | | | | |
| **Activity Specifications** | | | | | | | | | | |
| 6.1 Plant & temporary facilities | | | | | | | | | | |
| 6.2 Plant systems | | | | | | | | | | |
| 6.3 Boiler removal | | | | | | | | | | |
| 6.4 Reinforced concrete | | | | | | | | | | |
| 6.5 Turbine & condenser | | | | | | | | | | |
| 6.6 Plant structures & buildings | | | | | | | | | | |
| 6.7 Waste management | | | | | | | | | | |
| 6.8 Facility & site closeout | | | | | | | | | | |
| 6. Total | | | | | | | | | | |
| **Planning & Site Preparations** | | | | | | | | | | |
| 7. Prepare dismantling sequence | | | | | | | | | | |
| 8. Plant prep. & temp. svces | | | 361 | 54 | 415 | | | | | |
| 9. Rigging/CCEs/tooling/etc. | | | 306 | 46 | 351 | | | | | |
| **Detailed Work Procedures** | | | | | | | | | | |
| 10.1 Plant systems | | | | | | | | | | |
| 10.2 Remaining buildings | | | | | | | | | | |
| 10.3 Boiler | | | | | | | | | | |
| 10.4 Facility closeout | | | | | | | | | | |
| 10.5 Reinforced concrete | | | | | | | | | | |
| 10.6 Turbine & condensers | | | | | | | | | | |
| 10. Total | | | | | | | | | | |
| **Period 1 Additional Costs** | | | | | | | | | | |
| 11. Asbestos Remediation Project | 3870 | 443 | | 1078 | 5391 | | | | | |
| Subtotal Period 1 Activity Costs | 3870 | 443 | 667 | 1178 | 6158 | | | | | |

TABLE C-8
KEYSTONE STATION UNIT 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Period 1 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 63 | | | 9 | 72 | | | | | |
| Plant energy budget | | | 68 | 10 | 78 | | | | | |
| Subtotal Undistributed Costs Period 1 | 63 | | 68 | 20 | 150 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 718 | 108 | 826 | | | | | |
| Utility Staff Cost | | | 831 | 125 | 955 | | | | | |
| **TOTAL PERIOD 1 COST** | **3933** | **443** | **2283** | **1430** | **8089** | | | | | |
| **PERIOD 2** | | | | | | | | | | |
| **Disposal of Plant Systems** | | | | | | | | | | |
| **Fuel Systems** | | | | | | | | | | |
| 12. Totals | 5467 | | | 819 | 6288 | 23096 | | 151 | 14 | 196095 |
| **Power Systems** | | | | | | | | | | |
| 13. Totals | 2771 | | | 416 | 3187 | 5935 | | 1384 | 7 | 100245 |
| **Support Systems** | | | | | | | | | | |
| 14. Totals | 1171 | | | 176 | 1348 | 2002 | | 213 | 68 | 42589 |
| 15. Erect scaffolding for systems removal | 1162 | | | 174 | 1336 | 884 | | | | 9777 |
| **Removal of Major Equipment** | | | | | | | | | | |
| 16. Main Turbine/Generator | 84 | | | 13 | 97 | 2609 | | | | 2966 |
| 17. Main Condensers | 214 | | | 32 | 246 | 758 | | | | 7232 |

TABLE C-8
KEYSTONE STATION UNIT 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Demolition of Remaining Site Buildings** | | | | | | | | | | |
| 18.1 Boiler Building- Unit 2 | 5471 | | | 821 | 6292 | 6919 | | | | 141601 |
| 18.2 Circulating Water Pump Building- Unit 2 | 84 | | | 13 | 97 | 17 | | | | 1307 |
| 18.3 Clean Coal Surge Pile Retng Wall-Common | 84 | | | 13 | 96 | | | | | 1099 |
| 18.4 Coal Control Building-Common | 43 | | | 6 | 49 | | | | | 1029 |
| 18.5 Conveyor Tunnel-Common | 16 | | | 2 | 19 | | | | | 195 |
| 18.6 Cooling Tower-Unit 2 | 1735 | | | 260 | 1996 | 751 | | | | 36751 |
| 18.7 FO Pump House\Silo Machine Room-Common | 198 | | | 30 | 228 | 316 | | | | 4111 |
| 18.8 Make-Up Pump House-Common | 63 | | | 9 | 73 | 7 | | | | 1000 |
| 18.9 Miscellaneous Buildings-Common | 1614 | | | 242 | 1856 | 1744 | | | | 41932 |
| 18.10 Primary Water Treatment Building-Common | 359 | | | 54 | 413 | 28 | | | | 6711 |
| 18.11 Rotary Car Dumper Structure-Common | 151 | | | 23 | 173 | 4 | | | | 3068 |
| 18.12 Service Building-Common | 106 | | | 16 | 122 | 21 | | | | 2640 |
| 18.13 Site-Common | 4886 | | | 733 | 5618 | 1084 | | | | 42751 |
| 18.14 Stack-Unit 2 | 1402 | | | 210 | 1613 | 4860 | | | | 45498 |
| 18.15 Truck Hopper-Common | 308 | | | 46 | 355 | | | | | 7293 |
| 18.16 Turbine Building-Unit 2 | 2245 | | | 337 | 2582 | 2281 | | | | 56386 |
| 18.17 Turbine Pedestal-Unit 2 | 1059 | | | 159 | 1218 | | | | | 16928 |
| 18. Totals | 19825 | | | 2974 | 22799 | 18034 | | | | 410301 |
| Subtotal Period 2 Activity Costs | 30696 | 0 | 0 | 4605 | 35300 | 53318 | 0 | 1752 | 94 | 769203 |
| **Period 2 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 3950 | | | 593 | 4543 | | | | | |
| Small tool allowance | 365 | | | 55 | 420 | | | | | |
| Pipe cutting equipment | 143 | | | 21 | 164 | | | | | |
| Plant energy budget | | | 509 | 76 | 586 | | | | | |
| Subtotal Undistributed Costs Period 2 | 4458 | | 509 | 745 | 5713 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 6444 | 967 | 7411 | | | | | |
| Utility Staff Cost | | | 7902 | 1185 | 9087 | | | | | |
| **TOTAL PERIOD 2** | **35154** | | **14855** | **7502** | **57511** | **53318** | | **1752** | **94** | **769203** |

TABLE C-8
KEYSTONE STATION UNIT 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 3** | | | | | | | | | | |
| **Site Closeout Activities** | | | | | | | | | | |
| 19. Grade & landscape site | 1408 | | | 211 | 1619 | | | | | 20638 |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 9 | 1 | 10 | | | | | |
| Utility Staff Cost | | | 1296 | 194 | 1491 | | | | | |
| TOTAL PERIOD 3 | 1408 | | 1305 | 406 | 3120 | | | | | 20638 |
| TOTAL COST TO DECOMMISSION | 40495 | 443 | 18443 | 9339 | 68720 | 53317 | | 1752 | 94 | 789840 |

| | | | |
|---|---|---|---|
| TOTAL COST TO DECOMMISSION WITH 15.73% CONTINGENCY | | $68,720,304 | |
| TOTAL SCRAP METAL REMOVED: | Carbon Steel | 53,317 | TONS |
| | Copper | 1,752 | TONS |
| | Total | 55,069 | TONS |
| SCRAP CREDIT: | Carbon Steel | $5,331,700 | |
| | Copper | $2,102,400 | |
| | Total | $7,434,100 | |
| ADJUSTED COST TO DISMANTLE: | | $61,286,204 | |
| TOTAL CRAFT LABOR REQUIREMENTS: | | 789,840 | MAN-HRS |

**TABLE C-9**
**CONEMAUGH STATION UNIT 1**
**DISMANTLING COST ESTIMATE**

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 1** | | | | | | | | | | |
| **Period 1 costs assigned to Conemaugh Unit 1** | | | | | | | | | | |
| **PERIOD 2** | | | | | | | | | | |
| **Disposal of Plant Systems** | | | | | | | | | | |
| **Fuel Systems** | | | | | | | | | | |
| 1. Totals | 8096 | | | 1215 | 9311 | 28928 | 3352 | 254 | 37 | 290398 |
| **Power Systems** | | | | | | | | | | |
| 2. Totals | 2846 | | | 427 | 3271 | 6137 | | 1390 | 9 | 102869 |
| **Support Systems** | | | | | | | | | | |
| 3. Totals | 511 | | | 75 | 586 | 863 | | 95 | 7 | 18624 |
| 4. Erect scaffolding for systems removal | 779 | | | 117 | 896 | 593 | | | | 6554 |
| **Removal of Major Equipment** | | | | | | | | | | |
| 5. Main Turbine/Generator | 84 | | | 13 | 97 | 2609 | | | | 2966 |
| 6. Main Condensers | 214 | | | 32 | 246 | 758 | | | | 7232 |
| **Demolition of Remaining Site Buildings** | | | | | | | | | | |
| 7.1 Auxiliary Boilers Area-Unit 1 | 46 | | | 7 | 53 | 42 | | | | 1112 |
| 7.2 Boiler Building-Unit 1 | 5489 | | | 823 | 6313 | 6943 | | | | 142136 |
| 7.3 Chimney-Unit 1 | 1692 | | | 254 | 1945 | 6074 | | | | 55421 |
| 7.4 Circ Water Pump House\ Tunnel-Unit 1 | 154 | | | 23 | 177 | 17 | | | | 3294 |
| 7.5 Cooling Tower-Unit 1 | 1150 | | | 173 | 1323 | 585 | | | | 24198 |
| 7.6 Turbine Building-Unit 1 | 2245 | | | 337 | 2582 | 2281 | | | | 56386 |
| 7.7 Turbine Pedestal-Unit 1 | 1059 | | | 159 | 1218 | | | | | 16928 |
| 7. Totals | 11836 | | | 1775 | 13611 | 15943 | | | | 299475 |
| Subtotal Period 2 Activity Costs | 24363 | 0 | 0 | 3654 | 28017 | 55834 | 3352 | 1743 | 56 | 728117 |

## TABLE C-9
## CONEMAUGH STATION UNIT 1
## DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Period 2 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 3955 | | | 593 | 4548 | | | | | |
| Small tool allowance | 336 | | | 51 | 387 | | | | | |
| Pipe cutting equipment | 143 | | | 21 | 164 | | | | | |
| Plant energy budget | | | 508 | 76 | 584 | | | | | |
| Subtotal Undistributed Costs Period 2 | 4434 | | 508 | 741 | 5683 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 6425 | 964 | 7388 | | | | | |
| Utility Staff Cost | | | 7878 | 1182 | 9059 | | | | | |
| **TOTAL PERIOD 2** | **28797** | | **14811** | **6541** | **50147** | **55834** | **3352** | **1743** | **56** | **728117** |
| **PERIOD 3** | | | | | | | | | | |
| **Site Closeout Activities** | | | | | | | | | | |
| 8. Grade & landscape site | | | | | | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 13 | 2 | 15 | | | | | |
| Utility Staff Cost | | | 1300 | 195 | 1495 | | | | | |
| **TOTAL PERIOD 3** | | | **1313** | **197** | **1510** | | | | | |
| **TOTAL COST TO DECOMMISSION** | **28797** | **0** | **16124** | **6738** | **51659** | **55834** | **3352** | **1743** | **56** | **728117** |

**TOTAL COST TO DECOMMISSION WITH 15% CONTINGENCY:** **$51,659,248**

| | | | |
|---|---|---|---|
| **TOTAL SCRAP METAL REMOVED:** | **Carbon Steel** | **55,834** | **TONS** |
| | **Stainless Steel** | **3,352** | **TONS** |
| | **Copper** | **1,743** | **TONS** |
| | **Total** | **60,929** | **TONS** |
| **SCRAP CREDIT:** | **Carbon Steel** | **$5,583,400** | |
| | **Stainless Steel** | **$1,843,600** | |
| | **Copper** | **$2,091,600** | |
| | **Total** | **$9,518,600** | |

**ADJUSTED COST TO DISMANTLE:** **$42,140,648**

**TOTAL CRAFT LABOR REQUIREMENTS:** **728,117** **MAN-HRS**

TABLE C-10
CONEMAUGH STATION UNIT 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 1** | | | | | | | | | | |
| 1. Review plant dwgs & specs. | | | | | | | | | | |
| 2. End product description | | | | | | | | | | |
| 3. Define major work sequence | | | | | | | | | | |
| 4. Perform SER and EA | | | | | | | | | | |
| 5. Perform Site-Specific Cost Study | | | | | | | | | | |
| **Activity Specifications** | | | | | | | | | | |
| 6.1 Plant & temporary facilities | | | | | | | | | | |
| 6.2 Plant systems | | | | | | | | | | |
| 6.3 Boiler removal | | | | | | | | | | |
| 6.4 Reinforced concrete | | | | | | | | | | |
| 6.5 Turbine & condenser | | | | | | | | | | |
| 6.6 Plant structures & buildings | | | | | | | | | | |
| 6.7 Waste management | | | | | | | | | | |
| 6.8 Facility & site closeout | | | | | | | | | | |
| 6. Total | | | | | | | | | | |
| **Planning & Site Preparations** | | | | | | | | | | |
| 7. Prepare dismantling sequence | | | | | | | | | | |
| 8. Plant prep. & temp. svces | | | 361 | 54 | 415 | | | | | |
| 9. Rigging/CCEs/tooling/etc. | | | 306 | 46 | 351 | | | | | |
| **Detailed Work Procedures** | | | | | | | | | | |
| 10.1 Plant systems | | | | | | | | | | |
| 10.2 Remaining buildings | | | | | | | | | | |
| 10.3 Boiler | | | | | | | | | | |
| 10.4 Facility closeout | | | | | | | | | | |
| 10.5 Reinforced concrete | | | | | | | | | | |
| 10.6 Turbine & condensers | | | | | | | | | | |
| 10. Total | | | | | | | | | | |
| **Period 1 Additional Costs** | | | | | | | | | | |
| 11. Asbestos Remediation Project | 4885 | 524 | | 1352 | 6761 | | | | | |
| Subtotal Period 1 Activity Costs | 4885 | 524 | 667 | 1452 | 7528 | | | | | |

TABLE C-10
CONEMAUGH STATION UNIT 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Period 1 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 65 | | | 10 | 75 | | | | | |
| Plant energy budget | | | 70 | 10 | 80 | | | | | |
| Subtotal Undistributed Costs Period 1 | 65 | | 70 | 20 | 155 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 742 | 111 | 853 | | | | | |
| Utility Staff Cost | | | 858 | 129 | 987 | | | | | |
| **TOTAL PERIOD 1 COST** | **4950** | **524** | **2337** | **1712** | **9523** | | | | | |
| **PERIOD 2** | | | | | | | | | | |
| **Disposal of Plant Systems** | | | | | | | | | | |
| **Fuel Systems** | | | | | | | | | | |
| 12. Totals | 7248 | | | 1087 | 8336 | 23107 | 3260 | 222 | 31 | 259365 |
| **Power Systems** | | | | | | | | | | |
| 13. Totals | 2732 | | | 410 | 3142 | 5757 | | 1339 | 7 | 98816 |
| **Support Systems** | | | | | | | | | | |
| 14. Totals | 1218 | | | 183 | 1401 | 2180 | | 258 | 68 | 44283 |
| 15. Erect scaffolding for systems removal | 1162 | | | 174 | 1336 | 884 | | | | 9777 |
| **Removal of Major Equipment** | | | | | | | | | | |
| 16. Main Turbine/Generator | 84 | | | 13 | 97 | 2609 | | | | 2966 |
| 17. Main Condensers | 214 | | | 32 | 246 | 758 | | | | 7232 |

TABLE C-10
CONEMAUGH STATION UNIT 2
DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Demolition of Remaining Site Buildings** | | | | | | | | | | |
| 18.1 Absorber Building | 1349 | | | 202 | 1552 | 2001 | | | | 36955 |
| 18.2 Ash Disposal Waste Treatment Bldg-Common | 204 | | | 31 | 234 | 15 | | | | 3104 |
| 18.3 Ash Refuse Treatment Cntrl House-Common | 42 | | | 6 | 49 | <1 | | | | 580 |
| 18.4 Boiler Building- Unit 2 | 5471 | | | 821 | 6292 | 6919 | | | | 141601 |
| 18.5 Car Dumper-Common | 12 | | | 2 | 14 | <1 | | | | 269 |
| 18.6 Chimney-Unit 2 | 1692 | | | 254 | 1945 | 6074 | | | | 55421 |
| 18.7 Circ Water Pump House\Tunnel-Unit 2 | 154 | | | 23 | 177 | 17 | | | | 3294 |
| 18.8 Coal Transfer Towers-Common | 190 | | | 29 | 219 | 7 | | | | 6985 |
| 18.9 Cooling Tower-Unit 2 | 1150 | | | 173 | 1323 | 585 | | | | 24202 |
| 18.10 Crusher House-Common | 28 | | | 4 | 32 | 23 | | | | 685 |
| 18.11 Dewatering Area-Common | 286 | | | 43 | 329 | 134 | | | | 6886 |
| 18.12 Limestone Handling Area-Common | 44 | | | 7 | 51 | 24 | | | | 1178 |
| 18.13 Make-Up Pump House-Common | 221 | | | 33 | 254 | 6 | | | | 4463 |
| 18.14 Miscellaneous Buildings-Common | 1102 | | | 165 | 1268 | 1718 | | | | 29645 |
| 18.15 Plant Waste Neutralizing Bldg-Common | 22 | | | 3 | 25 | 3 | | | | 422 |
| 18.16 Service Building | 106 | | | 16 | 122 | 21 | | | | 2640 |
| 18.17 Sewage Treatment Plant-Common | 15 | | | 2 | 17 | <1 | | | | 248 |
| 18.18 Site-Common | 1665 | | | 250 | 1915 | 494 | | | | 25204 |
| 18.19 Stack-Common | 1004 | | | 151 | 1154 | 2627 | | | | 30401 |
| 18.20 Turbine Building-Unit 2 | 2245 | | | 337 | 2582 | 2281 | | | | 56386 |
| 18.21 Turbine Pedestal-Unit 2 | 1059 | | | 159 | 1218 | | | | | 16928 |
| 18. Totals | 18063 | | | 2709 | 20772 | 22951 | | | | 447497 |
| Subtotal Period 2 Activity Costs | 30722 | | | 4608 | 35329 | 58247 | 3260 | 1823 | 111 | 869933 |
| **Period 2 Undistributed Costs** | | | | | | | | | | |
| Heavy equipment rental | 3955 | | | 593 | 4548 | | | | | |
| Small tool allowance | 405 | | | 61 | 467 | | | | | |
| Pipe cutting equipment | 143 | | | 21 | 164 | | | | | |
| Plant energy budget | | | 508 | 76 | 584 | | | | | |
| Subtotal Undistributed Costs Period 2 | 4503 | | 508 | 751 | 5763 | | | | | |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 6425 | 964 | 7388 | | | | | |
| Utility Staff Cost | | | 7878 | 1182 | 9059 | | | | | |
| TOTAL PERIOD 2 | 35225 | | 14811 | 7505 | 57539 | 58247 | 3260 | 1823 | 111 | 869933 |

## TABLE C-10
## CONEMAUGH STATION UNIT 2
## DISMANTLING COST ESTIMATE

| Activity | Remove ($000's) | Bury ($000's) | Other ($000's) | Cntgcy ($000's) | Total ($000's) | Carbon Steel (Tons) | Stainless Steel (Tons) | Copper (Tons) | Other (Tons) | Craft Labor (Man-Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **PERIOD 3** | | | | | | | | | | |
| **Site Closeout Activities** | | | | | | | | | | |
| 19. Grade & landscape site | 451 | | | 68 | 519 | | | | | 7894 |
| **Staff Costs** | | | | | | | | | | |
| DOC Staff Cost | | | 13 | 2 | 15 | | | | | |
| Utility Staff Cost | | | 1300 | 195 | 1495 | | | | | |
| **TOTAL PERIOD 3** | 451 | | 1313 | 265 | 2029 | | | | | 7894 |
| **TOTAL COST TO DECOMMISSION** | 40626 | 524 | 18461 | 9483 | 69094 | 58247 | 3260 | 1823 | 111 | 877827 |

**TOTAL COST TO DECOMMISSION WITH 15.91% CONTINGENCY:** $69,093,584

**TOTAL SCRAP METAL REMOVED:**

| | | |
|---|---|---|
| Carbon Steel | 58,247 | TONS |
| Stainless Steel | 3,260 | TONS |
| Copper | 1,823 | TONS |
| Total | 63,330 | TONS |

**SCRAP CREDIT:**

| | |
|---|---|
| Carbon Steel | $5,824,700 |
| Stainless Steel | $1,793,000 |
| Copper | $2,187,600 |
| Total | $9,805,300 |

**ADJUSTED COST TO DISMANTLE:** $59,288,284

**TOTAL CRAFT LABOR REQUIREMENTS:** 877,827 MAN-HRS