Verde. Large components (Pressurizer, Steam Generators, and Reactor Coolant Pumps) are sent to WCS. Disposal costs for large components are based on NUREG-1307 [38] per-component costs for disposal at WCS. Resin and filter package Class A waste is sent to the *EnergySolutions* facility in Clive Utah.

The dismantling of the components residing closest to the reactor core generates radioactive waste that may be considered unsuitable for shallow-land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the NRC for Class C radioactive waste (Greater-than Class C or GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the federal government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste. However, to date, the federal government has not identified a cost, if any, for GTCC disposal or a schedule for acceptance.

For purposes of this analysis, the GTCC radioactive waste is assumed to be packaged and disposed of in a manner similar to high-level waste and at a cost equivalent to that envisioned for the spent fuel. The GTCC is packaged in the same canisters used for spent fuel and is assumed to be stored on site in the ISFSI and shipped to the DOE following completion of all spent fuel shipments.

1.3.3 Radiological Criteria for License Termination

In 1997, the NRC published Subpart E, "Radiological Criteria for License Termination [18] amending 10 CFR Part 20. This subpart provides radiological criteria for releasing a facility for unrestricted use. The regulation states that the site can be released for unrestricted use if radioactivity levels are such that the average member of a critical group would not receive a Total Effective Dose Equivalent (TEDE) in excess of 25 millirem per year and provided that residual radioactivity has been reduced to levels that are As Low As Reasonably Achievable (ALARA). The decommissioning estimates for Palo Verde assume that the site will be remediated to a residual level consistent with the NRC-prescribed level for radioactive material.

It should be noted that the NRC and the Environmental Protection Agency (EPA) differ on the amount of residual radioactivity considered

acceptable in site remediation. The EPA has two limits that apply to radioactive materials. An EPA limit of 15 millirem per year is derived from criteria established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Superfund.[19] An additional limit of 4 millirem per year, as defined in 40 CFR Part 141.66, is applied to drinking water.[20]

On October 9, 2002, the NRC signed an agreement with the EPA on the radiological decommissioning and decontamination of NRC-licensed sites. The Memorandum of Understanding (MOU) [21] provides that the EPA will defer exercise of authority under the CERCLA for the majority of facilities decommissioned under NRC authority. The MOU also includes provisions for NRC and EPA consultation for certain sites when, at the time of license termination, (1) groundwater contamination exceeds EPA-permitted levels; (2) the NRC contemplates restricted release of the site; and/or (3) residual radioactive soil concentrations exceed levels defined in the MOU.

The MOU does not impose any new requirements on NRC licensees and should reduce the involvement of the EPA with NRC licensees who are decommissioning. Most sites are expected to meet the NRC criteria for unrestricted use, and the NRC believes that only a few sites will have groundwater or soil contamination in excess of the levels specified in the MOU that trigger consultation with the EPA. However, if there are other hazardous materials on the site, the EPA may be involved in the cleanup. As such, the possibility of dual regulation remains for certain licensees. The present study does not include any costs for such an occurrence.

2. DECON DECOMMISSIONING ALTERNATIVE

This cost study was developed to decommission the Palo Verde units for the NRC-approved DECON decommissioning alternative. This alternative deals with the immediate removal of all regulated radioactive material from the site and ultimate release of the site for unrestricted and/or alternative use. The following sections describe the basic activities associated with the DECON alternative. 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 DECON alternative, as defined by the NRC in the Code of Federal Regulations, is "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." This study recognizes the constraint imposed by the spent fuel residing on site during the decommissioning process, and also the costs associated with the final transfer of the spent fuel containers to the DOE after the shutdown of each of the units, as well as the decontamination and demolition of the ISFSI following removal of all spent fuel and GTCC material. These costs are included in Appendix L.

The conceptual approach that the NRC has described in its regulations divides 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. During the first phase, notification is to be provided to the NRC certifying the permanent cessation of operations and the removal of fuel from the reactor vessel. The licensee would then be prohibited from reactor operation.

The second phase encompasses activities during the storage period or during major decommissioning activities, or a combination of the two. The third phase pertains to the activities involved in license termination. The decommissioning estimate developed for Palo Verde is also divided into phases or periods; however, demarcation of the phases is based upon major milestones within the project or significant changes in the projected expenditures.

2.1 Period 0 – Pre-Shutdown

In anticipation of the cessation of plant operations, detailed preparations are undertaken to provide a smooth transition from plant operations to site decommissioning. Through implementation of a staffing transition plan, the organization required to manage the intended decommissioning activities is assembled from available plant staff and outside resources. These pre-shutdown consulting activities are performed by plant staff familiar with decommissioning pre-planning, i.e. historical site assessment, cost estimating, staff transition, and licensing. Preparations include the planning for permanent defueling of the reactor, revision of technical specifications applicable to the operating conditions and requirements, a characterization of the facility and major components, and the development of the PSDAR.

In addition to the PSDAR, two additional documents will be required by the NRC in support of the decommissioning program. The first is a Site-Specific DCE, which will give in greater detail the expected expenditures and time frames for the various aspects of the decommissioning scenario selected by the Owners of Palo Verde. With the NRC acceptance of the Site-Specific DCE, the owners will have full access to their decommissioning trust funds. The second document is an Irradiated Spent Fuel Management Plan, which will detail the expected timetable and costs for the caretaking and transfer of the spent fuel to the DOE.

The PSDAR, required within two years of the notice to cease operations, provides a description of the licensee's planned decommissioning activities, a timetable, and the associated financial requirements of the intended decommissioning program. Upon receipt of the PSDAR, the NRC will make the document available to the public for comment in a local hearing to be held near the reactor site. Ninety days following submittal and NRC receipt of the PSDAR, the licensee may begin to perform major decommissioning activities under a modified 10 CFR § 50.59 procedure, i.e., without specific NRC approval. Major activities are defined as any activity that results in permanent removal of major radioactive components, permanently modifies the structure of the containment, or results in dismantling components (for shipment) containing GTCC, in accordance with 10 CFR Part 61. Major components are further defined as comprising the reactor vessel and internals, large bore reactor coolant system piping, and other large components that are radioactive. The NRC includes the following additional criteria for use of the 10 CFR § 50.59 process in decommissioning. The proposed activity must not:

- foreclose release of the site for possible unrestricted use,

- significantly increase decommissioning costs,
- cause any significant environmental impact, or
- violate the terms of the licensee's existing license.

Existing operational technical specifications are reviewed and modified to reflect plant conditions and the safety concerns associated with permanent cessation of operations. The environmental impact associated with the planned decommissioning activities is also considered. Typically, a licensee will not be allowed to proceed if the consequences of a particular decommissioning activity are greater than that bounded by previously evaluated environmental assessments or impact statements. In this instance, the licensee would have to submit a license amendment for the specific activity and update the environmental report.

The decommissioning program outlined in the PSDAR will be designed to accomplish the required tasks within the ALARA guidelines (as defined in 10 CFR Part 20) for protection of personnel from exposure to radiation hazards. It will also address the continued protection of the health and safety of the public and the environment during the dismantling activity. Consequently, with the development of the PSDAR, activity specifications, cost-benefit and safety analyses, work packages, and procedures would be assembled in support of the proposed decontamination and dismantling activities.

2.2 Period 1 – Preparations

The following activities are initiated following final plant shutdown and in preparation for actual decommissioning activities:

- Notifications of permanent defueling and cessation of operations.
- Characterization of the site and surrounding environs. This includes radiation surveys of work areas, major components (including the reactor vessel and its internals), internal piping, and primary shield walls.
- Isolation of the spent fuel storage pools and fuel handling systems, such that decommissioning operations can commence on the balance of the plant. Decommissioning operations are scheduled around the fuel handling area to optimize the overall project schedule. The fuel is transferred to the DOE or the ISFSI as it decays to the point that it meets the minimum cooling time criteria of the canisters. Consequently, it is assumed that the fuel pools remain operational for approximately

six years following the cessation of plant operations. The spent fuel pools are assumed to be emptied six years after each unit's final shutdown date.

- Deactivation of plant systems & processing plant waste.
- Specification of transport and disposal requirements for activated materials and/or hazardous materials, including shielding and waste stabilization.
- Removal of radioactive source material.
- Development of procedures for occupational exposure control, control and release of liquid and gaseous effluent, processing of radwaste (including dry-active waste, resins, filter media, metallic and non-metallic components generated in decommissioning), site security and emergency programs, and industrial safety.

2.3 Period 2 – Decommissioning Operations

This period includes the physical decommissioning activities associated with the removal and disposal of contaminated and activated components and structures, including the successful termination of the 10 CFR Part 50 operating licenses. Significant decommissioning activities in this phase include:

- Construction of temporary facilities and/or modification of existing facilities to support dismantling activities. This may include a centralized processing area to facilitate equipment removal and component preparations for off-site disposal.
- Reconfiguration and modification of site structures and facilities as needed to support decommissioning operations. This may include the upgrading of roads (on- and off-site) as required to facilitate hauling and transport. Modifications may be required to the containment structure to facilitate access of large/heavy equipment. Modifications may also be required to the refueling area of the buildings to support the segmentation of the reactor vessel internals and component extraction.
- Design and fabrication of temporary and permanent shielding to support removal and transportation activities, construction of contamination control envelopes, and the procurement of specialty tooling.
- Procurement (lease or purchase) of shipping casks, cask liners, and industrial packages.

- Decontamination of components and piping systems as required to control (minimize) worker exposure.
- Removal of piping and components no longer essential to support decommissioning operations.
- Removal of control rod drive housings and the head service structure from reactor vessel head. Segmentation of the vessel closure head.
- Removal and segmentation of the upper internals assemblies. Segmentation will maximize the loading of the shielded transport casks, i.e., by weight and activity. The operations are conducted under water using remotely operated tooling and contamination controls.
- Disassembly and segmentation of the remaining reactor internals, including the core shroud and lower core support barrel. Some material is expected to exceed Class C disposal requirements. As such, the segments will be packaged in modified fuel storage canisters for geologic disposal.
- This study assumes that each unit has legacy GTCC material present in the spent fuel pool at final shutdown. Weight equivalent to the capacity of two GTCC storage canisters are assumed per unit. This material will be stored on the ISFSI pad until the DOE removes all GTCC canisters from the site.
- Segmentation of the reactor vessel. A shielded platform is installed for segmentation as cutting operations are performed in-air using remotely operated equipment within a contamination control envelope. The water level is maintained just below the cut to minimize the working area dose rates. Segments are transferred in-air to containers that are stored under water, for example, in an isolated area of the refueling canal.
- Removal of the activated portions of the concrete biological shield and accessible contaminated concrete surfaces. If dictated by the steam generator and pressurizer removal scenarios, those portions of the associated steam generator cubicles necessary for access and component extraction are removed.
- Removal of the steam generators and pressurizer for controlled disposal. These components can serve as their own burial containers provided that all penetrations are properly sealed and the internal contaminants are stabilized, e.g., with grout. Steel shielding will be added, as necessary, to those external areas of the package to meet transportation limits and regulations. Additional shielding is not required for the retired (stored) steam generators.

- Retired (stored) closure heads will be shipped intact by rail to the disposal site.
- Transfer of the spent fuel from the storage pools to the ISFSI for interim storage or shipment directly to the DOE.

At least two years prior to the anticipated date of license termination, an LTP is required. Submitted as a supplement to the Updated Final Safety Analysis Report (UFSAR) or its equivalent, the 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 the decommissioning, and any associated environmental concerns. The NRC will notice the receipt of the plan, make the plan available for public comment, and schedule a local hearing. LTP approval will be subject to any conditions and limitations as deemed appropriate by the Commission. The licensee may then commence with the final remediation of site facilities and services, including:

- Removal of remaining plant systems and associated components as they become nonessential to the decommissioning program or worker health and safety (e.g., waste collection and treatment systems, electrical power, and ventilation systems).
- Removal of the steel liners from the refueling canal, disposing of the activated and contaminated sections as radioactive waste. Removal of any activated/ contaminated concrete.
- Surveys of the decontaminated areas of the containment structures.
- Removal of the contaminated equipment and material from the auxiliary and fuel buildings, and any other contaminated facility. Use radiation and contamination control techniques until radiation surveys indicate that the structures and equipment can be released for unrestricted access and conventional demolition. This activity may necessitate the dismantling and disposition of most of the systems and components (both clean and contaminated) located within these buildings. This activity will facilitate surface decontamination and subsequent verification surveys required prior to obtaining release for demolition.
- Removal of the remaining components, equipment, and plant services in support of the area release survey(s).
- Routing of material removed in the decontamination and dismantling process to a central processing area. Material certified to be free of

contamination is released for unrestricted disposition, e.g., as scrap, recycle, or general disposal. Contaminated material is characterized and packaged for controlled disposal at a LLRW disposal facility.

Incorporated into the LTP is the Final Survey Plan. This plan identifies the radiological surveys to be performed once the decontamination activities are completed and is developed using the guidance provided in the "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)."[22] This document incorporates the statistical approaches to survey design and data interpretation used by the EPA. It also identifies state-of-the-art, commercially available instrumentation and procedures for conducting radiological surveys. Use of this guidance ensures that the surveys are conducted in a manner that provides a high degree of confidence that applicable NRC criteria are satisfied. Once the survey is complete, the results are provided to the NRC in a format that can be verified. The NRC then reviews and evaluates the information, performs an independent confirmation of radiological site conditions, and makes a determination on final termination of the license.

The NRC will amend the operating license(s) to reduce the licensed area to the ISFSI area if it determines that site remediation has been performed in accordance with the LTP, and that the terminal radiation survey and associated documentation demonstrate that the property (exclusive of the ISFSI) is suitable for release.

2.4 Period 3 – Site Restoration

Following completion of decommissioning operations, site restoration activities 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. Although performed in a controlled and safe manner, blasting, coring, drilling, scarification (surface removal), and the other decontamination activities will substantially degrade power block structures, including the reactor and auxiliary buildings. Under certain circumstances, verifying that subsurface radionuclide concentrations meet NRC site release requirements will require removal of grade slabs and lower floors, potentially weakening footings and structural supports. This removal activity will be necessary for those facilities and plant areas where historical records, when available, indicate the potential for radionuclides having been present in the soil indicate system failures, or where it is required to confirm that subsurface process and drain lines were not breached over the operating life of the station.

Dismantling of site structures following decommissioning is 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 effort to dismantle site structures with a work force already mobilized on site is more efficient than if the process were deferred. Site facilities quickly degrade without 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 non-essential structures and site facilities are dismantled as a continuation of the decommissioning activity. Foundations and exterior walls are removed to a nominal depth of three feet below grade. The three-foot depth allows for the placement of gravel for drainage, as well as topsoil, so that vegetation can be established for erosion control. Site areas affected by the dismantling activities are restored and the plant area graded as required to prevent ponding and inhibit the refloating of subsurface materials.

Non-contaminated concrete rubble produced by demolition activities is processed to remove reinforcing steel and miscellaneous embedments. The processed material is then used on site to backfill foundation voids. Excess materials are trucked to an on-site landfill.

2.5 ISFSI Operations and Decommissioning

Transfer of spent fuel to the DOE will be initially from the spent fuel pools and subsequently from the ISFSI once the fuel pools have been emptied and the structures released for decommissioning. This estimate includes ISFSI costs in the periods following License Termination through Site Restoration (Insurance, ISFSI Licensing Fees, ISFSI Operating Costs), which are included in Appendix C. ISFSI-related operations and spent fuel transfer costs, license termination costs, demolition costs, and site restoration costs, are included in Appendices L and N.

When all fuel and GTCC canisters from the ISFSI have been shipped off site, the ISFSI will be decommissioned. The Commission will terminate the 10 CFR Part 50 general license in accordance with an ISFSI license termination plan.

The assumed design for the ISFSI is based upon the use of a multi-purpose canister, which contains the spent fuel assemblies, and a concrete overpack that the canister is placed within for pad storage. The overpack liners are

assumed to have some level of neutron-induced activation as a result of the long-term storage of the fuel, i.e., to levels exceeding free-release limits. As an allowance, seven overpacks per unit (site total of 21) are assumed to require remediation, equivalent to the number of overpacks required to accommodate the final core offloads at Palo Verde. The remaining overpacks, once the canisters containing the spent fuel assemblies have been removed, will be dismantled using conventional techniques for the demolition of reinforced concrete. The concrete storage pad will then be removed, and the area graded and landscaped to conform to the surrounding environment.

3. COST ESTIMATE

The cost analysis prepared for decommissioning Palo Verde consider the unique features of the site, including the NSSS, power generation systems, support services, site buildings, and ancillary facilities. The basis of the estimates, including the sources of information relied upon, the estimating methodology employed, site-specific considerations, and other pertinent assumptions, is described in this section.

3.1 BASIS OF ESTIMATE

A site-specific cost estimate was developed using drawings and plant documents provided by the OA. Components were inventoried from the mechanical and electrical Piping & Instrument Diagrams (P&IDs). Structural 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 plant to be addressed in remediation of the site.

The utility staffing levels for this estimate reflect the same number of personnel as used in the 2019 estimate. Representative labor rates for each designated craft and salaried worker were provided by the OA for use in construction of the unit removal factors, as well as for estimating the carrying costs for site management, worker supervision and essential support services, e.g., health physics and security. This study assumes that the OA will act as the DOC and provide direct management of the decommissioning operations for the project. As DOC, the OA will provide contract management of the decommissioning labor force, including subcontractors, as well as directing all decontamination and dismantling activities.

The security model is based on the existing operating levels as provided by Palo Verde. The operating staff levels are divided equally between all three units at Unit 1 shutdown. As spent fuel conditions progress from wet pool storage to dry storage and decommissioning activities are completed, the staff is reduced accordingly. The staffing levels per unit will maintain access control, material control, and safeguard the spent fuel (in accordance with the requirements of 10 CFR Part 37, Part 72, and Part 73).

3.2 METHODOLOGY

The methodology used to develop the estimates follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates" [23], and the DOE "Decommissioning Handbook" [21]. These documents present a unit factor method for estimating decommissioning activity costs, which simplifies the estimating calculations. Unit factors for concrete removal ($/cubic yard), steel removal ($/ton), and cutting costs ($/inch) were developed using local labor rates. The activity-dependent costs were estimated with the item quantities (cubic yards and tons), developed from plant drawings and inventory documents. Removal rates and material costs for the conventional disposition of components and structures relied upon information available in the industry publication, "Building Construction Cost with RSMeans Data," published by Gordian [25].

This analysis reflects lessons learned from TLG's involvement in the Shippingport Station Decommissioning Project, completed in 1989, as well as the decommissioning of the Cintichem reactor, hot cells, and associated facilities, completed in 1997. In addition, the planning and engineering for the Rancho Seco, Trojan, Yankee Rowe, Big Rock Point, Maine Yankee, Humboldt Bay-3, Oyster Creek, Connecticut Yankee, Crystal River, Vermont Yankee, Fort Calhoun, Pilgrim, and Indian Point nuclear units have provided additional insight into the process, the regulatory aspects, and the technical challenges of decommissioning commercial nuclear units.

The unit factor method provides a demonstrable basis for establishing reliable cost estimates. The detail provided in the unit factors, including activity duration, labor costs (by craft), and equipment and consumable costs, ensures that essential elements have not been omitted. Appendix E presents the detailed development of a typical unit factor. Appendix F provides the values contained within one set of factors developed for this analysis.

Regulatory Guide 1.184[26] Revision 1, issued in October 2013, describes the methods and procedures that are acceptable to the NRC staff for implementing the requirements that relate to the initial activities and the major phases of the decommissioning process. The costs and schedules presented in this analysis follow the general guidance and sequence in the regulations. The format and content of the estimates is also consistent with the recommendations of Regulatory Guide 1.202,[27] issued February 2005.

Work Difficulty Factors

TLG has historically applied work difficulty adjustment factors (WDFs) to account for the inefficiencies in working in a power plant environment. WDFs were assigned to each unique set of unit factors, commensurate with the inefficiencies associated with working in confined, hazardous environments. The ranges used for the WDFs are as follows:

• Access Factor	10% to 20%
• Respiratory Protection Factor	10% to 50%
• Radiation/ALARA Factor	10% to 40%
• Protective Clothing Factor	10% to 30%
• Work Break Factor	8.33%

The factors and their associated range of values were developed in conjunction with the AIF/NESP-036 study. The application of the factors is discussed in more detail in that publication.

Scheduling Program Durations

The unit factors, adjusted by the WDFs as described above, are applied against the inventory of materials to be removed in the radiologically controlled areas. The resulting man-hours, or crew-hours, are used in the development of the decommissioning program schedule, using resource loading and event sequencing considerations. The scheduling of conventional removal and dismantling activities are based upon productivity information available from the "Building Construction Cost Data" publication.

An activity duration critical path is used to determine the total decommissioning program schedule. The schedule is relied upon in calculating the carrying costs, which include program management, administration, field engineering, equipment rental, and support services such as quality control and security. This systematic approach for assembling decommissioning estimates ensures a high degree of confidence in the reliability of the resulting cost estimate.

3.3 IMPACT OF DECOMMISSIONING MULTIPLE REACTOR UNITS

In estimating the decommissioning of three co-located reactor units there can be opportunities to achieve economies of scale, by sharing costs between units, and coordinating the sequence of work activities. There will also be schedule constraints, particularly where there are requirements for specialty equipment

and staff, or practical limitations on when final status surveys can take place. For purposes of the estimates, Units 1, 2, and 3 are assumed essentially identical. Common facilities, assigned to Unit 3 in previous estimates, have been allocated on an equal basis across the three units where possible. A summary of the principal impacts is listed below.

- The sequence of work generally follows the principal that the work is done at Unit 1 first, followed by similar work at Units 2 and 3. This permits the experience gained at Unit 1 to be applied by the workforce at the later units. It should be noted however, that the estimates do not consider productivity improvements at the later units, since there is little documented experience with decommissioning multiple units simultaneously. The work associated with developing activity specifications and procedures can be considered essentially identical between the units, therefore the later units' costs are assumed to be a fraction of the first unit (~ 43%).
- Segmenting the reactor vessel and internals will require the use of special equipment. The decommissioning project will be scheduled such that later unit reactor internals and vessel are segmented after the activities at Unit 1 have been completed.
- Some program management and support costs, particularly costs associated with the more senior positions, can be avoided with multiple reactors undergoing decommissioning simultaneously. As a result, the estimates are based on a "lead" unit that includes these senior positions, and an "additional" unit that excludes these positions. The designation as lead is based on the unit undertaking the most complex tasks (for instance vessel segmentation) or performing tasks for the first time.
- The final radiological survey schedule is also affected by a multi-unit decommissioning schedule. It would be considered impractical to try to complete the final status survey of Unit 1, while Units 2 and 3 still have ongoing radiological remediation work and waste handling in process. As such, the transfer of the spent fuel from the storage pools and subsequent decontamination of the fuel buildings is coordinated to synchronize the final status survey for the station.
- The final demolition of buildings at Units 1, 2 and 3 are considered to take place concurrently. This is considered a reasonable assumption since access to the buildings is considered good at the station.
- Unit 1, as the first unit to enter decommissioning, incurs the majority of site characterization costs.

- Shared systems and structures, assigned to Unit 3 in previous estimates, have been allocated on an equal basis across the three units where possible.
- Station costs such as emergency response fees, regulatory agency fees, corporate overhead, and insurance are generally allocated on an equal basis between the units.

3.4 FINANCIAL COMPONENTS OF THE COST MODEL

TLG's proprietary decommissioning cost model, DECCER, produces many distinct cost elements. These direct expenditures, however, do not comprise the total cost to accomplish the project goal, i.e., license termination and site restoration.

3.4.1 Contingency

Inherent in any cost estimate that does not rely on historical data is the inability to specify the precise source of costs imposed by factors such as tool breakage, accidents, illnesses, weather delays, and labor stoppages. In the DECCER cost model, contingency fulfills this role. Contingency is added to each line item to account for costs that are difficult or impossible to develop analytically. Such costs are historically inevitable over the duration of a job of this magnitude; therefore, this cost analysis includes funds to cover these types of expenses.

The activity- and period-dependent costs are combined to develop the total decommissioning cost. A contingency is then applied on a line-item basis, using one or more of the contingency types listed in the AIF/NESP-036 study. "Contingencies" are defined in the American Association of Cost Engineers "Project and Cost Engineers' Handbook [28] 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 analysis are based upon ideal conditions and maximum efficiency; therefore, consistent with industry practice, a contingency factor has been applied. In the AIF/NESP-036 study, the types of unforeseeable events that are likely to occur in decommissioning are discussed and guidelines are provided for percentage contingency in each category. It should be noted that contingency, as used in this analysis, does not account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the station.

The use and role of contingency within decommissioning estimates is not a "safety factor issue." 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. An estimate without contingency, or from which contingency has been removed, can disrupt the orderly progression of events and jeopardize a successful conclusion to the decommissioning process.

For example, the most technologically challenging task in decommissioning a commercial nuclear station is the disposition of the reactor vessel and internal components, now highly radioactive after a lifetime of exposure to core activity. The disposition of these components forms the basis of the critical path (schedule) for decommissioning operations. Cost and schedule are interdependent, and any deviation in schedule has a significant impact on cost for performing a specific activity.

Disposition of the reactor vessel internals involves the underwater cutting of complex components that are highly radioactive. Costs are based upon optimum segmentation, handling, and packaging scenarios. The schedule is primarily dependent upon the turnaround time for the heavily shielded shipping casks, including preparation, loading, and decontamination of the containers for transport. The number of casks required is a function of the pieces generated in the segmentation activity, a value calculated on optimum performance of the tooling employed in cutting the various subassemblies. The expected optimization, however, may not be achieved, resulting in delays and additional program costs. For this reason, contingency must be included to mitigate the consequences of the expected inefficiencies inherent in this complex activity, along with related concerns associated with the operation of highly specialized tooling, field conditions, and water clarity.

Contingency funds are an integral part of the total cost to complete the decommissioning process. Exclusion of this component puts at risk a successful completion of the intended tasks and, potentially, subsequent related activities. For this study, TLG examined the major activity-related problems (decontamination, segmentation, equipment handling, packaging, transport, and waste disposal) that necessitate a contingency. Individual activity contingencies ranged from 10% to 75%,

depending on the degree of difficulty judged to be appropriate from TLG's actual decommissioning experience.

The contingency values used in this study are as follows:

• Decontamination	50%
• Contaminated Component Removal	25%
• Contaminated Component Packaging	10%
• Contaminated Component Transport	15%
• Low-Level Radioactive Waste Disposal	25%
• Reactor Segmentation	75%
• NSSS Component Removal	25%
• Reactor Waste Packaging	25%
• Reactor Waste Transport	25%
• Reactor Vessel Component Disposal	50%
• GTCC Disposal	15%
• Non-Radioactive Component Removal	15%
• Heavy Equipment and Tooling	15%
• Supplies	25%
• Engineering	15%
• Energy	15%
• Characterization and Termination Surveys	30%
• Construction	15%
• Taxes and Fees	10%
• Insurance	10%
• Staffing	15%
• Spent Fuel Storage (Dry) Systems	15%
• Spent Fuel Transfer Costs	15%
• Operations and Maintenance Expenses	15%
• ISFSI Decommissioning License Termination Costs	25%

The contingency values are applied to the appropriate components of the estimates on a line-item basis. A composite value is then reported at the end of each estimate. For example, the composite contingency values are 20.0%, 20.3%, and 20.0% for Units 1, 2, and 3, respectively. A flat 15% contingency is applied to the ISFSI campaign costs, shown in Appendix N.

Two of the owners of the Palo Verde station are regulated utilities that are based in states that have specific requirements for the application of contingency as it relates to nuclear power plant DCEs. The California Public Utilities Commission has expressed a desire for owners to conservatively establish an appropriate contingency factor for inclusion in the decommissioning revenue requirements. To that end, a document[29] was prepared by Pacific Gas and Electric Company to address the California commission's request. In addition to the contingency based on the AIF guidelines as identified above, additional contingency was added to the consolidated cash flows in Appendix P to accomplish this need. Additional contingency was added to reflect an overall project contingency of 25%. This contingency was incorporated on a line-item basis, with each line item receiving a pro-rated share of the increase. The nominal increase in contingency to achieve an overall contingency rate of 25% is a multiplier of 1.242 as a site average; each Appendix has a separate calculation to arrive at a 25% value.

The Public Utility Commission of Texas has issued regulations regarding contingency within nuclear DCEs.[30] The Commission's Substantive Rule §25.231(b)(1)(F)(i) requires use of a contingency of 10% of the cost of decommissioning. As a modification to the contingency based on the AIF guidelines as identified above, an administrative reduction was incorporated in the overall contingency on the cash flows in Appendix Q to fulfill this requirement. This contingency reduction was incorporated on a line-item basis, with each line item receiving a pro-rated share of the decrease. The nominal decrease in contingency to achieve an overall contingency rate of 10% is a multiplier of 0.497 as a site average; each Appendix has a separate calculation to arrive at a 10% value.

3.4.2 Financial Risk

In addition to the routine uncertainties addressed by contingency, another cost element that is sometimes necessary to consider when bounding decommissioning costs relates to uncertainty, or risk. Examples can include changes in work scope, pricing, job performance, and other variations that could conceivably, but not necessarily, occur. Consideration is sometimes necessary to generate a level of confidence in the estimate, within a range of probabilities. TLG considers these types of costs under the broad term "financial risk." Included within the category of financial risk are:

- Delays in approval of the decommissioning plan due to intervention, public participation in local community meetings, legal challenges, and national and local hearings.
- Changes in the project work scope from the baseline estimate, involving the discovery of unexpected levels of contaminants, contamination in places not previously expected, contaminated soil previously undiscovered (either radioactive or hazardous material contamination), variations in plant inventory, or configuration not indicated by the as-built drawings.
- Regulatory changes, e.g., affecting worker health and safety, site release criteria, waste transportation, and disposal.
- Policy decisions altering national commitments, e.g., in the ability to accommodate certain waste forms for disposition or in the timetable for such, e.g., the start and rate of acceptance of spent fuel by the DOE.
- Pricing changes for basic inputs such as labor, energy, materials, and disposal. Items subject to widespread price competition (such as materials) may not show significant variation; however, others such as waste disposal could exhibit large pricing uncertainties, particularly in markets where limited access to services is available.

This cost study does not add any additional costs to the estimate for financial risk, because there is insufficient historical data from which to project future liabilities. Consequently, the areas of uncertainty or risk are revisited periodically and addressed through repeated revisions or updates of the base estimate.

3.5 SITE-SPECIFIC CONSIDERATIONS

There are several site-specific considerations that affect the method for dismantling and removal of equipment from the site and the degree of restoration required. The cost impacts of these considerations are identified in this section.

3.5.1 Spent Fuel Disposition

The cost to dispose of spent fuel generated from plant operations is not reflected within the estimates to decommission Palo Verde. Ultimate disposition of the spent fuel is within the province of the DOE's Waste Management System, as defined by the Nuclear Waste Policy Act. Any

delay in the transfer of spent fuel may increase the on-site management costs. As such, the disposal cost was financed by a 1 mill/kWhr surcharge paid into the DOE's waste fund during operations. On November 19, 2013, the U.S. Court of Appeals for the D.C. Circuit ordered the Secretary of the Department of Energy to suspend collecting annual fees for nuclear waste disposal from nuclear power plant operators until the DOE has conducted a legally adequate fee assessment.

The NRC does, however, require licensees to establish a program to manage and provide funding for the management of all irradiated fuel at the reactor site until title of the fuel is transferred to the Secretary of Energy. This requirement is prepared for through inclusion of transfer costs for the spent fuel containers to the DOE within the estimates, as described below.

For the basis of this cost study, it is assumed the existing Palo Verde ISFSI will continue storing spent fuel throughout the decommissioning of Palo Verde, with the OA providing operation and maintenance of the facility through the license termination and site restoration of the ISFSI in 2098. This study assumes no transfer of fuel among the three Palo Verde units. Table 3.1 provides details regarding the spent fuel and GTCC disposition assumptions used in this analysis. Upon shutdown of each unit, it is assumed that the operation and maintenance cost of the spent fuel pools is a decommissioning cost. The decommissioning organization is expected to assume management responsibilities for all fuel bundles in the fuel pools at each unit's shutdown. Each unit includes the continued cost of wet storage of the spent fuel until each cycle has decayed for six years from reactor core discharge date.

Within six years of each unit's shut down, some spent fuel will be transferred from the pools to the DOE and the remainder will be relocated to the ISFSI until such time that transfer to a DOE permanent or interim storage facility can be completed. The spent fuel pools are assumed to be emptied six years after each respective unit's final shutdown date. The cost estimate assumes that the spent fuel storage facility and support systems are isolated from the balance of the systems to allow more flexibility in dismantling and to provide cost savings.

The decommissioning scenario has been developed to permit continued operation of the Fuel Building of each unit. Once the spent fuel assemblies have been placed in dry storage or transferred to the DOE, each unit's wet

spent fuel storage and handling facilities will be available for decommissioning.

The ISFSI is currently licensed to operate under a 10 CFR Part 50 general license (in accordance with 10 CFR 72, Subpart K [14]). The estimate assumes that as decommissioning progresses, the 10 CFR Part 50 license will be reduced to the ISFSI, such that the ISFSI will remain under the General License.

It is assumed that spent fuel will be shipped either to the DOE's geological repository or to an interim spent fuel storage facility during the operational period of the ISFSI facility. The estimate includes ISFSI costs that the OA expects not to be reimbursed by the DOE. This includes ISFSI costs in the periods following License Termination through Site Restoration (Insurance, ISFSI Licensing Fees, ISFSI Operating Fees), which are included in Appendix C. Once all spent fuel and GTCC canisters have been removed from the site, the dry storage facility will be removed.

This estimate also includes certain ISFSI-related costs that are assumed to be reimbursable by the DOE. A summary of these costs, which are included in Appendices L and N, is below.

- Spent fuel transfer costs
- Capital costs for spent fuel canisters and overpacks
- Construction of an ISFSI shield wall
- Installation of an ISFSI crane and cask handling equipment
- ISFSI transfer equipment
- ISFSI operation and maintenance costs (including property taxes)
- Allowance for cost of instrumentation of last 5 pads
- ISFSI staffing costs
- ISFSI security costs

The post-shutdown costs to transfer spent fuel from each spent fuel pool to the DOE or ISFSI and the costs to subsequently transfer casks from the ISFSI to the DOE are reflected within the decommissioning estimate for dry fuel storage as outlined in Appendix L.

TABLE 3.1
PALO VERDE
SPENT FUEL AND GTCC DISPOSITION

Canisters Prior to Shutdown	Pool to DOE 21 FA[1]	Pool to ISFSI 24 FA	Pool to ISFSI 37 FA	ISFSI to DOE 24 FA	ISFSI to DOE 37 FA	GTCC/ Legacy[2]	Total Casks to ISFSI	Total Casks to DOE
Unit 1	15	51	42	-	-	-	93	15
Unit 2	21	53	43	-	-	-	96	21
Unit 3	21	48	44	-	-	-	92	21
Total	57	152	129	-	-	-	281	57

Canisters After Shutdown through 2057	Pool to DOE	Pool to ISFSI 24 FA	Pool to ISFSI 37 FA	ISFSI to DOE 24 FA	ISFSI to DOE 37 FA	GTCC/ Legacy	Total Casks to ISFSI	Total Casks to DOE
Unit 1	25	-	10	22	-	10	10	47
Unit 2	24	-	7	8	-	10	7	32
Unit 3	29	-	7	8	-	10	7	37
Total	78	-	24	38	-	30	24	116

Canisters 2058 through 2097	Pool to DOE	Pool to ISFSI 24 FA	Pool to ISFSI 37 FA	ISFSI to DOE 24 FA	ISFSI to DOE 37 FA	GTCC/ Legacy	Total Casks to ISFSI	Total Casks to DOE
Unit 1	-	-	-	29	52	-	-	81
Unit 2	-	-	-	45	50	-	-	95
Unit 3	-	-	-	40	51	-	-	91
Total	-	-	-	114	153	-	-	267

Total assemblies discharged	12,123
Assemblies accepted by DOE from the ISFSI	9,288
Total 24 assembly casks required	152
Total 37 assembly casks required	153
Total fuel casks loaded to ISFSI	305
Assemblies accepted by DOE from the pool	2,835
21 assembly casks accepted by DOE from the pool	135

Total Casks

Unit 1 to ISFSI	103
Unit 1 to DOE	143
Unit 2 to ISFSI	103
Unit 2 to DOE	148
Unit 3 to ISFSI	99
Unit 3 to DOE	149
GTCC/Legacy Waste	30
Total Casks (spent fuel & GTCC)	470

Notes: [1] Fuel Assemblies

[2] Legacy GTCC waste includes an allowance of 2 canisters per unit remaining from plant operations in spent fuel pool; the remaining 8 canisters per unit hold the GTCC resulting from vessel internals segmentation operations.

3.5.2 Reactor Vessel and Internal Components

The reactor vessel, steam generators, pressurizer, coolant pumps, and piping will be chemically decontaminated prior to any dismantling work. The reactor pressure vessel and its internal components are segmented for disposal in shielded transportation casks. Segmentation and packaging of the internals packages are performed in the refueling canal where a turntable and remote cutter will be installed. The vessel is segmented in place, using a mast-mounted cutter supported off the lower head and directed from a shielded work platform installed overhead in the reactor cavity. Transportation cask specifications and Department of Transportation (DOT) regulations dictate segmentation and packaging methodology. All packages must meet the current physical and radiological limitations and regulations. Cask shipments will be made in DOT-approved, currently available, truck casks.

The dismantling of reactor internals at Palo Verde will generate GTCC radioactive waste generally unsuitable for shallow land disposal. Although the material is not classified as high-level waste, the DOE has indicated it will accept title to this waste for disposal at the future high-level waste repository. However, the DOE has not yet established acceptance criteria or a disposition schedule for this material, and numerous questions remain as to the ultimate disposal cost and waste form requirements. As such, for purposes of this study, the GTCC waste resulting from reactor vessel internals segmentation is assumed to be packaged and disposed of in the same manner as high-level waste, at a cost equivalent to that envisioned for the spent fuel.

Reactor coolant piping is cut from the reactor vessel once the water level in the vessel (used for personnel shielding during dismantling and cutting operations in and around the vessel) is dropped below the nozzle zone. The piping is boxed and shipped by shielded van. The reactor coolant pumps and motors are lifted out intact, packaged, and transported for disposal.

3.5.3 Steam Generators and Other NSSS Components

The recommended method of removal for the steam generators is to extract the steam generators through the existing containment equipment hatch. This approach is the same as the one used to replace the original steam generators.

The containment polar crane will be modified to support the removal.

The generators will then be rigged for removal, disconnected from the surrounding piping, and maneuvered into the open area where they will be lowered onto a dolly. The dolly will allow the lower end of the steam generator to slowly roll outside of the Reactor Building as it is being lowered. Once the steam generator has been lowered to the horizontal position, it will be lowered onto a prime mover and moved to an on-site storage area to await transport to the disposal facility. The second steam generator will be removed using the same technique.

Once at the storage area, the secondary side of the generator (steam dome, separator, and dryer portions above the u-bends) will be removed, segmented, and packaged for disposal. The primary section (tube section and lower channel head) will be cut into smaller sections, which allow unrestricted rail shipment. The generator sections will then be loaded onto a prime mover and moved to an on-site railhead where they will be transported to the WCS facility in Andrews County, Texas. The pressurizer on each unit will be removed using the same techniques and shipped intact.

Palo Verde Units 1, 2, and 3 have already replaced their original sets of steam generators; they are currently stored on site within a concrete protective structure and will remain there until final plant decommissioning. The costs for transportation and disposal of these original sets of steam generators have been included in this estimate.

3.5.4 Main Turbine and Condenser

The main turbine will be dismantled using conventional maintenance procedures. The turbine rotors and shafts will be removed to a laydown area. The lower turbine casings will be removed from their anchors by controlled demolition. The main condensers will also be disassembled and moved to a laydown area. Turbine components are assumed to be clean and will be surveyed and free-released. The condensers for all units are assumed to be contaminated and they will be sent for disposal at the WCS facility in Andrews County, Texas. Components will be packaged and readied for transport in accordance with the intended disposition.

3.5.5 Transportation Methods

Contaminated piping, components, and structural material other than the highly activated reactor vessel and internal components will qualify

as Low Specific Activity (LSA)- II or III, Type A, or Surface Contaminated Object, SCO-I or II, as described in Title 49 of the Code of Federal Regulations.[31] The contaminated material will be packaged in general design packages, as defined in 49 CFR 173.410 in Industrial Packages (IP I, II, or III, as defined in subpart 10 CFR 173.411) or Type A packages as defined in 49 CFR 173.465 for transport unless demonstrated to qualify as their own shipping containers. The reactor vessel and internal components are expected to be transported in accordance with 10 CFR Part 71, as a Type B waste container. It is conceivable that the reactor, due to its limited specific activity, could qualify as LSA II or III. However, the high radiation levels on the outer surface would require that additional shielding be incorporated within the packaging to attenuate the dose to levels acceptable for transport.

Transport of the highly activated metal, produced in the segmentation of the reactor vessel and internal components, will be by shielded truck cask. Cask shipments may exceed 95,000 pounds, including vessel segment(s), supplementary shielding, cask tie-downs, and tractor-trailer. The maximum level of activity per shipment assumed permissible was based upon the license limits of the available shielded transport casks. The segmentation scheme for the vessel and internal segments is designed to meet these limits.

The transport of large intact components, e.g., large heat exchangers and other oversized components will be by a combination of truck, rail, and/or multi-wheeled transporter.

3.5.6 Low-Level Radioactive Waste Disposal

The low-level radioactive waste requiring controlled disposal will be sent to disposal facilities in Utah and Texas. Transportation costs are estimated using published tariffs from Tri-State Motor Transit. [32] Truck transport assumes a maximum normal road weight limit of 80,000 pounds for all shipments, with the exception of the overweight shielded casks and non-divisible large components.

A majority of LLRW generated in the decontamination and dismantling of Palo Verde is disposed of at the WCS facility in Andrews County, Texas. This site will receive contaminated material such as steam generator primary side material, pressurizer, and reactor coolant piping, packaged system components and piping. Contaminated concrete, concrete rubble, and Dry Active Waste (DAW) is assumed to

be sent to the Energy*Solutions* Utah disposal facility. Class B and C waste (principally reactor pressure vessel (RPV) internals) are assumed to be buried at the Waste Control Specialists (WCS) facility in Andrews County, Texas. Clean metallic scrap material primarily from the Turbine Building will be surveyed prior to release.

Based upon current disposal rates for metallic waste, volume reduction and waste processing are not considered economical.

3.5.7 Stored Steam Generators and Storage Facility

This study includes the disposal costs of six retired steam generators (two per unit). They are assumed to be stored in the on-site storage facility until the time of the decommissioning. All activities associated with the stored steam generators and storage facility are considered non-critical and will not affect the overall decommissioning schedule. These generators are assumed to be packaged and transported in the same manner as the steam generators extracted from the Reactor Buildings. The stored steam generators are not expected to require any substantial decontamination or shielding prior to shipment for disposal. Appendix G summarizes the retired steam generator disposal and the facility decommissioning costs.

3.5.8 Water Reclamation Facility

Dismantling of the water reclamation facility is delayed until the spent fuel assemblies from each unit have been placed in dry storage or transferred to the DOE, and each unit's wet spent fuel storage and handling facilities are available for decommissioning. No program management or heavy equipment period-dependent costs have been allocated to this facility. Staff and equipment assigned to the unit activities can support this work since the task can be started and interrupted when critical path activities allow for usage of equipment and labor during this time. Assuming all release criteria are met; the building structures can be removed in an orderly fashion using acceptable controlled demolition techniques. The use of soil remediation technologies will not be required since it is assumed hazardous and radiological release criteria will also be met.

The buildings will be removed to a nominal depth of three feet below grade level. Concrete will be processed (crushed) prior to use as backfill. Holes will be drilled in the foundation base mat to allow for natural drainage. Building and structure sub grade voids will be backfilled with clean

demolition debris and graded. Underground piping will be excavated, and all voids backfilled. Appendix H summarizes the facility decommissioning costs.

3.5.9 Water Reclamation Supply System Pipeline & Structures

Dismantling of the water reclamation facility supply system and structures is delayed until the spent fuel assemblies from each unit have been placed in dry storage or transferred to the DOE, and each unit's wet spent fuel storage and handling facilities are available for decommissioning. There are no specific program management or heavy equipment period-dependent costs assigned since the task can be started and interrupted when critical path activities allow for usage of equipment and labor during this time.

These activities include the removal of the 91st Avenue Wastewater Treatment Plant Interface Structure, Buckeye Irrigation Company Interface, and the Hassayampa Pumping Station. The buildings will be demolished to a nominal depth of three feet below grade level. Concrete will be processed (crushed) prior to use as backfill. Holes will be drilled in the foundation base mat to allow for natural drainage. All piping up to three feet below grade will be excavated and removed. All piping below three feet below grade will be left in place and filled with concrete slurry to prevent any future collapse. Appendix I summarizes the decommissioning costs.

3.5.10 Evaporation Ponds

The study includes the removal, restoration, and closure of all three evaporation ponds. All activities associated with the Evaporation Ponds are considered non-critical and will not affect the overall decommissioning schedule. There are no program management or heavy equipment period-dependent costs assigned since the task can be started and interrupted when critical path activities allow for usage of equipment and labor.

Based upon plant operations and radiological survey information, trace levels of radioactive materials were detected in the two older Evaporation Ponds. Beginning in 1996 and at least annually thereafter samples have been obtained from both Evaporation Ponds and dose calculations each year have indicated that the highest dose from residual radioactivity is

less than 1 mRem/year TEDE. Consequently, no allowance has been provided for remediation of the Evaporation Ponds.

The costs for the site restoration and closure (including development of a Subpart D Permitted landfill in accordance with Arizona statutes) were provided by APS (Arizona Public Service) for inclusion in this report. These costs include complete removal of the sediment, liners, and drainage system, and regrade and revegetation of the surrounding area. The study also includes the cost to develop an onsite Subpart D Permitted landfill which will contain the sediment from the three evaporation ponds. Appendix J summarizes these costs.

3.5.11 Make-up Water Reservoirs

The study includes the removal, site restoration, and closure costs for both make-up water reservoirs. Dismantling of the make-up water reservoirs is delayed until the spent fuel assemblies from each unit have been placed in dry storage or transferred to the DOE, and each unit's wet spent fuel storage and handling facilities are available for decommissioning. There are no program management or heavy equipment period-dependent costs assigned since the task can be started and interrupted when critical path activities allow for usage of equipment and labor during this time.

The costs for the site restoration and closure in accordance with Arizona statutes were provided by APS for inclusion in this report. These costs include complete removal of the sediment, liners and drainage system and regrade and revegetation of the surrounding area. Appendix K summarizes the facility decommissioning costs.

3.5.12 ISFSI

The ISFSI is assumed to have sufficient capacity to accommodate operational and decommissioning fuel storage requirements. The estimate includes ISFSI costs that the OA expects will not be reimbursed by the DOE. This includes ISFSI costs in the periods following License Termination through Site Restoration (Insurance, ISFSI Licensing Fees, ISFSI Operating Costs), which are included in Appendix C. Incremental capital costs related to the utilization of the ISFSI during the decommissioning period have been included in the estimate with the assumption that they are fully reimbursable from the DOE. These costs have been included in separate appendices in this report. The costs

associated with purchase of canisters and overpacks, ISFSI operational costs, and periodic transfer costs from the spent fuel pool to the ISFSI/DOE and from the ISFSI to the DOE are shown in Appendix L. Costs associated with transfer of the Unit 1 fuel building crane to the ISFSI, instrumentation of ISFSI pads, purchase ISFSI transfer equipment, and construction of a radiation shield wall along one side of the ISFSI are shown in Appendix N.

Palo Verde will use the NAC International Universal MPC (Multi-Purpose Canister) System with a maximum loading of 24 assemblies per canister through the year 2018. In 2020, Palo Verde began using the NAC International Magnastor system with a maximum loading of 37 assembly per canister system for the storage and transportation of spent fuel. See Table 3.1 for details regarding spent fuel assumptions for quantities of dry fuel storage and GTCC canisters. Canisters provided by the DOE for transfer from the fuel pool to the DOE are assumed to be provided at no cost; plant personnel will still perform the loading and transfer of these canisters, at the rate of $312 thousand per canister. The loading and transfer of canisters from the ISFSI to the DOE are assumed to be 50% of the wet transfer cost, or $156 thousand per canister.

Some overpack liners are assumed to have some level of neutron-induced activation due to the long-term storage of the fuel, i.e., to levels exceeding free-release limits. Seven overpacks per unit (site total of 21) are assumed to require remediation, equivalent to the number of overpacks required to accommodate the final core offloads at Palo Verde (241 assemblies per unit for a site total of 723 assemblies). The cost of the disposition of this material, as well as the demolition of the ISFSI facility, is included in the estimate.

Considering the use of a 37-assembly canister system, the current ISFSI facility will have adequate capacity to store the GTCC waste. There is no cost included in this estimate for the construction of an additional storage pad.

It is assumed that on-site landfill facilities may be reopened for the disposal of ISFSI demolition debris, if required. The ISFSI decommissioning and demolition will occur in 2098, immediately following the completion of fuel transfer to the DOE in 2097. This is based upon the assumed date that the U.S. DOE begins receipt of spent fuel from the utilities (2034), Palo Verde's priority in the queue, and an assumed rate of shipment from the site to DOE beyond the published DOE queue. For the

first 19 years of this period (2034-2052), the annual fuel pickup rate is aligned with DOE/RW-0567, Acceptance Priority Ranking and Annual Capacity Report. Beginning in year 20 (2053) and continuing until 2097, the annual fuel pickup rate is based on a schedule provided by the OA. Direct canister closure and transfer costs from the pool or ISFSI to a DOE transport vehicle, ISFSI operations, and maintenance costs for the ISFSI are included in this estimate and are assumed to be paid from reimbursements by the DOE. Appendix L summarizes the ISFSI facility fuel transfer and decommissioning costs.

3.5.13 Stored Reactor Closure Heads & Storage Facility

This study includes the disposal costs of three retired reactor closure heads (one per unit). They are assumed to be stored in the on-site storage facility until the time of the decommissioning. All activities associated with the stored closure heads and storage facility are considered non-critical and will not affect the overall decommissioning schedule. These components are assumed to be packaged and transported intact to the disposal site. The stored reactor closure heads are not expected to require any substantial decontamination or shielding prior to shipment for disposal. Appendix M summarizes the retired closure head disposal and the facility decommissioning costs.

3.5.14 On-Site Clean Fill Disposal

Construction debris resulting from the decommissioning project is considered suitable for on-site disposal. This saves some of the transportation costs and the tipping fees at a commercial disposal facility. An existing landfill may be expanded for the disposal of this construction debris, or existing voids (excluding the evaporation ponds) may be utilized for this purpose.

3.5.15 Site Conditions Following Decommissioning

Following the decommissioning effort, the structures and remaining systems will meet the site release limit that will be specified in the Palo Verde NRC license termination plan. The NRC involvement in the decommissioning process typically will end at this point. Local building codes, state environmental regulations, and the OA's future plans for the site will dictate the next steps in the decommissioning process. TLG assumed the total removal of all plant systems and all the above-grade structures from the site except the switchyard and site drainage facilities.

3.5.16 Utility Staffing

This estimate assumes that the OA will act as its own DOC (Decommissioning Operations Contractor) for the project. As such, some contractor management, supervisory, and professional positions will be eliminated. Staffing levels are assigned for each unit by sub-period and functional area. Economies of a multi-unit decommissioning are recognized by establishing a primary and a secondary staff level. The unit assigned the primary staff will include common supervisory positions and positions that may be shared across all units. The types of positions and staffing levels are adjusted based upon the type of activity occurring in each sub-period. The staffing model allows for sharing of resources with other OA operating units and other corporate functions and assignments.

Staffing costs include direct salary as well as an allowance for overheads. A profile of the staffing level for the three-unit decommissioning, including contractors and craft, is provided in Figure 3.1 (at the end of Section 3). The graph shows minimal staff during the pre-shutdown planning phase, which starts five years before the shutdown of Unit 1. Because the shutdowns of the three units will occur within less than a three-year period, the utility and craft staffing levels will increase rapidly during the first three years of the decommissioning. Utility staffing levels will gradually decrease after completing the removal of physical systems at each of the three units.

Staffing levels and management support will vary based upon the amount and type of decommissioning work. Craft labor levels decrease after systems removal and structures decontamination and drop substantially during the delay period and the license termination survey period. However, craft staff levels increase again during the site restoration period due to the work associated with structures demolition.

ISFSI support staff levels during license termination and demolition in 2098 are also included. The ISFSI staffing costs for operation, maintenance, and security of the ISFSI are included and shown in Appendix L.

3.5.17 Miscellaneous Structures Demolition

Appendix C, Tables C-1,2, and 3, activity index 3b.1.1.28 "Miscellaneous Structures & Foundations" includes the cost to remove many of the

smaller common buildings at the site. The facilities included within this line item are listed below.

Blowdown Demineralizer Area
Concrete Block Barriers
Condensate Demineralizer Transfer Pump Area
Diesel Generator Rework Shop
Demineralized Water Storage
Electrical Equipment Facilities
Electrical Battery Storage Building
Emergency Diesel Generator Buildings
Fire Protection Storage Shed
General Maintenance Shop
ICE House
Large Motor Storage Sheds
LSR Waste Holdup Tank Area
Lube Oil Tank Area
Metrology Tower Building
Miscellaneous Yard Foundations
New Fuel Depot Underground Storage Tanks
New Protected Area Security Extension Facility
New Vehicle Maintenance Facility
Pop-Up Barriers
Reactor Makeup Tank Area
Regen Waste Neutral Tank Area
Resin Storage Shed
Sally-Port (West Side)
Single Point Vehicle Access
Spray Pond Pumphouse
Sub-Synchronous Resonance Equipment Building
Startup Transformer Yard
Sulfuric Acid Tank Area
Training Mockup Facility
Turbine Building Tank Storage Area
Underground Weld Test Building
Valve Service Shop
Welding Combination Shop

3.5.18 New Structures

No new structures were added to the site inventory for the 2023 estimate.

3.6 ASSUMPTIONS

The following are the major assumptions made in the development of the cost analysis for decommissioning Palo Verde.

3.6.1 Estimating Basis

1. The estimate is performed in accordance with the methodology described in the AIF/NESP-036 study.
2. Decommissioning costs are reported in the year of projected expenditure; however, the values are provided in 2023 dollars for the current estimate. Costs are not inflated, escalated, or discounted over the period of performance.
3. Plant drawings, equipment, and structural specifications used in the estimate were provided by the OA.
4. All units are assumed to be essentially identical except for common structures and systems. Common systems and structures, assigned to and incorporated within the estimate for Unit 3 in previous estimates, have been allocated on an equal basis across the three units where possible.
5. Additional decommissioning costs for secondary side systems contamination caused by the Unit 2 steam generator tube rupture are included in the estimate. The turbines have been treated as clean components in the estimate. The condensers have been treated as contaminated components for all three units in this estimate.

3.6.2 Labor Costs

1. The craft labor required to decontaminate and dismantle the nuclear units will be acquired through standard site contracting practices. The current rates for labor at the site (fully loaded) are used as an estimating basis.
2. Utility staffing requirements will vary with the level of effort associated with the various phases of the project. Once the decommissioning program commences, the operations staff will be reduced to only those staff positions necessary to support the decommissioning program and ISFSI activities. Staff transition costs from plant operations to decommissioning are included in this study. The total transition costs are calculated for the site and

divided equally between the three units. Employee labor cost data and craft labor rates for site administration, operations, construction, and maintenance personnel were provided by the OA for positions identified by TLG.

3. Site security, radiological controls, and overall site administration during decommissioning and dismantling will be provided by the OA. There is a significant nuclear security presence at each reactor until the spent fuel has been removed from the spent fuel pool to the ISFSI. The spent fuel pools are assumed to be emptied six years after that unit's final shutdown date, at which time the nuclear security force for that unit is significantly reduced.

4. Engineering services for such items as writing activity specifications and detailed work procedures will be provided by outside contractors with the appropriate expertise.

5. All work (except vessel and internals removal activities) will be performed on an 8-hour per day, 5-day per week basis, with no overtime. There are 11 paid holidays per year. Vessel and internal removal activities will be performed using two shifts, with an additional charge for back shift activities.

3.6.3 Design Conditions

1. Any fuel cladding failure that occurred during the lifetime of the plant is assumed to have released fission products at sufficiently low levels that the buildup of quantities of long-lived isotopes (e.g., ^{137}Cs, ^{90}Sr, or transuranics) has been prevented from reaching levels exceeding those which permit the major NSSS components to be shipped under current DOT regulations, and to be buried within the requirements of 10 CFR Part 61.

2. The estimated curie content of the vessel and internal components were derived from those listed in NUREG/CR-3474.[33] Actual estimates were derived from the Ci/gram values in NUREG/CR-3474 and adjusted for the different mass of the Palo Verde components, operating life, and periods of decay. Additional short-lived isotopes were derived from NUREG/CR-0130[34] and NUREG/CR-0672[35] and benchmarked to the long-lived values from NUREG/CR-3474.

3. Segmentation of the reactor vessel internal components will produce a limited quantity of activated material with radionuclide inventories exceeding Class C quantities, as defined in 10 CFR Part

61. The GTCC material is generally not suitable for shallow land disposal and will most likely be disposed of as high-level waste in the DOE's geological repository (unless the NRC approves an alternative solution). The cost of disposal, unlike that for the spent fuel, is not addressed by the DOE's 1 mill/kWhr surcharge on plant electrical generation. As such, the disposal cost for GTCC presumes the packaging of this material in canisters similar to those used for spent fuel disposal, at an equivalent cost in dollars per cubic foot to what the DOE is charging for the disposal of spent fuel using the 1-mill/kWhr surcharge.

4. The only neutron-activated concrete expected to be above release levels is the bioshield, adjacent to and surrounding the reactor vessel. Aside from this, and material resulting from the scarifying of some concrete surfaces, the bulk of concrete in the Reactor Building and other buildings on site is assumed to meet NRC release limits for on-site disposal of material.

5. Control elements will be removed and transferred to the DOE along with the spent fuel, i.e., there is no additional cost provided for their disposal.

3.6.4 General

1. The existing plant equipment is considered obsolete and suitable for scrap as deadweight quantities only. The OA will make economically reasonable efforts to salvage equipment following final plant shutdown. Nonetheless, because placing a salvage value on this machinery and equipment would be speculative, and the value would be small in comparison to overall decommissioning expenses, this estimate does not attempt to quantify the value that the OA may realize based upon those efforts. It is difficult to predict whether the market for used equipment will be stronger or weaker than it is today. For these reasons, no equipment salvage value was included in the estimate.

2. Scrap generated during decommissioning is not included as a credit in this study for two reasons: (1) the relatively low market value of scrap; and (2) the relatively high cost of releasing the material from the site, i.e., the time and expense associated with "contamination-free" certification. It is assumed, for purposes of this estimate, that any value received from the sale of the material would be more than offset by the on-site processing costs.

3. The concrete debris resulting from building demolition activities is crushed on site to reduce the size of the debris. The resulting crushed concrete is used to backfill below grade voids. The rebar removed from the concrete crushing process is disposed of as scrap steel in a similar fashion as other scrap metal as discussed previously.

4. Costs for electrical power required to decommission the plant are included in the estimate. For estimating purposes, the plant is assumed to be de-energized, with decommissioning activities relying on temporary power connections. The OA will provide the temporary power packs and cabling to support the work. During DECON Period 2, Decommissioning Operations, electrical power systems are isolated and removed as they become non-essential to the decommissioning program.

5. Current plant staffing will remove all items of furniture, tools, mobile equipment (such as forklifts, trucks, bulldozers, and other similar mobile equipment), and other such items that can be easily removed without the use of special equipment at no cost or credit to the project.

6. Existing warehouses will be cleared of non-essential material and remain for use until they are dismantled as they become unnecessary to the decommissioning program.

7. The current OA staffing performs the following activities at no cost or credit to the project during the first six months of the planning period:

    - Fuel oil tanks will be emptied and cleaned by flushing or steam cleaning prior to disposal.
    - Acid and caustic tanks will be emptied.
    - Lubricating and transformer oils will be drained and removed from site by a waste disposal vendor.
    - All hazardous and legacy radioactive material will be removed and disposed of.

8. The decommissioning activities will be performed in accordance with the current regulations assumed to be in place at the time of decommissioning. This includes the ability to dispose of demolition debris on-site. Changes in regulations may have a cost impact on decommissioning.

9. Material and equipment costs for conventional demolition and/or construction activities were taken from RSMeans Building Construction Cost Data.

10. The 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, and the use of respiratory protection and personnel protective clothing. These items lengthen a task's duration, which increases the costs and lengthens the overall schedule. ALARA planning is considered in the costs for engineering and planning, and in the development of activity specifications and detailed procedures. Changes to 10 CFR Part 20 worker exposure limits may impact the decommissioning cost and project schedule.

11. FEMA and state fees associated with emergency planning are assumed to continue for approximately 18 months following the cessation of operations. At this time, the FEMA fees are discontinued. The timing is based upon the anticipated condition of the spent fuel (i.e., the hottest spent fuel assemblies are assumed to be cool enough that no substantial Zircaloy oxidation and off-site event would occur with the loss of spent fuel pool water). State and local fees are continued until the spent fuel pools are emptied and all spent fuel is transferred to dry storage casks.

12. Nuclear liability insurance provides coverage for damage or injuries due to radiation exposure from equipment, material, etc., used during decommissioning. Nuclear liability insurance is phased out upon final decontamination of the site. Nuclear property insurance will cease upon termination of the 10 CFR Part 50 or Part 72 license(s). Insurance costs in the estimate are based on premium information for required policies identified by the OA. Premium discounts during specific intervals throughout the analysis are in accordance with NRC guidelines.

13. A $1 million annual property tax allowance is included in the estimate. This cost is shared equally among the three units and is applied through the dry fuel storage period. Sales tax will be included at the local rates for purchased material.

14. This estimate assumes that processed water which meets state and federal release limits can be disposed of without additional cost.

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

16. The concrete circulating water piping will be abandoned by accessing the underground piping and permanently backfilling the voids. Contaminated underground concrete pipe will be removed entirely or decontaminated and abandoned. Underground steel pipe will be removed completely. Electrical manholes will be backfilled with suitable earthen material and abandoned. The Water Reclamation & Supply System concrete piping (35 miles of piping from Palo Verde to Phoenix) will be filled with concrete.

17. All site vestiges will be removed to a nominal depth of three feet below ground, with non-contaminated subgrade foundations remaining in place below this level. Holes will be drilled in each of the foundation basemats to allow for natural drainage. Building and structures subgrade voids will be backfilled with clean demolition fill. The site will be graded and landscaped.

18. The existing electrical switchyard will remain after decommissioning in support of the utility's electrical transmission and distribution system.

19. Most railroad tracks on site will be removed; an active spur connecting the ISFSI to the main line will remain to support rail shipments of spent fuel.

20. Road and parking areas with asphalt or concrete surfacing will be broken up and the material used as backfill on site. All gravel road and parking areas will remain in place and be covered with fill. Culverts, head walls, and stone riprap will remain in place to allow natural drainage.

21. The OA will have some existing scaffolding quantities available from plant operations to support the decommissioning project. Therefore, only costs associated with the remaining required scaffolding are included.

22. No significant quantities of asbestos, industrial solvents, chromated water, lead, or mercury are expected to be present on site at the time of decommissioning. Therefore, remediation costs for these types of materials are not included in the study.

23. This study has assumed that the Arizona Revised Statues, specifically 49-762.01 through 49-762.08 and 49-701.01, all regarding the definition and handling of solid waste, do not

interfere with the on-site disposal of concrete rubble; nor do they create any requirement for the removal of below grade clean or decontaminated structures, which this study assumes are abandoned in place. The establishment of a solid waste disposal facility on site will create a long-term liability for the management and caretaking of the disposal facility. Any costs for this ongoing management and caretaking are not included in this estimate.

3.7 COST ESTIMATE SUMMARY

Summaries of the radiological decommissioning costs and annual expenditures are provided in Appendices B, C, G, and H through Q. Table 6.1 provides a breakdown of these costs into the components of decontamination, removal, packaging, transportation, waste disposal, project management (staffing), and "other" cost categories. The costs were extracted from the detailed cost tables in Appendices C, G, H, I, J, K, L, M, N, and O. Note that Appendix O represents a consolidation of the cash flows from Appendices B, C, G, H, I, J, K, L, M, and N; it folds all site costs into the three Palo Verde unit costs. Appendices P and Q represent consolidated cash flows with contingencies of 25% and 10%, respectively. The following should be considered when reviewing these tables:

- "Decon" as used in the headings of these tables, refers to decontamination activities, as opposed to the NRC term DECON which refers to the prompt removal decommissioning scenario.
- "Total" as used in the headings of these tables, is the sum of Decon, Remove, Pack, Ship, Bury, Other (spent fuel, insurance, staffing, fees, etc.) and Contingency.
- The subtotal reported for the major cost categories does not include contingency, which is reported in a separate column.
- "Other" includes different types of costs, which are not easily categorized (such as characterization contract services, license termination survey, contract sources, plant preparation costs, etc.).

Appendices C, G, H, I, J, K, L, M, and N provide the supporting, detailed costs elements. The cost elements are assigned to one of three subcategories: "License Termination," "Spent Fuel Management," and "Site Restoration." The subcategory "License Termination" is used to accumulate costs that are consistent with "decommissioning" as defined by the NRC (i.e., 10 CFR § 50.2). The cost reported for this subcategory is generally sufficient to terminate the unit's operating license, recognizing that there may be some additional cost

impact from spent fuel management. Costs are included in the years 2040 through 2045 for Units 1, 2, and 3 pre-planning; these costs are shown in Appendix C, Tables C-1, C-2, and C-3 in Period 0.

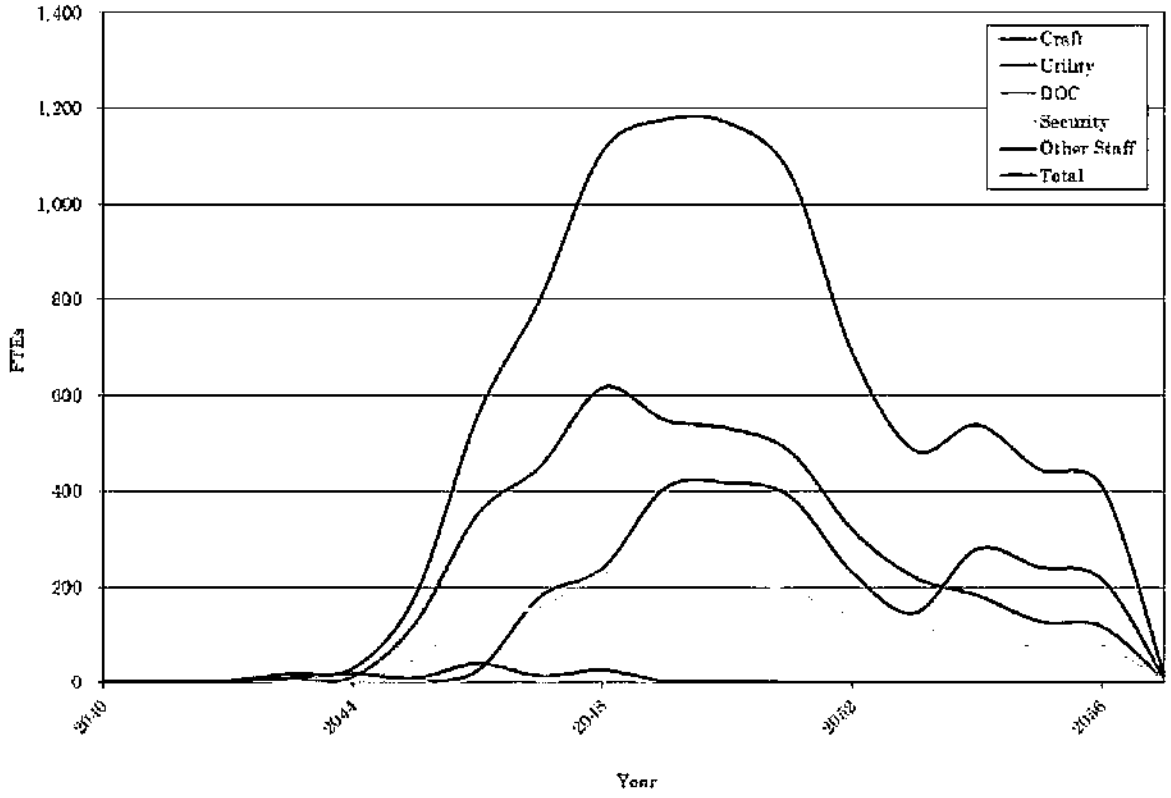
The "Spent Fuel Management" subcategory contains costs associated with the caretaking of the spent fuel and operation of the ISFSI in the periods following License Termination through Site Restoration until all fuel is offsite.

"Site Restoration" is used to capture costs associated with the dismantling and demolition of buildings and facilities demonstrated to be free from contamination. This includes structures never exposed to radioactive materials, as well as those facilities that have been decontaminated to appropriate levels. Structures are removed to a depth of three feet and backfilled to conform to local grade.

The cost of GTCC disposal is included in the "Nuclear Steam Supply System Removal" cost element. While designated for disposal at a federal facility along with the spent fuel, GTCC waste is still classified as low-level radioactive waste and, as such, included as a "License Termination" expense.

Decommissioning costs are reported in 2023 dollars. Costs are not inflated, escalated, or discounted over the period of expenditure (or remaining lifetime of the plant).

FIGURE 3.1
PALO VERDE STAFFING LEVELS



Notes:

1) Labor for fuel transfers from ISFSI to DOE after 2057, for GTCC canister transfers to DOE in 2097, and for decommissioning and demolition of the ISFSI in 2098 not shown

2) The labor hour basis of this chart was taken from Appendices C, G, H, I, J, K, L, M, and N; however, not all line items in these appendices have labor hour values available (e.g., spent fuel canister transfers to the DOE).

4. SCHEDULE ESTIMATE

The schedules for the decommissioning scenarios considered in this study follow the sequence presented in the AIF/NESP-036 study, with minor changes to reflect recent experience and site-specific constraints. In addition, the schedule has been updated to reflect the spent fuel management plans described in Section 3.5.1.

A timeline for the decommissioning of Units 1, 2, 3, and the ISFSI is presented in Figure 4.1. Appendix D presents a more detailed schedule of decommissioning activities for each unit. The scheduling sequence assumes that fuel is removed from the spent fuel pool within the first six years after operations cease at each unit. The key activities listed in the schedule do not reflect a one-to-one correspondence with those activities in the cost tables but reflect dividing some activities for clarity and combining others for convenience. The schedule was prepared using Microsoft Project. [36]

4.1 SCHEDULE ESTIMATE ASSUMPTIONS

The schedule reflects the results of a precedence network developed for the site decommissioning activities, i.e., a PERT (Program Evaluation and Review Technique) Software Package. The work activity durations used in the precedence network reflect the actual man-hour estimates from the cost tables, 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:

- Planning of decommissioning activities starts approximately five years prior to permanent shutdown of Unit 1. During the pre-shutdown planning period a staff of project and technical personnel are dedicated to the project.
- The Fuel Buildings are isolated until such time that all spent fuel has been discharged from the spent fuel pools to the DOE or to the ISFSI. Decontamination and dismantling of the storage pools is initiated once the transfer of spent fuel is complete.
- Period 2 decommissioning activities for Unit 1 will begin immediately following the 18-month Period 1 preparation phase after the cessation of plant operations. Period 2 activities for Units 2 and 3 will begin following a 12-month Period 1 preparation phase. Sequencing the integrated decommissioning of Palo Verde is intended to maintain an even level of staff resources.

- All work (except vessel and internals removal) is performed during an 8-hour workday, 5 days per week, with no overtime. There are eleven paid holidays per year.
- Reactor and internals removal activities are performed by using separate crews for different activities working on different shifts, with a corresponding backshift charge for the second shift. The number of cask shipments out of the Reactor Building is expected to average three every two weeks. Non-cask shipments will be limited to 10 per week.
- 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.
- Dismantlement and demolition of the miscellaneous non-radioactive facilities are assumed to be performed off the overall critical path schedule. Such activities start after Unit 1 shutdown and are assumed to be complete prior to the end of the site restoration phase (Period 3).

4.2 PROJECT SCHEDULE

The period-dependent costs presented in the Appendix C detailed cost tables are based upon the durations developed in the schedule. 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 period-dependent costs. A second critical path is also shown for the spent fuel cooling period, which determines the release of the fuel buildings for final decontamination.

Project timelines are provided in Figure 4.1. Milestone dates are based on shutdown dates of June 1, 2045, April 24, 2046, and November 25, 2047 for Units 1, 2, and 3, respectively.

The OA also provided the assumed completion date for transfer of Palo Verde fuel from the ISFSI to the DOE, i.e., by the end of 2097. The schedule and timeline for the ISFSI therefore shows ISFSI decontamination and demolition in 2098, following the completion of transfer of the spent fuel and GTCC canisters from the ISFSI to the DOE.

FIGURE 4.1
DECOMMISSIONING TIMELINES
(not to scale)

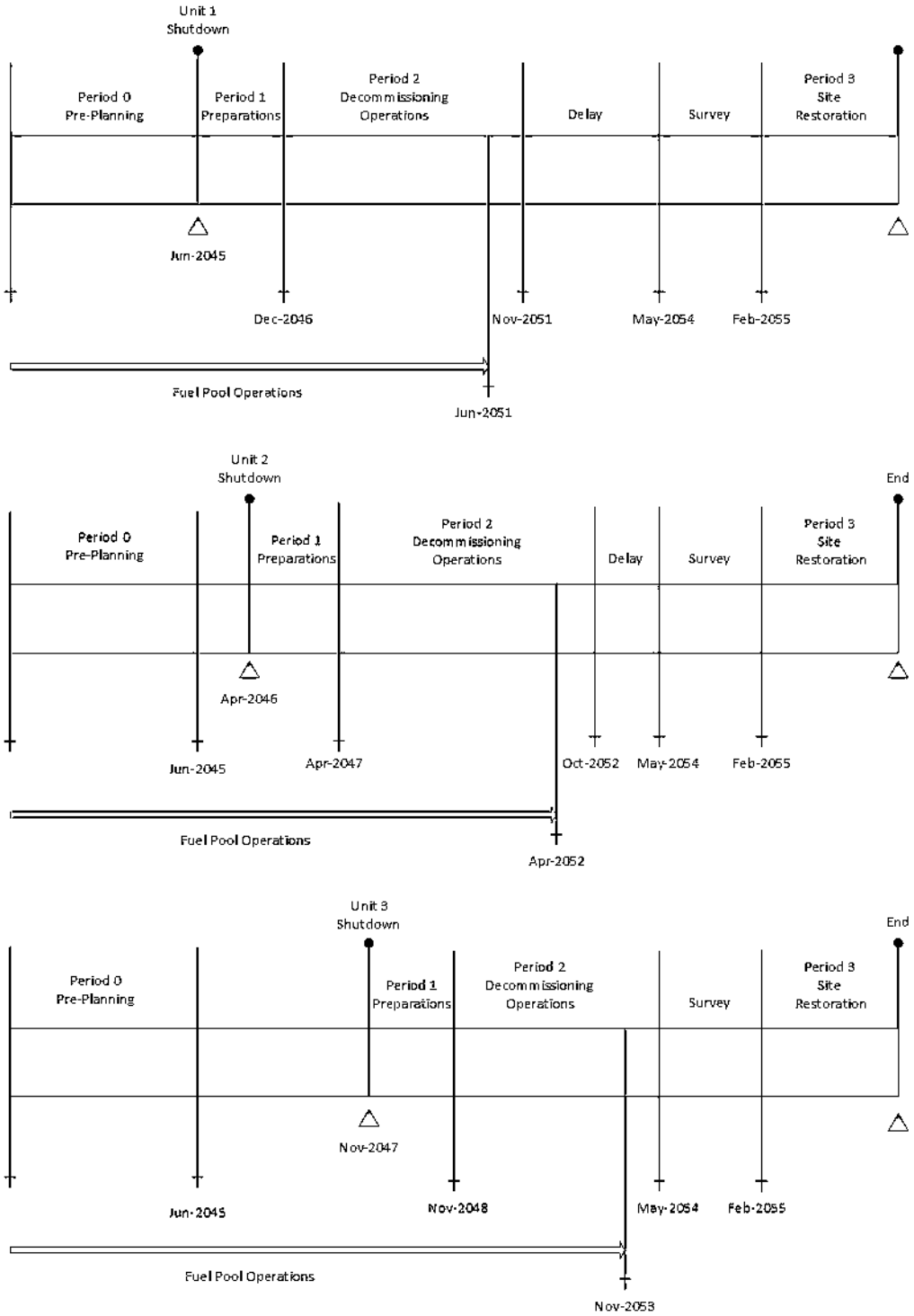
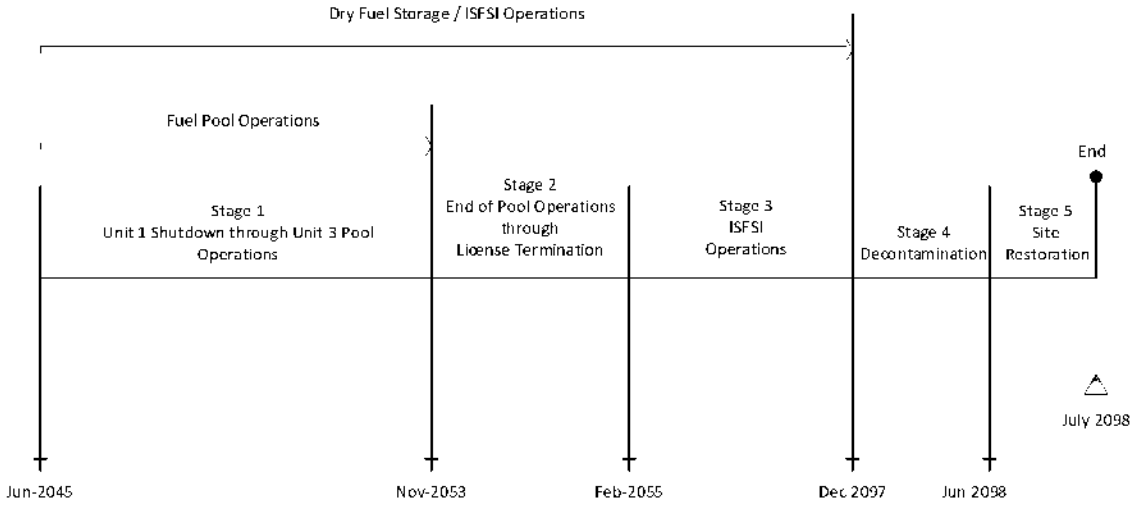


FIGURE 4.1 (continued)
DECOMMISSIONING TIMELINES
(not to scale)



5. RADIOACTIVE WASTES

The objectives of the decommissioning process are the removal of all radioactive material from the site that would restrict its future use and the termination of the NRC license(s). This currently requires the remediation of all radioactive material at the site in excess of applicable legal limits. Under the Atomic Energy Act [37] 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, 10 CFR Part 71 defines radioactive material for the purpose of transportation and 10 CFR Part 61 specifies its disposition.

Title 49 of the Code of Federal Regulations is the principle set of rules and regulations (sometimes called administrative law) issued by the Departments of Transportation and Homeland Security, federal agencies of the United States regarding transportation and transportation related security. Most of the materials being transported for controlled burial are categorized as LSA or SCO materials containing Type A quantities, as defined in 49 CFR Parts 173-178. Shipping containers are required to be Industrial Packages (IP-1, IP-2 or IP-3, as defined in § 173.411) or Type A packages (§ 173.465). 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 containers, with proper closure of all openings, access ways, and penetrations.

The volumes of radioactive waste generated during the various decommissioning activities at the site are shown on a line-item basis in Appendix C and summarized in Table 5.1. The quantified waste volume summaries shown in these tables are consistent with 10 CFR Part 61 classifications. The volumes are calculated based on the exterior dimensions for containerized material and on the displaced volume of components serving as their own waste containers.

The reactor vessel and internals are categorized as large quantity shipments and, accordingly, will be shipped in reusable, shielded truck casks with disposable liners. In calculating disposal costs, the burial fees are applied against the liner volume, as well as the special handling requirements of the payload. Packaging efficiencies are lower for the highly activated materials (greater than Type A quantity waste), where high concentrations of gamma-emitting radionuclides limit the capacity of the shipping containers.

No process system containing/handling radioactive substances at shutdown is presumed to meet material release criteria by decay alone, i.e., systems radioactive at shutdown will still be radioactive over the period during which the

decommissioning is accomplished, due to the presence of long-lived radionuclides. While the dose rates decrease with time, radionuclides such as ^{137}Cs will still control the disposition requirements.

The waste material generated in the decontamination and dismantling of Palo Verde is primarily generated during Period 2. Material that is contaminated or potentially contaminated will be removed and sent primarily to the WCS facility in Andrews County, Texas.

For purposes of constructing the estimates, the current cost for disposal at the WCS facility is used for most of the radioactive waste produced from the decommissioning activities. Separate rates were used for containerized waste and large components. Demolition debris including miscellaneous steel, scaffolding, and concrete is disposed of at a bulk rate at the Energy*Solutions* facility in Clive, Utah. This decommissioning waste stream destination also includes Class A resins and dry active waste.

Class A waste is disposed of at the WCS facility in Andrews County, Texas. Metallic waste is buried at a cost of $264 per cubic foot (based upon an average waste density of 65 pounds per cubic foot). Large component waste burial is at a cost of $312, $353, and $177 per cubic foot for SGs, RCPs, and PZR, respectively. Concrete, soil, asbestos, and other bulk debris are disposed of at a rate of $117 per cubic foot (based upon an average waste density of 88 pounds per cubic foot) at the Energy*Solutions* facility in Clive, Utah. Dry active wastes, e.g., cloth, paper, and plastics, are disposed of at $62 per cubic foot, with an assumed density of 20 pounds per cubic foot at the Energy*Solutions* facility in Clive, Utah.

Disposal costs for the Class B and C irradiated hardware material and Class B waste from liquid waste processing were based upon existing Palo Verde agreements with WCS for the Andrews County, Texas disposal facility.

Class B resin and filter waste is disposed of at $2,556 per cubic foot at the Waste Control Specialists facility in Andrews County, Texas. Classes B and C wastes resultant from irradiated reactor hardware are disposed of at $10,442 per cubic foot.

GTCC waste is disposed of at a rate of $5,752 per cubic foot, as packaged in a spent fuel canister. GTCC waste is stored on site at the ISFSI until the DOE is ready to receive the shipments; this is assumed to occur in 2097.

TABLE 5.1
PALO VERDE
DECOMMISSIONING WASTE SUMMARY [1,2]

Unit	Waste Category	Volume (cubic feet)	Weight (pounds)
1	Class A Bulk (concrete, metal siding)	35,862	1,694,053
	Class A Metallic (containerized waste and large components)	458,298	30,241,962
	Class A DAW	20,385	407,707
	Class A (low activity resin and filters)	6,673	546,018
	Class B (irradiated vessel internals and higher-activity resin and filters)	2,002	243,294
	Class C (irradiated vessel internals)	224	34,938
	GTCC (irradiated vessel internals and legacy waste)	4,433	905,513
	Waste Processing (not used in 2023 estimate)	0	0
	Scrap Metal (non-contaminated)		133,130,000
2	Class A Bulk (concrete, metal siding)	35,862	1,694,054
	Class A Metallic (containerized waste and large components)	535,914	35,178,221
	Class A DAW	21,736	434,722
	Class A (low activity resin and filters)	6,761	551,309
	Class B (irradiated vessel internals and higher-activity resin and filters)	2,002	243,294
	Class C (irradiated vessel internals)	224	34,938
	GTCC (irradiated vessel internals and legacy waste)	4,433	905,513
	Waste Processing (not used in 2023 estimate)	0	0
	Scrap Metal (non-contaminated)		128,792,000
3	Class A Bulk (concrete, metal siding)	35,862	1,694,053
	Class A Metallic (containerized waste and large components)	458,746	30,246,884
	Class A DAW	20,410	408,196
	Class A (low activity resin and filters)	6,738	549,906
	Class B (irradiated vessel internals and higher-activity resin and filters)	2,002	243,294
	Class C (irradiated vessel internals)	224	34,938
	GTCC (irradiated vessel internals and legacy waste)	4,433	905,513
	Waste Processing (not used in 2023 estimate)	0	0
	Scrap Metal (non-contaminated)		134,588,000

[1] Waste is classified according to the requirement delineated in Title 10 CFR, Part 61.55

[2] Columns may not add due to rounding

TABLE 5.1
(continued)
PALO VERDE
DECOMMISSIONING WASTE SUMMARY [1,2]

Unit	Waste Category	Volume (cubic feet)	Weight (pounds)
Steam Gen.	Class A Metallic (containerized waste and large components)	146,958	13,246,071
RPV Heads	Class A Metallic (containerized waste and large components)	15,216	924,428
ISFSI	Class A Metallic (containerized waste and large components)	48,798	4,855,432
Other	Subpart D Waste (Evaporation Ponds)	67,500,000	
Totals	Class A Bulk (concrete, metal siding)	107,587	5,082,160
	Class A Metallic (containerized waste and large components)	1,663,929	114,692,998
	Class A DAW	62,531	1,250,625
	Class A (low activity resin and filters)	20,172	1,647,233
	Class B (irradiated vessel internals and higher-activity resin and filters)	6,007	729,882
	Class C (irradiated vessel internals)	673	104,814
	GTCC (irradiated vessel internals and legacy waste)	13,300	2,716,539
	Waste Processing (not used in 2023 estimate)	-	-
	Subpart D Waste (Evaporation Ponds)	67,500,000	-
	Scrap Metal (non-contaminated)		396,510,000

[1] Waste is classified according to the requirement delineated in Title 10 CFR, Part 61.55

[2] Columns may not add due to rounding

FIGURE 5.1
RADIOACTIVE WASTE DISPOSITION

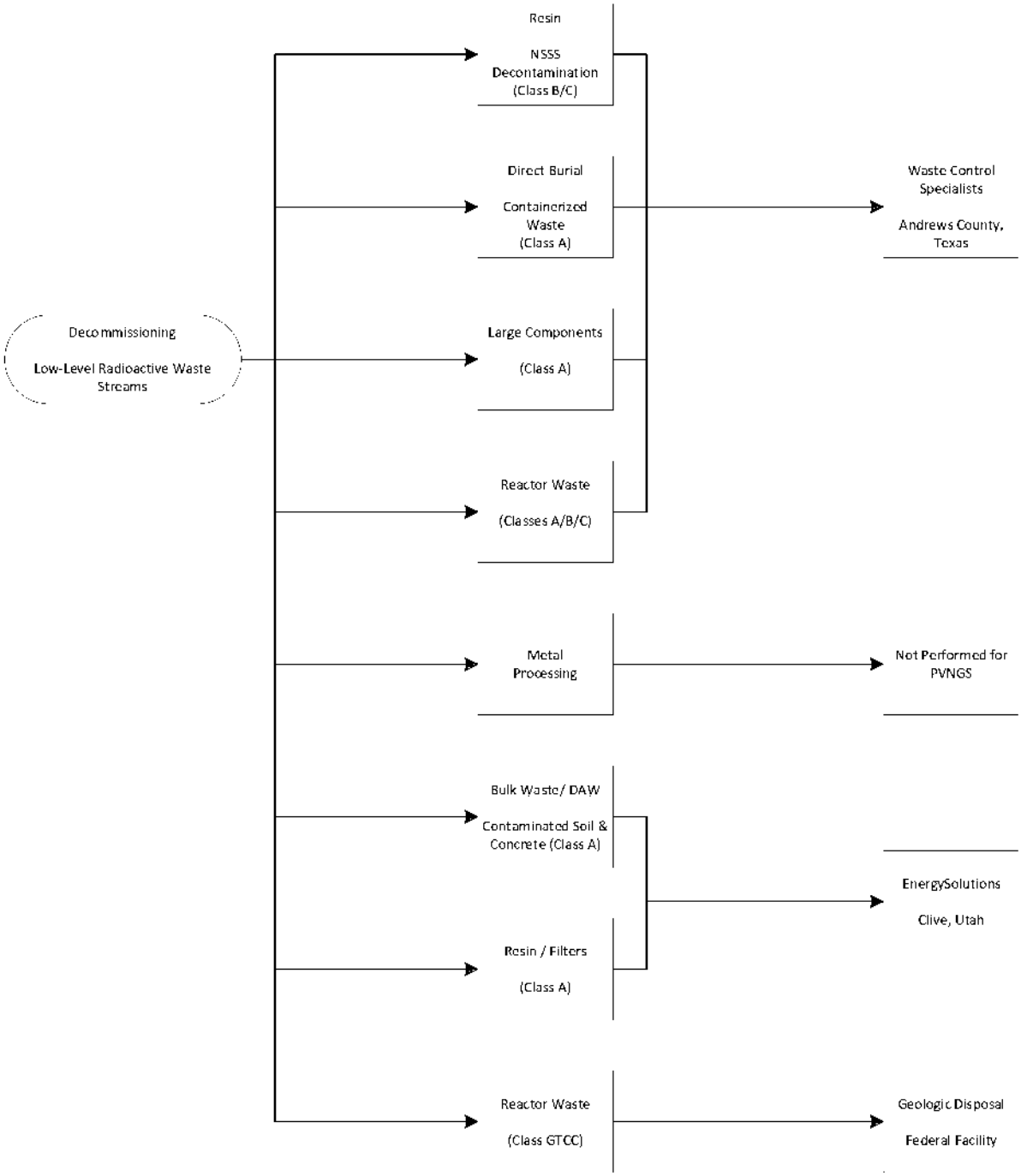


FIGURE 5.2
DECOMMISSIONING WASTE DESTINATIONS
RADIOLOGICAL

6. RESULTS

The analysis to estimate the costs to decommission Palo Verde relied primarily upon the site-specific, technical information developed from previous analyses. The systems and structures data was updated for the current estimate. While not an engineering study, the estimates provide the OA with sufficient information to assess its financial obligations as they pertain to the eventual decommissioning of the nuclear station.

The estimates described in this report are based on numerous fundamental assumptions, including regulatory requirements, project contingencies, LLRW disposal practices, high-level radioactive waste management options, and site restoration requirements. The decommissioning scenarios assume continued operation of the plants' spent fuel pools for a minimum of six years following the cessation of operations for continued cooling of the assemblies. An ISFSI will be used to store the spent fuel until such time that the DOE can complete the transfer of the assemblies to its repository.

The cost projected to promptly decommission (DECON) Palo Verde is estimated to be $3.81 billion (2023 dollars). Most of this cost, approximately 75%, is associated with the physical decontamination and dismantling of the nuclear units so that the licenses can be terminated. The management, interim storage, and eventual transfer of the spent fuel accounts for approximately 15%. The remaining 10% is for the demolition of the designated structures and limited restoration of the site and off-site facilities.

The primary cost contributors, identified in Tables 6.1, are either labor-related or associated with the management and disposition of the radioactive waste. Program management is the largest single contributor to the overall cost. The magnitude of the expense is a function of both the size of the organization required to manage the decommissioning, and the duration of the program. It is assumed, for purposes of this analysis, that the OA will oversee the decommissioning program and self-manage the decommissioning labor force and the associated subcontractors. The size and composition of the management organization varies with the decommissioning phase and associated site activities. However, once the operating licenses are terminated, the staff is substantially reduced for the conventional demolition and restoration of the site, and for the long-term care of the spent fuel.

As described in this report, the spent fuel pools will remain operational for six years following the cessation of operations. The pools will be isolated and independent spent fuel islands created. This will allow decommissioning operations to proceed in and

around the pool area. Over the six-year period, the spent fuel will be packaged into DOE-provided transport casks (21 assemblies per canister) or transferred to the ISFSI for interim storage (37 assemblies per canister). The costs of transferring the fuel to the DOE from the spent fuel pool or the ISFSI are assumed non-reimbursable by the DOE and are included in this estimate in Appendix L.

The cost for waste disposal includes only those costs associated with the controlled disposition of the LLRW generated from decontamination and dismantling activities, including plant equipment and components, structural material, filters, resins, and dry-active waste. Radioactively contaminated material will be sent either to WCS in Andrews, Texas, or to the Energy*Solutions* facility in Clive, Utah for burial. Highly activated components, requiring additional isolation from the environment, are packaged for geologic disposal. The cost of geologic disposal is based upon a cost equivalent for spent fuel.

The cost identified in the summary table for off-site waste processing of metallic wastes is reported as zero, since the pricing for such processing of metallic waste is not cost effective with the current LLRW disposal rates.

Removal costs reflect the labor-intensive nature of the decommissioning process, as well as the management controls required to ensure a safe and successful program. Decontamination and packaging costs also have a large labor component that is based upon prevailing union wages. Non-radiological demolition is a natural extension of the decommissioning process. With a work force mobilized to support decommissioning operations, non-radiological demolition can be an integrated activity and a logical expansion of the work being performed in the process of terminating the operating license. Prompt demolition reduces future liabilities and can be more cost effective than deferral, due to the deterioration of the facilities (and therefore the working conditions) with time.

The reported cost for transport includes the tariffs and surcharges associated with moving large components and/or overweight shielded casks overland, as well as the general expense, e.g., labor and fuel, of transporting material to the destinations identified in this report. For purposes of this analysis, material is primarily moved overland by truck.

License termination survey costs are associated with the labor intensive and complex activity of verifying that contamination has been removed from the site to the levels specified by the regulating agency. This process involves a systematic survey of all remaining plant surface areas and surrounding environs, sampling, isotopic analysis, and documentation of the findings. The status of any plant components and materials

not removed in the decommissioning process will also require confirmation and will add to the expense of surveying the facilities alone.

The remaining costs include allocations for heavy equipment and temporary services, as well as for such expenses as regulatory fees and premiums for nuclear insurance. While site operating costs are greatly reduced following the final cessation of plant operations, certain administrative functions do need to be maintained either at a basic functional nor regulatory level.

TABLE 6.1
SUMMARY OF DECOMMISSIONING COST ELEMENTS - TOTAL COSTS
Palo Verde Nuclear Generating Station
(thousands of 2023 dollars)

Column Index	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
				Shared Facilities											
	Unit 1	Unit 2	Unit 3	ISFSI	Stored S/G & Storage Fac.	Stored Rx Closure Head & Storage Fac.	Water Reclamation Facility	Water Reclamation Facility Supply Line	Evaporation Ponds	Make-up Water Resevoir	ISFSI Campaign Costs	Total [1]	Unit 1 [2] (Including allocations)	Unit 2 [3] (Including allocations)	Unit 3 [4] (Including allocations)
Report Reference	App. C-1	App. C-2	App. C-3	App. L	App. G	App. M	App. H	App. I	App. J	App. K	App. N				
Work Category															
Characterization and License Termination Surveys	22,382	17,494	17,493	6,776	-	-	-	-	277	85	-	64,507	24,761	19,874	19,873
Decon	24,549	24,609	24,603	-	-	-	-	-	-	-	-	73,761	24,549	24,609	24,603
DOC Staff	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy	16,976	16,208	16,208	33			-	-	-	-	-	49,425	16,987	16,219	16,219
GTCC DOE Disposal	35,595	35,595	35,595	-	-	-	-	-	-	-	-	106,786	35,595	35,595	35,595
Health Physics Supplies	22,848	23,472	22,768	-	-	-	-	-	-	-	-	69,089	22,848	23,472	22,768
Insurance	8,510	7,023	6,187	21,693	-	-	-	-	-	-	-	43,413	15,741	14,254	13,418
LLRW Disposal	127,652	152,894	127,693	10,334	53,303	6,366	-	-	-	-	-	478,243	150,986	176,229	151,028
Non-Craft Contractors	11,400	4,879	4,879	-	-	-	842	827	1,711	-	-	24,539	12,527	6,006	6,006
Off-Site LLRW Processing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	10,560	10,701	10,701	3,563	768	790	-	-	4,784	272	-	42,139	13,953	14,093	14,093
Packaging	13,465	15,472	13,477	671	28,804	635	-	-	-	-	-	72,523	23,502	25,508	23,513
Process Liquid Waste	9,129	9,129	9,129	-	-	-	-	-	-	-	-	27,387	9,129	9,129	9,129
Property Taxes	4,259	3,931	3,349	45,772	-	-	-	-	-	-	-	57,311	19,517	19,188	18,606
Regulatory / NRC	6,955	4,123	3,625	729	-	-	-	-	-	-	-	15,432	7,198	4,366	3,868
Removal	109,133	114,661	110,709	12,453	650	101	10,777	74,625	63,874	5,358	-	502,341	165,079	170,607	166,655
RV	31,150	31,206	31,206	-	-	-	-	-	-	-	-	93,562	31,150	31,206	31,206
RV Internals	61,496	61,764	61,764	-	-	-	-	-	-	-	-	185,025	61,496	61,764	61,764
Security	80,812	76,931	71,191	161,743			-	-	-	-	-	390,677	134,726	130,845	125,105
Shipping	10,673	12,484	10,689	2,275	4,660	2,007	-	-	-	-	-	42,788	13,654	15,464	13,669
Spent Fuel / EP / ISFSI Equipment & Materials	-	-	-	-	-	-	-	-	-	-	12,563	12,563	4,188	4,188	4,188
Spent Fuel / EP / ISFSI Labor	-	-	-	5,966	-	-	-	-	-	-	4,188	10,154	3,385	3,385	3,385
Spent Fuel / EP / ISFSI Other	15,444	14,624	13,159	16,760	-	-	-	-	-	-	-	59,987	21,031	20,210	18,746
Spent Fuel Capital and Transfer	-	-	-	152,634	-	-	-	-	-	-	-	152,634	50,878	50,878	50,878
Spent Fuel Pool Isolation	16,480	10,987	10,987	-	-	-	-	-	-	-	-	38,453	16,480	10,987	10,987
Steam Generators	34,504	34,504	34,504	-	-	-	-	-	-	-	-	103,513	34,504	34,504	34,504
Remedial Action Surveys	9,044	9,954	9,954	-	-	-	-	-	-	-	-	28,952	9,044	9,954	9,954
Utility Staff	277,784	262,353	303,785	65,323	-	-	1,369	-	6,415	544	-	917,573	302,335	286,903	328,336
Utility Transition Costs	50,449	50,449	50,449				-	-	-	-	-	151,346	50,449	50,449	50,449
Total	1,011,251	1,005,448	1,004,106	506,724	88,185	9,898	12,988	75,452	77,061	6,259	16,750	3,814,123	1,275,690	1,269,887	1,268,546
NRC License Termination	915,876	913,798	914,246	-	87,513	9,765	-	-	-	-	-	2,841,199	948,303	946,224	946,672
Spent Fuel Management	21,534	22,495	19,006	506,724	-	-	-	-	-	-	16,750	589,509	199,025	196,986	193,498
Site Restoration	70,840	69,155	70,855	-	672	132	12,988	75,452	77,061	6,259	-	383,415	128,362	126,676	128,376
Total [1]	1,011,251	1,005,448	1,004,106	506,724	88,185	9,898	12,988	75,452	77,061	6,259	16,750	3,814,123	1,275,690	1,269,887	1,268,546

[1] Numbers may not total due to rounding
[2] Column M represents the cost from Column A, plus 1/3 of the shared facilities costs totals from columns D through K
[3] Column N represents the cost from Column B, plus 1/3 of the shared facilities costs totals from columns D through K
[4] Column O represents the cost from Column C, plus 1/3 of the shared facilities costs totals from columns D through K

TABLE 6.1a
SUMMARY OF DECOMMISSIONING COST ELEMENTS - LICENSE TERMINATION COSTS
Palo Verde Nuclear Generating Station
(thousands of 2023 dollars)

Column Index	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
				Shared Facilities											
	Unit 1	Unit 2	Unit 3	ISFSI	Stored S/G & Storage Fac.	Stored Rx Closure Head & Storage Fac.	Water Reclamation Facility	Water Reclamation Facility Supply Line	Evaporation Ponds	Make-up Water Resevoir	ISFSI Campaign Costs	Total [4]	Unit 1 [2] (Including allocations)	Unit 2 [3] (Including allocations)	Unit 3 [4] (Including allocations)
Report Reference	App. C-1	App. C-2	App. C-3	App. L	App. G	App. M	App. H	App. I	App. J	App. K	App. N				
Work Category															
Characterization and License Termination Surveys	22,382	17,494	17,493	-	-	-	-	-	-	-	-	57,369	22,382	17,494	17,493
Decon	24,549	24,609	24,603	-	-	-	-	-	-	-	-	73,761	24,549	24,609	24,603
DOC Staff	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy	16,466	15,699	15,699	-	-	-	-	-	-	-	-	47,863	16,466	15,699	15,699
GTCC DOE Disposal	35,595	35,595	35,595	-	-	-	-	-	-	-	-	106,786	35,595	35,595	35,595
Health Physics Supplies	22,848	23,472	22,768	-	-	-	-	-	-	-	-	69,089	22,848	23,472	22,768
Insurance	8,510	7,023	6,187	-	-	-	-	-	-	-	-	21,721	8,510	7,023	6,187
LLRW Disposal	127,652	152,894	127,693	-	53,303	6,366	-	-	-	-	-	467,908	147,541	172,784	147,583
Non-Craft Contractors	10,351	4,430	4,430	-	-	-	-	-	-	-	-	19,212	10,351	4,430	4,430
Off-Site LLRW Processing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	9,276	9,417	9,417	-	746	682	-	-	-	-	-	29,538	9,752	9,893	9,893
Packaging	13,465	15,472	13,477	-	28,804	635	-	-	-	-	-	71,853	23,278	25,285	23,290
Process Liquid Waste	9,129	9,129	9,129	-	-	-	-	-	-	-	-	27,387	9,129	9,129	9,129
Property Taxes	3,567	3,239	2,656	-	-	-	-	-	-	-	-	9,462	3,567	3,239	2,656
Regulatory / NRC	6,955	4,123	3,625	-	-	-	-	-	-	-	-	14,703	6,955	4,123	3,625
Removal	61,250	67,864	62,212	-	0	76	-	-	-	-	-	191,402	61,275	67,889	62,238
RV	31,150	31,206	31,206	-	-	-	-	-	-	-	-	93,562	31,150	31,206	31,206
RV Internals	61,496	61,764	61,764	-	-	-	-	-	-	-	-	185,025	61,496	61,764	61,764
Security	69,091	66,388	62,731	-	-	-	-	-	-	-	-	198,209	69,091	66,388	62,731
Shipping	10,673	12,484	10,689	-	4,660	2,007	-	-	-	-	-	40,512	12,895	14,706	12,911
Spent Fuel / EP / ISFSI Equipment & Materials	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel / EP / ISFSI Labor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel / EP / ISFSI Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel Capital and Transfer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel Pool Isolation	16,480	10,987	10,987	-	-	-	-	-	-	-	-	38,453	16,480	10,987	10,987
Steam Generators	34,504	34,504	34,504	-	-	-	-	-	-	-	-	103,513	34,504	34,504	34,504
Remedial Action Surveys	9,044	9,954	9,954	-	-	-	-	-	-	-	-	28,952	9,044	9,954	9,954
Utility Staff	260,993	245,602	286,976	-	-	-	-	-	-	-	-	793,571	260,993	245,602	286,976
Utility Transition Costs	50,449	50,449	50,449	-	-	-	-	-	-	-	-	151,346	50,449	50,449	50,449
Total	915,876	913,797	914,246	-	87,513	9,765	-	-	-	-	-	2,841,199	948,303	946,224	946,672
NRC License Termination	915,876	913,798	914,246	-	87,513	9,765	-	-	-	-	-	2,841,199	948,303	946,224	946,672
Spent Fuel Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Site Restoration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total [1]	915,876	913,798	914,246	-	87,513	9,765	-	-	-	-	-	2,841,199	948,303	946,224	946,672

[1] Numbers may not total due to rounding
[2] Column M represents the cost from Column A, plus 1/3 of the shared facilities costs totals from columns D through K
[3] Column N represents the cost from Column B, plus 1/3 of the shared facilities costs totals from columns D through K
[4] Column O represents the cost from Column C, plus 1/3 of the shared facilities costs totals from columns D through K

TABLE 6.1b
SUMMARY OF DECOMMISSIONING COST ELEMENTS - SPENT FUEL MANAGEMENT COSTS
Palo Verde Nuclear Generating Station
(thousands of 2023 dollars)

Column Index	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
				Shared Facilities											
	Unit 1	Unit 2	Unit 3	ISFSI	Stored S/G & Storage Fac.	Stored Rx Closure Head & Storage Fac.	Water Reclamation Facility	Water Reclamation Facility Supply Line	Evaporation Ponds	Make-up Water Resevoir	ISFSI Campaign Costs	Total [1]	Unit 1 [2] (Including allocations)	Unit 2 [3] (Including allocations)	Unit 3 [4] (Including allocations)
Report Reference	**App. C-1**	**App. C-2**	**App. C-3**	**App. L**	**App. G**	**App. M**	**App. H**	**App. I**	**App. J**	**App. K**	**App. N**				
Work Category															
Characterization and License Termination Surveys	-	-	-	6,776	-	-	-	-	-	-	-	6,776	2,259	2,259	2,259
Decon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DOC Staff	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy	-	-	-	33	-	-	-	-	-	-	-	33	11	11	11
GTCC DOE Disposal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Health Physics Supplies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insurance	-	-	-	21,693	-	-	-	-	-	-	-	21,693	7,231	7,231	7,231
LLRW Disposal	-	-	-	10,334	-	-	-	-	-	-	-	10,334	3,445	3,445	3,445
Non-Craft Contractors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Off-Site LLRW Processing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	3,563	-	-	-	-	-	-	-	3,563	1,188	1,188	1,188
Packaging	-	-	-	671	-	-	-	-	-	-	-	671	224	224	224
Process Liquid Waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Property Taxes	-	-	-	45,772	-	-	-	-	-	-	-	45,772	15,257	15,257	15,257
Regulatory / NRC	-	-	-	729	-	-	-	-	-	-	-	729	243	243	243
Removal	-	-	-	12,453	-	-	-	-	-	-	-	12,453	4,151	4,151	4,151
RV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RV Internals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Security	7,372	6,193	4,110	161,743	-	-	-	-	-	-	-	179,418	61,286	60,108	58,024
Shipping	-	-	-	2,275	-	-	-	-	-	-	-	2,275	758	758	758
Spent Fuel / EP / ISFSI Equipment & Materials	-	-	-	-	-	-	-	-	-	-	12,563	12,563	4,188	4,188	4,188
Spent Fuel / EP / ISFSI Labor	-	-	-	5,966	-	-	-	-	-	-	4,188	10,154	3,385	3,385	3,385
Spent Fuel / EP / ISFSI Other	15,444	14,624	13,159	16,760	-	-	-	-	-	-	-	59,987	21,031	20,210	18,746
Spent Fuel Capital and Transfer	-	-	-	152,634	-	-	-	-	-	-	-	152,634	50,878	50,878	50,878
Spent Fuel Pool Isolation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steam Generators	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Remedial Action Surveys	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Utility Staff	1,718	1,678	1,737	65,323	-	-	-	-	-	-	-	70,456	23,492	23,452	23,512
Utility Transition Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	24,534	22,495	19,006	506,724	-	-	-	-	-	-	16,750	589,509	199,025	196,986	193,498
NRC License Termination	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel Management	24,534	22,495	19,006	506,724	-	-	-	-	-	-	16,750	589,509	199,025	196,986	193,498
Site Restoration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total [1]	24,534	22,495	19,006	506,724	-	-	-	-	-	-	16,750	589,509	199,025	196,986	193,498

[1] Numbers may not total due to rounding
[2] Column M represents the cost from Column A, plus 1/3 of the shared facilities costs totals from columns D through K
[3] Column N represents the cost from Column B, plus 1/3 of the shared facilities costs totals from columns D through K
[4] Column O represents the cost from Column C, plus 1/3 of the shared facilities costs totals from columns D through K

TABLE 6.1c
SUMMARY OF DECOMMISSIONING COST ELEMENTS - SITE RESTORATION COSTS
Palo Verde Nuclear Generating Station
(thousands of 2023 dollars)

Column Index	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
				Shared Facilities											
	Unit 1	Unit 2	Unit 3	ISFSI	Stored S/G & Storage Fac.	Stored Rx Closure Head & Storage Fac.	Water Reclamation Facility	Water Reclamation Facility Supply Line	Evaporation Ponds	Make-up Water Resevoir	ISFSI Campaign Costs	Total [1]	Unit 1 [2] (Including allocations)	Unit 2 [3] (Including allocations)	Unit 3 [4] (Including allocations)
Report Reference	App. C-1	App. C-2	App. C-3	App. L	App. G	App. M	App. H	App. I	App. J	App. K	App. N				
Work Category															
Characterization and License Termination Surveys	-	-	-	-	-	-	-	-	277	85	-	362	121	121	121
Decon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DOC Staff	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy	510	510	510	-	-	-	-	-	-	-	-	1,529	510	510	510
GTCC DOE Disposal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Health Physics Supplies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LLRW Disposal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-Craft Contractors	1,049	449	449	-	-	-	842	827	1,711	-	-	5,326	2,175	1,575	1,575
Off-Site LLRW Processing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	1,284	1,284	1,284	-	21	107	-	-	4,784	272	-	9,038	3,013	3,013	3,013
Packaging	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Process Liquid Waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Property Taxes	693	693	693	-	-	-	-	-	-	-	-	2,078	693	693	693
Regulatory / NRC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Removal	47,883	46,797	48,497	-	650	25	10,777	74,625	63,874	5,358	-	298,486	99,652	98,567	100,267
RV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RV Internals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Security	4,350	4,350	4,350	-	-	-	-	-	-	-	-	13,049	4,350	4,350	4,350
Shipping	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel / EP / ISFSI Equipment & Materials	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel / EP / ISFSI Labor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel / EP / ISFSI Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel Capital and Transfer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel Pool Isolation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steam Generators	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Remedial Action Surveys	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Utility Staff	15,073	15,073	15,073	-	-	-	1,369	-	6,415	544	-	53,546	17,849	17,849	17,849
Utility Transition Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	70,840	69,155	70,855	-	672	132	12,988	75,452	77,061	6,259	-	383,415	128,362	126,676	128,376
NRC License Termination	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Site Restoration	70,840	69,155	70,855	-	672	132	12,988	75,452	77,061	6,259	-	383,415	128,362	126,676	128,376
Total [1]	70,840	69,155	70,855	-	672	132	12,988	75,452	77,061	6,259	-	383,415	128,362	126,676	128,376

[1] Numbers may not total due to rounding
[2] Column M represents the cost from Column A, plus 1/3 of the shared facilities costs totals from columns D through K
[3] Column N represents the cost from Column B, plus 1/3 of the shared facilities costs totals from columns D through K
[4] Column O represents the cost from Column C, plus 1/3 of the shared facilities costs totals from columns D through K

7. REFERENCES

1. NRC issued Operating Licenses NPF-41, NPF-51, and NPF-74 for Palo Verde Units 1, 2, and 3 respectively.

2. U.S. Code of Federal Regulations, Title 10, Parts 30, 40, 50, 51, 70 and 72, "General Requirements for Decommissioning Nuclear Facilities," Nuclear Regulatory Commission, Federal Register Volume 53, Number 123 (p 24018 et seq.), June 27, 1988. [Open]

3. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," Rev. 2, October 2011. [Open]

4. "Regulatory Improvement for Power Reactors Transitioning to Decommissioning," NRC Regulatory Basis Document, Docket ID NRC-2015-0070, RIN Number 3150-AJ59, November 20, 2017. [Open]

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APPENDIX A
SUMMARY OF 1998 STUDY
COST REDUCTION ALTERNATIVES

Excerpt from 1998 Palo Verde Decommissioning Cost Study - Executive Summary:

EXECUTIVE SUMMARY APPENDIX
COST ALTERNATIVE STUDY

A study prepared for the Operating Agent (OA) of the Palo Verde Nuclear Generating Station (PVNGS) by TLG Services, Inc. (TLG), evaluates the costs associated with decommissioning cost reduction alternatives. A baseline estimate for Unit 1 of PVNGS using the DECON decommissioning alternative was prepared for use as a comparison of cost savings. The following is a summary of the ten alternatives evaluated. A breakdown of cost savings and associated comments is reported in the Summary Table herein.

1. Removal of the reactor vessel and internals as an integrated package, transported for intact disposal.

2. Use of a second shift in the decontamination and dismantling of PVNGS, assessing the ultimate impact on the decommissioning schedule and associated costs.

3. Use of alternative disposal sites for clean waste. This evaluation will consider expanding the current on-site waste disposal facility. Each alternative will be ranked based on feasibility and overall cost.

4. Evaluation of alternative burial sites for LLW. This evaluation will consider development of an on-site, Part 61 licensed facility. Each alternative will be ranked based on feasibility and overall cost.

5. Incremental decontamination and dismantling costs of a single unit with secondary-side contamination at two levels: (1) Current Unit 1, and (2) Unit 2 immediately after 1989 tube rupture event.

6. Establishment of an on-site LLW decontamination, processing, and salvage facility. Three cases will be established for a 70%, 80%, and 90% reduction in the volume of LLW that will require controlled disposal.

7. Disposal of all LLW at the Chem-Nuclear Systems, Inc., Barnwell, S.C., disposal facility. Costs will be based on the November 1, 1996, CNSI instituted weight-based cost schedule.

8. The assumption of responsibility for the management of all decommissioning operations by the OA (currently assumed to be performed by a DOC).

9. Based on item 8 above, evaluation of decommissioning planning being initiated early, so as to have the required approvals at or shortly after (3-6 months) final shutdown. (Decontamination and dismantling would begin as soon as possible for Unit 1. Schedules for Units 2 and 3 would follow so as to maximize the use of rented, leased, or purchased equipment.)

10. Isolation of the fuel building from the remainder of the facility (electrical, thermal, and hydraulic) so as not to impede D&D operations. This will include alternatives to monitor and control the fuel building activities from other than the current location.

The alternatives were evaluated and grouped into three categories to better define their cost impact.

Cost Bounding: These alternatives change the base scope of the study by adding assumptions that currently should be considered, and further bound the cost estimate by identifying changes that will add to the scope or further define the level of detail required.

Cost Reductions: Changes to the base case that reduce the overall cost of the decommissioning project. This category can be further defined by cost reductions that can occur under current regulatory requirements and those which would require modifications to current requirements.

Not Cost-Effective: Those alternatives that showed no cost benefit, or that increase the base cost.

After reviewing each alternative and evaluating the cost impacts and savings to the original decommissioning cost estimate, TLG has developed a list of three recommendations for inclusion into the base case study.

TLG recommends three of the cost reduction alternatives. Alternative #8, the OA management of the decommissioning project (serving as DOC) is the highest ranked alternative for cost reduction. Of all the current options, it is the most feasible and easiest to adopt and offers a potential cost savings of $18.5 million. The next two recommendations are waste-related. Alternative # 3, the on-site disposition of clean construction debris rather than shipment to a local vendor would result in substantial savings of approximately $7.6 million. Similarly, Alternative # 6 the on-site

processing of low-level waste is a viable alternative. A review of state-of-the-art processes in processing and volume reduction is recommended; TLG feels the potential of 90% volume reduction is not unrealistic and should be investigated prior to the planning of such a facility. Although even 70% reduction could yield $ 0.9 million dollars in savings, a 90% reduction could result in savings of up to $5.5 million.

TLG also recommends further investigation into one of the cost savings alternatives that would require regulatory revisions for the OA -- that being to create an on-site facility for the storage of low-level waste. While the cost for such a facility might not be economical for a single unit, the money to be saved with three units would be substantial. The site's remote location, its stable profile as a nuclear area, and the fact that Arizona is the next host state for the Southwest Compact all contribute to the potential for a successful and profitable venture. TLG recommends that the OA consider a feasibility study to determine the technical and political viability of obtaining a Part 61 license. A feasibility study would not only examine the financial aspects (startup, operation, maintenance) of such a venture, but would also consider such environmental aspects as community involvement and licensing issues/requirements.

Two cost reduction alternatives were approved by the OA to be utilized in the development of this cost study:

Alternative # 8 in which the OA will act as Decommissioning Operations Contractor (DOC), providing contract management of the decommissioning labor force and subcontractors, directing all decontamination and dismantling activities. Other activities that are included but not limited to, are engineering services for such items as writing activity specifications, detailed procedures, detailed activation analyses, and structural modifications.

Alternative # 3 in which an on-site facility will be used for clean construction debris disposal is the second alternative utilized in the study. Environmental closure requirements will need to be defined before selection of the on-site location is determined.

SUMMARY TABLE: COST REDUCTION ALTERNATIVES

(Millions of 1998 Dollars)

	Alternative	Category	Potential Cost Impact/ Savings	TLG Rec	Comments
1	One-Piece Vessel Lift	C	(35.2)		Regulation revisions required, several utilities submitting similar scenario. Until NRC approves scenario, alternative remains unlikely.
2	Alternative Shift Schedule	NC	3.0		Fuel storage restricts schedule reduction, savings are offset by cost of second shift operations.
3	Alternative Disposal Site - Clean fill	C	(7.6)	Yes	Existing voids created by Evaporator Ponds and Water Make-up utilized for clean fill disposal, acceptable per Arizona Revised Statute.
4	Alternative Burial Site-On-site Part 61 Licensed LLW Facility	C	(220)	Yes *	Regulation revision required, on-site development highly speculative, greatest potentials for savings with highest risk.
5	Secondary-Side Contamination	B	20.7	Yes	Major cost impact, should be added to cost estimate. Further characterization should be performed to verify extent of contamination.
6	On-Site Recycling -70% Vol. Reduction -80% Vol. Reduction -90% Vol. Reduction	C	 (0.9) (7.0) (5.5)	Yes *	On-site facility capital and operating cost (70% reduction) is within 1% of off-site vendor cost. Due to responsibilities assumed by vendor and potential of achieving similar savings, recommend further investigation. New technologies yet to be proven must be evaluated as they become available.
7	Weight-Based Burial	B	(3.7)	*	Savings less than 1% of total decommissioning cost to utilize Barnwell. Recommend cost estimate to assume Southwest Compact burial will be available.
8	OA Assumes DOC Responsibilities	C	(18.5)	Yes	Most feasible and easiest to adopt. Minimal risk with good record indicated at other utilities.
9	Pre-Planning	NC	(1.2)		Cost savings are offset by delay in fuel storage pool decommissioning. $4.2 million savings offset by $3 million additional cost due to lengthening of schedule caused by fuel storage delay. Savings in period not worth increase in schedule.
10	Fuel Building Isolation	B	0		Base estimate allocates $2.1 million (21,000 man-hours) for license and related document modifications. This is equal to several current utility allocations. Including building modification cost of $1.1 million, base estimate allocates $3.2 million. No savings are indicated.

Legend: * Further investigation required.
B = Cost Bounding C = Cost Reduction NC = Not Cost-Effective

APPENDIX B

SCHEDULE OF ANNUAL EXPENDITURES

TABLE B-1
SCHEDULE OF ANNUAL EXPENDITURES
DECON, UNIT 1
(Thousands of 2023 Dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2040	136	0	0	0	0	136
2041	231	0	0	0	0	231
2042	231	0	0	0	0	231
2043	601	0	0	0	0	601
2044	867	0	0	0	0	867
2045	69,100	1,560	1,580	28	3,877	76,145
2046	96,109	17,504	4,035	8,612	24,155	150,416
2047	74,163	39,148	2,561	48,646	14,852	179,370
2048	71,633	35,554	2,482	45,291	13,574	168,533
2049	56,964	15,855	2,021	26,691	6,550	108,081
2050	56,964	15,855	2,021	26,691	6,550	108,081
2051	40,633	13,333	1,353	20,966	5,953	82,238
2052	5,122	203	0	8	2,029	7,361
2053	5,108	202	0	8	2,023	7,341
2054	22,601	1,894	335	24	1,815	26,669
2055	19,745	13,208	308	5	1,446	34,711
2056	17,551	14,957	270	0	1,410	34,189
2057	527	450	8	0	42	1,028
2058 - 96	0	0	0	0	0	0
2097	0	1,558	0	0	23,462	25,020
Total	538,286	171,282	16,976	176,969	107,738	1,011,251

TABLE B-2
SCHEDULE OF ANNUAL EXPENDITURES
DECON, UNIT 2
(Thousands of 2023 Dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2040	136	0	0	0	0	136
2041	231	0	0	0	0	231
2042	231	0	0	0	0	231
2043	601	0	0	0	0	601
2044	867	0	0	0	0	867
2045	358	0	0	0	0	358
2046	91,622	2,771	1,927	355	5,001	101,677
2047	73,172	38,026	3,444	46,412	23,254	184,308
2048	77,362	40,989	2,568	61,648	15,568	198,135
2049	60,274	20,666	2,156	32,161	8,279	123,536
2050	54,669	13,954	2,021	22,424	5,872	98,941
2051	54,669	13,954	2,021	22,424	5,872	98,941
2052	34,674	11,153	1,148	16,928	5,136	69,039
2053	5,108	202	0	8	1,864	7,182
2054	22,601	1,894	335	24	1,584	26,439
2055	19,706	13,209	308	5	1,407	34,634
2056	17,506	14,959	270	0	1,410	34,144
2057	526	450	8	0	42	1,026
2058 - 96	0	0	0	0	0	0
2097	0	1,558	0	0	23,462	25,020
Total	514,311	173,786	16,208	202,390	98,753	1,005,448

TABLE B-3
SCHEDULE OF ANNUAL EXPENDITURES
DECON, UNIT 3
(Thousands of 2023 Dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2040	136	0	0	0	0	136
2041	231	0	0	0	0	231
2042	231	0	0	0	0	231
2043	601	0	0	0	0	601
2044	867	0	0	0	0	867
2045	358	0	0	0	0	358
2046	0	0	0	0	0	0
2047	13,709	303	273	4	610	14,900
2048	105,631	16,336	3,597	9,399	18,448	153,412
2049	74,985	38,978	2,561	48,473	14,598	179,595
2050	73,743	34,960	2,473	44,264	13,188	168,628
2051	67,300	14,118	2,021	22,437	5,874	111,750
2052	67,484	14,157	2,027	22,498	5,890	112,056
2053	65,228	14,124	1,926	22,261	5,804	109,343
2054	38,389	7,175	743	7,848	2,841	56,996
2055	19,725	13,269	308	5	1,407	34,714
2056	17,529	15,029	270	0	1,410	34,238
2057	527	452	8	0	42	1,029
2058 - 96	0	0	0	0	0	0
2097	0	1,558	0	0	23,462	25,020
Total	546,673	170,460	16,208	177,189	93,576	1,004,106

TABLE B-4
SCHEDULE OF ANNUAL EXPENDITURES
STORED STEAM GENERATORS & STORAGE FACILITY
(Thousands of 2023 Dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	456	230	0	0	0	686
2046	3,667	10,881	0	26,651	2,330	43,529
2047	3,667	10,881	0	26,651	2,330	43,529
2048	0	0	0	0	0	0
2049	0	0	0	0	0	0
2050	0	0	0	0	0	0
2051	0	0	0	0	0	0
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
2054	0	0	0	0	0	0
2055	96	344	0	0	0	440
Total	7,886	22,336	0	53,303	4,660	88,185

TABLE B-5
SCHEDULE OF ANNUAL EXPENDITURES
WATER RECLAMATION FACILITY
(Thousands of 2023 Dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2053	1,850	345	0	0	0	2,195
2054	1,429	1,958	0	0	0	3,387
2055	1,429	1,958	0	0	0	3,387
2056	2,491	1,529	0	0	0	4,020
Total	7,198	5,791	0	0	0	12,988

TABLE B-6
SCHEDULE OF ANNUAL EXPENDITURES
WATER RECLAMATION SUPPLY SYSTEM PIPELINE & STRUCTURES
(Thousands of 2023 Dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2053	480	345	0	0	0	825
2054	34,222	2,762	0	0	0	36,984
2055	34,222	2,762	0	0	0	36,984
2056	207	452	0	0	0	658
Total	69,131	6,321	0	0	0	75,452

TABLE B-7
SCHEDULE OF ANNUAL EXPENDITURES
EVAPORATION PONDS
(Thousands of 2023 Dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	14,165	11,853	0	0	0	26,018
2046	0	0	0	0	0	0
2047	0	0	0	0	0	0
2048	3,371	3,371	0	0	0	6,742
2049	3,371	3,371	0	0	0	6,742
2050	3,371	3,371	0	0	0	6,742
2051	3,371	3,371	0	0	0	6,742
2052	3,371	3,371	0	0	0	6,742
2053	3,371	3,371	0	0	0	6,742
2054	3,371	3,371	0	0	0	6,742
2055	1,927	1,927	0	0	0	3,853
Total	39,687	37,375	0	0	0	77,061

TABLE B-8
SCHEDULE OF ANNUAL EXPENDITURES
MAKE-UP WATER RESERVOIR
(Thousands of 2023 Dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2053	188	0	0	0	0	188
2054	1,440	1,440	0	0	0	2,879
2055	1,440	1,440	0	0	0	2,879
2056	156	156	0	0	0	313
Total	3,224	3,036	0	0	0	6,259

TABLE B-9
SCHEDULE OF ANNUAL EXPENDITURES
DECON, ISFSI
(Thousands of 2023 Dollars)

Year	Spent Fuel Capital and Transfer	Period Dependent Costs	ISFSI License Termination	ISFSI Demolition and Site Restoration	Total
2046	1,792	0	0	0	1,792
2047	3,583	0	0	0	3,583
2048	5,017	0	0	0	5,017
2049	3,225	0	0	0	3,225
2050	5,017	0	0	0	5,017
2051	34,617	0	0	0	34,617
2052	21,473	0	0	0	21,473
2053	24,160	0	0	0	24,160
2054	1,433	0	0	0	1,433
2055	1,433	0	0	0	1,433
2056	1,433	0	0	0	1,433
2057	1,613	7,683	0	0	9,296
2058	1,613	7,683	0	0	9,296
2059	1,613	7,683	0	0	9,296
2060	1,613	7,683	0	0	9,296
2061	1,613	7,683	0	0	9,296
2062	1,613	7,683	0	0	9,296
2063	1,433	7,683	0	0	9,116
2064	1,433	7,683	0	0	9,116
2065	1,433	7,683	0	0	9,116
2066	1,613	7,683	0	0	9,296
2067	1,613	7,683	0	0	9,296
2068	1,613	7,683	0	0	9,296
2069	1,075	7,683	0	0	8,758
2070	1,613	7,683	0	0	9,296
2071	1,254	7,683	0	0	8,937
2072	1,075	7,683	0	0	8,758
2073	896	7,683	0	0	8,579
2074	1,075	7,683	0	0	8,758
2075	896	7,683	0	0	8,579

TABLE B-9 (continued)
SCHEDULE OF ANNUAL EXPENDITURES
DECON, ISFSI
(Thousands of 2023 Dollars)

Year	Spent Fuel Capital and Transfer	Period Dependent Costs	ISFSI License Termination	ISFSI Demolition and Site Restoration	Total
2076	1,075	7,683	0	0	8,758
2077	896	7,683	0	0	8,579
2078	1,075	7,683	0	0	8,758
2079	1,075	7,683	0	0	8,758
2080	1,075	7,683	0	0	8,758
2081	1,075	7,683	0	0	8,758
2082	896	7,683	0	0	8,579
2083	896	7,683	0	0	8,579
2084	896	7,683	0	0	8,579
2085	1,075	7,683	0	0	8,758
2086	1,075	7,683	0	0	8,758
2087	1,075	7,683	0	0	8,758
2088	1,075	7,683	0	0	8,758
2089	1,075	7,683	0	0	8,758
2090	1,075	7,683	0	0	8,758
2091	896	7,683	0	0	8,579
2092	896	7,683	0	0	8,579
2093	896	7,683	0	0	8,579
2094	1,075	7,683	0	0	8,758
2095	1,075	7,683	0	0	8,758
2096	1,254	7,683	0	0	8,937
2097	1,254	7,683	0	0	8,937
2098	0	2,282	22,296	14,504	39,083
Total	152,634	317,290	22,296	14,504	506,724

TABLE B-10
SCHEDULE OF ANNUAL EXPENDITURES
STORED REACTOR CLOSURE HEADS & STORAGE FACILITY
(Thousands of 2023 Dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	444	345	0	0	0	789
2046	159	159	0	3,183	1,003	4,504
2047	159	159	0	3,183	1,003	4,504
2048	0	0	0	0	0	0
2049	0	0	0	0	0	0
2050	0	0	0	0	0	0
2051	0	0	0	0	0	0
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
2054	61	40	0	0	0	101
Total	822	703	0	6,366	2,007	9,898

TABLE B-11
SCHEDULE OF ANNUAL EXPENDITURES
ISFSI CAMPAIGN COSTS
(Thousands of 2023 Dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2046	2,439	7,317	0	0	0	9,756
2047	0	0	0	0	0	0
2048	48	143	0	0	0	191
2049	301	902	0	0	0	1,202
2050	301	902	0	0	0	1,202
2051	1,100	3,300	0	0	0	4,400
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
Total	4,188	12,563	0	0	0	16,750

APPENDIX C
DECON DECOMMISSIONING COST ESTIMATE

Page

Table C-1
Palo Verde NGS Unit 1
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Buriad / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 0a - Pre-Shutdown Early Planning																					
Period 0a Period-Dependent Costs																					
0a.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.3	Plant energy budget	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.4	Utility Staff Cost	-	-	-	-	-	-	2,108	316	2,424	2,424	-	-	-	-	-	-	-	-	-	22,717
0a.4	Subtotal Period 0a Period-Dependent Costs	-	-	-	-	-	-	2,108	316	2,424	2,424	-	-	-	-	-	-	-	-	-	22,717
0a.0	TOTAL PERIOD 0a COST	-	-	-	-	-	-	2,108	316	2,424	2,424	-	-	-	-	-	-	-	-	-	22,717
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	110	17	127	127	-	-	-	-	-	-	-	-	-	1,300
1a.1.2	Notification of Cessation of Operations									*a*											
1a.1.3	Remove fuel & source material									*n/a*											
1a.1.4	Notification of Permanent Defueling									a											
1a.1.5	Deactivate plant systems & process waste									a											
1a.1.6	Prepare and submit PSDAR	-	-	-	-	-	-	189	25	195	195	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	390	58	448	448	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									*a*											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	85	13	97	97	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	85	13	97	97	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	110	17	127	127	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	685	95	780	780	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	263	39	302	302	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Prepare/submit Defueled Technical Specifications	-	-	-	-	-	-	635	95	730	730	-	-	-	-	-	-	-	-	-	7,500
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	423	64	487	487	-	-	-	-	-	-	-	-	-	5,000
1a.1.16	Prepare/submit Irradiated Fuel Management Plan	-	-	-	-	-	-	85	13	97	97	-	-	-	-	-	-	-	-	-	1,000
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	417	63	479	431	-	48	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	353	53	406	365	-	41	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	42	6	49	49	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	601	90	691	691	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	550	83	633	633	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Biological shield	-	-	-	-	-	-	42	6	49	49	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Steam generators	-	-	-	-	-	-	264	40	304	304	-	-	-	-	-	-	-	-	-	3,120
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	136	20	156	78	-	78	-	-	-	-	-	-	-	1,600
1a.1.17.9	Main Turbine	-	-	-	-	-	-	34	5	39	-	-	39	-	-	-	-	-	-	-	400
1a.1.17.10	Main Condensers	-	-	-	-	-	-	34	5	39	-	-	39	-	-	-	-	-	-	-	400
1a.1.17.11	Plant structures & buildings	-	-	-	-	-	-	264	40	304	152	-	152	-	-	-	-	-	-	-	3,120
1a.1.17.12	Waste management	-	-	-	-	-	-	390	58	448	448	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.13	Facility & site closeout	-	-	-	-	-	-	76	11	88	44	-	44	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	3,204	481	3,684	3,241	-	440	-	-	-	-	-	-	-	37,827
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	203	30	234	234	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svcss	-	-	-	-	-	-	4,000	600	4,600	4,600	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	119	18	136	136	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,800	420	3,220	3,220	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	104	16	120	120	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	13,119	2,013	15,132	14,992	-	440	-	-	-	-	-	-	-	78,157
Period 1a Additional Costs																					
1a.2.1	Staff Transition	-	-	-	-	-	-	43,868	6,580	50,449	50,449	-	-	-	-	-	-	-	-	-	-
1a.2	Subtotal Period 1a Additional Costs	-	-	-	-	-	-	43,868	6,580	50,449	50,449	-	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	2,329	233	2,562	2,562	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	333	33	366	366	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	888	-	-	-	-	-	222	1,110	1,110	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	857	-	-	-	-	-	99	755	755	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	13	7	-	88	-	12	70	70	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	2,344	352	2,695	2,695	-	-	-	-	-	-	-	-	-	-

Table C-1
Palo Verde NGS Unit 1
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 1a Period-Dependent Costs (continued)																					
1a.4.7	NRC Fees	-	-	-	-	-	-	1,252	125	1,377	1,377	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,013	101	1,114	-	1,114	-	-	-	-	-	-	-	-	-
1a.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	988	148	1,136	-	1,136	-	-	-	-	-	-	-	-	-
1a.4.10	ISFSI Operating Costs	-	-	-	-	-	-	42	6	49	-	49	-	-	-	-	-	-	-	-	-
1a.4.11	Security Staff Cost	-	-	-	-	-	-	9,630	1,445	11,075	11,075	-	-	-	-	-	-	-	-	-	173,333
1a.4.12	Utility Staff Cost	-	-	-	-	-	-	35,716	5,357	41,073	41,073	-	-	-	-	-	-	-	-	-	422,240
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,545	13	7	-	38	53,647	8,133	63,383	61,084	2,299	-	-	610	-	-	-	12,190	20	595,573
1a.0	TOTAL PERIOD 1a COST	-	1,545	13	7	-	38	110,935	16,726	129,263	126,524	2,299	440	-	610	-	-	-	12,190	20	673,730
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	401	60	461	415	-	46	-	-	-	-	-	-	-	4,735
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	85	13	97	97	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	212	32	243	243	-	-	-	-	-	-	-	-	-	2,500
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	114	17	131	33	-	99	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	85	13	97	97	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	85	13	97	97	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	85	13	97	97	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	307	46	354	354	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	102	15	117	58	-	58	-	-	-	-	-	-	-	1,200
1b.1.1.10	Missile shields	-	-	-	-	-	-	38	6	44	44	-	-	-	-	-	-	-	-	-	450
1b.1.1.11	Biological shield	-	-	-	-	-	-	102	15	117	117	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.12	Steam generators	-	-	-	-	-	-	390	58	448	448	-	-	-	-	-	-	-	-	-	4,600
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	85	13	97	49	-	49	-	-	-	-	-	-	-	1,000
1b.1.1.14	Main Turbine	-	-	-	-	-	-	132	20	152	-	-	152	-	-	-	-	-	-	-	1,560
1b.1.1.15	Main Condensers	-	-	-	-	-	-	132	20	152	-	-	152	-	-	-	-	-	-	-	1,560
1b.1.1.16	Auxiliary building	-	-	-	-	-	-	231	35	266	239	-	27	-	-	-	-	-	-	-	2,730
1b.1.1.17	Reactor building	-	-	-	-	-	-	231	35	266	239	-	27	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	2,815	422	3,238	2,629	-	609	-	-	-	-	-	-	-	33,245
1b.1.2	Decon primary loop	1,655	-	-	-	-	-	-	827	2,482	2,482	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	1,655	-	-	-	-	-	2,815	1,250	5,720	5,111	-	609	-	-	-	-	-	-	1,067	33,245
Period 1b Additional Costs																					
1b.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	14,330	2,150	16,480	16,480	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	6,568	1,970	8,539	8,539	-	-	-	-	-	-	-	-	30,500	10,852
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	20,899	4,120	25,019	25,019	-	-	-	-	-	-	-	-	30,500	10,852
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	1,193	-	-	-	-	-	-	179	1,371	1,371	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process decommissioning water waste	75	-	55	85	-	150	-	93	458	458	-	-	-	429	-	-	-	25,760	84	-
1b.3.4	Process decommissioning chemical flush waste	4	-	164	475	-	3,396	-	939	4,978	4,978	-	-	-	-	1,329	-	-	141,637	219	-
1b.3.5	Small tool allowance	-	1	-	-	-	-	-	0	2	2	-	-	-	-	-	-	-	-	-	-
1b.3.6	Pipe cutting equipment	-	1,400	-	-	-	-	-	210	1,610	1,610	-	-	-	-	-	-	-	-	-	-
1b.3.7	Decon rig	2,442	-	-	-	-	-	-	366	2,809	2,809	-	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	3,714	1,401	219	560	-	3,547	-	1,787	11,228	11,228	-	-	-	429	1,329	-	-	167,397	302	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	43	-	-	-	-	-	-	11	53	53	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	1,168	117	1,284	1,284	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	167	17	184	184	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	502	-	-	-	-	-	126	628	628	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	329	-	-	-	-	-	49	379	379	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	8	4	-	22	-	7	41	41	-	-	-	359	-	-	-	7,183	12	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	2,350	353	2,703	2,703	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	372	37	409	409	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	508	51	558	-	558	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	495	74	570	-	570	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	21	3	24	-	21	-	-	-	-	-	-	-	-	-
1b.4.12	Security Staff Cost	-	-	-	-	-	-	4,828	724	5,553	5,553	-	-	-	-	-	-	-	-	-	88,904
1b.4.13	Utility Staff Cost	-	-	-	-	-	-	23,786	3,568	27,353	27,353	-	-	-	-	-	-	-	-	-	278,441

Table C-1
Palo Verde NGS Unit 1
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Buriad / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
1b.1	Subtotal Period 1b Period-Dependent Costs	43	331	8	1	-	22	38,695	5,136	39,739	38,587	1,153	-	-	359	-	-	-	7,183	12	365,345
1b.0	TOTAL PERIOD 1b COST	5,411	2,233	227	561	-	3,569	57,109	12,293	81,706	79,941	1,153	609	-	789	1,329	-	-	174,580	31,911	109,140
PERIOD 1 TOTALS		5,411	3,778	240	571	-	3,606	168,344	29,019	210,969	206,469	3,451	1,049	-	1,398	1,329	-	-	186,771	31,931	1,083,170
PERIOD 2a - Large Component Removal																					
Period 2a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
2a.1.1.1	Reactor Coolant Piping	145	146	36	67	-	508	-	250	1,152	1,152	-	-	-	1,789	-	-	-	124,358	6,161	-
2a.1.1.2	Pressurizer Quench Tank	9	7	1	3	-	57	-	22	107	107	-	-	-	201	-	-	-	14,051	375	-
2a.1.1.3	Reactor Coolant Pumps & Motors	125	71	514	421	-	3,755	-	1,133	6,019	6,019	-	-	-	10,637	-	-	-	1,108,000	5,267	100
2a.1.1.4	Pressurizer	-	41	599	114	-	509	-	215	1,478	1,478	-	-	-	2,879	-	-	-	324,870	1,666	625
2a.1.1.5	Steam Generators	257	3,993	8,728	1,351	-	14,379	-	5,797	34,504	34,504	-	-	-	49,515	-	-	-	4,415,357	40,664	1,167
2a.1.1.6	CRDMs/ICIs/Service Structure Removal	136	380	472	144	-	1,357	-	571	3,060	3,060	-	-	-	8,222	-	-	-	333,327	10,981	-
2a.1.1.7	Reactor Vessel Internals	42	7,158	24,146	1,387	-	10,977	456	17,330	61,496	61,496	-	-	-	5,147	678	221	-	584,638	37,773	1,669
2a.1.1.8	Reactor Vessel	105	8,747	3,997	1,570	-	5,469	456	10,807	31,150	31,150	-	-	-	18,058	-	-	-	1,270,178	37,773	1,669
2a.1.1	Totals	818	20,543	38,497	5,062	-	37,012	912	36,124	138,967	138,967	-	-	-	96,449	678	221	-	7,975,278	140,965	5,230
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	119	-	-	-	-	-	18	137	-	-	137	-	-	-	-	-	-	3,424	-
2a.1.3	Main Condensers	-	1,293	1,486	1,301	-	16,955	-	4,906	25,941	25,941	-	-	-	65,575	-	-	-	4,165,312	35,111	-
Cascading Costs from Clean Building Demolition																					
2a.1.4.1	Auxiliary Building	-	184	-	-	-	-	-	28	212	212	-	-	-	-	-	-	-	1,303	4,270	-
2a.1.4.2	Containment	-	490	-	-	-	-	-	69	529	529	-	-	-	-	-	-	-	4,270	274	-
2a.1.4.3	Main Steam Support Structure	-	36	-	-	-	-	-	5	42	42	-	-	-	-	-	-	-	274	2,104	-
2a.1.4.4	Radwaste Building	-	178	-	-	-	-	-	27	205	205	-	-	-	-	-	-	-	2,104	632	-
2a.1.4.5	Fuel Building	-	84	-	-	-	-	-	13	96	96	-	-	-	-	-	-	-	632	8,883	-
2a.1.4	Totals	-	942	-	-	-	-	-	141	1,083	1,083	-	-	-	-	-	-	-	8,883	-	-
Disposal of Plant Systems																					
2a.1.5.1	Auxiliary Feedwater (AF)	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	1,309	1,500	-
2a.1.5.2	Auxiliary Steam (AS)	-	44	-	-	-	-	-	7	50	-	-	50	-	-	-	-	-	1,500	1,794	-
2a.1.5.3	Auxiliary Steam (AS) - RCA	-	177	42	82	-	411	-	156	817	817	-	-	-	1,589	-	-	-	100,889	5,888	-
2a.1.5.4	Auxiliary Steam - Common (AS)	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	3,070	-
2a.1.5.5	CT Makeup & Blowdown (TB)	-	19	4	4	-	48	-	18	92	92	-	-	-	185	-	-	-	11,785	451	-
2a.1.5.6	CT Makeup & Blowdown - Common (TB)	-	769	496	474	-	6,171	-	1,856	9,766	9,766	-	-	-	23,839	-	-	-	1,516,266	20,143	-
2a.1.5.7	Chemical Production (CC)	-	16	-	-	-	-	-	2	19	-	-	19	-	-	-	-	-	-	630	-
2a.1.5.8	Chemical Production - Common (CC)	-	55	-	-	-	-	-	8	63	-	-	63	-	-	-	-	-	-	1,794	-
2a.1.5.9	Chlorine Injection (CI)	-	56	-	-	-	-	-	8	64	-	-	64	-	-	-	-	-	-	1,820	-
2a.1.5.10	Chlorine Injection - Common (CI)	-	20	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	730	-
2a.1.5.11	Circulating Water (CW)	-	106	-	-	-	-	-	16	122	-	-	122	-	-	-	-	-	-	3,545	-
2a.1.5.12	Condensate (CD)	-	189	-	-	-	-	-	28	218	-	-	218	-	-	-	-	-	-	6,510	-
2a.1.5.13	Condensate Storage & Transfer (CT)	-	261	39	31	-	408	-	174	908	908	-	-	-	1,542	-	-	-	99,005	6,046	-
2a.1.5.14	Condenser Air Removal (AR)	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	1,316	-
2a.1.5.15	Demineralized Water (DW)	-	64	-	-	-	-	-	10	73	-	-	73	-	-	-	-	-	-	2,085	-
2a.1.5.16	Demineralized Water - Common (DW)	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	1,251	-
2a.1.5.17	Diesel Fuel Oil & Trans - Common (DF)	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	287	-
2a.1.5.18	Diesel Fuel Oil & Transfer (DF)	-	49	-	-	-	-	-	7	57	-	-	57	-	-	-	-	-	-	1,192	-
2a.1.5.19	Diesel Generator (DG)	-	58	-	-	-	-	-	9	67	-	-	67	-	-	-	-	-	-	1,362	-
2a.1.5.20	FW Heater Extract Steam & Drains (ED)	-	438	-	-	-	-	-	66	504	-	-	504	-	-	-	-	-	-	11,838	-
2a.1.5.21	Feedwater (FW)	-	93	-	-	-	-	-	14	106	-	-	106	-	-	-	-	-	-	3,094	-
2a.1.5.22	Feedwater (FW) - RCA	-	22	14	13	-	170	-	51	270	270	-	-	-	656	-	-	-	41,735	541	-
2a.1.5.23	Generator Hydrogen & CO2 (GH)	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	102	-
2a.1.5.24	Generator Seal Oil (SO)	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	236	-
2a.1.5.25	HVAC - Misc Site Structures (HS)	-	15	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	530	-
2a.1.5.26	HVAC - Miscellaneous Common (HS)	-	4	-	-	-	-	-	1	4	-	-	4	-	-	-	-	-	-	115	-
2a.1.5.27	Lube Oil (LO)	-	36	-	-	-	-	-	5	42	-	-	42	-	-	-	-	-	-	1,188	-
2a.1.5.28	Lube Oil Stor & Trans & Purification(OS)	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	1,038	-
2a.1.5.29	Main Steam (SG)	-	232	-	-	-	-	-	35	267	-	-	267	-	-	-	-	-	-	8,052	-
2a.1.5.30	Main Steam (SG) - RCA	-	99	44	37	-	488	-	157	826	826	-	-	-	1,873	-	-	-	119,916	2,297	-
2a.1.5.31	Main Turbine (MT)	-	887	688	617	-	8,044	-	2,289	12,006	12,006	-	-	-	31,043	-	-	-	1,976,152	10,189	-
2a.1.5.32	Main Turbine Control Oil (CO)	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	176	-

Table C-1
Palo Verde NGS Unit 1
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(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Disposal of Plant Systems (continued)																					
2a.1.5.33	Secondary Chemical Control (SC)	-	171	-	-	-	-	-	26	197	-	-	197	-	-	-	-	-	-	5,637	-
2a.1.5.34	Sewage Treatment Plant - Common	-	1	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	14	-
2a.1.5.35	Stator Cooling (CE)	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	139	-
2a.1.5.36	Steam Gen Feedwater Pump Turbine (FT)	-	192	85	71	-	920	-	297	1,566	1,566	-	-	-	3,530	-	-	-	226,098	4,717	-
2a.1.5.37	Turbine Cooling Water (TC)	-	139	-	-	-	-	-	21	160	-	-	160	-	-	-	-	-	-	4,676	-
2a.1.5.38	Turbine Steam Seal & Drain (GS)	-	114	28	19	-	242	-	94	492	492	-	-	-	927	-	-	-	59,177	2,751	-
2a.1.5	Totals	-	1,090	1,137	1,297	-	16,897	-	5,380	29,102	28,743	-	2,358	-	65,169	-	-	-	4,151,624	120,348	-
2a.1.6	Scaffolding in support of decommissioning	-	3,195	23	20	-	261	-	869	4,368	4,368	-	-	-	1,008	-	-	-	64,051	34,758	-
2a.1	Subtotal Period 2a Activity Costs	818	30,182	11,413	7,680	-	71,125	912	17,138	139,596	137,101	-	2,495	-	228,201	678	221	-	16,556,760	343,788	5,230
Period 2a Additional Costs																					
2a.2.1	Remedial Action Surveys	-	-	-	-	-	-	2,694	808	3,502	3,502	-	-	-	-	-	-	-	-	40,091	-
2a.2.2	GTCC SFP Legacy Waste	-	339	-	-	-	-	10,550	1,697	12,557	12,557	-	-	-	-	-	-	887	181,103	4,000	160
2a.2	Subtotal Period 2a Additional Costs	-	339	-	-	-	-	13,244	2,476	16,059	16,059	-	-	-	-	-	-	887	181,103	44,091	160
Period 2a Collateral Costs																					
2a.3.1	Process decommissioning water waste	129	-	97	149	-	268	-	162	799	799	-	-	-	752	-	-	-	45,102	117	-
2a.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2a.3.3	Small tool allowance	-	271	-	-	-	-	-	41	311	280	-	31	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	129	271	97	149	-	268	-	203	1,110	1,079	-	31	-	752	-	-	-	45,102	147	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	164	-	-	-	-	-	-	41	205	205	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	823	92	1,015	1,015	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	642	64	707	707	-	-	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	1,941	-	-	-	-	-	1,235	6,176	6,176	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	1,286	-	-	-	-	-	643	4,929	4,929	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	133	75	-	385	-	121	714	714	-	-	-	6,232	-	-	-	124,644	203	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	4,295	644	4,939	4,939	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	1,297	130	1,426	1,426	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,542	154	1,696	-	1,696	-	-	-	-	-	-	-	-	-
2a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,906	286	2,192	-	2,192	-	-	-	-	-	-	-	-	-
2a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	81	12	94	-	94	-	-	-	-	-	-	-	-	-
2a.4.12	Security Staff Cost	-	-	-	-	-	-	16,348	2,452	18,801	18,801	-	-	-	-	-	-	-	-	-	292,361
2a.4.13	Utility Staff Cost	-	-	-	-	-	-	75,047	11,257	86,304	86,304	-	-	-	-	-	-	-	-	-	868,682
2a.4	Subtotal Period 2a Period-Dependent Costs	164	9,227	133	75	-	385	102,081	17,132	129,197	125,215	3,982	-	-	6,232	-	-	-	124,644	203	1,161,546
2a.0	TOTAL PERIOD 2a COST	1,110	40,019	11,673	7,903	-	71,778	116,237	67,219	345,963	339,455	3,982	2,526	-	235,185	678	221	887	16,707,610	388,228	1,166,937
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	Chemical & Volume Control (CH)	2,017	2,167	494	389	-	5,074	-	2,927	13,068	13,068	-	-	-	19,412	-	-	-	1,246,883	80,047	-
2b.1.1.2	Chemical Waste (CM)	400	486	77	63	-	820	-	546	2,401	2,401	-	-	-	3,149	-	-	-	201,501	18,894	-
2b.1.1.3	Chemical Waste - Common (CM)	90	65	10	9	-	119	-	93	385	385	-	-	-	458	-	-	-	29,130	2,255	-
2b.1.1.4	Containment Building (ZC)	-	1	0	0	-	0	-	0	2	2	-	-	-	2	-	-	-	118	15	-
2b.1.1.5	Containment Hydrogen Control (HP)	-	97	20	15	-	198	-	77	405	405	-	-	-	748	-	-	-	48,116	2,151	-
2b.1.1.6	Containment Leakage Test (CL)	-	31	14	11	-	178	-	56	293	293	-	-	-	690	-	-	-	43,331	312	-
2b.1.1.7	Containment Purge (CP)	-	32	13	11	-	150	-	49	255	255	-	-	-	577	-	-	-	36,798	327	-
2b.1.1.8	Domestic Water (DS)	-	110	-	-	-	-	-	16	126	-	-	126	-	-	-	-	-	-	3,675	-
2b.1.1.9	Domestic Water - Common (DS)	-	82	-	-	-	-	-	12	94	-	-	94	-	-	-	-	-	-	2,761	-
2b.1.1.10	Electrical (Clean)	-	983	-	-	-	-	-	148	1,131	-	-	1,131	-	-	-	-	-	-	30,827	-
2b.1.1.11	Electrical (Clean) - Common	-	77	-	-	-	-	-	12	88	-	-	88	-	-	-	-	-	-	2,107	-
2b.1.1.12	Electrical (Clean) - Common - RCA	-	55	10	9	-	123	-	47	244	241	-	-	-	475	-	-	-	30,159	1,149	-
2b.1.1.13	Electrical (Clean) - RCA	-	758	155	146	-	1,900	-	702	3,661	3,661	-	-	-	7,349	-	-	-	466,835	16,187	-
2b.1.1.14	Electrical (Contaminated)	-	4,397	522	512	-	6,671	-	2,896	14,998	14,998	-	-	-	25,739	-	-	-	1,638,951	97,755	-
2b.1.1.15	Essential Chilled Water (EC)	-	16	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	547	-
2b.1.1.16	Essential Chilled Water (EC)-RCA	-	178	32	22	-	281	-	122	637	637	-	-	-	1,082	-	-	-	69,340	3,797	-
2b.1.1.17	Essential Cooling Water (EW)	-	57	-	-	-	-	-	8	65	-	-	65	-	-	-	-	-	-	1,917	-
2b.1.1.18	Essential Cooling Water-(EW)-RCA	-	88	31	27	-	346	-	116	608	608	-	-	-	1,334	-	-	-	85,125	1,997	-
2b.1.1.19	Essential Spray Pond (SP)	-	283	-	-	-	-	-	42	325	-	-	325	-	-	-	-	-	-	9,865	-

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Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems (continued)																					
2b.1.1.20	Fire Protection (FP)	-	105	-	-	-	-	-	16	121	-	-	121	-	-	-	-	-	-	3,645	-
2b.1.1.21	Fire Protection (FP) - RCA	-	557	154	116	-	1,512	-	550	2,890	2,890	-	-	-	5,785	-	-	-	371,572	12,006	-
2b.1.1.22	Fire Protection - Common (FP) - RCA	-	368	137	126	-	1,638	-	534	2,803	2,803	-	-	-	6,326	-	-	-	402,376	7,877	-
2b.1.1.23	Gaseous Radwaste (GR)	-	232	38	27	-	348	-	153	798	798	-	-	-	1,327	-	-	-	85,625	5,181	-
2b.1.1.24	HVAC - Ancillary Building (HN) - Common	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	83	-
2b.1.1.25	HVAC - Auxiliary Building (HA)	-	436	299	211	-	2,756	-	860	4,561	4,561	-	-	-	10,477	-	-	-	677,111	10,352	-
2b.1.1.26	HVAC - Containment Building (HC)	-	461	179	137	-	1,788	-	601	3,166	3,166	-	-	-	6,829	-	-	-	439,260	9,573	-
2b.1.1.27	HVAC - Control Building (HJ)	-	87	-	-	-	-	-	13	100	-	-	100	-	-	-	-	-	-	3,112	-
2b.1.1.28	HVAC - Diesel Generator Building (HD)	-	8	-	-	-	-	-	1	10	-	-	10	-	-	-	-	-	-	295	-
2b.1.1.29	HVAC - Radwaste (HR)	-	133	42	36	-	471	-	161	843	843	-	-	-	1,812	-	-	-	116,774	2,861	-
2b.1.1.30	HVAC - Turbine Building (HT)	-	160	-	-	-	-	-	24	184	-	-	184	-	-	-	-	-	-	6,322	-
2b.1.1.31	Instrument & Service Air (IA)	-	35	-	-	-	-	-	5	41	-	-	41	-	-	-	-	-	-	1,213	-
2b.1.1.32	Instrument & Service Air (IA) - RCA	-	775	135	78	-	995	-	467	2,448	2,448	-	-	-	3,731	-	-	-	241,352	14,791	-
2b.1.1.33	Liquid Radwaste (LR)	515	766	122	91	-	1,188	-	772	3,455	3,455	-	-	-	4,538	-	-	-	291,979	27,224	-
2b.1.1.34	Normal Chilled Water (WC)	-	69	-	-	-	-	-	10	80	-	-	80	-	-	-	-	-	-	2,562	-
2b.1.1.35	Normal Chilled Water (WC) - RCA	-	210	45	35	-	456	-	176	922	922	-	-	-	1,747	-	-	-	112,038	4,562	-
2b.1.1.36	Nuclear Cooling Water (NC)	-	53	-	-	-	-	-	8	61	-	-	61	-	-	-	-	-	-	1,746	-
2b.1.1.37	Nuclear Cooling Water (NC) - RCA	-	198	260	213	-	2,771	-	875	4,816	4,816	-	-	-	10,347	-	-	-	680,329	11,151	-
2b.1.1.38	Nuclear Sampling (SS)	-	240	30	18	-	231	-	123	643	643	-	-	-	867	-	-	-	56,786	5,121	-
2b.1.1.39	Oily Waste & Nonrad Waste - Common (OW)	-	153	35	33	-	402	-	155	807	807	-	-	-	1,669	-	-	-	109,042	3,462	-
2b.1.1.40	Oily Waste & Nonradioactive Waste (OW)	-	581	78	66	-	857	-	377	1,959	1,959	-	-	-	3,292	-	-	-	210,616	13,291	-
2b.1.1.41	Plant Cooling Water (PW)	-	114	-	-	-	-	-	17	131	-	-	131	-	-	-	-	-	-	3,929	-
2b.1.1.42	Post Accident Sampling	-	11	1	1	-	13	-	6	32	32	-	-	-	50	-	-	-	3,169	275	-
2b.1.1.43	Radiation Monitoring (SQ)	-	33	5	3	-	41	-	20	106	106	-	-	-	167	-	-	-	10,820	782	-
2b.1.1.44	Radioactive Waste Drain (RD)	522	192	62	52	-	675	-	567	2,370	2,370	-	-	-	2,591	-	-	-	165,981	19,157	-
2b.1.1.45	Radioactive Waste Drain - Common (RD)	7	6	1	1	-	8	-	7	28	28	-	-	-	29	-	-	-	1,844	258	-
2b.1.1.46	Reactor Coolant (RC)	26	176	20	12	-	159	-	100	490	490	-	-	-	585	-	-	-	38,217	4,444	-
2b.1.1.47	Safety Injection (SI)	-	1,741	679	528	-	6,851	-	2,295	12,092	12,092	-	-	-	26,194	-	-	-	1,688,105	41,385	-
2b.1.1.48	Service Gases (GA) - RCA	-	218	38	22	-	291	-	134	703	703	-	-	-	1,097	-	-	-	71,538	4,164	-
2b.1.1.49	Solid Radwaste (SR)	132	221	40	31	-	389	-	230	1,054	1,054	-	-	-	1,528	-	-	-	98,132	7,907	-
2b.1.1.50	zDecommissioning Crew Set-up	-	3,785	-	-	-	-	-	578	4,363	-	-	4,363	-	-	-	-	-	-	83,075	-
2b.1.1	Totals	3,709	22,699	3,777	3,050	-	39,742	-	17,697	90,674	83,744	-	6,930	-	152,391	-	-	-	9,764,507	590,092	-
2b.1.2	Scaffolding in support of decommissioning	-	3,994	29	25	-	326	-	1,086	5,459	5,459	-	-	-	1,280	-	-	-	80,061	18,147	-
Decontamination of Site Buildings																					
2b.1.3.1	Auxiliary Building	597	338	74	159	-	956	-	693	2,858	2,858	-	-	-	9,861	-	-	-	488,398	22,059	-
2b.1.3.2	Containment	1,218	1,838	307	840	-	7,685	-	3,146	15,035	15,035	-	-	-	58,640	-	-	-	2,623,131	67,811	-
2b.1.3.3	DAW Processing & Storage (Common)	30	14	1	6	-	25	-	26	102	102	-	-	-	403	-	-	-	13,020	1,010	-
2b.1.3.4	Decon & Laundry Facility (Common)	21	8	6	4	-	47	-	26	112	112	-	-	-	210	-	-	-	12,578	708	-
2b.1.3.5	Holdup Tank & Pump House	352	324	88	47	-	610	-	423	1,841	1,841	-	-	-	2,288	-	-	-	149,929	16,085	-
2b.1.3.6	Hot Instrmnt Calib Facility (Common)	1	0	0	0	-	1	-	1	3	3	-	-	-	13	-	-	-	610	32	-
2b.1.3.7	LLRW Storage Facility (Common)	41	20	3	9	-	40	-	37	150	150	-	-	-	588	-	-	-	27,392	1,417	-
2b.1.3.8	Outage Support Facility (Common)	124	59	6	27	-	110	-	109	436	436	-	-	-	1,749	-	-	-	82,640	4,229	-
2b.1.3.9	Radwaste Building	846	387	241	165	-	1,863	-	1,085	4,587	4,587	-	-	-	8,651	-	-	-	522,790	22,190	-
2b.1.3.10	Refueling Water Storage Tank	486	395	91	51	-	667	-	525	2,213	2,213	-	-	-	2,496	-	-	-	163,942	21,082	-
2b.1.3	Totals	3,637	3,439	814	1,310	-	12,044	-	5,992	27,287	27,287	-	-	-	84,893	-	-	-	4,090,429	156,620	-
2b.1.4	Prepare/submit License Termination Plan	-	-	-	-	-	-	347	52	399	399	-	-	-	-	-	-	-	-	-	4,096
2b.1.5	Receive NRC approval of termination plan									a											
2b.1	Subtotal Period 2b Activity Costs	7,396	30,132	4,620	4,385	-	52,112	347	24,828	123,819	116,889	-	6,930	-	238,541	-	-	-	13,935,000	790,159	4,096
Period 2b Additional Costs																					
2b.2.1	Remedial Action Surveys	-	-	-	-	-	-	3,593	1,078	4,671	4,671	-	-	-	-	-	-	-	-	53,474	-
2b.2	Subtotal Period 2b Additional Costs	-	-	-	-	-	-	3,593	1,078	4,671	4,671	-	-	-	-	-	-	-	-	53,474	-
Period 2b Collateral Costs																					
2b.3.1	Process decommissioning water waste	312	-	241	371	-	657	-	400	1,981	1,981	-	-	-	1,878	-	-	-	112,666	396	-
2b.3.2	Process decommissioning chemical flush waste	7	-	256	856	-	1,489	-	594	3,180	3,180	-	-	-	2,396	-	-	-	255,343	448	-
2b.3.3	Small tool allowance	-	477	-	-	-	-	-	72	548	548	-	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	319	477	497	1,227	-	2,145	-	1,065	5,710	5,710	-	-	-	4,274	-	-	-	368,009	845	-

Table C-1
Palo Verde NGS Unit 1
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 2b Period-Dependent Costs																					
2b.4.1	Decon supplies	2,314	-	-	-	-	-	-	578	2,892	2,892	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	1,231	123	1,354	1,354	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	857	86	943	943	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	9,060	-	-	-	-	-	2,265	11,325	11,325	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	5,862	-	-	-	-	-	879	6,742	6,742	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	234	131	-	675	-	212	1,252	1,252	-	-	-	10,926	-	-	-	218,514	356	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	4,522	678	5,200	5,200	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	1,729	173	1,902	1,902	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	2,057	206	2,262	-	2,262	-	-	-	-	-	-	-	-	-
2b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	2,542	381	2,924	-	2,924	-	-	-	-	-	-	-	-	-
2b.4.11	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	611	96	707	707	-	-	-	-	-	-	-	-	-	-
2b.4.12	ISFSI Operating Costs	-	-	-	-	-	-	109	16	125	-	125	-	-	-	-	-	-	-	-	-
2b.4.13	Security Staff Cost	-	-	-	-	-	-	21,905	3,271	25,076	25,076	-	-	-	-	-	-	-	-	-	390,621
2b.4.14	Utility Staff Cost	-	-	-	-	-	-	70,536	10,580	81,116	81,116	-	-	-	-	-	-	-	-	-	837,434
2b.4	Subtotal Period 2b Period-Dependent Costs	2,314	14,922	234	131	-	675	106,029	19,545	143,851	138,540	5,311	-	-	10,926	-	-	-	218,514	356	1,228,056
2b.0	TOTAL PERIOD 2b COST	10,029	45,581	5,890	5,742	-	54,982	109,969	16,456	278,051	265,810	5,311	6,930	-	258,741	-	-	-	14,521,520	341,904	1,232,151
PERIOD 2d - Decontamination Following Wet Fuel Storage																					
Period 2d Direct Decommissioning Activities																					
2d.1.1	Remove spent fuel racks	321	31	156	70	-	909	-	422	1,908	1,508	-	-	-	3,515	-	-	-	223,325	968	-
Disposal of Plant Systems																					
2d.1.2.1	Electrical Spent Fuel	-	190	37	35	-	457	-	171	889	889	-	-	-	1,766	-	-	-	112,166	4,048	-
2d.1.2.2	Fire Protection - Common (FP)	-	67	-	-	-	-	-	10	77	-	-	77	-	-	-	-	-	-	2,334	-
2d.1.2.3	Fuel Pool Cooling & Cleanup (PC)	560	411	163	125	-	1,624	-	824	3,707	3,707	-	-	-	6,204	-	-	-	393,088	13,370	-
2d.1.2.4	HVAC - Fuel Building (HF)	-	173	108	75	-	981	-	310	1,642	1,642	-	-	-	3,738	-	-	-	240,970	8,320	-
2d.1.2.5	Sanitary Drain & Treatment - Common (ST)	-	81	-	-	-	-	-	12	93	-	-	93	-	-	-	-	-	-	2,667	-
2d.1.2.6	Sanitary Drainage & Treatment (ST)	-	16	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	577	-
2d.1.2	Totals	560	938	303	235	-	3,062	-	1,329	6,426	6,238	-	189	-	11,706	-	-	-	752,223	26,817	-
Decontamination of Site Buildings																					
2d.1.3.1	Fuel Building	425	508	61	40	-	484	-	473	1,992	1,992	-	-	-	2,151	-	-	-	128,216	22,125	-
2d.1.3	Totals	425	508	61	40	-	484	-	473	1,992	1,992	-	-	-	2,151	-	-	-	128,216	22,125	-
2d.1.4	Scaffolding in support of decommissioning	-	799	6	5	-	65	-	217	1,092	1,092	-	-	-	252	-	-	-	16,013	8,689	-
2d.1	Subtotal Period 2d Activity Costs	1,306	2,276	526	350	-	4,520	-	2,440	11,418	11,229	-	189	-	17,624	-	-	-	1,116,777	58,600	-
Period 2d Additional Costs																					
2d.2.1	License Termination Survey Planning	-	-	-	-	-	-	960	288	1,248	1,248	-	-	-	-	-	-	-	-	-	4,160
2d.2.2	Operational Tools & Equipment	-	-	96	125	-	1,323	-	359	1,903	1,903	-	-	-	4,500	-	-	-	325,000	147	-
2d.2.3	Excavation of Underground Services	-	1,159	-	-	-	-	986	348	1,893	1,893	-	-	-	-	-	-	-	-	6,874	-
2d.2.4	Remedial Action Surveys	-	-	-	-	-	-	670	201	871	871	-	-	-	-	-	-	-	-	9,966	-
2d.2	Subtotal Period 2d Additional Costs	-	1,159	96	125	-	1,323	2,015	1,196	5,915	5,915	-	-	-	4,500	-	-	-	325,000	16,986	4,160
Period 2d Collateral Costs																					
2d.3.1	Process decommissioning water waste	80	-	62	96	-	170	-	103	512	512	-	-	-	486	-	-	-	29,187	95	-
2d.3.2	Process decommissioning chemical flush waste	2	-	50	261	-	455	-	163	971	971	-	-	-	732	-	-	-	77,960	137	-
2d.3.3	Small tool allowance	-	47	-	-	-	-	-	7	54	54	-	-	-	-	-	-	-	-	-	-
2d.3.4	Decommissioning Equipment Disposition	-	-	120	105	-	1,368	-	370	1,962	1,962	-	-	-	5,290	-	-	-	336,079	147	-
2d.3	Subtotal Period 2d Collateral Costs	82	47	278	462	-	1,993	-	643	3,500	3,500	-	-	-	6,508	-	-	-	443,226	379	-
Period 2d Period-Dependent Costs																					
2d.4.1	Decon supplies	134	-	-	-	-	-	-	34	168	168	-	-	-	-	-	-	-	-	-	-
2d.4.2	Insurance	-	-	-	-	-	-	229	23	252	252	-	-	-	-	-	-	-	-	-	-
2d.4.3	Property taxes	-	-	-	-	-	-	160	16	176	176	-	-	-	-	-	-	-	-	-	-
2d.4.4	Health physics supplies	-	966	-	-	-	-	-	241	1,207	1,207	-	-	-	-	-	-	-	-	-	-
2d.4.5	Heavy equipment rental	-	1,093	-	-	-	-	-	164	1,256	1,256	-	-	-	-	-	-	-	-	-	-
2d.4.6	Disposal of DAW generated	-	-	36	20	-	103	-	32	192	192	-	-	-	1,674	-	-	-	33,482	55	-
2d.4.7	Plant energy budget	-	-	-	-	-	-	449	67	517	517	-	-	-	-	-	-	-	-	-	-
2d.4.8	NRC Fees	-	-	-	-	-	-	304	30	334	334	-	-	-	-	-	-	-	-	-	-
2d.4.9	Emergency Planning Fees	-	-	-	-	-	-	385	38	422	-	422	-	-	-	-	-	-	-	-	-
2d.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	239	36	275	275	-	-	-	-	-	-	-	-	-	-

Table C-1
Palo Verde NGS Unit 1
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 2d Period-Dependent Costs (continued)																					
2d.1.11	ISFSI Operating Costs	-	-	-	-	-	-	20	3	23	-	23	-	-	-	-	-	-	-	-	-
2d.1.12	Security Staff Cost	-	-	-	-	-	-	1,506	226	1,732	1,103	629	-	-	-	-	-	-	-	-	25,929
2d.1.13	Utility Staff Cost	-	-	-	-	-	-	8,134	1,220	9,355	9,149	206	-	-	-	-	-	-	-	-	98,729
2d.1	Subtotal Period 2d Period-Dependent Costs	134	2,058	36	20	-	103	11,425	2,131	15,908	14,629	1,279	-	-	1,674	-	-	-	33,482	55	124,658
2d.0	TOTAL PERIOD 2d COST	1,522	5,541	981	957	-	7,988	18,141	6,410	36,740	35,272	1,279	189	-	30,307	-	-	-	1,921,184	76,019	128,818
PERIOD 2e - Delay before License Termination																					
Period 2e Period-Dependent Costs																					
2e.1.1	Insurance	-	-	-	-	-	-	1,190	119	1,309	1,309	-	-	-	-	-	-	-	-	-	-
2e.1.2	Property taxes	-	-	-	-	-	-	829	83	912	912	-	-	-	-	-	-	-	-	-	-
2e.1.3	Health physics supplies	-	398	-	-	-	-	-	100	498	498	-	-	-	-	-	-	-	-	-	-
2e.1.4	Disposal of DAW generated	-	-	5	3	-	15	-	5	28	28	-	-	-	248	-	-	-	4,959	8	-
2e.1.5	Plant energy budget	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2e.1.6	NRC Fees	-	-	-	-	-	-	855	85	940	940	-	-	-	-	-	-	-	-	-	-
2e.1.7	Emergency Planning Fees	-	-	-	-	-	-	1,589	159	1,748	-	1,748	-	-	-	-	-	-	-	-	-
2e.1.8	ISFSI Operating Costs	-	-	-	-	-	-	105	16	121	-	121	-	-	-	-	-	-	-	-	-
2e.1.9	Security Staff Cost	-	-	-	-	-	-	7,814	1,172	8,986	5,724	3,262	-	-	-	-	-	-	-	-	134,588
2e.1.10	Utility Staff Cost	-	-	-	-	-	-	3,235	485	3,721	3,609	112	-	-	-	-	-	-	-	-	36,221
2e.1	Subtotal Period 2e Period-Dependent Costs	-	398	5	3	-	15	15,617	2,224	18,262	13,020	5,243	-	-	248	-	-	-	4,959	8	170,754
2e.0	TOTAL PERIOD 2e COST	-	398	5	3	-	15	15,617	2,224	18,262	13,020	5,243	-	-	248	-	-	-	1,959	8	170,751
PERIOD 2f - License Termination																					
Period 2f Direct Decommissioning Activities																					
2f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	178	53	231	231	-	-	-	-	-	-	-	-	-	-
2f.1.2	Terminate license									a											
2f.1	Subtotal Period 2f Activity Costs	-	-	-	-	-	-	178	53	231	231	-	-	-	-	-	-	-	-	-	-
Period 2f Additional Costs																					
2f.2.1	License Termination Survey	-	-	-	-	-	-	9,511	2,853	12,364	12,364	-	-	-	-	-	-	-	-	198,844	2,080
2f.2	Subtotal Period 2f Additional Costs	-	-	-	-	-	-	9,511	2,853	12,364	12,364	-	-	-	-	-	-	-	-	198,844	2,080
Period 2f Period-Dependent Costs																					
2f.4.1	Insurance	-	-	-	-	-	-	306	37	402	402	-	-	-	-	-	-	-	-	-	-
2f.4.2	Property taxes	-	-	-	-	-	-	255	25	280	280	-	-	-	-	-	-	-	-	-	-
2f.4.3	Health physics supplies	-	1,525	-	-	-	-	-	381	1,906	1,906	-	-	-	-	-	-	-	-	-	-
2f.4.4	Disposal of DAW generated	-	-	7	1	-	21	-	7	39	39	-	-	-	337	-	-	-	6,734	11	-
2f.4.5	Plant energy budget	-	-	-	-	-	-	358	54	412	412	-	-	-	-	-	-	-	-	-	-
2f.4.6	NRC Fees	-	-	-	-	-	-	515	51	566	566	-	-	-	-	-	-	-	-	-	-
2f.4.7	ISFSI Operating Costs	-	-	-	-	-	-	32	5	37	-	37	-	-	-	-	-	-	-	-	-
2f.4.8	Security Staff Cost	-	-	-	-	-	-	2,401	360	2,761	1,759	1,002	-	-	-	-	-	-	-	-	41,338
2f.4.9	Utility Staff Cost	-	-	-	-	-	-	9,016	1,352	10,369	9,961	404	-	-	-	-	-	-	-	-	99,635
2f.4	Subtotal Period 2f Period-Dependent Costs	-	1,525	7	1	-	21	12,942	2,272	16,771	15,328	1,441	-	-	337	-	-	-	6,734	11	140,973
2f.0	TOTAL PERIOD 2f COST	-	1,525	7	4	-	21	22,631	5,179	29,367	27,923	1,444	-	-	337	-	-	-	6,734	198,855	143,053
PERIOD 2 TOTALS		12,692	93,013	48,006	14,610	-	134,679	277,895	127,518	708,383	681,480	17,258	9,645	-	519,820	673	224	887	33,162,310	1,507,914	2,841,714
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Administrative Bldg. A (Common)	-	103	-	-	-	-	-	15	119	-	-	119	-	-	-	-	-	-	1,165	-
3b.1.1.2	Administrative Bldg. B (Common)	-	100	-	-	-	-	-	15	115	-	-	115	-	-	-	-	-	-	1,104	-
3b.1.1.3	Administrative Bldg. D (Common)	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	183	-
3b.1.1.4	Administrative Bldg. E (Common)	-	90	-	-	-	-	-	14	104	-	-	104	-	-	-	-	-	-	1,151	-
3b.1.1.5	Administrative Bldg. F (Common)	-	130	-	-	-	-	-	19	149	-	-	149	-	-	-	-	-	-	1,118	-
3b.1.1.6	Auxiliary Boiler Foundations (Common)	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	36	-
3b.1.1.7	Auxiliary Building	-	1,656	-	-	-	-	-	248	1,904	-	-	1,904	-	-	-	-	-	-	11,728	-
3b.1.1.8	Calibration Lab (Common)	-	2	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	13	-
3b.1.1.9	Chemical Injection Pump House	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	63	-

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(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Buriad / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Demolition of Remaining Site Buildings (continued)																					
3b.1.1.10	Chemical Storage Building (Common)	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	383	-
3b.1.1.11	Condensate Storage Tank	-	115	-	-	-	-	-	17	132	-	-	132	-	-	-	-	-	-	1,787	-
3b.1.1.12	Containment	-	3,030	-	-	-	-	-	454	3,484	-	-	3,484	-	-	-	-	-	-	25,043	-
3b.1.1.13	Control Building	-	901	-	-	-	-	-	135	1,037	-	-	1,037	-	-	-	-	-	-	9,292	-
3b.1.1.14	Cooling Tower Electrical Equipment	-	18	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	188	-
3b.1.1.15	Cooling Towers	-	1,212	-	-	-	-	-	182	1,394	-	-	1,394	-	-	-	-	-	-	7,343	-
3b.1.1.16	Corridor Building	-	74	-	-	-	-	-	11	85	-	-	85	-	-	-	-	-	-	922	-
3b.1.1.17	DAW Processing & Storage (Common)	-	23	-	-	-	-	-	3	27	-	-	27	-	-	-	-	-	-	116	-
3b.1.1.18	Decon & Laundry Facility (Common)	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	196	-
3b.1.1.19	Diesel Generator Building	-	307	-	-	-	-	-	46	354	-	-	354	-	-	-	-	-	-	2,158	-
3b.1.1.20	Energy Information Center (Common)	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	334	-
3b.1.1.21	Fire Pumphouse (Common)	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	78	-
3b.1.1.22	Flex Buildings (Common)	-	129	-	-	-	-	-	19	149	-	-	149	-	-	-	-	-	-	1,671	-
3b.1.1.23	Holdup Tank & Pump House	-	41	-	-	-	-	-	6	47	-	-	47	-	-	-	-	-	-	296	-
3b.1.1.24	Hot Instrmnt Calib Facility (Common)	-	3	-	-	-	-	-	0	4	-	-	4	-	-	-	-	-	-	19	-
3b.1.1.25	Intake Structure, Canals, & Circ Tunnels	-	1,871	-	-	-	-	-	281	2,152	-	-	2,152	-	-	-	-	-	-	3,859	-
3b.1.1.26	LLRW Storage Facility (Common)	-	61	-	-	-	-	-	9	70	-	-	70	-	-	-	-	-	-	352	-
3b.1.1.27	Main Steam Support Structure	-	210	-	-	-	-	-	31	241	-	-	241	-	-	-	-	-	-	1,700	-
3b.1.1.28	Misc. Structures & Foundations (Common)	-	826	-	-	-	-	-	124	950	-	-	950	-	-	-	-	-	-	6,796	-
3b.1.1.29	North Admin Annex Building (Common)	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	675	-
3b.1.1.30	Nuclear Service Spray Ponds	-	1,215	-	-	-	-	-	182	1,398	-	-	1,398	-	-	-	-	-	-	7,151	-
3b.1.1.31	Operations Support Building	-	128	-	-	-	-	-	19	147	-	-	147	-	-	-	-	-	-	1,730	-
3b.1.1.32	Outage Support Facility (Common)	-	349	-	-	-	-	-	52	402	-	-	402	-	-	-	-	-	-	2,925	-
3b.1.1.33	Protected Area Sec. Blast Wall (Common)	-	1,211	-	-	-	-	-	182	1,392	-	-	1,392	-	-	-	-	-	-	6,997	-
3b.1.1.34	Radwaste Building	-	1,603	-	-	-	-	-	240	1,843	-	-	1,843	-	-	-	-	-	-	21,636	-
3b.1.1.35	Refueling Water Storage Tank	-	78	-	-	-	-	-	12	89	-	-	89	-	-	-	-	-	-	452	-
3b.1.1.36	Retention Tanks (Common)	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	404	-
3b.1.1.37	SG Voltage Regulator Buildings (Common)	-	11	-	-	-	-	-	2	12	-	-	12	-	-	-	-	-	-	87	-
3b.1.1.38	Security HQ and Guard House (Common)	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	158	-
3b.1.1.39	Service Building (Common)	-	49	-	-	-	-	-	7	56	-	-	56	-	-	-	-	-	-	371	-
3b.1.1.40	Sewage Treatment Plant (Common)	-	2	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	13	-
3b.1.1.41	Site Fencing & Paving & RR (Common)	-	603	-	-	-	-	-	91	694	-	-	694	-	-	-	-	-	-	9,840	-
3b.1.1.42	Spare Turbine Rotor Laydown Pads (Com)	-	1	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	9	-
3b.1.1.43	Station B/O Gas TB Generator (Common)	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	36	-
3b.1.1.44	Subsynchronous Resonance Protection	-	2	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	30	-
3b.1.1.45	Switchgear Building	-	27	-	-	-	-	-	4	31	-	-	31	-	-	-	-	-	-	322	-
3b.1.1.46	Technical Support Center (Common)	-	85	-	-	-	-	-	13	97	-	-	97	-	-	-	-	-	-	513	-
3b.1.1.47	Transformer Area	-	77	-	-	-	-	-	12	89	-	-	89	-	-	-	-	-	-	447	-
3b.1.1.48	Turbine Building	-	2,565	-	-	-	-	-	385	2,950	-	-	2,950	-	-	-	-	-	-	37,106	-
3b.1.1.49	Turbine Building Pedestal	-	3,870	-	-	-	-	-	581	4,451	-	-	4,451	-	-	-	-	-	-	59,125	-
3b.1.1.50	Turbine Maintenance Facility	-	16	-	-	-	-	-	2	19	-	-	19	-	-	-	-	-	-	214	-
3b.1.1.51	Vehicle Maintenance Facility (Common)	-	22	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	336	-
3b.1.1.52	WRF Train 7 (Common)	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	7	-
3b.1.1.53	Walsh Furniture Storage Bldg#4 (Common)	-	44	-	-	-	-	-	7	50	-	-	50	-	-	-	-	-	-	705	-
3b.1.1.54	Warehouse (Common)	-	329	-	-	-	-	-	49	378	-	-	378	-	-	-	-	-	-	5,516	-
3b.1.1.55	Warehouse - Office Facility (Common)	-	291	-	-	-	-	-	44	335	-	-	335	-	-	-	-	-	-	2,157	-
3b.1.1.56	Yard Tunnels	-	357	-	-	-	-	-	53	410	-	-	410	-	-	-	-	-	-	5,290	-
3b.1.1.57	Fuel Building	-	770	-	-	-	-	-	115	885	-	-	885	-	-	-	-	-	-	6,150	-
3b.1.1	Totals	-	24,875	-	-	-	-	-	3,731	28,606	-	-	28,606	-	-	-	-	-	-	251,245	-
Site Closeout Activities																					
3b.1.2	Remove Rubble	-	301	-	-	-	-	-	45	347	-	-	347	-	-	-	-	-	-	8,639	-
3b.1.3	Grade & landscape site	-	68	-	-	-	-	-	9	78	-	-	78	-	-	-	-	-	-	325	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	132	20	152	152	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	25,240	-	-	-	-	132	3,806	29,178	152	-	29,026	-	-	-	-	-	-	260,210	1,560
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	1,751	-	-	-	-	6	263	2,020	-	-	2,020	-	-	-	-	-	-	7,276	-
3b.2.2	Construction Debris	-	-	-	-	-	-	1,010	152	1,162	-	-	1,162	-	-	-	-	-	-	-	-
3b.2.3	Firing Range Closure	-	87	-	-	-	-	101	28	216	-	-	216	-	-	-	-	-	-	616	-
3b.2	Subtotal Period 3b Additional Costs	-	1,838	-	-	-	-	1,117	443	3,397	-	-	3,397	-	-	-	-	-	-	7,892	-
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	152	-	-	-	-	-	23	175	-	-	175	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	152	-	-	-	-	-	23	175	-	-	175	-	-	-	-	-	-	-	-

Table C-1
Palo Verde NGS Unit 1
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 3b Period-Dependent Costs																					
3b.1.1	Insurance	-	-	-	-	-	-	301	30	332	332	-	-	-	-	-	-	-	-	-	-
3b.1.2	Property taxes	-	-	-	-	-	-	630	63	693	-	-	693	-	-	-	-	-	-	-	-
3b.1.3	Heavy equipment rental	-	6,020	-	-	-	-	-	903	6,923	-	-	6,923	-	-	-	-	-	-	-	-
3b.1.4	Plant energy budget	-	-	-	-	-	-	443	66	510	-	-	510	-	-	-	-	-	-	-	-
3b.1.5	NRC ISFSI Fees	-	-	-	-	-	-	234	23	258	-	258	-	-	-	-	-	-	-	-	-
3b.1.6	ISFSI Operating Costs	-	-	-	-	-	-	80	12	92	-	92	-	-	-	-	-	-	-	-	-
3b.1.7	Security Staff Cost	-	-	-	-	-	-	5,988	891	6,829	(0)	2,179	4,650	-	-	-	-	-	-	-	102,233
3b.1.8	Utility Staff Cost	-	-	-	-	-	-	13,978	2,096	16,069	(0)	996	15,073	-	-	-	-	-	-	-	152,367
3b.1	Subtotal Period 3b Period-Dependent Costs	-	6,020	-	-	-	-	21,599	4,085	31,704	332	3,824	27,548	-	-	-	-	-	-	-	254,601
3b.0	TOTAL PERIOD 3b COST	-	33,250	-	-	-	-	22,848	8,356	64,454	188	3,824	60,146	-	-	-	-	-	-	268,102	256,161
PERIOD 3d - GTCC shipping																					
Period 3d Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
3d.1.1.1	Vessel & Internals GTCC Disposal	-	-	1,246	-	-	20,402	-	3,372	25,020	25,020	-	-	-	-	-	-	3,547	724,110	-	-
3d.1.1	Totals	-	-	1,246	-	-	20,402	-	3,372	25,020	25,020	-	-	-	-	-	-	3,547	724,110	-	-
3d.1	Subtotal Period 3d Activity Costs	-	-	1,246	-	-	20,402	-	3,372	25,020	25,020	-	-	-	-	-	-	3,547	724,410	-	-
PERIOD 3 TOTALS		-	33,250	1,246	-	-	20,402	22,848	11,728	89,474	25,504	3,824	60,146	-	-	-	-	3,547	724,410	268,102	256,161
TOTAL COST TO DECOMMISSION		18,073	130,041	19,492	15,181	-	158,688	171,195	188,582	1,011,251	915,877	24,531	70,840	-	521,218	2,002	221	1,433	34,078,490	1,807,947	1,203,762

TOTAL COST TO DECOMMISSION WITH 20.01% CONTINGENCY:	**$1,011,251**	**thousands of 2023 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 90.57% OR:	**$915,877**	**thousands of 2023 dollars**
SPENT FUEL MANAGEMENT COST IS 2.43% OR:	**$24,534**	**thousands of 2023 dollars**
NON-NUCLEAR DEMOLITION COST IS 7.01% OR:	**$70,840**	**thousands of 2023 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**523,415**	**Cubic Feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**4,433**	**Cubic Feet**
TOTAL SCRAP METAL REMOVED:	**66,565**	**Tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,807,947**	**Man-hours**

End Notes:
n/a - indicates that this activity not charged as decommissioning expense
a - indicates that this activity performed by decommissioning staff
0 - indicates that this value is less than 0.5 but is non-zero
A cell containing " - " indicates a zero value

Table C-2
Palo Verde NGS Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 0a - Pre-Shutdown Early Planning																					
Period 0a Period-Dependent Costs																					
0a.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.3	Plant energy budget	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.1.1	Utility Staff Cost	-	-	-	-	-	-	2,108	316	2,424	2,424	-	-	-	-	-	-	-	-	-	26,785
0a.1	Subtotal Period 0a Period-Dependent Costs	-	-	-	-	-	-	2,108	316	2,424	2,424	-	-	-	-	-	-	-	-	-	26,785
0a.0	TOTAL PERIOD 0a COST	-	-	-	-	-	-	2,108	316	2,424	2,424	-	-	-	-	-	-	-	-	-	26,785
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	47	7	54	54	-	-	-	-	-	-	-	-	-	556
1a.1.2	Notification of Cessation of Operations									a											
1a.1.3	Remove fuel & source material									n/a											
1a.1.4	Notification of Permanent Defueling									a											
1a.1.5	Deactivate plant systems & process waste									a											
1a.1.6	Prepare and submit PSDAR	-	-	-	-	-	-	72	11	83	83	-	-	-	-	-	-	-	-	-	856
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	167	25	192	192	-	-	-	-	-	-	-	-	-	1,969
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	36	5	42	42	-	-	-	-	-	-	-	-	-	428
1a.1.10	End product description	-	-	-	-	-	-	36	5	42	42	-	-	-	-	-	-	-	-	-	428
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	47	7	54	54	-	-	-	-	-	-	-	-	-	556
1a.1.12	Define major work sequence	-	-	-	-	-	-	272	41	313	313	-	-	-	-	-	-	-	-	-	3,210
1a.1.13	Perform SER and EA	-	-	-	-	-	-	112	17	129	129	-	-	-	-	-	-	-	-	-	1,327
1a.1.14	Prepare/submit Detailed Technical Specifica	-	-	-	-	-	-	272	41	313	313	-	-	-	-	-	-	-	-	-	3,210
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	181	27	208	208	-	-	-	-	-	-	-	-	-	2,140
1a.1.16	Prepare/submit Irradiated Fuel Management	-	-	-	-	-	-	36	5	42	42	-	-	-	-	-	-	-	-	-	428
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	178	27	205	185	-	21	-	-	-	-	-	-	-	2,106
1a.1.17.2	Plant systems	-	-	-	-	-	-	151	23	174	156	-	17	-	-	-	-	-	-	-	1,783
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	18	3	21	21	-	-	-	-	-	-	-	-	-	214
1a.1.17.4	Reactor internals	-	-	-	-	-	-	257	39	296	296	-	-	-	-	-	-	-	-	-	3,039
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	236	35	271	271	-	-	-	-	-	-	-	-	-	2,782
1a.1.17.6	Biological shield	-	-	-	-	-	-	18	3	21	21	-	-	-	-	-	-	-	-	-	214
1a.1.17.7	Steam generators	-	-	-	-	-	-	113	17	130	130	-	-	-	-	-	-	-	-	-	1,335
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	58	9	67	33	-	33	-	-	-	-	-	-	-	685
1a.1.17.9	Main Turbine	-	-	-	-	-	-	14	2	17	-	-	17	-	-	-	-	-	-	-	171
1a.1.17.10	Main Condensers	-	-	-	-	-	-	14	2	17	-	-	17	-	-	-	-	-	-	-	171
1a.1.17.11	Plant structures & buildings	-	-	-	-	-	-	113	17	130	65	-	65	-	-	-	-	-	-	-	1,335
1a.1.17.12	Waste management	-	-	-	-	-	-	167	25	192	192	-	-	-	-	-	-	-	-	-	1,969
1a.1.17.13	Facility & site closeout	-	-	-	-	-	-	33	5	38	19	-	19	-	-	-	-	-	-	-	385
1a.1.17	Total	-	-	-	-	-	-	1,371	206	1,577	1,388	-	188	-	-	-	-	-	-	-	16,190
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	87	13	100	100	-	-	-	-	-	-	-	-	-	1,027
1a.1.19	Plant prep. & temp. svcss	-	-	-	-	-	-	4,000	600	4,600	4,600	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	51	8	58	58	-	-	-	-	-	-	-	-	-	599
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,800	420	3,220	3,220	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	45	7	51	51	-	-	-	-	-	-	-	-	-	526
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	9,633	1,445	11,078	10,890	-	188	-	-	-	-	-	-	-	33,151
Period 1a Additional Costs																					
1a.2.1	Staff Transition	-	-	-	-	-	-	43,868	6,580	50,449	50,449	-	-	-	-	-	-	-	-	-	-
1a.2	Subtotal Period 1a Additional Costs	-	-	-	-	-	-	43,868	6,580	50,449	50,449	-	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,551	155	1,706	1,706	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	222	22	244	244	-	-	-	-	-	-	-	-	-	-
1a.1.3	Health physics supplies	-	556	-	-	-	-	-	139	695	695	-	-	-	-	-	-	-	-	-	-
1a.1.1	Heavy equipment rental	-	437	-	-	-	-	-	66	503	503	-	-	-	-	-	-	-	-	-	-
1a.1.5	Disposal of DAW generated	-	-	8	5	-	28	-	7	48	48	-	-	-	376	-	-	-	7,522	12	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	1,560	234	1,794	1,794	-	-	-	-	-	-	-	-	-	-

Table C-2
Palo Verde NGS Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 1a Period-Dependent Costs (continued)																					
1a.1.7	NRC Fees	-	-	-	-	-	-	475	48	523	523	-	-	-	-	-	-	-	-	-	-
1a.1.8	Emergency Planning Fees	-	-	-	-	-	-	674	67	742	-	742	-	-	-	-	-	-	-	-	-
1a.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	658	99	757	-	757	-	-	-	-	-	-	-	-	-
1a.4.10	ISFSI Operating Costs	-	-	-	-	-	-	28	4	32	-	32	-	-	-	-	-	-	-	-	-
1a.4.11	Security Staff Cost	-	-	-	-	-	-	6,411	962	7,373	7,373	-	-	-	-	-	-	-	-	-	115,397
1a.1.12	Utility Staff Cost	-	-	-	-	-	-	19,057	2,859	21,916	21,916	-	-	-	-	-	-	-	-	-	229,871
1a.1	Subtotal Period 1a Period-Dependent Costs	-	993	8	5	-	23	30,637	4,661	36,327	34,797	1,530	-	-	376	-	-	-	7,522	12	345,269
1a.0	TOTAL PERIOD 1a COST	-	993	8	5	-	23	84,138	12,687	97,854	96,135	1,530	188	-	376	-	-	-	7,522	12	378,720
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	172	26	197	178	-	20	-	-	-	-	-	-	-	2,026
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	36	5	42	42	-	-	-	-	-	-	-	-	-	428
1b.1.1.3	Reactor internals	-	-	-	-	-	-	91	14	104	104	-	-	-	-	-	-	-	-	-	1,070
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	49	7	56	14	-	42	-	-	-	-	-	-	-	578
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	36	5	42	42	-	-	-	-	-	-	-	-	-	428
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	36	5	42	42	-	-	-	-	-	-	-	-	-	428
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	36	5	42	42	-	-	-	-	-	-	-	-	-	428
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	132	20	151	151	-	-	-	-	-	-	-	-	-	1,554
1b.1.1.9	Facility closeout	-	-	-	-	-	-	43	7	50	25	-	25	-	-	-	-	-	-	-	514
1b.1.1.10	Missile shields	-	-	-	-	-	-	16	2	19	19	-	-	-	-	-	-	-	-	-	193
1b.1.1.11	Biological shield	-	-	-	-	-	-	43	7	50	50	-	-	-	-	-	-	-	-	-	514
1b.1.1.12	Steam generators	-	-	-	-	-	-	167	25	192	192	-	-	-	-	-	-	-	-	-	1,969
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	36	5	42	21	-	21	-	-	-	-	-	-	-	428
1b.1.1.14	Main Turbine	-	-	-	-	-	-	57	8	65	-	-	65	-	-	-	-	-	-	-	668
1b.1.1.15	Main Condensers	-	-	-	-	-	-	57	8	65	-	-	65	-	-	-	-	-	-	-	668
1b.1.1.16	Auxiliary building	-	-	-	-	-	-	89	15	114	102	-	11	-	-	-	-	-	-	-	1,168
1b.1.1.17	Reactor building	-	-	-	-	-	-	89	15	114	102	-	11	-	-	-	-	-	-	-	1,168
1b.1.1	Total	-	-	-	-	-	-	1,205	181	1,386	1,125	-	261	-	-	-	-	-	-	-	14,228
1b.1.2	Decon primary loop	1,655	-	-	-	-	-	-	827	2,482	2,482	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	1,655	-	-	-	-	-	1,205	1,008	3,868	3,608	-	261	-	-	-	-	-	-	1,067	14,228
Period 1b Additional Costs																					
1b.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	9,554	1,433	10,987	10,987	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	2,809	843	3,651	3,651	-	-	-	-	-	-	-	-	13,042	4,610
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	12,362	2,276	14,638	14,638	-	-	-	-	-	-	-	-	13,042	4,610
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	1,193	-	-	-	-	-	-	179	1,371	1,371	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process decommissioning water waste	79	-	58	90	-	159	-	99	484	484	-	-	-	458	-	-	-	27,199	98	-
1b.3.4	Process decommissioning chemical flush was	4	-	164	475	-	3,396	-	939	4,978	4,978	-	-	-	-	1,329	-	-	141,637	249	-
1b.3.5	Small tool allowance	-	1	-	-	-	-	-	0	2	2	-	-	-	-	-	-	-	-	-	-
1b.3.6	Pipe cutting equipment	-	1,400	-	-	-	-	-	210	1,610	1,610	-	-	-	-	-	-	-	-	-	-
1b.3.7	Decon rig	2,442	-	-	-	-	-	-	366	2,809	2,809	-	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	3,718	1,401	222	564	-	3,555	-	1,793	11,254	11,254	-	-	-	458	1,329	-	-	168,836	347	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	29	-	-	-	-	-	-	7	36	36	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	785	78	863	863	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	112	11	123	123	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	315	-	-	-	-	-	79	394	394	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	221	-	-	-	-	-	33	255	255	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	5	8	-	14	-	1	28	28	-	-	-	221	-	-	-	1,488	7	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	1,580	237	1,817	1,817	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	155	15	170	170	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	341	34	375	-	375	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	338	50	388	-	388	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	14	2	16	-	16	-	-	-	-	-	-	-	-	-
1b.4.12	Security Staff Cost	-	-	-	-	-	-	3,245	487	3,732	3,732	-	-	-	-	-	-	-	-	-	58,111
1b.4.13	Utility Staff Cost	-	-	-	-	-	-	12,436	1,865	14,302	14,302	-	-	-	-	-	-	-	-	-	149,298

Table C-2
Palo Verde NGS Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
1b.1	Subtotal Period 1b Period-Dependent Costs	29	537	5	8	-	14	19,002	2,904	22,498	21,718	775	-	-	221	-	-	-	1,188	7	207,709
1b.0	TOTAL PERIOD 1b COST	5,402	1,988	227	567	-	3,569	32,569	7,981	52,252	51,217	775	261	-	678	1,329	-	-	178,321	14,153	228,578
PERIOD 1 TOTALS		5,402	2,932	235	571	-	3,582	116,707	20,697	150,106	147,352	2,305	449	-	1,054	1,329	-	-	180,846	14,465	605,297
PERIOD 2a - Large Component Removal																					
Period 2a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
2a.1.1.1	Reactor Coolant Piping	145	146	36	67	-	508	-	250	1,152	1,152	-	-	-	1,789	-	-	-	121,853	6,464	-
2a.1.1.2	Pressurizer Quench Tank	9	7	1	3	-	37	-	22	107	107	-	-	-	201	-	-	-	11,051	375	-
2a.1.1.3	Reactor Coolant Pumps & Motors	125	71	514	121	-	3,755	-	1,133	6,019	6,019	-	-	-	10,637	-	-	-	1,108,000	5,267	100
2a.1.1.4	Pressurizer	-	41	59	114	-	509	-	215	1,478	1,478	-	-	-	2,879	-	-	-	324,870	1,696	925
2a.1.1.5	Steam Generators	257	3,993	8,728	1,351	-	14,379	-	5,797	34,504	34,504	-	-	-	49,515	-	-	-	4,415,357	40,664	1,197
2a.1.1.6	CRDMs/ICIs/Service Structure Removal	136	380	472	144	-	1,357	-	571	3,060	3,060	-	-	-	8,222	-	-	-	333,927	10,981	-
2a.1.1.7	Reactor Vessel Internals	12	7,175	24,173	1,107	-	11,096	458	17,414	61,764	61,764	-	-	-	5,528	673	221	-	387,233	37,973	1,677
2a.1.1.8	Reactor Vessel	105	8,764	4,016	1,570	-	5,469	458	10,825	31,206	31,206	-	-	-	18,058	-	-	-	1,270,178	37,973	1,677
2a.1.1	Totals	818	20,577	38,518	5,081	-	37,131	916	36,226	139,291	139,291	-	-	-	96,830	673	221	-	7,977,873	141,365	5,216
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	119	-	-	-	-	-	18	137	-	-	137	-	-	-	-	-	-	3,424	-
2a.1.3	Main Condensers	-	1,293	1,486	1,301	-	16,955	-	4,906	25,941	25,941	-	-	-	65,575	-	-	-	1,165,812	35,411	-
Cascading Costs from Clean Building Demolition																					
2a.1.4.1	Auxiliary Building	-	184	-	-	-	-	-	28	212	212	-	-	-	-	-	-	-	-	1,303	-
2a.1.4.2	Containment	-	460	-	-	-	-	-	69	529	529	-	-	-	-	-	-	-	-	4,270	-
2a.1.4.3	Main Steam Support Structure	-	36	-	-	-	-	-	5	42	42	-	-	-	-	-	-	-	-	274	-
2a.1.4.4	Radwaste Building	-	178	-	-	-	-	-	27	205	205	-	-	-	-	-	-	-	-	2,404	-
2a.1.4.5	Fuel Building	-	84	-	-	-	-	-	13	96	96	-	-	-	-	-	-	-	-	632	-
2a.1.4	Totals	-	942	-	-	-	-	-	141	1,083	1,083	-	-	-	-	-	-	-	-	8,883	-
Disposal of Plant Systems																					
2a.1.5.1	Auxiliary Feedwater (AF)	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	1,309	-
2a.1.5.2	Auxiliary Steam (AS)	-	14	-	-	-	-	-	7	50	-	-	50	-	-	-	-	-	-	1,500	-
2a.1.5.3	Auxiliary Steam (AS) - RCA	-	177	12	32	-	411	-	156	817	817	-	-	-	1,569	-	-	-	100,889	3,888	-
2a.1.5.4	Auxiliary Steam - Common (AS)	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	3,070	-
2a.1.5.5	CT Makeup & Blowdown (TB)	-	19	4	4	-	48	-	18	92	92	-	-	-	185	-	-	-	11,785	451	-
2a.1.5.6	CT Makeup & Blowdown - Common (TB)	-	769	496	474	-	6,171	-	1,856	9,766	9,766	-	-	-	23,839	-	-	-	1,516,266	20,143	-
2a.1.5.7	Chemical Production (CC)	-	16	-	-	-	-	-	2	19	-	-	19	-	-	-	-	-	-	630	-
2a.1.5.8	Chemical Production - Common (CC)	-	55	-	-	-	-	-	8	63	-	-	63	-	-	-	-	-	-	1,794	-
2a.1.5.9	Chlorine Injection (CI)	-	56	-	-	-	-	-	8	64	-	-	64	-	-	-	-	-	-	1,820	-
2a.1.5.10	Chlorine Injection - Common (CI)	-	20	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	730	-
2a.1.5.11	Circulating Water (CW)	-	106	-	-	-	-	-	16	122	-	-	122	-	-	-	-	-	-	3,545	-
2a.1.5.12	Condensate (CD)	-	986	425	355	-	1,623	-	1,498	7,887	7,887	-	-	-	17,742	-	-	-	1,135,825	24,161	-
2a.1.5.13	Condensate Storage & Transfer (CT)	-	261	89	81	-	403	-	171	903	903	-	-	-	1,542	-	-	-	99,005	6,016	-
2a.1.5.14	Condenser Air Removal (AR)	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	1,316	-
2a.1.5.15	Demineralized Water (DW)	-	64	-	-	-	-	-	10	73	-	-	73	-	-	-	-	-	-	2,085	-
2a.1.5.16	Demineralized Water - Common (DW)	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	1,251	-
2a.1.5.17	Diesel Fuel Oil & Trans - Common (DF)	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	287	-
2a.1.5.18	Diesel Fuel Oil & Transfer (DF)	-	49	-	-	-	-	-	7	57	-	-	57	-	-	-	-	-	-	1,492	-
2a.1.5.19	Diesel Generator (DG)	-	58	-	-	-	-	-	9	67	-	-	67	-	-	-	-	-	-	1,862	-
2a.1.5.20	FW Heater Extract Steam & Drains (ED)	-	2,181	775	669	-	8,714	-	2,901	15,240	15,240	-	-	-	33,505	-	-	-	2,140,957	54,682	-
2a.1.5.21	Feedwater (FW)	-	395	188	180	-	2,343	-	730	3,836	3,836	-	-	-	9,050	-	-	-	575,585	10,447	-
2a.1.5.22	Feedwater (FW) - RCA	-	30	14	13	-	170	-	53	280	280	-	-	-	656	-	-	-	41,735	773	-
2a.1.5.23	Generator Hydrogen & CO2 (GH)	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	102	-
2a.1.5.24	Generator Seal Oil (SO)	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	236	-
2a.1.5.25	HVAC - Misc Site Structures (HS)	-	15	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	530	-
2a.1.5.26	HVAC - Miscellaneous Common (HS)	-	4	-	-	-	-	-	1	4	-	-	4	-	-	-	-	-	-	115	-
2a.1.5.27	Lube Oil (LO)	-	36	-	-	-	-	-	5	42	-	-	42	-	-	-	-	-	-	1,188	-
2a.1.5.28	Lube Oil Stor & Trans & Purification(OS)	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	1,038	-
2a.1.5.29	Main Steam (SG)	-	895	398	338	-	4,401	-	1,415	7,447	7,447	-	-	-	16,963	-	-	-	1,081,291	20,710	-
2a.1.5.30	Main Steam (SG) - RCA	-	134	13	37	-	488	-	165	867	867	-	-	-	1,873	-	-	-	119,916	3,293	-
2a.1.5.31	Main Turbine (MT)	-	587	688	617	-	8,044	-	2,269	12,006	12,006	-	-	-	31,043	-	-	-	1,976,152	10,489	-
2a.1.5.32	Main Turbine Control Oil (CO)	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	176	-

Table C-2
Palo Verde NGS Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Disposal of Plant Systems (continued)																					
2a.1.5.33	Secondary Chemical Control (SC)	-	171	-	-	-	-	-	26	197	-	-	197	-	-	-	-	-	-	5,637	-
2a.1.5.34	Sewage Treatment Plant - Common	-	1	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	14	-
2a.1.5.35	Stator Cooling (CE)	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	139	-
2a.1.5.36	Steam Gen Feedwater Pump Turbine (FT)	-	192	85	71	-	920	-	237	1,505	1,505	-	-	-	3,530	-	-	-	226,098	4,717	-
2a.1.5.37	Turbine Cooling Water (TC)	-	139	-	-	-	-	-	21	160	-	-	160	-	-	-	-	-	-	4,675	-
2a.1.5.38	Turbine Steam Seal & Drain (GS)	-	114	28	19	-	242	-	91	492	492	-	-	-	927	-	-	-	59,177	2,731	-
2a.1.5	Totals	-	7,639	3,221	2,838	-	36,977	-	11,792	62,467	61,203	-	1,264	-	142,105	-	-	-	9,085,280	199,083	-
2a.1.6	Scaffolding in support of decommissioning	-	3,195	23	20	-	261	-	869	4,368	4,368	-	-	-	1,008	-	-	-	64,051	34,758	-
2a.1	Subtotal Period 2a Activity Costs	818	33,765	13,273	9,240	-	91,323	916	53,952	233,286	231,885	-	1,400	-	305,818	673	221	-	21,293,020	122,923	5,216
Period 2a Additional Costs																					
2a.2.1	Remedial Action Surveys	-	-	-	-	-	-	2,709	813	3,522	3,522	-	-	-	-	-	-	-	-	40,319	-
2a.2.2	GTCC SFP Legacy Waste	-	339	-	-	-	-	10,550	1,667	12,557	12,557	-	-	-	-	-	-	887	181,103	4,000	160
2a.2	Subtotal Period 2a Additional Costs	-	339	-	-	-	-	13,260	2,480	16,079	16,079	-	-	-	-	-	-	887	181,103	44,319	160
Period 2a Collateral Costs																					
2a.3.1	Process decommissioning water waste	111	-	105	161	-	286	-	176	869	869	-	-	-	817	-	-	-	48,991	159	-
2a.3.2	Process decommissioning chemical flush was	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2a.3.3	Small tool allowance	-	321	-	-	-	-	-	48	369	332	-	37	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	141	321	105	161	-	286	-	224	1,237	1,201	-	37	-	817	-	-	-	48,991	159	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	165	-	-	-	-	-	-	41	206	206	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	928	93	1,021	1,021	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	646	65	711	711	-	-	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	5,614	-	-	-	-	-	1,404	7,018	7,018	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	4,310	-	-	-	-	-	647	4,957	4,957	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	166	93	-	480	-	151	890	890	-	-	-	7,769	-	-	-	155,386	253	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	4,319	648	4,967	4,967	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	831	83	914	914	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,657	166	1,823	-	1,823	-	-	-	-	-	-	-	-	-
2a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,917	288	2,204	-	2,204	-	-	-	-	-	-	-	-	-
2a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	82	12	94	-	94	-	-	-	-	-	-	-	-	-
2a.4.12	Security Staff Cost	-	-	-	-	-	-	16,411	2,466	18,907	18,907	-	-	-	-	-	-	-	-	-	294,528
2a.4.13	Utility Staff Cost	-	-	-	-	-	-	77,359	11,604	88,963	88,963	-	-	-	-	-	-	-	-	-	889,636
2a.4	Subtotal Period 2a Period-Dependent Costs	165	9,925	166	93	-	480	104,180	17,696	132,675	128,554	4,121	-	-	7,769	-	-	-	155,386	253	1,184,164
2a.0	TOTAL PERIOD 2a COST	1,123	44,349	13,544	9,494	-	92,089	118,356	74,323	383,278	377,719	4,121	1,437	-	314,404	673	221	887	21,678,500	167,654	1,189,570
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	Chemical & Volume Control (CH)	2,017	2,167	491	389	-	5,071	-	2,927	13,063	13,063	-	-	-	19,442	-	-	-	1,246,683	30,047	-
2b.1.1.2	Chemical Waste (CM)	400	496	77	63	-	820	-	546	2,401	2,401	-	-	-	3,149	-	-	-	201,501	18,894	-
2b.1.1.3	Chemical Waste - Common (CM)	90	65	10	9	-	119	-	93	385	385	-	-	-	458	-	-	-	29,130	2,255	-
2b.1.1.4	Containment Building (ZC)	-	1	0	0	-	0	-	0	2	2	-	-	-	2	-	-	-	118	15	-
2b.1.1.5	Containment Hydrogen Control (HP)	-	97	20	15	-	196	-	77	405	405	-	-	-	748	-	-	-	48,116	2,154	-
2b.1.1.6	Containment Leakage Test (CL)	-	31	11	11	-	178	-	56	293	293	-	-	-	690	-	-	-	43,331	812	-
2b.1.1.7	Containment Purge (CP)	-	32	13	11	-	150	-	49	255	255	-	-	-	577	-	-	-	36,798	827	-
2b.1.1.8	Domestic Water (DS)	-	110	-	-	-	-	-	16	126	-	-	126	-	-	-	-	-	-	3,675	-
2b.1.1.9	Domestic Water - Common (DS)	-	82	-	-	-	-	-	12	94	-	-	94	-	-	-	-	-	-	2,761	-
2b.1.1.10	Electrical (Clean)	-	983	-	-	-	-	-	148	1,131	-	-	1,131	-	-	-	-	-	-	30,827	-
2b.1.1.11	Electrical (Clean) - Common	-	77	-	-	-	-	-	12	88	-	-	88	-	-	-	-	-	-	2,407	-
2b.1.1.12	Electrical (Clean) - Common - RCA	-	55	10	9	-	128	-	17	241	241	-	-	-	475	-	-	-	30,159	1,119	-
2b.1.1.13	Electrical (Clean) - RCA	-	758	155	146	-	1,900	-	702	3,661	3,661	-	-	-	7,049	-	-	-	466,835	16,187	-
2b.1.1.14	Electrical (Contaminated)	-	4,897	522	512	-	6,671	-	2,896	14,998	14,998	-	-	-	25,799	-	-	-	1,638,951	97,755	-
2b.1.1.15	Essential Chilled Water (EC)	-	16	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	547	-
2b.1.1.16	Essential Chilled Water (EC)-RCA	-	178	32	22	-	284	-	122	637	637	-	-	-	1,082	-	-	-	69,840	3,797	-
2b.1.1.17	Essential Cooling Water (EW)	-	57	-	-	-	-	-	8	65	-	-	65	-	-	-	-	-	-	1,917	-
2b.1.1.18	Essential Cooling Water-(EW)-RCA	-	88	31	27	-	346	-	116	608	608	-	-	-	1,334	-	-	-	85,125	1,997	-
2b.1.1.19	Essential Spray Pond (SP)	-	283	-	-	-	-	-	42	325	-	-	325	-	-	-	-	-	-	9,865	-

Table C-2
Palo Verde NGS Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems (continued)																					
2b.1.1.20	Fire Protection (FP)	-	105	-	-	-	-	-	16	121	-	-	121	-	-	-	-	-	-	3,645	-
2b.1.1.21	Fire Protection (FP) - RCA	-	557	151	116	-	1,512	-	550	2,890	2,890	-	-	-	5,785	-	-	-	371,572	12,003	-
2b.1.1.22	Fire Protection - Common (FP) - RCA	-	368	137	126	-	1,638	-	534	2,803	2,803	-	-	-	6,926	-	-	-	402,376	7,877	-
2b.1.1.23	Gaseous Radwaste (GR)	-	232	78	27	-	348	-	153	798	798	-	-	-	1,927	-	-	-	85,625	5,181	-
2b.1.1.24	HVAC - Ancillary Building (HN) - Common	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	83	-
2b.1.1.25	HVAC - Auxiliary Building (HA)	-	486	299	211	-	2,756	-	860	4,561	4,561	-	-	-	10,177	-	-	-	677,111	10,352	-
2b.1.1.26	HVAC - Containment Building (HC)	-	461	179	137	-	1,788	-	601	3,166	3,166	-	-	-	6,829	-	-	-	439,260	9,573	-
2b.1.1.27	HVAC - Control Building (HJ)	-	87	-	-	-	-	-	13	100	-	-	100	-	-	-	-	-	-	3,112	-
2b.1.1.28	HVAC - Diesel Generator Building (HD)	-	8	-	-	-	-	-	1	10	-	-	10	-	-	-	-	-	-	265	-
2b.1.1.29	HVAC - Radwaste (HR)	-	133	42	36	-	471	-	161	843	843	-	-	-	1,812	-	-	-	115,774	2,861	-
2b.1.1.30	HVAC - Turbine Building (HT)	-	160	-	-	-	-	-	24	184	-	-	184	-	-	-	-	-	-	6,322	-
2b.1.1.31	Instrument & Service Air (IA)	-	35	-	-	-	-	-	5	41	-	-	41	-	-	-	-	-	-	1,213	-
2b.1.1.32	Instrument & Service Air (IA) - RCA	-	775	135	76	-	995	-	467	2,448	2,448	-	-	-	3,731	-	-	-	241,352	14,791	-
2b.1.1.33	Liquid Radwaste (LR)	515	766	122	91	-	1,188	-	772	3,455	3,455	-	-	-	4,538	-	-	-	291,979	27,224	-
2b.1.1.34	Normal Chilled Water (WC)	-	69	-	-	-	-	-	10	80	-	-	80	-	-	-	-	-	-	2,362	-
2b.1.1.35	Normal Chilled Water (WC) - RCA	-	210	45	35	-	456	-	176	922	922	-	-	-	1,747	-	-	-	112,038	4,562	-
2b.1.1.36	Nuclear Cooling Water (NC)	-	53	-	-	-	-	-	8	61	-	-	61	-	-	-	-	-	-	1,746	-
2b.1.1.37	Nuclear Cooling Water (NC) - RCA	-	498	260	213	-	2,771	-	875	4,616	4,616	-	-	-	10,647	-	-	-	680,829	11,451	-
2b.1.1.38	Nuclear Sampling (SS)	-	240	80	18	-	231	-	128	648	648	-	-	-	887	-	-	-	56,786	5,121	-
2b.1.1.39	Oily Waste & Nonrad Waste - Common (OW)	-	153	35	33	-	432	-	155	807	807	-	-	-	1,666	-	-	-	106,042	3,462	-
2b.1.1.40	Oily Waste & Nonradioactive Waste (OW)	-	581	78	66	-	857	-	377	1,959	1,959	-	-	-	3,292	-	-	-	210,616	13,291	-
2b.1.1.41	Plant Cooling Water (PW)	-	114	-	-	-	-	-	17	131	-	-	131	-	-	-	-	-	-	3,929	-
2b.1.1.42	Post Accident Sampling	-	11	1	1	-	18	-	6	32	32	-	-	-	50	-	-	-	3,169	275	-
2b.1.1.43	Radiation Monitoring (SQ)	-	33	5	3	-	41	-	20	106	106	-	-	-	167	-	-	-	10,820	732	-
2b.1.1.44	Radioactive Waste Drain (RD)	522	492	62	52	-	675	-	567	2,370	2,370	-	-	-	2,591	-	-	-	165,931	19,457	-
2b.1.1.45	Radioactive Waste Drain - Common (RD)	7	6	1	1	-	8	-	7	28	28	-	-	-	29	-	-	-	1,844	258	-
2b.1.1.46	Reactor Coolant (RC)	26	176	20	12	-	156	-	100	490	490	-	-	-	585	-	-	-	38,217	4,444	-
2b.1.1.47	Safety Injection (SI)	-	1,711	679	526	-	6,851	-	2,295	12,092	12,092	-	-	-	26,191	-	-	-	1,688,105	41,335	-
2b.1.1.48	Service Gases (GA) - RCA	-	218	33	22	-	291	-	134	708	708	-	-	-	1,097	-	-	-	71,533	4,164	-
2b.1.1.49	Solid Radwaste (SR)	132	221	10	31	-	399	-	230	1,051	1,051	-	-	-	1,528	-	-	-	98,132	7,907	-
2b.1.1.50	zDecommissioning Crew Set-up	-	3,785	-	-	-	-	-	568	4,353	-	-	4,353	-	-	-	-	-	-	83,075	-
2b.1.1	Totals	3,709	22,749	3,777	3,050	-	39,742	-	17,697	90,674	83,744	-	6,930	-	152,391	-	-	-	9,764,507	590,052	-
2b.1.2	Scaffolding in support of decommissioning	-	3,994	29	25	-	328	-	1,086	5,459	5,459	-	-	-	1,260	-	-	-	80,061	13,417	-
Decontamination of Site Buildings																					
2b.1.3.1	Auxiliary Building	597	368	74	159	-	995	-	693	2,858	2,858	-	-	-	9,861	-	-	-	488,398	22,059	-
2b.1.3.2	Containment	1,218	1,838	307	840	-	7,685	-	3,146	15,035	15,035	-	-	-	58,640	-	-	-	2,623,131	67,811	-
2b.1.3.3	DAW Processing & Storage (Common)	30	14	1	6	-	25	-	26	102	102	-	-	-	403	-	-	-	19,020	1,010	-
2b.1.3.4	Decon & Laundry Facility (Common)	21	8	6	1	-	47	-	28	112	112	-	-	-	210	-	-	-	12,578	708	-
2b.1.3.5	Holdup Tank & Pump House	352	324	33	47	-	610	-	425	1,841	1,841	-	-	-	2,283	-	-	-	149,929	16,033	-
2b.1.3.6	Hot Instrument Calib Facility (Common)	1	0	0	0	-	1	-	1	3	3	-	-	-	13	-	-	-	610	32	-
2b.1.3.7	LLRW Storage Facility (Common)	41	20	3	9	-	40	-	37	150	150	-	-	-	588	-	-	-	27,392	1,417	-
2b.1.3.8	Outage Support Facility (Common)	124	59	6	27	-	110	-	109	436	436	-	-	-	1,749	-	-	-	82,640	4,229	-
2b.1.3.9	Radwaste Building	816	387	211	165	-	1,868	-	1,085	4,537	4,537	-	-	-	8,651	-	-	-	522,790	22,190	-
2b.1.3.10	Refueling Water Storage Tank	486	593	91	51	-	667	-	525	2,213	2,213	-	-	-	2,196	-	-	-	168,942	21,032	-
2b.1.3	Totals	3,687	3,439	811	1,310	-	12,041	-	5,992	27,287	27,287	-	-	-	84,893	-	-	-	4,090,129	156,620	-
2b.1.4	Prepare/submit License Termination Plan	-	-	-	-	-	-	148	22	171	171	-	-	-	-	-	-	-	-	-	1,753
2b.1.5	Receive NRC approval of termination plan									a											
2b.1	Subtotal Period 2b Activity Costs	7,396	30,132	4,620	4,385	-	52,112	148	24,798	123,591	116,661	-	6,930	-	238,541	-	-	-	13,935,000	790,159	1,753
Period 2b Additional Costs																					
2b.2.1	Remedial Action Surveys	-	-	-	-	-	-	4,278	1,283	5,562	5,562	-	-	-	-	-	-	-	-	63,667	-
2b.2	Subtotal Period 2b Additional Costs	-	-	-	-	-	-	4,278	1,283	5,562	5,562	-	-	-	-	-	-	-	-	63,667	-
Period 2b Collateral Costs																					
2b.3.1	Process decommissioning water waste	312	-	241	371	-	657	-	400	1,980	1,980	-	-	-	1,877	-	-	-	112,637	396	-
2b.3.2	Process decommissioning chemical flush was	7	-	295	856	-	1,489	-	534	3,180	3,180	-	-	-	2,396	-	-	-	255,343	448	-
2b.3.3	Small tool allowance	-	477	-	-	-	-	-	72	548	548	-	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	319	477	536	1,227	-	2,145	-	1,005	5,709	5,709	-	-	-	4,274	-	-	-	367,979	845	-

Table C-2
Palo Verde NGS Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 2b Period-Dependent Costs																					
2b.1.1	Decon supplies	2,355	-	-	-	-	-	-	589	2,944	2,944	-	-	-	-	-	-	-	-	-	-
2b.1.2	Insurance	-	-	-	-	-	-	1,465	147	1,612	1,612	-	-	-	-	-	-	-	-	-	-
2b.1.3	Property taxes	-	-	-	-	-	-	1,020	102	1,122	1,122	-	-	-	-	-	-	-	-	-	-
2b.1.4	Health physics supplies	-	9,547	-	-	-	-	-	2,387	11,934	11,934	-	-	-	-	-	-	-	-	-	-
2b.1.5	Heavy equipment rental	-	6,980	-	-	-	-	-	1,047	8,027	8,027	-	-	-	-	-	-	-	-	-	-
2b.1.6	Disposal of DAW generated	-	-	240	134	-	692	-	217	1,283	1,283	-	-	-	11,197	-	-	-	223,943	365	-
2b.1.7	Plant energy budget	-	-	-	-	-	-	5,384	808	6,192	6,192	-	-	-	-	-	-	-	-	-	-
2b.1.8	NRC Fees	-	-	-	-	-	-	1,313	131	1,444	1,444	-	-	-	-	-	-	-	-	-	-
2b.1.9	Emergency Planning Fees	-	-	-	-	-	-	2,449	245	2,694	-	2,694	-	-	-	-	-	-	-	-	-
2b.1.10	Spent Fuel Pool O&M	-	-	-	-	-	-	3,027	454	3,481	-	3,481	-	-	-	-	-	-	-	-	-
2b.1.11	Liquid Radwaste Processing Equipment/Serv	-	-	-	-	-	-	763	115	878	878	-	-	-	-	-	-	-	-	-	-
2b.1.12	ISFSI Operating Costs	-	-	-	-	-	-	129	19	149	-	149	-	-	-	-	-	-	-	-	-
2b.1.13	Security Staff Cost	-	-	-	-	-	-	25,962	3,894	29,857	29,857	-	-	-	-	-	-	-	-	-	165,088
2b.1.14	Utility Staff Cost	-	-	-	-	-	-	83,582	12,537	96,580	96,580	-	-	-	-	-	-	-	-	-	697,072
2b.1	Subtotal Period 2b Period-Dependent Costs	2,355	16,527	240	134	-	692	125,465	22,752	168,195	161,872	6,323	-	-	11,197	-	-	-	223,943	365	1,462,160
2b.0	TOTAL PERIOD 2b COST	10,071	47,135	5,396	5,746	-	54,949	129,922	49,838	303,056	289,903	6,323	6,930	-	254,015	-	-	-	14,526,920	855,006	1,468,918
PERIOD 2d - Decontamination Following Wet Fuel Storage																					
Period 2d Direct Decommissioning Activities																					
2d.1.1	Remove spent fuel racks	321	31	156	70	-	909	-	422	1,908	1,908	-	-	-	3,515	-	-	-	223,925	968	-
2d.1.2.1	Electrical Spent Fuel	-	190	87	35	-	457	-	171	889	889	-	-	-	1,766	-	-	-	112,166	4,048	-
2d.1.2.2	Fire Protection - Common (FP)	-	67	-	-	-	-	-	10	77	-	-	77	-	-	-	-	-	-	2,334	-
2d.1.2.3	Fuel Pool Cooling & Cleanup (FC)	590	411	163	125	-	1,624	-	824	3,707	3,707	-	-	-	6,204	-	-	-	399,088	13,370	-
2d.1.2.4	HVAC - Fuel Building (HF)	-	173	108	75	-	981	-	310	1,642	1,642	-	-	-	3,736	-	-	-	240,970	8,820	-
2d.1.2.5	Sanitary Drain & Treatment - Common (ST)	-	81	-	-	-	-	-	12	93	-	-	93	-	-	-	-	-	-	2,667	-
2d.1.2.6	Sanitary Drainage & Treatment (ST)	-	16	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	577	-
2d.1.2	Totals	590	938	305	235	-	3,062	-	1,329	6,426	6,238	-	189	-	11,706	-	-	-	752,223	26,817	-
Decontamination of Site Buildings																					
2d.1.3.1	Fuel Building	425	508	61	40	-	484	-	478	1,992	1,992	-	-	-	2,151	-	-	-	128,216	22,125	-
2d.1.3	Totals	425	508	61	40	-	484	-	478	1,992	1,992	-	-	-	2,151	-	-	-	128,216	22,125	-
2d.1.4	Scaffolding in support of decommissioning	-	799	6	5	-	65	-	217	1,092	1,092	-	-	-	252	-	-	-	16,013	8,689	-
2d.1	Subtotal Period 2d Activity Costs	1,306	2,276	526	350	-	4,520	-	2,440	11,418	11,229	-	189	-	17,624	-	-	-	1,119,777	58,600	-
Period 2d Additional Costs																					
2d.2.1	License Termination Survey Planning	-	-	-	-	-	-	960	288	1,248	1,248	-	-	-	-	-	-	-	-	-	4,160
2d.2.2	Operational Tools & Equipment	-	-	96	125	-	1,323	-	359	1,903	1,903	-	-	-	4,500	-	-	-	325,000	147	-
2d.2.3	Excavation of Underground Services	-	1,159	-	-	-	-	386	348	1,893	1,893	-	-	-	-	-	-	-	-	6,874	-
2d.2.4	Remedial Action Surveys	-	-	-	-	-	-	670	201	871	871	-	-	-	-	-	-	-	-	9,966	-
2d.2	Subtotal Period 2d Additional Costs	-	1,159	96	125	-	1,323	2,015	1,196	5,915	5,915	-	-	-	4,500	-	-	-	325,000	16,986	4,160
Period 2d Collateral Costs																					
2d.3.1	Process decommissioning water waste	80	-	62	96	-	170	-	103	512	512	-	-	-	486	-	-	-	29,179	95	-
2d.3.2	Process decommissioning chemical flush was	2	-	50	261	-	455	-	193	971	971	-	-	-	732	-	-	-	77,360	137	-
2d.3.3	Small tool allowance	-	17	-	-	-	-	-	7	51	51	-	-	-	-	-	-	-	-	-	-
2d.3.4	Decommissioning Equipment Disposition	-	-	120	105	-	1,368	-	370	1,962	1,962	-	-	-	5,290	-	-	-	336,079	147	-
2d.3	Subtotal Period 2d Collateral Costs	82	17	278	462	-	1,992	-	613	3,500	3,500	-	-	-	6,508	-	-	-	443,218	379	-
Period 2d Period-Dependent Costs																					
2d.4.1	Decon supplies	134	-	-	-	-	-	-	34	168	168	-	-	-	-	-	-	-	-	-	-
2d.4.2	Insurance	-	-	-	-	-	-	229	23	252	252	-	-	-	-	-	-	-	-	-	-
2d.4.3	Property taxes	-	-	-	-	-	-	160	16	176	176	-	-	-	-	-	-	-	-	-	-
2d.4.4	Health physics supplies	-	966	-	-	-	-	-	241	1,207	1,207	-	-	-	-	-	-	-	-	-	-
2d.4.5	Heavy equipment rental	-	1,063	-	-	-	-	-	164	1,256	1,256	-	-	-	-	-	-	-	-	-	-
2d.4.6	Disposal of DAW generated	-	-	96	20	-	103	-	32	192	192	-	-	-	1,674	-	-	-	33,482	55	-
2d.4.7	Plant energy budget	-	-	-	-	-	-	419	67	517	517	-	-	-	-	-	-	-	-	-	-
2d.4.8	NRC Fees	-	-	-	-	-	-	196	20	216	216	-	-	-	-	-	-	-	-	-	-
2d.4.9	Emergency Planning Fees	-	-	-	-	-	-	383	38	422	-	422	-	-	-	-	-	-	-	-	-
2d.4.10	Liquid Radwaste Processing Equipment/Serv	-	-	-	-	-	-	239	36	275	275	-	-	-	-	-	-	-	-	-	-

Table C-2
Palo Verde NGS Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 2d Period-Dependent Costs (continued)																					
2d.1.11	ISFSI Operating Costs	-	-	-	-	-	-	20	3	23	-	23	-	-	-	-	-	-	-	-	-
2d.1.12	Security Staff Cost	-	-	-	-	-	-	1,506	226	1,732	1,103	629	-	-	-	-	-	-	-	-	25,929
2d.1.13	Utility Staff Cost	-	-	-	-	-	-	8,134	1,220	9,355	9,149	206	-	-	-	-	-	-	-	-	98,729
2d.1	Subtotal Period 2d Period-Dependent Costs	134	2,058	76	20	-	103	11,318	2,121	15,730	14,511	1,279	-	-	1,674	-	-	-	33,482	55	124,658
2d.0	TOTAL PERIOD 2d COST	1,522	5,511	981	957	-	7,933	18,333	6,400	36,622	35,151	1,279	189	-	30,806	-	-	-	1,921,177	76,019	123,818
PERIOD 2e - Delay before License Termination																					
Period 2e Period-Dependent Costs																					
2e.1.1	Insurance	-	-	-	-	-	-	760	76	836	836	-	-	-	-	-	-	-	-	-	-
2e.1.2	Property taxes	-	-	-	-	-	-	529	53	582	582	-	-	-	-	-	-	-	-	-	-
2e.1.3	Health physics supplies	-	254	-	-	-	-	-	64	318	318	-	-	-	-	-	-	-	-	-	-
2e.1.4	Disposal of DAW generated	-	-	3	2	-	10	-	3	18	18	-	-	-	158	-	-	-	3,168	5	-
2e.1.5	Plant energy budget	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2e.1.6	NRC Fees	-	-	-	-	-	-	453	45	499	499	-	-	-	-	-	-	-	-	-	-
2e.1.7	Emergency Planning Fees	-	-	-	-	-	-	878	88	966	-	966	-	-	-	-	-	-	-	-	-
2e.1.8	ISFSI Operating Costs	-	-	-	-	-	-	67	10	77	-	77	-	-	-	-	-	-	-	-	-
2e.1.9	Security Staff Cost	-	-	-	-	-	-	4,991	719	5,710	3,656	2,054	-	-	-	-	-	-	-	-	85,985
2e.1.10	Utility Staff Cost	-	-	-	-	-	-	2,097	310	2,377	2,305	71	-	-	-	-	-	-	-	-	23,136
2e.1	Subtotal Period 2e Period-Dependent Costs	-	254	3	2	-	10	9,746	1,397	11,413	8,215	3,198	-	-	158	-	-	-	3,168	5	109,072
2e.0	TOTAL PERIOD 2e COST	-	254	3	2	-	10	9,746	1,397	11,413	8,215	3,198	-	-	158	-	-	-	3,168	5	109,072
PERIOD 2f - License Termination																					
Period 2f Direct Decommissioning Activities																					
2f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	178	53	231	231	-	-	-	-	-	-	-	-	-	-
2f.1.2	Terminate license									a											
2f.1	Subtotal Period 2f Activity Costs	-	-	-	-	-	-	178	53	231	231	-	-	-	-	-	-	-	-	-	-
Period 2f Additional Costs																					
2f.2.1	License Termination Survey	-	-	-	-	-	-	9,511	2,853	12,364	12,364	-	-	-	-	-	-	-	-	198,844	2,080
2f.2	Subtotal Period 2f Additional Costs	-	-	-	-	-	-	9,511	2,853	12,364	12,364	-	-	-	-	-	-	-	-	198,844	2,080
Period 2f Period-Dependent Costs																					
2f.4.1	Insurance	-	-	-	-	-	-	366	37	402	402	-	-	-	-	-	-	-	-	-	-
2f.4.2	Property taxes	-	-	-	-	-	-	255	25	280	280	-	-	-	-	-	-	-	-	-	-
2f.4.3	Health physics supplies	-	1,525	-	-	-	-	-	381	1,906	1,906	-	-	-	-	-	-	-	-	-	-
2f.4.4	Disposal of DAW generated	-	-	7	1	-	21	-	7	39	39	-	-	-	337	-	-	-	6,734	11	-
2f.4.5	Plant energy budget	-	-	-	-	-	-	358	54	412	412	-	-	-	-	-	-	-	-	-	-
2f.4.6	NRC Fees	-	-	-	-	-	-	325	32	357	357	-	-	-	-	-	-	-	-	-	-
2f.4.7	ISFSI Operating Costs	-	-	-	-	-	-	32	5	37	-	37	-	-	-	-	-	-	-	-	-
2f.4.8	Security Staff Cost	-	-	-	-	-	-	2,401	360	2,761	1,759	1,002	-	-	-	-	-	-	-	-	41,338
2f.4.9	Utility Staff Cost	-	-	-	-	-	-	9,016	1,352	10,369	9,964	404	-	-	-	-	-	-	-	-	99,635
2f.4	Subtotal Period 2f Period-Dependent Costs	-	1,525	7	1	-	21	12,753	2,253	16,563	15,119	1,444	-	-	337	-	-	-	6,734	11	140,973
2f.0	TOTAL PERIOD 2f COST	-	1,525	7	4	-	21	22,441	5,160	29,158	27,714	1,444	-	-	337	-	-	-	6,734	198,855	143,053
PERIOD 2 TOTALS		12,716	98,804	49,881	16,203	-	155,007	293,798	137,118	763,527	738,605	16,365	8,556	-	593,220	673	224	887	38,136,800	1,597,539	3,034,426
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Administrative Bldg. A (Common)	-	103	-	-	-	-	-	15	119	-	-	119	-	-	-	-	-	-	1,485	-
3b.1.1.2	Administrative Bldg. B (Common)	-	100	-	-	-	-	-	15	115	-	-	115	-	-	-	-	-	-	1,404	-
3b.1.1.3	Administrative Bldg. D (Common)	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	183	-
3b.1.1.4	Administrative Bldg. E (Common)	-	90	-	-	-	-	-	14	104	-	-	104	-	-	-	-	-	-	1,151	-
3b.1.1.5	Administrative Bldg. F (Common)	-	130	-	-	-	-	-	19	149	-	-	149	-	-	-	-	-	-	1,118	-
3b.1.1.6	Auxiliary Boiler Foundations (Common)	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	36	-
3b.1.1.7	Auxiliary Building	-	1,656	-	-	-	-	-	248	1,904	-	-	1,904	-	-	-	-	-	-	11,728	-
3b.1.1.8	Calibration Lab (Common)	-	2	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	13	-
3b.1.1.9	Chemical Injection Pump House	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	63	-

Table C-2
Palo Verde NGS Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Demolition of Remaining Site Buildings (continued)																					
3b.1.1.10	Chemical Storage Building (Common)	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	383	-
3b.1.1.11	Condensate Storage Tank	-	115	-	-	-	-	-	17	132	-	-	132	-	-	-	-	-	-	1,787	-
3b.1.1.12	Containment	-	3,030	-	-	-	-	-	454	3,484	-	-	3,484	-	-	-	-	-	-	25,043	-
3b.1.1.13	Control Building	-	901	-	-	-	-	-	135	1,037	-	-	1,037	-	-	-	-	-	-	9,252	-
3b.1.1.14	Cooling Tower Electrical Equipment	-	18	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	188	-
3b.1.1.15	Cooling Towers	-	1,212	-	-	-	-	-	182	1,394	-	-	1,394	-	-	-	-	-	-	7,313	-
3b.1.1.16	Corridor Building	-	74	-	-	-	-	-	11	85	-	-	85	-	-	-	-	-	-	922	-
3b.1.1.17	DAW Processing & Storage (Common)	-	23	-	-	-	-	-	3	27	-	-	27	-	-	-	-	-	-	416	-
3b.1.1.18	Dozen & Laundry Facility (Common)	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	166	-
3b.1.1.19	Diesel Generator Building	-	307	-	-	-	-	-	46	354	-	-	354	-	-	-	-	-	-	2,158	-
3b.1.1.20	Energy Information Center (Common)	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	334	-
3b.1.1.21	Fire Pumphouse (Common)	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	78	-
3b.1.1.22	Flex Buildings (Common)	-	129	-	-	-	-	-	19	149	-	-	149	-	-	-	-	-	-	1,671	-
3b.1.1.23	Holdup Tank & Pump House	-	41	-	-	-	-	-	6	47	-	-	47	-	-	-	-	-	-	296	-
3b.1.1.24	Hot Instrmnt Calib Facility (Common)	-	3	-	-	-	-	-	0	4	-	-	4	-	-	-	-	-	-	19	-
3b.1.1.25	Intake Structure, Canals, & Circ Tunnels	-	1,871	-	-	-	-	-	281	2,152	-	-	2,152	-	-	-	-	-	-	3,859	-
3b.1.1.26	LLRW Storage Facility (Common)	-	61	-	-	-	-	-	9	70	-	-	70	-	-	-	-	-	-	352	-
3b.1.1.27	Main Steam Support Structure	-	210	-	-	-	-	-	31	241	-	-	241	-	-	-	-	-	-	1,700	-
3b.1.1.28	Misc. Structures & Foundations (Common)	-	826	-	-	-	-	-	124	950	-	-	950	-	-	-	-	-	-	6,796	-
3b.1.1.29	North Admin Annex Building (Common)	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	675	-
3b.1.1.30	Nuclear Service Spray Ponds	-	1,218	-	-	-	-	-	183	1,400	-	-	1,400	-	-	-	-	-	-	7,165	-
3b.1.1.31	Operations Support Building	-	128	-	-	-	-	-	19	147	-	-	147	-	-	-	-	-	-	1,730	-
3b.1.1.32	Outage Support Facility (Common)	-	349	-	-	-	-	-	52	402	-	-	402	-	-	-	-	-	-	2,925	-
3b.1.1.33	Protected Area Sec. Blast Wall (Common)	-	1,211	-	-	-	-	-	182	1,392	-	-	1,392	-	-	-	-	-	-	6,997	-
3b.1.1.34	Radwaste Building	-	1,603	-	-	-	-	-	240	1,843	-	-	1,843	-	-	-	-	-	-	21,636	-
3b.1.1.35	Refueling Water Storage Tank	-	78	-	-	-	-	-	12	89	-	-	89	-	-	-	-	-	-	452	-
3b.1.1.36	Retention Tanks (Common)	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	404	-
3b.1.1.37	SG Voltage Regulator Buildngs (Common)	-	11	-	-	-	-	-	2	12	-	-	12	-	-	-	-	-	-	87	-
3b.1.1.38	Security HQ and Guard House (Common)	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	158	-
3b.1.1.39	Service Building (Common)	-	49	-	-	-	-	-	7	56	-	-	56	-	-	-	-	-	-	871	-
3b.1.1.40	Sewage Treatment Plant (Common)	-	2	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	13	-
3b.1.1.41	Site Fencing & Paving & RR (Common)	-	603	-	-	-	-	-	91	694	-	-	694	-	-	-	-	-	-	9,840	-
3b.1.1.42	Spare Turbine Rotor Laydown Pads (Com)	-	1	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	9	-
3b.1.1.43	Station B/O Gas TB Generator (Common)	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	86	-
3b.1.1.44	Subsynchronous Resonance Protection	-	2	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	30	-
3b.1.1.45	Switchgear Building	-	27	-	-	-	-	-	4	31	-	-	31	-	-	-	-	-	-	322	-
3b.1.1.46	Technical Support Center (Common)	-	85	-	-	-	-	-	13	97	-	-	97	-	-	-	-	-	-	513	-
3b.1.1.47	Transformer Area	-	77	-	-	-	-	-	12	89	-	-	89	-	-	-	-	-	-	447	-
3b.1.1.48	Turbine Building	-	2,565	-	-	-	-	-	385	2,950	-	-	2,950	-	-	-	-	-	-	37,106	-
3b.1.1.49	Turbine Building Pedestal	-	3,870	-	-	-	-	-	581	4,451	-	-	4,451	-	-	-	-	-	-	59,425	-
3b.1.1.50	Turbine Maintenance Facility	-	16	-	-	-	-	-	2	19	-	-	19	-	-	-	-	-	-	214	-
3b.1.1.51	Vehicle Maintenance Facility (Common)	-	22	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	336	-
3b.1.1.52	WRF Train 7 (Common)	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	7	-
3b.1.1.53	Walsh Furniture Storage Bldg#4 (Common)	-	44	-	-	-	-	-	7	50	-	-	50	-	-	-	-	-	-	365	-
3b.1.1.54	Warehouse (Common)	-	329	-	-	-	-	-	49	378	-	-	378	-	-	-	-	-	-	5,516	-
3b.1.1.55	Warehouse - Office Facility (Common)	-	291	-	-	-	-	-	44	335	-	-	335	-	-	-	-	-	-	2,457	-
3b.1.1.56	Yard Tunnels	-	357	-	-	-	-	-	53	410	-	-	410	-	-	-	-	-	-	5,290	-
3b.1.1.57	Fuel Building	-	770	-	-	-	-	-	115	885	-	-	885	-	-	-	-	-	-	6,150	-
3b.1.1	Totals	-	24,877	-	-	-	-	-	3,732	28,609	-	-	28,609	-	-	-	-	-	-	251,258	-
Site Closeout Activities																					
3b.1.2	Remove Rubble	-	302	-	-	-	-	-	45	347	-	-	347	-	-	-	-	-	-	8,643	-
3b.1.3	Grade & landscape site	-	68	-	-	-	-	-	9	78	-	-	78	-	-	-	-	-	-	325	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	57	8	65	65	-	-	-	-	-	-	-	-	-	938
3b.1	Subtotal Period 3b Activity Costs	-	25,242	-	-	-	-	57	3,795	29,094	65	-	29,029	-	-	-	-	-	-	260,227	938
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	1,751	-	-	-	-	6	264	2,021	-	-	2,021	-	-	-	-	-	-	7,278	-
3b.2.2	Construction Debris	-	-	-	-	-	-	1,010	152	1,162	-	-	1,162	-	-	-	-	-	-	-	-
3b.2.3	Firing Range Closure	-	87	-	-	-	-	101	28	216	-	-	216	-	-	-	-	-	-	616	-
3b.2	Subtotal Period 3b Additional Costs	-	1,838	-	-	-	-	1,117	443	3,398	-	-	3,398	-	-	-	-	-	-	7,894	-
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	152	-	-	-	-	-	23	175	-	-	175	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	152	-	-	-	-	-	23	175	-	-	175	-	-	-	-	-	-	-	-

Table C-2
Palo Verde NGS Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes: Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 3b Period-Dependent Costs																					
3b.1.1	Insurance	-	-	-	-	-	-	301	30	332	332	-	-	-	-	-	-	-	-	-	-
3b.1.2	Property taxes	-	-	-	-	-	-	630	68	698	-	-	698	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	6,020	-	-	-	-	-	903	6,923	-	-	6,923	-	-	-	-	-	-	-	-
3b.4.4	Plant energy budget	-	-	-	-	-	-	443	66	510	-	-	510	-	-	-	-	-	-	-	-
3b.4.5	NRC ISFSI Fees	-	-	-	-	-	-	234	23	258	-	258	-	-	-	-	-	-	-	-	-
3b.1.6	ISFSI Operating Costs	-	-	-	-	-	-	80	12	92	-	92	-	-	-	-	-	-	-	-	-
3b.1.7	Security Staff Cost	-	-	-	-	-	-	5,988	891	6,879	(0)	2,179	4,850	-	-	-	-	-	-	-	102,233
3b.1.8	Utility Staff Cost	-	-	-	-	-	-	13,973	2,096	16,069	(0)	996	15,073	-	-	-	-	-	-	-	152,367
3b.4	Subtotal Period 3b Period-Dependent Costs	-	6,020	-	-	-	-	21,849	4,085	31,704	332	3,824	27,548	-	-	-	-	-	-	-	254,601
3b.0	TOTAL PERIOD 3b COST	-	33,253	-	-	-	-	22,772	8,345	64,370	397	3,824	60,149	-	-	-	-	-	-	268,121	255,268
PERIOD 3d - GTCC shipping																					
Period 3d Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
3d.1.1.1	Vessel & Internals GTCC Disposal	-	-	1,246	-	-	20,402	-	3,372	25,020	25,020	-	-	-	-	-	-	3,547	724,110	-	-
3d.1.1	Totals	-	-	1,246	-	-	20,402	-	3,372	25,020	25,020	-	-	-	-	-	-	3,547	724,110	-	-
3d.1	Subtotal Period 3d Activity Costs	-	-	1,246	-	-	20,402	-	3,372	25,020	25,020	-	-	-	-	-	-	3,547	724,410	-	-
3d.0	TOTAL PERIOD 3d COST	-	-	1,246	-	-	20,402	-	3,372	25,020	25,020	-	-	-	-	-	-	3,547	724,410	-	-
PERIOD 3 TOTALS		-	33,253	1,246	-	-	20,402	22,772	11,717	89,391	25,417	3,824	60,149	-	-	-	-	3,547	724,110	268,121	255,268
TOTAL COST TO DECOMMISSION		18,118	134,589	51,362	16,775	-	179,001	435,385	169,819	1,005,448	913,798	22,495	69,155	-	600,274	2,002	224	4,433	39,042,050	1,880,125	3,521,777

TOTAL COST TO DECOMMISSION WITH 20.32% CONTINGENCY:	**$1,005,418**	**thousands of 2023 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 90.88% OR:	**$913,798**	**thousands of 2023 dollars**
SPENT FUEL MANAGEMENT COST IS 2.24% OR:	**$22,495**	**thousands of 2023 dollars**
NON-NUCLEAR DEMOLITION COST IS 6.88% OR:	**$69,155**	**thousands of 2023 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**602,501**	**Cubic Feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**4,433**	**Cubic Feet**
TOTAL SCRAP METAL REMOVED:	**64,396**	**Tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,880,125**	**Man-hours**

End Notes:
n/a - indicates that this activity not charged as decommissioning expense
a - indicates that this activity performed by decommissioning staff
0 - indicates that this value is less than 0.5 but is non-zero
A cell containing " - " indicates a zero value