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PSEG
Nuclear L.L.C.

10 CFR 50.12
10 CFR 50.82

APR 0 7 2008

LR-N08-0037

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Salem Nuclear Generating Station Unit 2
Facility Operating License No. DPR-75
NRC Docket No. 50-311

Subject: **Request for Exemption from 10 CFR 50.82(a)(8)**

In accordance with the provisions of 10 CFR 50.12, PSEG Nuclear, LLC (PSEG Nuclear) hereby requests an exemption from Nuclear Regulatory Commission (NRC) regulations to permit the immediate withdrawal of certain funds from the nuclear decommissioning trust funds (DTF) maintained by PSEG Nuclear for the Salem Nuclear Generating Station Unit 2 (the "Facility"). Specifically, PSEG Nuclear requests an exemption from provisions of 10 CFR 50.82(a)(8)(i) and (ii) which may restrict the withdrawal of funds from DTF until after permanent plant shutdown.

The purpose of this exemption request is to permit the use of DTF, not to exceed $5.47 million[1], in order to pay for the prompt disposal of certain major radioactive components (MRCs). These MRCs are the four steam generators that are scheduled to be removed from Salem Unit 2 during the Spring 2008 outage. PSEG Nuclear desires to remove these MRCs from the site during the Summer of 2008. Arrangements have been made with the State of South Carolina for shipment of the MRCs to Barnwell during the third quarter of 2008.

If left on-site until the Facility is decommissioned, the disposal of these MRCs would be covered by the DTF. A similar exemption request was previously submitted by the STP Nuclear Operating Company on September 19, 2007 and is currently pending before the NRC for disposition.

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[1] $5.47 million is the PSEG Nuclear share of the disposal costs. Decommissioning costs of Salem Unit 2 are shared by both PSEG Nuclear and Exelon Corporation; $10 million is estimate for the total cost of the disposal, including contingency funding. The PSEG share is 54.71% ($10 million x 54.71% = $5.47 million).

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PSEG Nuclear requests that the NRC grant the exemption because:

- The exemption is "authorized by law, will not present an undue risk to the public health and safety, and [is] consistent with the common defense and security," in accordance with 10 CFR 50.12(a)(1), and
- Special circumstances are present that satisfy 10 CFR 50.12(a)(2).

Enclosure 1 of this submittal documents that the request satisfies these provisions. Enclosure 2 provides the Decommissioning Cost Analysis for the Salem Generating Station Unit 2

Granting this exemption will be consistent with the NRC decommissioning regulations (10 CFR 82(a)(6)) as it: (1) would not foreclose release of the site for possible unrestricted use (in fact, it would enhance PSEG Nuclear's ability to achieve unrestricted release); (2) would not result in significant environmental impacts not previously reviewed by the NRC; and (3) would not undermine the existing and continuing reasonable assurance that adequate funds will be available for decommissioning. Prompt disposal of the MRCs would facilitate eventual unrestricted release of the Facility, thus improving environmental conditions. In addition, authorizing the use of DTF to provide for prompt disposal would give PSEG Nuclear the ability to take advantage of cost effective disposal alternatives that are currently available and thereby eliminate the uncertainty associated with the future cost and availability of disposal capacity. Prompt disposal of MRC source terms is prudent and consistent with the underlying purpose of the Commission's decommissioning regulations. Finally, assurance of the adequacy of the availability of funds for Facility decommissioning is supported by a site-specific decommissioning cost estimate and the associated funding program.

PSEG Nuclear recognizes that on May 29, 2007, a rulemaking petition was submitted to the NRC (RM 50-88) seeking to amend the NRC's regulations to provide a process for NRC approval of the use of decommissioning trust funds for the disposal of MRCs by licensees for operating reactors. The NRC provided Notice regarding this pending petition and an opportunity for public comment on August 21, 2007 (72 FR 46569). It is unlikely that the time required to complete the NRC's rulemaking process will accommodate PSEG Nuclear's schedule for removal of the MRCs. Therefore, PSEG Nuclear is submitting this exemption request now, because granting this request will facilitate removing the MRCs from the site consistent with the current steam generator replacement schedule. PSEG Nuclear requests that NRC grant this request by November 1, 2008.

This letter and enclosures contain no new commitments.

Should you have any questions regarding this submittal, please contact Mr. Jeff Keenan at (856) 339-5429.

Sincerely,

Robert C. Braun
Site Vice President
Salem Generating Station

Enclosures: (2)

cc:

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ENCLOSURE 1

EXEMPTION REQUEST

SALEM NUCLEAR GENERATING STATION UNIT 2

I. EXEMPTION REQUEST

In accordance with the provisions of 10 CFR 50.12, "Specific Exemptions," PSEG Nuclear LLC (PSEG Nuclear) the holder of operating license DPR-75 for the Salem Nuclear Generating Station Unit 2 (the "Facility") requests that the Nuclear Regulatory Commission (NRC) grant an exemption from provisions of 10 CFR 50.82, "Termination of License." Specifically, PSEG Nuclear requests an exemption from the requirements of 10 CFR 50.82(a)(8)(i) and (ii), to the extent required in order to permit the immediate withdrawal of funds from the nuclear decommissioning trust funds (DTF) maintained by PSEG Nuclear for Salem Nuclear Generating Station Unit 2.

The purpose of this exemption request is to permit the use of DTF, not to exceed $5.47 million, in order to pay for the disposal of certain major radioactive components (MRCs). These MRCs are the four steam generators that are scheduled to be removed from Salem Unit 2 during the Spring 2008 outage. PSEG Nuclear desires to remove these MRCs from the site during the Summer of 2008. Arrangements have been made with the State of South Carolina for shipment of the MRCs to Barnwell during the third quarter of 2008.

Prompt disposal will result in a number of benefits: (1) the inventory of radioactive waste and associated source term at the site will be reduced; (2) the costs and inconveniences associated with maintaining the MRCs on-site will be avoided; (3) the overall cost to decommission the site will be reduced; (4) uncertainty regarding future disposal cost and capacity for these MRCs will be eliminated; and (5) assurance of adequate funds to decommission the reactors at the time the reactors cease operation will be maintained. Assurance of the adequacy of the availability of funds for Facility decommissioning is supported by a site-specific decommissioning cost estimate and the associated funding program for Salem Unit 2.

Authorization of the use of DTF for prompt disposal of the MRCs is in the public interest, because it will immediately reduce on-site waste inventories, eliminate risks associated with future disposal, and reduce the eventual cost and complexity of decommissioning the Facility. Consequently, authorization to expend DTF for prompt disposal of the MRCs would be entirely consistent with the underlying intent and purpose of 10 CFR 50.82(a)(8), which is to provide reasonable assurance that the decommissioning trust funds will be adequate to accomplish their intended purpose.

II. REQUIREMENTS

10 CFR 50.82(a)(8)(i) provides that decommissioning trust funds may be used by licensees if:

(A) The withdrawals are for expenses for legitimate decommissioning activities consistent with the definition of decommissioning in section 50.2;

(B) The expenditure would not reduce the value of the decommissioning fund below an amount necessary to place and maintain the reactor in a safe storage condition if unforeseen conditions or expenses arise; and

> (C) The withdrawals would not inhibit the ability of the licensee to complete funding of any shortfalls in the decommissioning trust needed to ensure the availability of funds to ultimately release the site and terminate the license.

NRC has further conditioned the withdrawal of decommissioning trust funds by limiting the withdrawal rate from the trust. Section 50.82(a)(8)(ii) provides:

> Initially, 3 percent of the generic amount specified in § 50.75 may be used for decommissioning planning. For licensees that have submitted the certifications required under § 50.82(a)(1) and commencing 90 days after the NRC has received the [post-shutdown decommissioning activities report] PSDAR, an additional 20 percent may be used. A site-specific decommissioning cost estimate must be submitted to the NRC prior to the licensee using any funding in excess of these amounts.

Section 50.82 refers to the definition of "decommissioning" in section 50.2, which defines the term "decommission" rather than "decommissioning." By that definition, the term "decommission" means:

> to remove a facility or site safely from service and reduce residual radioactivity to a level that permits (1) release of the property for unrestricted use and termination of the license; or (2) release of the property under restricted conditions and termination of the license.

In the absence of an exemption by the NRC, these provisions may be construed to restrict the ability of PSEG Nuclear to use DTF for the disposal of MRCs prior to permanent cessation of operation at the Facility, even though removal of the MRCs would reduce the level of radioactivity at the Salem site and would not adversely impact the ability to fund future decommissioning.

A request for an exemption from these requirements must satisfy the requirements of 10 CFR 50.12. As demonstrated below, this exemption request satisfies the provisions of Section 50.12.

III. BACKGROUND

In the Statements of Consideration for the 1996 amendments to 10 CFR 50.82, the NRC stated in response to a comment as follows:

> The NRC has concluded that allowing decommissioning trust funds withdrawals for disposals by nuclear power plants that continue to operate is not warranted. These activities are more appropriately considered operating activities and should be financed that way.

(61 FR 39278, 39293).

Consequently, licensees have been precluded from using decommissioning trust funds for prompt disposal of radioactive waste, including MRCs that are prematurely removed from service and effectively "decommissioned." Unlike other waste routinely generated during normal plant operations, replacement of MRCs is not an anticipated operating activity, but rather these MRCs were originally expected to remain in service throughout the life of the plant.

Significantly, NRC's rules do not address the reality that MRCs need to be removed from service during plant operating life. For example, the definition of "major decommissioning activities" in 10 CFR 50.2 includes removal of "major radioactive components," which specifically includes reactor vessels and steam generators. 10 CFR 50.82(a)(5) contemplates, however, that "major decommissioning activities," *i.e.*, removal of MRCs, would not be performed by licensees until after permanent cessation of operations. This regulatory scheme implicitly acknowledges that removal and disposal of MRCs such as steam generators and RPV heads is not a routine operational activity, but rather is a decommissioning activity. Further support for this conclusion is found in the 1996 rulemaking history where NRC stated that removal and disposal of some "large components" would be considered "routine operations," but specifically excluded from such routine operations the removal of any large components that fall within the definition of "major radioactive component" (61 FR 39286). In fact, the response to comments made clear that a definition of "major radioactive component" was added for this very purpose, *i.e.*, to distinguish the removal and disposal of certain equipment during normal operations from the removal of components such as steam generators and reactor pressure vessel heads that would constitute "major decommissioning activity" *per se*.

PSEG Nuclear has elected to improve plant operations and long term performance by replacing in 2008 the specified MRCs with components made of improved materials. PSEG Nuclear has considered storing them on-site as other licensees have as it appreciates that if it left these steam generators on-site until the facility ceases operations, it could without question use the funds from the DTF at that time. However, PSEG Nuclear, based on the factors discussed earlier, has decided to remove them from the site. Disposing them now would comply with 10 CFR 50.82(a)(6) in that such disposal: (1) would not foreclose release of the site for possible unrestricted use (in fact, it would enhance PSEG Nuclear's ability to achieve unrestricted release); (2) would not result in significant environmental impacts not previously reviewed by the NRC; (3) would be consistent with the Facility's stakeholder views, and (4) would not undermine the existing and continuing reasonable assurance that adequate funds will be available for decommissioning. Moreover, PSEG Nuclear has an opportunity to enter into favorable contractual arrangements for disposal of the existing steam generators, eliminating risks associated with future changes in disposal cost and/or availability of disposal capacity. The PSEG Nuclear share of the disposal cost of the steam generators is estimated to be about $ 4.8M (total cost is estimated at $8.8 million).

PSEG Nuclear recognizes that by using DTF to pay for prompt disposal, the PSEG Nuclear will be paying in current dollars to eliminate this future cost of decommissioning, and as a consequence will forgo future earnings on these funds. However, the loss of the benefit of future earnings is off-set by the elimination of future risk and uncertainty relating to the cost and availability of disposal capacity, as well as the benefits of eliminating the burdens associated with on-site storage and reducing the on-site inventory of waste. Moreover, the remaining funds will be sufficient to fully decommission the site consistent with the activities planned in the site-specific estimate. In that regard, it is particularly significant that PSEG Nuclear intends to seek renewal of the Facility license that will provide additional time for accumulation of the funds.

IV. BASIS FOR GRANTING THE EXEMPTION

The permanent disposal of an MRC is a decommissioning activity. Such disposal involves the removal of a "major radioactive component" or large item of capital equipment from service. However, the NRC definition of "decommission" implies that an entire reactor facility must be removed from service before related activities fall within NRC-sanctioned decommissioning

(See 10 CFR 50.2). Further, when the NRC promulgated the decommissioning rule in 1988, it noted in the Statements of Consideration to the final rule that "decommissioning activities are initiated when a licensee decides to terminate licensed activities" (53 FR 24,018, at 24,019).

The MRCs at issue here will have been removed from service well in advance of the rest of the Facility. Accordingly, an exemption with respect to 10 CFR 50.82(a)(8)(i)(A) is needed because the Facility and site are not being removed from service, and therefore, payment for MRC disposal falls outside the definition "decommissioning activity" as the NRC Staff has interpreted 10 CFR 50.82(a)(8)(i)(A). It should be noted, however, that the regulations and this interpretation appear to be internally inconsistent, because 10 CFR 50.2 also provides that the permanent removal of "major radioactive components" is a "major decommissioning activity" and steam generators and RPVs are included as examples in the definition of "major radioactive component."

An exemption also is needed because Section 50.82(a)(8)(ii) provides only for planning costs to be paid from decommissioning trust funds in advance of submittal of a PSDAR, implying that no other pre-PSDAR decommissioning costs are allowed. The expenditures for which the exemptions are being requested are not planning activities. Rather, they are necessary to remove the MRCs from the plant site and dispose of them, and the exemption request is to permit the funds necessary for that purpose to be withdrawn from the DTF to fund current disposal activities irrespective of the 10 CFR 50.82(a)(8)(ii) restrictions.

A. Facility Decommissioning Trust Fund

1. Status of the Decommissioning Trust Fund

The DTF maintained by PSEG Nuclear are currently robustly funded and fully meet NRC's decommissioning financial assurance requirements. As reflected in PSEG's decommissioning funding status report dated March 30, 2007, and submitted to NRC in accordance with 10 CFR 50.75(f), the minimum decommissioning fund estimate required for PSEG's 54.71% portion of the Facility based on the NRC formula in 10 CFR 50.75, is approximately $204.4 million or $356.0 for the total liability for Unit 2. The reported DTF balance for PSEG's portion, as of December 31, 2006 totaled $224.8 million for Unit 2. Thus, without projected earnings taken into account as permitted by NRC's rules, the DTF balance already substantially exceeds NRC minimum requirements and is sufficient to be considered fully "pre-paid" for purposes of compliance with 10 CFR 50.75(e)(1)(i). If earnings are credited, as permitted by NRC's rules, the $224.8 million value would be escalated to be $301.3 million as expressed for purposes of comparison to the current $204.4 million minimum funding requirement.

2. Site-Specific Decommissioning Cost Estimate Is Comprehensive

The NRC requires in 10 CFR 50.75(f)(2) that each licensee prepare and submit a Decommissioning Cost Estimate (DCE) at least five years prior to the projected end of operations. As noted above, however, even though operations are projected to continue for at least 30 years, PSEG Nuclear already has a detailed DCE. The most recent DCE update, which was done in 2003, adjusted to 2008 dollars, resulted in a total estimated cost, including spent fuel storage and Greenfield costs, of $378.2 million for Unit 2, or $206.9 million for PSEG Nuclear's share. The total spent fuel costs are estimated to be $124.8 million, of which the PSEG Nuclear share is $71.6 million.

The current site-specific estimates reflect the significant industry experience with the conduct of decommissioning as of 2002. By that time, there were several commercial nuclear power plants undergoing decommissioning, including Maine Yankee, Connecticut Yankee, Yankee Rowe, Trojan, and Big Rock Point. These projects were building on the lessons learned from other completed decommissioning projects such as Elk River and Shippingport. This experience included some generally acknowledged missteps made in the beginning stages of the current projects that led to additional costs beyond what had been projected. By 2004 these problems had been resolved, the projects were proceeding rapidly toward license termination, and the causes of the early-stage problems were well understood.

The PSEG Nuclear cost estimates take into account the industry lessons learned. For example, the 2002 update includes an improved Greater than Class C (GTCC) segmentation analysis, reducing the assumed volume of this waste. It also assumes that the reactor vessel and reactor vessel internals would be removed by an outside contractor, which is consistent with current decommissioning practices.

The PSEG Nuclear cost estimates take into account site-specific parameters that affect the total cost. These parameters include site-specific equipment and material inventories, PSEG Nuclear staffing costs, projected spent fuel inventories, and site-specific spent fuel storage and shipping schedules. The end result is a site-specific decommissioning cost estimate in which PSEG Nuclear has a high degree of confidence.

3. The Site-Specific Decommissioning Cost Estimate Is Reliable

As discussed above, the DCE contains a thorough and comprehensive analysis of the costs of decommissioning. The reliability of current industry DCEs is demonstrated by recent decommissioning experience. Data for the three large PWRs that have been fully demolished (Connecticut Yankee, Maine Yankee, and Trojan) show that final decommissioning costs were less than projected in the DCE for two (Maine Yankee and Trojan) and 24% higher for one (Connecticut Yankee). Despite the Connecticut Yankee experience, a table top review of the data indicates that the DCEs are reliable planning tools.[2] Furthermore, the cause of the difference in the case of Connecticut Yankee is now well understood, as explained below.

Both Maine Yankee and Connecticut Yankee started the decommissioning process after an unplanned shutdown. Maine Yankee shut down in December of 1996 and made the decision to decommission in August of 1997. Maine Yankee decided on a Decommissioning Operations Contractor (DOC) approach, with a DOC selected in August of 1998, approximately 20 months after shutdown. Connecticut Yankee shut down in December of 1996 after the decision was made to decommission. Connecticut Yankee also elected to utilize a DOC approach, selecting a DOC in April 1999, more than two years after shutdown.

Connecticut Yankee experienced problems with the selected DOC, and terminated the contract in 2003. These management problems significantly increased the decommissioning costs, resulting in an actual cost some 24 percent higher than the Connecticut Yankee DCE. While management problems also could cause future decommissioning costs to be unnecessarily high, it is likely that such significant problems will be avoided.

The experience of Maine Yankee shows that the cost associated with the type of problems experienced by Connecticut Yankee can be adequately mitigated if they occur in future decommissioning projects. Maine Yankee also had problems with its selected DOC and

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2 *Table Top Review – Decommissioning Costs for Power Reactors*, CAF and Associates, April 2007.

decided to terminate its contract. Maine Yankee, however, acted more quickly than Connecticut Yankee. While Connecticut Yankee terminated its DOC contract four years after DOC selection, Maine Yankee did so after only two years. As a result, Maine Yankee was able to quickly return its decommissioning project to schedule and budget and complete decommissioning within the DCE. The Maine Yankee experience shows that significant management problems can be overcome if promptly recognized and addressed.

The industry experience with decommissioning plants over the last decade contributes significantly to the reliability of current industry DCEs and provides a knowledge base that will result in more cost-efficient decommissioning in the future. Future decommissioning projects will be able to avoid mistakes and reduce costs through lessons-learned. Since the Facility Operating License (OL) is very likely to be renewed and consequently will be in operation longer than most plants, it will be able to benefit from the decommissioning experiences of dozens of much older plants that will be decommissioned during the remaining operating life of Salem Units 1 & 2. The predictable result will be further lessons learned and opportunities for more efficiency.

B. Withdrawal of Funds Now From the Decommissioning Trust Fund Will Not Jeopardize PSEG Nuclear's Ability to Fully Decommission the Facility

1. There Will Be Sufficient Funds Available To Decommission Facility

As noted above the DTF balance for Unit 2 was $224.8 million as of December 31, 2006. If the Unit 2 balance was reduced by a total of $4.8 million in 2008, the adjusted DTF balance would be $220.0 million for Unit 2. The NRC minimum value in 2006 dollars was estimated to be $204.4 million. As such, even after the withdrawal of funds to pay for the MRC disposal, the DTF balance is sufficient to meet the NRC requirements without considering projected earnings or license extension. Taking credit for earnings as permitted by the NRC rules, the balance would be expected to grow to $ 301.3 million expressed in current dollars (2% per year for the remaining current license, plus 3.5 years). If we assume a twenty year license extension, and future earnings, the DTF balance for Unit 2 is projected to grow to $421 million.

The credit for earnings on existing trust fund balances illustrates the adequacy of the existing trust funds to fund both the NRC minimum funding requirement and spent fuel management costs. For example, if PSEG Nuclear's share of spent fuel management costs of $71.6 million is deducted from $301.3 million value (taking credit for earnings based upon the current license without license renewal), the remaining balance of $229.7 million still exceeds PSEG Nuclear's share of the NRC minimum amount which is $204.4 million. If license renewal could be taken into account the value the remaining value would be $349.4 million ($421 million less $71.6 million) as compared to $204.4 million.

2. The Withdrawal Will Not Reduce the Value of the Decommissioning Fund Below an Amount Necessary to Place and Maintain the Reactor in a Safe Storage Condition If Unforeseen Conditions or Expenses Arise

The use of DTF funds for the requested purpose will not reduce the value of the DTFs below an amount necessary to place and maintain the reactors in a safe storage condition. As discussed in Section IV.B.1 above, the remaining DTF balances (after withdrawal of $8.8 million was made) would continue to exceed the NRC minimum requirements for financial assurance for decommissioning.

Moreover, even with the requested withdrawals, PSEG would have sufficient funds to complete the NRC-required radiological decommissioning based on the site specific decommissioning cost estimate. In addition, the funds will be sufficient to manage the post-shutdown storage of spent fuel as estimated as well as provide for complete site restoration.

3. Decommissioning Funding for Salem Unit 2 Is Assured Even in the Event of Any Shortfall in Available Funds

The current status of DTF funding and program of continued contributions provide reasonable assurance that the DTF will continue to be adequate to fund decommissioning after the requested withdrawals are made.

V. JUSTIFICATION FOR EXEMPTION AND SPECIAL CIRCUMSTANCES

10 CFR 50.12, "Specific Exemptions," provides that the NRC may grant exemptions from the requirements of the regulations if three conditions are met: (1) the exemption is authorized by law; (2) the exemption will not present an undue risk to the public health and safety; and (3) the exemption is consistent with the common defense and security. In addition, Section 50.12 provides that the NRC will not consider granting an exemption unless special circumstances are present. As demonstrated below, each of these conditions is satisfied and special circumstances are present.

A. The Requested Exemption is Authorized by Law

The NRC has the authority under the Atomic Energy Act to grant exemptions from its regulations if doing so would not violate the requirements of law. This exemption is authorized by law as is required by 10 CFR 50.12(a)(1). No law exists that precludes the activities covered by this exemption request. The provisions of 10 CFR 50.82 were adopted at the discretion of the Commission consistent with its statutory authority. No statute required the NRC to adopt the specific provisions from which PSEG Nuclear seeks an exemption. Rather, the NRC may determine that alternative means are adequate to provide reasonable assurance of safety.

B. The Requested Exemption Will Not Present an Undue Risk to the Public Health and Safety

This exemption will not present an undue risk to the public health and safety. To the contrary, granting this exemption will result in increasing the protection to the public health and safety as multiple source terms will be removed from the site and properly disposed of decades in advance of the time the MRCs would be removed if they were stored on-site until the reactor ceases operation. This will provide for permanent disposal of the MRCs and eliminate any risk of future exposures from these sources at the site. Moreover, ample decommissioning funding assurance will continue to be provided after withdrawals are made to pay for the near-term MRC disposal activity.

C. The Requested Exemption is Consistent with the Common Defense and Security

This exemption is consistent with the common defense and security because the use of DTF to dispose of the MRCs will have no effect on the physical security of the site or the protection of special nuclear material from theft. Moreover, to the extent that residual radioactivity in the MRCs maintained in storage represents any potential threat, near-term permanent disposal enhances security.

D. Special Circumstances

This exemption is justified based on five of the six special circumstances enumerated in 10 CFR 50.12(a)(2):

1. Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. (10 CFR 50.12(a)(2)(ii))

The underlying purpose of the rule is to provide assurance that there will be adequate funds for the ultimate decommissioning of the site. The application of the regulation restricts the expenditure of decommissioning trust funds in this circumstance, which is unnecessary to achieve the underlying purpose of the rule. The purpose of the restrictions on fund withdrawal is to protect the health and safety of the public by assuring that there will be adequate funds available to complete NRC-required decommissioning activities following termination of the operating license. The analysis in Section IV of the site-specific decommissioning cost estimate and the status of the DTF amply demonstrates that funding will be adequate to complete decommissioning even if funds are withdrawn for early disposal of the MRCs.

This conclusion is further supported by the fact that the NRC regulations recognize that a site-specific decommissioning cost estimate provides a reasonable basis for not restricting licensee expenditure of decommissioning funds. Under 10 CFR 50.82(a)(8)(ii), after a licensee ceases operations, its expenditure of decommissioning funds is restricted until it has submitted a site-specific decommissioning cost estimate. Once this cost estimate is provided to the NRC, a licensee may withdraw unlimited funds without obtaining prior NRC approval. This interpretation of the regulation was specifically stated in the 1996 Statements of Consideration. ("*Response*. The NRC's intent in the proposed rule was not to use a formal approval mechanism for decommissioning expenditures once the licensee submits its site-specific decommissioning cost estimate. The final rule has been modified as suggested by the commenter."). (61 FR 39285): Since PSEG's site-specific decommissioning cost estimate is being submitted with this exemption request, the NRC is being provided with reliable information, which is the equivalent to that required by 10 CFR 50.82(a)(8)(ii).

The NRC's regulatory scheme relies in large part on the ability of licensees to effectively plan for and manage the decommissioning activity. The above discussion demonstrates that PSEG Nuclear has an adequate basis upon which to make informed decisions regarding the effect and timing of activities and expenditure of funds. Further, it shows that PSEG Nuclear has a reasonable basis for determining that it is prudent from both a safety and economic sense to use DTF to dispose of these MRCs in the near-term, when permanent disposal can be accomplished on reasonable financial terms. In these circumstances, it is not necessary for NRC to prevent the licensees from exercising their sound business judgment regarding the timing of decommissioning expenditures.

2. Compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated. (10 CFR 50.12(a)(2)(iii))

If PSEG Nuclear elected to not remove the MRCs from the site, costs would be incurred unnecessarily to build, maintain, and decommission at least one on-site storage facility. These are unnecessary regulatory burdens that were never contemplated when the regulation was adopted, because the rule never fully addressed the possibility of MRCs being removed during the operating life of the plant. For example, as discussed above in Section III, the definition of "major decommissioning activities" assumed to occur after permanent cessation of operations includes removal of MRCs.

As noted above in Section IV.B.1, use of DTF would not have an adverse impact of the ability to decommission the site to unrestricted use standards. In fact, plans and funding for future decommissioning would be enhanced by reducing future risks and uncertainties. Consequently, application of the rule without granting this exemption results in unnecessary and avoidable costs and burdens to PSEG Nuclear and the consumers of the electricity produced from this site that were not anticipated when this rule was adopted.

3. The exemption would result in benefit to the public health and safety that compensates for any decrease in safety that may result from the grant of the exemption. (10 CFR 50.12(a)(2)(iv))

While PSEG Nuclear clearly is capable of maintaining protection of the public health and safety if the MRCs end up stored on-site, the exemption would result in benefit to the public health and safety, because removal of the MRCs would provide a permanent disposal solution. This eliminates any potential future risk associated with on-site storage, even if such risk is low. Furthermore, there is no associated decrease in safety. Thus, allowing the exemption will result in a net benefit to the public health and safety.

Prompt disposal of these MRCs furthers the objective of maintaining radiation exposures as low as reasonably achievable pursuant to 10 CFR 20.1101(b) by eliminating the potential for any future exposure from storing waste on-site. In addition, disposing of waste prior to the permanent cessation of operations is consistent with NRC policy to minimize the costs and complexity of decommissioning, which can only improve safety.

4. There is present any other material circumstance not considered when the regulation was adopted for which it would be in the public interest to grant an exemption. (10 CFR 50.12(a)(2)(vi))

As promulgated, the rule has never required that site-specific DCEs be developed during the operating life of the plant, but instead assumed that such estimates would be developed around the time a plant ceases operation. *See* 10 CFR 50.75(f)(2). In the absence of site-specific information, there may be an understandable preference for preserving funds in the DTF, because it would be difficult to make informed decisions regarding the sequencing of decommissioning activities and expenses. However, where detailed information is available through a site-specific DCE (as is the case here), the NRC and the licensees have the ability to evaluate the cost and benefits of prompt disposal versus deferring expenditures. Having DCEs is a changed circumstance that provides NRC with the ability to determine if there is reasonable assurance that sufficient funds will be available at the time of decommissioning if funds are withdrawn to cover the disposal costs for these MRCs.

The exemption request also satisfies the special circumstance criterion of 10 CFR 50.12(a)(2)(vi) in that, when this rule was adopted, the NRC did not consider that MRCs would be removed from the Facility long before permanent cessation of operation, and that the MRCs might be stored on-site because DTF did not include sub-accounts to address disposal of large components.

The NRC's rulemaking history makes clear that licensees may maintain sub-accounts in DTF that might be used for purposes unrestricted by NRC, such as covering the disposal costs for MRCs. In one example, American Electric Power Company set aside funds that were dedicated for disposal of steam generators from DC Cook. However, some state utility commissions do not favor the use of sub-accounts. In adopting the regulation, the NRC anticipated that sub-accounts would be used to separate the funds collected for NRC-jurisdiction decommissioning from other decommissioning uses, and did not contemplate that funds collected for non-NRC decommissioning purposes would be commingled with the NRC-required decommissioning funds (61 FR 39285).

In this case, the funds for NRC-jurisdictional decommissioning and other decommissioning are commingled in the DTF. The NRC did not intend to prevent the use of those funds solely because they are commingled, and to do so would create an unnecessary regulatory burden without any corresponding safety benefit. This is especially true in the current situation where the adequacy of decommissioning funding can be readily assessed based upon a site-specific decommissioning cost estimate that sets out the costs for the different elements of decommissioning (including the disposal of MRCs) in order to determine whether there are adequate funds to fulfill NRC decommissioning requirements.

5. Application of the regulation in the particular circumstances conflicts with other rules or requirements of the commission. (10 CFR 50.12(a)(2)(i))

Application of the regulations in 10 CFR 50.82(a) would conflict with the NRC philosophy favoring the timely disposition of nuclear waste; under circumstances where doing so is practicable. For example, materials licensees of the NRC are subject to the 1994 Decommission Timeliness Rule, 10 CFR 30.36, 40.42, 70.38, and 72.54, which require those licensees to decontaminate and decommission certain unused portions of operating nuclear materials facilities. Allowing contaminated land, buildings or equipment to remain on-site was seen as a possible public and environmental liability, and the NRC looked for ways to achieve early decommissioning of unused portions of materials facilities. For valid and sound reasons, reactor licensees are not subject to this rule and, in fact, are allowed the SAFSTOR option under 10 CFR 50.82. Nevertheless, the NRC should look favorably upon efforts to pursue near-term permanent disposal of MRCs where justified.

Another example of the NRC's preference for minimizing the on-site inventory of waste is reflected in 10 CFR 20.1406 which was added along with modifications to NRC's license termination rule in 1997 (62 FR 39058). This regulation provides:

> Applicants for licenses, other than renewals, after August 20, 1997, shall describe in the application how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize to the extent practicable, the generation of radioactive waste.

The intent of 10 CFR 20.1406 is to diminish the occurrence and severity of site contamination by taking measures that will control contamination and facilitate eventual decommissioning. Consistent with this philosophy, early removal of large components is consistent with 10 CFR 20.1406. In contrast, storage of MRCs on-site until permanent cessation of operations will increase the complexity of decommissioning and volume of waste to be disposed at the end of plant life. Moreover, this complexity will be exacerbated by the inventory of MRCs stored on-site at multiple plants. Thus, permitting the phased disposal of large components over time will reduce the inventory of waste material and eliminate this future decommissioning activity, consistent with the philosophy underlying 10 CFR 20.1406.

Though not required to do so, reactor licensees should be permitted to utilize DTF to pay for the permanent disposal of MRCs prior to cessation of operations. This is justified where sufficient funds are being accumulated in DTF (as is the case here), especially where early removal could take advantage of favorable disposal pricing. If the use of DTF is not permitted, MRCs could remain on-site for additional decades though out the industry, particularly given current trends towards license renewal.

Finally, delaying disposal introduces risks associated with potential changes in future disposal costs and availability of disposal capacity.

VI. CONCLUSION

Granting this exemption will be entirely consistent with the NRC decommissioning regulations as it: (1) would not foreclose release of the site for possible unrestricted use (in fact, it would enhance PSEG Nuclear's ability to achieve unrestricted release); (2) would not result in significant environmental impacts not previously reviewed by the NRC; and (3) would not undermine the existing and continuing reasonable assurance that adequate funds will be available for decommissioning. Disposal of the MRCs now would facilitate eventual unrestricted release of the Facility, thus improving environmental conditions. In addition, authorizing prompt disposal would give PSEG Nuclear the ability to take advantage of cost effective disposal alternatives and thereby eliminate the uncertainty associated with the future cost and availability of disposal capacity and allow it to fund important capital projects. It will also permit important projects to be funded that would need to be deferred or canceled if the funds for those projects were used to fund the disposal of these MRCs. Assurance of the adequacy of the availability of funds for the Facility decommissioning is supported by a site-specific decommissioning cost estimate and the associated funding program.

Granting this exemption encourages the prompt disposal of MRC source terms which is prudent and consistent with the underlying purpose of the Commission's decommissioning regulations. PSEG Nuclear's application for an exemption is in the public's interest.

ENCLOSURE 2

DECOMMISSIONING COST ANALYSIS

for the

SALEM NUCLEAR GENERATING

Station Unit 2

DECOMMISSIONING COST ANALYSIS

for the

SALEM GENERATING STATION,
UNITS 1 AND 2

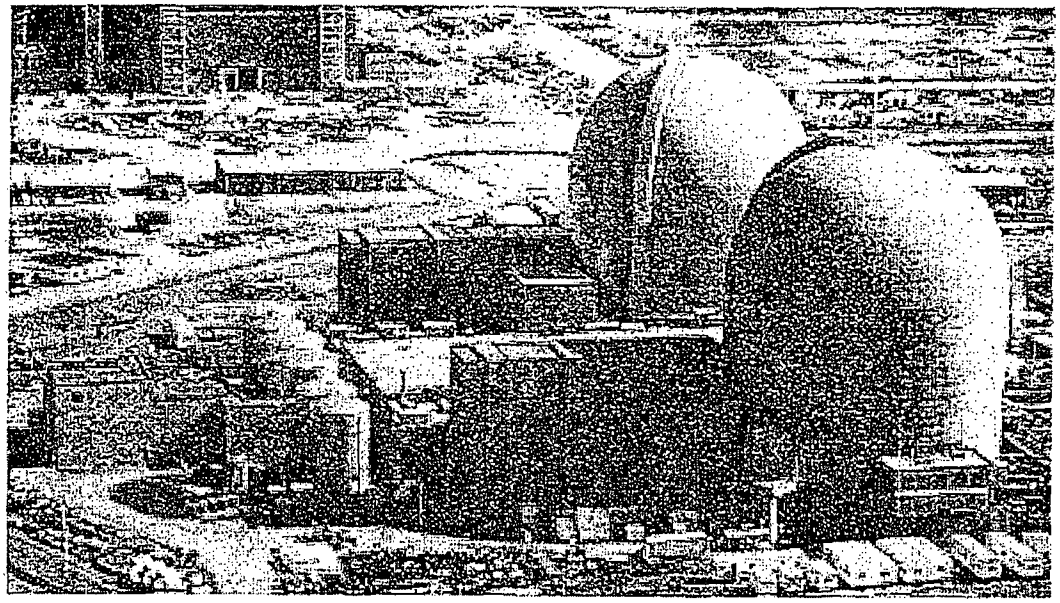

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TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

TABLES

FIGURES

APPENDICES

REVISION LOG

No.	CRA No.	Date	Item Revised	Reason for Revision
0		12-05-02		Original Issue

EXECUTIVE SUMMARY

This report presents the costs to promptly decommission (decontaminate and dismantle) the Salem Generating Station (Salem Station) following a scheduled cessation of plant operations. The analysis relies upon the site-specific, technical information developed for a previous evaluation prepared in 1995-96, updated to reflect current plant conditions and operating assumptions. The estimates are designed to provide PSEG Power, LLC with sufficient information to assess its financial obligations as they pertain to the eventual decommissioning of the nuclear station.

The estimates are based on numerous fundamental assumptions, including regulatory requirements, project contingencies, low-level radioactive waste disposal practices, high-level radioactive waste management options, and site restoration requirements. The estimates incorporate a cooling period of approximately five years for the spent fuel that resides in the plant's storage pools when operations cease. Any residual fuel remaining in the pools after the five-year period will be relocated to an on-site, interim storage facility to await the transfer to a DOE facility. The estimates also include the dismantling of non-essential structures and limited restoration of the site.

Alternatives and Regulations

The Nuclear Regulatory Commission (NRC) provided general decommissioning guidance in the rule adopted on June 27, 1988.[1] In this rule the NRC set forth technical and financial criteria for decommissioning licensed nuclear facilities. The regulations addressed planning needs, timing, funding methods, and environmental review requirements for decommissioning. The rule also defined three decommissioning alternatives as being acceptable to the NRC - DECON, SAFSTOR, and ENTOMB.

> DECON is defined as "the alternative in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations."[2]

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1 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.

2 Ibid. Page FR24022, Column 3.

SAFSTOR is defined as "the alternative in which the nuclear facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use."[3] Decommissioning is to be completed within 60 years, although longer time periods will be considered when necessary to protect public health and safety.

ENTOMB is defined as "the alternative in which radioactive contaminants are encased in a structurally long-lived material, such as concrete; the entombed structure is appropriately maintained and continued surveillance is carried out until the radioactive material decays to a level permitting unrestricted release of the property."[4] As with the SAFSTOR alternative, decommissioning is currently required to be completed within 60 years.

The 60-year restriction has limited the practicality of the ENTOMB alternative at commercial reactors that generate significant amounts of long-lived radioactive material. As such, the NRC is currently re-evaluating this option and the technical requirements and regulatory actions that would be necessary for entombment to become a viable option.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. The amendments allow for greater public participation and better define the transition process from operations to decommissioning. Regulatory Guide 1.184, issued in July 2000, further describes the methods and procedures that are acceptable to the NRC staff for implementing the requirements of the 1996 revised rule 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 process described in the amended regulations.

Methodology

The methodology used to develop the estimates described within this document follows the basic approach originally presented in the cost estimating guidelines[5] developed by the Atomic Industrial Forum (now Nuclear Energy Institute). This reference

3 Ibid.
4 Ibid. Page FR24023, Column 2.
5 T.S. LaGuardia et al., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

describes a unit factor method for determining decommissioning activity costs. The unit factors used in this analysis incorporate site-specific costs and the latest available information on worker productivity in decommissioning.

The estimates also reflect 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 Pathfinder, Shoreham, Rancho Seco, Trojan, Yankee Rowe, Big Rock Point, Maine Yankee, Humboldt Bay-3, Oyster Creek, Connecticut Yankee and San Onofre-1 nuclear units have provided additional insight into the process, the regulatory aspects, and technical challenges of decommissioning commercial nuclear units.

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 costs.

Contingency

Consistent with industry practice, contingencies are applied to the decontamination and dismantling costs developed as "specific provision for unforeseeable elements of cost within the defined project scope, particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur."[6] The cost elements in the estimates are based on ideal conditions; therefore, the types of unforeseeable events that are almost certain to occur in decommissioning, based on industry experience, are addressed through a percentage contingency applied on a line-item basis. This contingency factor is a nearly universal element in all large-scale construction and demolition projects. It should be noted that contingency, as used in this estimate, does not account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the 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, by contrast, are expected to be fully expended throughout the program. Inclusion of contingency is necessary to provide assurance that sufficient funding will be available to accomplish the intended tasks.

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6 Project and Cost Engineers' Handbook, Second Edition, American Association of Cost Engineers, Marcel Dekker, Inc., New York, New York, p. 239.

Low-Level Radioactive Waste Disposal

The contaminated and activated material generated in the decontamination and dismantling of a commercial nuclear reactor is classified as low-level (radioactive) waste, although not all of the material is suitable for "shallow-land" disposal. With the passage of the "Low-Level Radioactive Waste Disposal Act" in 1980, and its Amendments of 1985,[7] the states became ultimately responsible for the disposition of radioactive waste generated within their own borders.

New Jersey is a member of the three-state Atlantic Interstate Low-Level Radioactive Waste Management Compact, formed after South Carolina formally joined the Northeast Regional Compact. The Barnwell Low-Level Radioactive Waste Management Facility, located in South Carolina, is expected to be available to PSEG Nuclear to support the decommissioning of the Salem Station. It is also assumed that PSEG Nuclear could access other disposal sites should it prove cost effective. As such, rate schedules for both the Barnwell and the Envirocare facility in Utah were used to generate disposal costs.

High-Level Radioactive Waste Management

Congress passed the "Nuclear Waste Policy Act"[8] in 1982, assigning the responsibility for disposal of spent nuclear fuel created by the commercial nuclear generating plants to the DOE. This legislation also created a Nuclear Waste Fund to cover the cost of the program, which is funded by the sale of electricity from nuclear reactors since 1993, and an estimated equivalent value for assemblies irradiated prior to 1983. The Nuclear Waste Policy Act, along with the individual disposal contracts with utilities, specified that the DOE was to begin accepting spent fuel by January 31, 1998.

Since the original legislation, the DOE has announced several delays in the program schedule. Operation of DOE's yet-to-be constructed geologic repository is currently scheduled for the year 2010, assuming that the licensing could be completed expeditiously and a national transportation system established. The agency has no plans for receiving spent fuel from commercial nuclear plant sites prior to this date and startup operations may be phased in, creating additional delays.

The NRC requires licensees to establish a program to manage and provide funding for the caretaking of all irradiated fuel at the reactor site until title of the fuel is transferred to the DOE. For estimating purposes, PSEG Nuclear has assumed that the high-level waste repository, or some interim storage facility, will be fully

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7 "Low-Level Radioactive Waste Policy Amendments Act of 1985," Public Law 99-240, 1/15/86.

8 "Nuclear Waste Policy Act of 1982 and Amendments," U.S. Department of Energy's Office of Civilian Radioactive Management, 1982.

operational by 2015. Interim storage of the fuel, until the DOE has completed the transfer, will be in an independent facility located on the Artificial Island site. This will allow PSEG Nuclear to proceed with decommissioning and terminate its operating licenses in the shortest time possible.

The spent fuel storage facility, which is independently licensed and operated, will be sized to accommodate the inventory of spent fuel residing in the plant's storage pools at the cessation of operations, in addition to any operational inventory already in residence. When emptied, the station could be dismantled without maintaining the wet storage pools. Based upon this scenario, and an anticipated rate of transfer, spent fuel is projected to remain on site for approximately 30 years following the cessation of Unit 1 operations.

Site Restoration

The efficient removal of the contaminated materials at the site may result in damage to many of the site structures. Blasting, coring, drilling, and the other decontamination activities will substantially damage power block structures, potentially weakening the footings and structural supports. Prompt demolition once the license is terminated is clearly the most appropriate and cost-effective option. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures with a work force already mobilized is more efficient and less costly than if the process were deferred. Experience at shutdown generating stations has shown that plant facilities quickly degrade without maintenance, adding additional expense and creating potential hazards to the public and the demolition work force. Consequently, this study assumes that site structures will be removed to a nominal depth of three feet below the local grade level wherever possible. The site will then be graded and stabilized.

Summary

The DECON decommissioning alternative involves the prompt removal of the contaminated and activated plant components, including structural materials, from the site following permanent shutdown. The facility operator may then have unrestricted use of the site with no further requirement for a license. This study assumes that the remainder of the non-essential plant systems and structures, not previously removed in support of license termination, are dismantled and the site restored.

The scenario analyzed for the purpose of generating the estimates is described in Section 2. The assumptions are presented in Section 3, along with schedules of annual expenditures. The major cost contributors are identified in Section 6, with detailed activity costs, waste volumes, and associated manpower requirements delineated in Appendix C. A cost summary is provided at the end of this section for the major cost components.

COST SUMMARY
(Thousands of 2002 Dollars)

Activity	Unit 1	Unit 2	Station
Decontamination	13,463	13,577	27,040
Removal	79,587	100,874	180,461
Packaging	11,726	11,746	23,473
Transportation	11,632	11,734	23,366
Waste Disposal	80,911	82,039	162,950
Off-site Waste Processing	16,802	17,175	33,977
Program Management (including Engineering and Security)	233,535	272,325	505,860
Spent Fuel Pool Isolation	9,060	6,040	15,101
ISFSI Related (including capital)	67,207	53,776	120,983
Insurance and Regulatory Fees	11,464	9,209	20,672
Energy	8,046	7,344	15,390
Characterization and Licensing Surveys	6,440	6,440	12,880
Misc. Equipment and Site Services	6,026	6,423	12,449
Total [1]	555,899	598,702	1,154,601
License Termination [2]	523,818	544,985	1,068,803
Site Restoration	32,081	53,717	85,798

[1] Columns may not add due to rounding.
[2] Includes spent fuel management expenditures.

1. INTRODUCTION

This decommissioning analysis is designed to provide PSEG Power with sufficient information to prepare the financial planning documents for decommissioning, as required by the Nuclear Regulatory Commission (NRC or Commission). It is not a detailed assessment, but a financial analysis prepared in advance of the engineering and planning that will be required to carry out the decommissioning of the Salem Generating Station (Salem Station).

1.1 OBJECTIVES OF STUDY

The objectives of this study are to prepare comprehensive estimates of the costs to decommission Salem Station for the scenario outlined in Section 2, to define a sequence of events, and project the volume of waste produced from the decontamination and dismantling activities.

The Salem Station is jointly owned by PSEG Power, LLC (57%) and Exelon Generation Corporation (43%). However, for purposes of this study, only the undivided decommissioning costs (100%) are presented, since the division of ownership has no effect on the total expenditures required. PSEG Nuclear operates the station.

The Station is comprised of two identical units, constructed concurrently, with the construction permits being issued on the same date. For the purposes of this study, the shutdown dates were taken as August 13, 2016, and April 18, 2020, for Units 1 and 2, respectively. This time frame, which reflects 40 years of operating life for each unit, was used as an input for scheduling the decommissioning activities.

1.2 SITE DESCRIPTION

The Salem Station is located on the southern part of Artificial Island on the east bank of the Delaware River in Lower Alloways Creek Township, Salem County, New Jersey. The site is 15 miles south of the Delaware Memorial Bridge, 18 miles south of Wilmington, Delaware, 30 miles southwest of Philadelphia, Pennsylvania, and 7½ miles southwest of Salem, New Jersey.

The Nuclear Steam Supply System (NSSS) consists of a pressurized water reactor and a four-loop Reactor Coolant System (RCS). The system was supplied by the Westinghouse Electric Corporation. The licensed ratings for each of the two units is 3,411 MWt. The corresponding net dependable electrical output is 1,115 MWe.

The NSSS is housed within a "containment structure," a seismic Category I, reinforced-concrete, dry structure. The containment is a cylinder with a hemispherical dome and a flat, reinforced-concrete foundation mat. A welded steel liner plate anchored to the inside face of the containment serves as a leak-tight membrane.

Heat produced in the reactor is converted to electrical energy by the steam and power conversion system. A turbine-generator system converts the thermal energy of steam produced in the steam generators into mechanical shaft power and then into electrical energy. The plant's turbine-generators are each tandem-compound, four-element units. They consist of one high-pressure, double-flow, and three low-pressure, double-flow elements driving a direct-coupled generator at 1,800 rpm. The turbines are operated in a closed feedwater cycle that condenses the steam; the heated feedwater is returned to the steam generators. Heat rejected in the main condensers is removed by the circulating water system.

The circulating water system provides the heat sink required for removal of waste heat in the power plant's thermal cycle. The system has the principal function of removing heat by absorbing this energy in the main condenser. Water is withdrawn from the Delaware River by the circulating water pumps located at the intake structure. After passing through the plant condensers, the discharge is routed back into the Delaware estuary.

1.3 REGULATORY GUIDANCE

The NRC provided initial decommissioning guidance in its rule "General Requirements for Decommissioning Nuclear Facilities," issued in June 1988.[1]* This rule set forth technical and financial criteria for decommissioning licensed nuclear facilities. The regulation addressed decommissioning planning needs, timing, funding methods, and environmental review requirements. The intent of the rule was to ensure that decommissioning would be accomplished in a safe and timely manner and that adequate funds would be available for this purpose. Subsequent to the rule, the NRC issued Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors,"[2] which provided guidance to the licensees of nuclear facilities on the financial methods acceptable to the NRC staff for complying with the requirements of the rule. The regulatory guide addressed the funding requirements and provided guidance on the

* Annotated references for citations in Sections 1-6 are provided in Section 7.

content and form of the financial assurance mechanisms indicated in the rule amendments.

The rule defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR, and ENTOMB. It also placed limits on the time allowed to complete the decommissioning process. For SAFSTOR, the process is restricted in overall duration to 60 years unless it could be shown that a longer duration is necessary to protect public health and safety. The guidelines for ENTOMB are similar, providing the NRC with both sufficient leverage and flexibility to ensure that these deferred options are only used in situations where it is reasonable and consistent with the definition of decommissioning. At the conclusion of a 60-year dormancy period (or longer for ENTOMB if the NRC approves such a case), the site would still require significant remediation to meet the definition of unrestricted release and license termination.

The ENTOMB alternative has not been viewed as a viable option for power reactors due to the significant time required to isolate the long-lived radionuclides for decay to permissible levels. However, with recent rulemaking permitting the controlled release of a site, the NRC has re-evaluated this alternative. The resulting feasibility study, based upon an assessment by Pacific Northwest National Laboratory, concluded that the method did have conditional merit for some if not most reactors. However, the staff also found that additional rulemaking would be needed before this option could be treated as a generic alternative. The NRC is considering rulemaking to alter the 60-year time for completing decommissioning and to clarify the use of engineered barriers for reactor entombments. Pending completion of such rulemaking, entombment requests will be handled on a case-by-case basis.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants.[3] When the decommissioning regulations were adopted in 1988, it was assumed that the majority of licensees would decommission at the end of the operating license life. Since that time, several licensees permanently and prematurely ceased operations without having submitted a decommissioning plan. In addition, these licensees requested exemptions from certain operating requirements as being unnecessary once the reactor is defueled. Each case was handled individually without clearly defined generic requirements. The NRC amended the decommissioning regulations in 1996 to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. The new amendments allow for greater public participation and better define the transition process from operations to decommissioning.

Under the revised regulations, licensees would submit written certification to the NRC within 30 days after the decision to cease operations. Certification would also be required once the fuel was permanently removed from the reactor vessel. Submittal of these notices would entitle the licensee to a fee reduction and eliminate the obligation to follow certain requirements needed only during operation of the reactor. Within two years of submitting notice of permanent cessation of operations, the licensee would be required to submit a Post-Shutdown Decommissioning Activities Report (PSDAR) to the NRC. The PSDAR describes the planned decommissioning activities, the associated sequence and schedule, and an estimate of expected costs. Prior to completing decommissioning, the licensee would be required to submit an application to the NRC to terminate the license, along with a license termination plan (LTP).

1.3.1 Nuclear Waste Policy Act

Congress passed the Nuclear Waste Policy Act[4] in 1982, assigning the responsibility for disposal of spent nuclear fuel from the commercial nuclear generating plants to the Department of Energy (DOE). Two permanent disposal facilities were envisioned, as well as an interim facility. To recover the cost of permanent spent fuel disposal, this legislation created a Nuclear Waste Fund through which money was to be collected from the consumers of the electricity generated by commercial nuclear power plants. The Nuclear Waste Policy Act, along with the individual disposal contracts with utilities, specified that the DOE was to begin accepting spent fuel by January 31, 1998.

After pursuing a national site selection process, the Act was amended in 1987 to designate Yucca Mountain, Nevada, as the only site to be evaluated for geologic disposal of high-level waste. Also in 1987, the DOE announced a five-year delay in the opening date for the repository, from 1998 to 2003. Two years later, in 1989, an additional 7-year delay was announced, primarily due to problems in obtaining the required permits from the state of Nevada to perform the required characterization of the site.

Generators have responded to this impasse by initiating legal action and constructing supplemental storage as a means of maintaining necessary operating margins. In a recent decision, the U.S. Court of Appeals for the Federal Circuit reaffirmed the utility position that

DOE had breached its contractual obligation. However, even with the August 2000 ruling,[5] DOE's position has remained unchanged. The agency continues to maintain that its delayed performance is unavoidable because it does not have an operational repository and does not have authority to provide storage in the interim. Consequently, DOE has no plans to receive spent fuel from commercial U.S. reactors before the year 2010.

The NRC requires licensees to establish a program to manage and provide funding for the management of all irradiated fuel at the reactor until title of the fuel is transferred to the Secretary of Energy in 10 CFR 50.54 (bb).[6] This funding requirement is fulfilled through inclusion of certain high-level waste cost elements within the estimates, as described below.

For estimating purposes, PSEG Nuclear has assumed that the high-level waste repository, or some interim storage facility, will be fully operational by 2015. Interim storage of the fuel, until the DOE has completed the transfer, will be in an independent facility located on the Artificial Island site. This will allow PSEG Nuclear to proceed with decommissioning and terminate its operating licenses in the shortest time possible.

Based upon the projected capacity of the spent fuel storage pools, supplemental storage will be required before the current operating licenses expire so as to maintain full core off-load capability. Therefore, this analysis assumes that an on-site independent spent fuel storage installation (ISFSI) will be constructed to support plant operations and will be available to support decommissioning

The spent fuel storage facility, which is independently licensed and operated, will be sized to accommodate the inventory of spent fuel residing in the plant's storage pools at the cessation of operations, in addition to any operational inventory already in residence. When emptied, the station could be dismantled without maintaining the wet storage pools. Based upon this scenario, and an anticipated rate of transfer, spent fuel is projected to remain on site for approximately 30 years following the cessation of Unit 1 operations.

Expenditures are included in the analysis for the isolation and continued operation of the spent fuel pools throughout the first five years of decommissioning. Expenses are also included for loading the spent fuel assemblies remaining in the storage pools after the cessation of plant operations into multi-purpose canisters, for canister costs and overpacks, and for the operation of the ISFSI through the year 2046, when all the fuel is expected to be transferred to the DOE.

1.3.2 Low-Level Radioactive Waste Policy Amendments Act

Congress passed the "Low-Level Radioactive Waste Disposal Act" in 1980, declaring the states as being ultimately responsible for the disposition of low-level radioactive waste generated within their own borders. The federal law encouraged the formation of regional groups or compacts to implement this objective safely, efficiently and economically, and set a target date of 1986. With little progress, the "Amendments Act" of 1985[7] extended the target, with specific milestones and stiff sanctions for non-compliance.

New Jersey is a member of the three-state Atlantic Interstate Low-Level Radioactive Waste Management Compact, formed after South Carolina formally joined the Northeast Regional Compact. The Barnwell Low-Level Radioactive Waste Management Facility, located in South Carolina, is expected to be available to PSEG Nuclear to support the decommissioning of the Salem Station. It is also assumed that PSEG Nuclear could access other disposal sites should it prove cost-effective. As such, rate schedules for both the Barnwell and the Envirocare facility in Utah were used to generate disposal costs.

1.3.3 Radiological Criteria for License Termination

In 1997, the NRC published Subpart E, "Radiological Criteria for License Termination,"[8] amending Part 20 of Title 10 of the Code of Federal Regulations (10 CFR §20). This subpart provided radiological criteria for releasing a facility for unrestricted use. The regulation provides that the site could 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 residual radioactivity has been reduced to levels that are As Low As Reasonably Achievable (ALARA). The decommissioning estimate for the Salem Station assumes that the site will be remediated to a residual level consistent with the NRC-prescribed level.

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). An additional limit of 4 millirem per year, as defined in 40 CFR Part 141.16, is applied to drinking water.

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) provides that EPA will defer exercise of authority under 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) 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 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 EPA. However, if there are other hazardous materials on the site, EPA may be involved in the cleanup. As such, the possibility of dual regulation remains for certain licensees.

2. DECOMMISSIONING ALTERNATIVE

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

The conceptual approach that the 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 estimates developed for the Salem Station are 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 1 – PREPARATIONS

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. 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.

2.1.1 Engineering and Planning

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 in the vicinity of 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 Greater-than-Class C waste (GTCC), as defined by 10 CFR §61. Major components are further defined as comprising the reactor vessel and internals, large bore reactor system piping, and other large components that are radioactive. The NRC includes the following additional criteria for use of the §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 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 §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, in conjunction with the development of the PSDAR, activity specifications, cost-benefit and safety analyses, work packages and procedures must be assembled in support of the proposed decontamination and dismantling activities.

2.1.2 Site Preparations

Following final plant shutdown, and in preparation for actual decommissioning activities, the following activities are initiated:

- Characterization of the site and surrounding environs. This includes radiation surveys of work areas, major components (including the reactor vessel and its internals), sampling of internal piping contamination levels, and primary shield cores.

- Isolation of the spent fuel storage pool and fuel handling systems, such that decommissioning operations could commence on the balance of the plant. Decommissioning operations are scheduled around the fuel handling area to the greatest extent possible such that the overall project schedule is optimized. The fuel will be transferred to the DOE as it decays to the point that it meets the heat load criteria of the containers and, as such, it is assumed that the fuel pool will remain operational for a minimum of five years following the cessation of plant operations.

- Specification of transport and disposal requirements for activated materials and/or hazardous materials, including shielding and waste stabilization.

- 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.

2.2 PERIOD 2 – DECOMMISSIONING OPERATIONS

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) to facilitate hauling and transport. Building modifications may be required to the Reactor Building to facilitate access of large/heavy equipment. Modifications may also be required to the refueling area of the Reactor Building 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 canisters, 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 core former and lower core support assembly. Some material is expected to exceed Class C disposal requirements. As such, the segments will be packaged in a modified fuel canister for geologic disposal.

- Segmentation of the reactor vessel. Install shielded platform for segmentation of reactor vessel. Cutting operations are performed in-air using remotely operated equipment within a contamination control envelope, with the water level 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 cubicles necessary for access and component extraction are removed.

- Removal of the steam generators and pressurizer for controlled disposal. Decontaminate exterior surfaces, as required, and seal-weld openings (nozzles, inspection hatches, and other penetrations). These components can serve as their own burial containers provided that all penetrations are properly sealed and the internal contaminants are stabilized. Steel shields are added to those external areas of the steam generators necessary in order to meet transportation limits and regulations.

At least two years prior to the anticipated date of license termination, a LTP is required. Submitted as a supplement to the Final Safety Analysis Report (FSAR), or 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 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 structure.

- Removal of the contaminated equipment and material from the Auxiliary and Fuel Handling Building and any other contaminated facility. Radiation and contamination control techniques are used until radiation surveys indicate that the structures could 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 to a central processing area. Material certified to be free of contamination would be released for unrestricted disposition, e.g., as scrap, recycle, or general disposal. Contaminated material will be characterized and segregated for additional off-site processing (disassembly, chemical cleaning, volume reduction, and waste treatment), and/or packaged for controlled disposal at a low-level radioactive waste 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 NUREG/CR-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM).[9] 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 terminate the operating license 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 facility is suitable for release.

2.3 PERIOD 3 – SITE RESTORATION

Following completion of decommissioning operations, site restoration activities may begin. Efficient removal of the contaminated materials and verification that residual radionuclide concentrations are below the NRC limits may 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, Auxiliary, and Fuel Handling Buildings. Verifying that subsurface radionuclide concentrations meet NRC site release requirements may require removal of grade slabs and lower floors, potentially weakening footings and structural supports. This 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, where system failures have been recorded, or where it is required to confirm that subsurface process and drain lines were not breached over the operating life of the station.

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

This cost study presumes that non-essential structures and site facilities will be 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, and 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.

Concrete rubble produced by demolition activities will processed to remove rebar and miscellaneous embedments. The processed material will then be used on-site to backfill voids. Excess materials are trucked off-site for disposal as construction debris.

2.4 POST PERIOD 3 – ISFSI OPERATIONS

The ISFSI will continue to operate under a separate and independent license (10 CFR §72) following the relocation of the spent fuel from the plant's storage pools. Transfer of spent fuel to a DOE or interim facility will be exclusively from the ISFSI once the fuel pools have been emptied and the structures released for decommissioning. Assuming initiation of the federal Waste Management System in 2015, transfer of spent fuel from Salem Station is anticipated to continue through the year 2046. Any delay in the transfer process, for example, due to a delay in the scheduled opening of the geologic repository, a slower acceptance rate, or a combination of a delayed start date and lower transfer rate, will result in a longer on-site residence time for the fuel discharge from the reactor and therefore additional caretaking expenses.

At the conclusion of the spent fuel transfer process, the ISFSI will be decommissioned. The Commission will terminate the §72 license if it determines that the remediation of the ISFSI has been performed in accordance with an ISFSI license termination plan and that the final radiation survey and associated documentation demonstrate that the facility is suitable for release. Once the requirements are satisfied, the NRC can terminate the license for the ISFSI.

The currently proposed design for the ISFSI is based upon the use of concrete overpacks for pad storage. For purposes of this cost analysis, it is assumed that once the inner canisters containing the spent fuel assemblies have been removed and the license for the facility terminated, the modules could 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 estimates prepared for decommissioning the Salem Station consider the unique features of the site, including the nuclear steam supply system, power generation systems, support services, site buildings, and ancillary facilities. The bases of the estimates, including the sources of information relied upon, the estimating methodology employed, site-specific considerations and other pertinent assumptions are described in this section.

3.1 BASIS OF ESTIMATE

The current estimates were developed using the basic design information originally generated for the decommissioning analysis prepared in 1995-96.[10] The information was reviewed for the current estimate and updated, as deemed necessary. The site-specific considerations and assumptions used in the previous estimate were also revisited. Modifications were incorporated where new information was available or experience from ongoing decommissioning programs provided viable alternatives or improved processes.

3.2 METHODOLOGY

The methodology used to develop this cost estimate follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates,"[11] and the US DOE "Decommissioning Handbook."[12] 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 Data," published by R.S. Means.[13]

This estimate 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 Pathfinder, Shoreham, Rancho Seco, Trojan, Yankee Rowe, Big Rock Point, Maine Yankee, Humboldt Bay-3, Oyster Creek, Connecticut Yankee, and San Onofre-1 nuclear units has provided additional insight into the process, the regulatory aspects, and 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 A presents the detailed development of a typical unit factor. Appendix B provides the values contained within one set of factors developed for this analysis.

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 37%
• Protective Clothing Factor	10% to 30%
• Work Break Factor	8.33%
• Productivity	adjustable

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 relied 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 costs.

3.3 FINANCIAL COMPONENTS OF THE COST MODEL

TLG's proprietary decommissioning cost model, DECCER, produces a number of 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.

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 TLG's 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.

3.3.1 Contingency

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"[14] as "specific provision for unforeseeable elements of cost within the defined project scope; particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this estimate are based upon ideal conditions 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 estimate, 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, could 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 will be the disposition of the reactor vessel and internal components, which have become highly radioactive after a lifetime of exposure to radiation produced in the core. The disposition of these highly radioactive components forms the basis for the critical path (schedule) for decommissioning operations. Cost and schedule are inter-dependent 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 risk and uncertainties associated with this task are that the expected optimization 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 can range from 0% 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%

The overall contingency, when applied to the appropriate components of the estimates on a line item basis, results in an average value of 18.3%.

3.3.2 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:

- Transition activities and costs: ancillary expenses associated with eliminating 50% to 80% of the site labor force shortly after the cessation of plant operations, added cost for worker separation packages throughout the decommissioning program, national or company-mandated retraining, and retention incentives for key personnel.

- 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.

- Pricing changes for basic inputs, such as labor, energy, materials, and burial. Some of these inputs may vary slightly, e.g. -10% to +20%; burial could vary from -50% to +200% or more.

It has been TLG's experience that the results of a risk analysis, when compared with the base case estimate for decommissioning, indicate that the chances of the base decommissioning estimate's being too high is a low probability, and the chances that the estimate is too low is a much higher probability. This is mostly due to the pricing uncertainty for low-level radioactive waste burial, and to a lesser extent due to schedule increases from changes in plant conditions and to pricing variations in the cost of labor (both craft and staff). This cost study, however, does not add any additional costs to the estimate for financial risk since there is insufficient historical data from which to project future liabilities. Consequently, it is recommended that the areas of uncertainty or risk be revisited periodically and addressed through repeated revisions or updates of the base estimate.

3.4 SITE-SPECIFIC CONSIDERATIONS

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

3.4.1 Spent Fuel

The cost to dispose of the spent fuel generated from plant operations is not reflected within the estimate to decommission the Salem Station. 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. As such, the disposal cost is financed by a 1 mill/kWhr surcharge paid into the DOE's waste fund during operations. However, the NRC requires licensees to establish a program to manage and provide funding for the management of all irradiated fuel at the reactor until title of the fuel is transferred to the Secretary of Energy. This funding requirement is fulfilled through inclusion of certain high-level waste cost elements within the estimates, as described herein.

The total inventory of assemblies that will need to be handled during decommissioning is based upon several assumptions. The pickup of commercial fuel is assumed to begin in the year 2015 and will proceed on an oldest fuel first basis. The rate at which the fuel is removed from the commercial sites is based upon an annual capacity at the geologic repository of 3,000 metric tonnes. A delay in the startup of the repository, or a decrease in the rate of acceptance rate, will correspondingly prolong the transfer process and extend the duration that the fuel remains at the site.

For estimating purposes, spent fuel will be removed from the Salem Station site beginning in the year 2020, with the transfer complete by the end of year 2046. Built to support continuing plant operations, an ISFSI will be available to support decommissioning, i.e., the fuel residing in the pools following the cessation of plant operations could be relocated to the ISFSI so that decommissioning can proceed on the Fuel Handling Buildings. The assemblies will be relocated to the ISFSI during the first five years following final shutdown. Costs are included for the purchase of the 94 canisters and overpacks required to empty the pool (an additional eight will be used to package the GTCC).

Operation and maintenance costs for the ISFSI are included within the estimates and address the cost for staffing the facility, security, insurance, and licensing fees. Costs are also provided for the final disposition of the facility once the transfer is complete.

ISFSI Design Considerations

A multi-purpose (storage and transport) dry shielded storage canister with a vertical, reinforced concrete storage silo is used as a basis for the cost analyses. Approximately 50% of the silos 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. Approximately 10% of the concrete and steel is assumed to be removed from the overpacks for controlled disposal. The cost of the disposition of this material, as well as the demolition of the ISFSI facility, is included in the estimate.

3.4.2 Reactor Vessel and Internal Components

The NSSS (reactor vessel and reactor coolant system components) will be decontaminated using chemical agents prior to the start of cutting operations. A decontamination factor (average reduction) of 10 is presumed.

The reactor pressure vessel and internal components are segmented for disposal in shielded, reusable transportation casks. Segmentation will be performed in the refueling canal, where a turntable and remote cutter are installed. The vessel will be 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 transportation regulations will dictate segmentation and packaging methodology.

The dismantling of the reactor internals will generate radioactive waste considered unsuitable for shallow land disposal, i.e., GTCC. Although the material is not classified as high-level waste, DOE has indicated it will accept title to this waste for disposal at the future high-level waste repository.[15] However, the DOE has not been forthcoming with an acceptance criteria or 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 has been packaged and disposed of as high-level waste, at a cost equivalent to that envisioned for the spent fuel. It is not anticipated that DOE would accept this waste prior to completing the transfer of spent fuel. Therefore, until such time as the DOE is ready to accept GTCC waste, it is reasonable to assume that this material would remain in storage at Salem Station.

Intact disposal of the reactor vessel and internal components could provide savings in cost and worker exposure by eliminating the complex segmentation requirements, isolation of the GTCC material, and transport/storage of the resulting waste packages. Portland General Electric (PGE) was able to dispose of the Trojan reactor as an intact package. However, the location of the Trojan Nuclear Plant on the Columbia River simplified the transportation analysis since:

- the reactor package could be secured to the transport vehicle for the entire journey, i.e., the package was not lifted during transport,
- there were no man-made or natural terrain features between the plant site and the disposal location that could produce a large drop, and
- transport speeds were very low, limited by the overland transport vehicle and the river barge.

As a member of the Northwest Compact, PGE had a site available for disposal of the package, the US Ecology facility in Washington State. The characteristics of this arid site proved favorable in demonstrating compliance with land disposal regulations.

It is not known whether this option will be available when the Salem Station ceases operation. Future viability of this option will depend upon the ultimate location of the disposal site, as well as the disposal site licensee's ability to accept highly radioactive packages and effectively isolate them from the environment. Consequently, as a bounding condition, the study assumes the reactor vessel will have to be segmented.

3.4.3 Primary System Components

The following discussion deals with the removal and disposition of the steam generators, but the techniques involved are also applicable to other large components, such as heat exchangers, component coolers and the pressurizer. The steam generators' size, weight, and location within the Reactor Building will ultimately determine the removal strategy.

A potential method for removal (and the one used as the basis in this estimate) is the extraction of the generators through the existing equipment hatch. Sections of the steam generator cubicle walls, adjoining floor slabs, and floor grating may need to be removed to allow for the generators to be maneuvered to the hatch.

Grating within the work area will be decontaminated and removed. Next, a trolley crane will be set up for removal of the generators. By setting the trolley crane first, it can be used to move portions of the steam generator cubicle walls and floor slabs from the Reactor Building to a location where they can be decontaminated and transported to the material handling area.

The generators will be rigged for removal, disconnected from the surrounding piping and supports, and maneuvered into the open area where they will be lowered onto a dolly. Once each steam generator has been placed in the horizontal position, nozzles and other openings will be welded closed. The lower shell will have a carbon steel membrane welded to its outside surface for shielding, if required, during transport. The interior volume will be filled with low-density cellular concrete for stabilization of the internal contamination and to satisfy burial ground packaging requirements. When this stage has been completed, each generator will be moved out of containment and lowered onto a multi-wheeled transporter. The generators will be staged at an on-site storage area to await transport to the disposal facility. The pressurizer will be removed using the same technique. Each component will then be loaded onto a barge for transport to the disposal facility.

Reactor coolant piping will be 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) drops below the nozzle zone. The piping will be boxed and transported by shielded van. The reactor coolant pumps and motors will be lifted out intact, packaged, and transported for disposal.

3.4.4 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 condenser will also be disassembled and moved to a laydown area. Material will then be prepared for transportation to an off-site recycling facility where it will be surveyed and designated for decontamination, volume reduction, or conventional disposal. Components will be packaged and readied for transport in accordance with the intended disposition.

3.4.5 Transportation Methods

Contaminated piping, components, and structural material other than the highly activated reactor vessel and internal components will qualify as LSA-I, II or III or Surface Contaminated Object, SCO-I or II, as described in Title 49 of the Code of Federal Regulations.[16] The contaminated material will be packaged in Industrial Packages (IP I, II, or III) 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 §71, as Type B. 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 so as 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 are 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, barge, and/or multi-wheeled transporter.

The low-level radioactive waste requiring controlled disposal will be sent to one of two currently available burial facilities. Transportation costs are based upon the mileage to either the Envirocare facility in Clive, Utah, or the Barnwell facility in South Carolina. Memphis, Tennessee will be used as the destination for off-site processing. Transportation costs are estimated using published tariffs from Tri-State Motor Transit.[17]

3.4.6 Low-Level Radioactive Waste Disposal

To the greatest extent practical, metallic material generated in the decontamination and dismantling processes will be treated to reduce the total volume requiring controlled disposal. The treated material, meeting the regulatory and/or site release criterion, will be released as scrap, requiring no further cost consideration. Conditioning and recovery of the waste stream will be performed off site at a licensed processing center.

Material requiring controlled disposal will be packaged and transported to one of two currently available burial facilities. Very low-level radioactive material, e.g., structural steel and contaminated concrete, will be sent to Envirocare. More highly contaminated and activated material will be sent to Barnwell. Disposal fees are based upon current charges for operating waste with surcharges added for the highly activated components, e.g., generated in the segmentation of the reactor vessel.

3.4.7 Site Conditions Following Decommissioning

The NRC will terminate (or amend) the site licenses if it determines that site remediation has been performed in accordance with the license termination plan, and that the terminal radiation survey and associated documentation demonstrate that the facility is suitable for release. The NRC's involvement in the decommissioning process will end at this point. Building codes and environmental regulations will dictate the next step in the decommissioning process, as well as PSEG Nuclear's own future plans for the site, e.g., the electrical switchyard will remain in support of the electrical transmission and distribution system.

The large underground tunnels between the cooling water intake, Turbine Building, and discharge structure will be isolated, sealed, and abandoned in place. Site utility and service piping are abandoned in place. Electrical manholes are backfilled with suitable earthen material and abandoned. Asphalt surfaces in the immediate vicinity of site buildings are broken up and the material used for backfill on site, if needed. The site access road will remain.

The estimate does not assume the remediation of any significant volume of contaminated soil. This assumption may be affected by continued plant operations and/or future regulatory actions, such as the development of site-specific release criteria.

Structures will be removed to a nominal depth of three feet below grade. Concrete rubble generated from demolition activities will be processed and made available as clean fill. The site will be graded following the removal of non-essential structures to conform to the adjacent landscape, and vegetation will be established to inhibit erosion. This degree of site restoration will constitute compliance with the CAFRA document dated July 9, 1976.

3.5 ASSUMPTIONS

The following are the major assumptions made in the development of the estimate for decommissioning the site. Decommissioning activities will be performed in accordance with the current regulations that are assumed to be in place at the time of decommissioning, including the Industrial Site Recovery Act (ISRA), which is mandatory under current New Jersey State Regulations.

3.5.1 Estimating Basis

The study follows the principles of ALARA through the use of work duration adjustment factors. These factors address the impact of activities such as radiological protection instruction, mock-up training, and the use of respiratory protection and protective clothing. The factors lengthen a task's duration, increasing costs and lengthening 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 worker exposure limits may impact the decommissioning cost and project schedule.

3.5.2 Labor Costs

The craft labor required to decontaminate and dismantle the nuclear units will be acquired through standard site contracting practices. The current cost of labor at the site is used as an estimating basis. Costs for site administration, operations, construction, and maintenance personnel are based upon average salary information provided by PSEG Nuclear.

PSEG Nuclear, as the licensee, will oversee the decommissioning operations and provide site security, radiological controls, and overall site administration. PSEG Nuclear will provide contract management of the decommissioning labor force and subcontractors. Engineering services for preparing the activity specifications, work procedures, activation, and structural analyses, are provided by PSEG Nuclear personnel.

The costs associated for the transition of the operating organization to decommissioning, e.g., separation packages, retraining, severance, and incentives are not included in this estimate and are considered to be ongoing operating expenses.

3.5.3 Design Conditions

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., cesium-137, strontium-90, or transuranics) has been prevented from reaching levels exceeding those that permit the major NSSS components to be shipped under current transportation regulations and disposal requirements.

The curie contents of the vessel and internals at final shutdown are derived from those listed in NUREG/CR-3474.[18] Actual estimates are derived from the curie/gram values in NUREG/CR-3474 and adjusted for the different mass of Salem Station components, projected operating life, and different periods of decay. Additional short-lived isotopes were derived from NUREG/CR-0130[19] and NUREG/CR-0672[20] and benchmarked to the long-lived values from NUREG/CR-3474.

Contamination has been found in the heat exchanger tube sheets at several shutdown U.S. pressurized water reactors (due to primary to secondary side leakage in the steam generators). For purposes of this estimate, selected secondary-side components are designated for off-site processing, including portions of the turbine and condenser.

Activation of the Reactor Building structure is confined to the biological shield in this estimate. More extensive activation (at very low levels) of the interior structures within containment has been detected at several reactors and the owners have elected to dispose of the affected material at a controlled facility rather than reuse the material as fill on site or send it to a landfill. The ultimate disposition of the material removed from the Reactor Building will depend upon the site release criteria selected and the designated end use for the site.

3.5.4 General

Transition Activities

Existing warehouses will be cleared of non-essential material and remain for use by PSEG Nuclear and its subcontractors. The warehouses may be dismantled as they become surplus to the decommissioning program. The plant's operating staff will perform the following activities at no additional cost or credit to the project during the transition period:

- Drain and collect fuel oils, lubricating oils, and transformer oils for recycle and/or sale.
- Excess acid, caustic, and all chemicals listed (at shutdown) in the New Jersey "Right to Know Report" will be removed and the storage container returned to the vendor. It is assumed that these chemicals will have some value; therefore, the cost for their removal will be compensated through their subsequent sale.

Scrap and Salvage

The existing plant equipment is considered obsolete and suitable for scrap as deadweight quantities only. PSEG Nuclear will make economically reasonable efforts to salvage equipment following final plant shutdown. However, dismantling techniques assumed by TLG for equipment in this estimate are not consistent with removal techniques required for salvage (resale) of equipment. Experience has indicated that some buyers wanted equipment stripped down to very specific requirements before they would consider purchase. This required expensive rework after the equipment had been removed from its installed location. Since placing a salvage value on this machinery and equipment would be speculative, and the value would be small in comparison to the overall decommissioning expenses, this estimate does not attempt to quantify the value that PSEG Nuclear may realize based upon those efforts.

It is assumed, for purposes of this estimate, that any value received from the sale of scrap generated in the dismantling process would be more than offset by the on-site processing costs. The dismantling techniques assumed in the decommissioning estimate do not include the additional cost for size reduction and preparation to meet "furnace ready" conditions. For example, the recovery of copper from electrical cabling from a facility currently being decommissioned has required the removal and disposition of the PCB-contaminated insulation, an added expense. With a volatile market, the potential profit margin in scrap recovery is highly speculative, regardless of the ability to free release this material. This assumption is an implicit recognition of scrap value in the disposal of clean metallic waste at no additional cost to the project.

Furniture, tools, mobile equipment such as forklifts, trucks, bulldozers, and other such items of personal property owned by PSEG Nuclear will be removed at no cost or credit to the decommissioning project. Disposition may include relocation to other generating facilities. Spare parts will also be made available for alternative use.

Energy

For estimating purposes, the plant is assumed to be de-energized, with the exception of those facilities associated with spent fuel storage. Replacement power costs are used for the cost of energy consumption during decommissioning for tooling, lighting, ventilation, and essential services.

Insurance

Costs for continuing coverage (nuclear liability and property insurance) following cessation of plant operations and during decommissioning are included and based upon current operating premiums. Reductions in premiums, throughout the decommissioning process, are based upon the guidance and the limits for coverage defined in the NRC's proposed rulemaking "Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors." The NRC's financial protection requirements are based on various reactor (and spent fuel) configurations.

Property Taxes

Property tax payments will cease upon shutdown of each unit.

Site Modifications

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

3.6 COST ESTIMATE SUMMARY

The costs projected for the decommissioning of Salem Station are provided in Tables 3.1 and 3.2. Decommissioning costs are reported in the year of projected expenditure; however, the values are provided in thousands of 2002 dollars. Costs are not inflated, escalated, or discounted over the period of expenditure.

The annual expenditures are based upon the detailed activity costs reported in Appendix C, along with the schedule discussed in Section 4. Since the common plant systems and services will be needed to support Unit 2 operations (with several needed to support post shutdown fuel storage and decommissioning), the cost to decontaminate, dismantle, and dispose of the common systems is included within the decommissioning cost for Unit 2.

TABLE 3.1
SCHEDULE OF ANNUAL EXPENDITURES BY PERIOD
UNIT 1
(Thousands, 2002 Dollars)

Year	Period 1 Preparations	Period 2 Decommissioning Operations	Period 3 Site Restoration	Period 4 Dry Fuel Storage	Period 5 ISFSI Decommissioning	Totals
2016	19,764					19,764
2017	65,091					65,091
2018	10,691	87,654				98,345
2019		94,939				94,939
2020		77,754				77,754
2021		77,541				77,541
2022		35,518				35,518
2023		4,680				4,680
2024		4,693				4,693
2025		4,680				4,680
2026		15,889				15,889
2027		3,374	20,847			24,221
2028			9,434	332		9,766
2029				544		544
2030				544		544
2031				544		544
2032				545		545
2033				544		544
2034				544		544
2035				544		544
2036				545		545
2037				544		544
2038				544		544
2039				544		544
2040				545		545
2041				544		544
2042				544		544
2043				544		544
2044				545		545
2045				14,311		14,311
	95,546	406,722	30,281	23,350	[Unit 2]	555,899

TABLE 3.2
SCHEDULE OF ANNUAL EXPENDITURES BY PERIOD
UNIT 2
(Thousands, 2002 Dollars)

Year	Period 1 Preparations	Period 2 Decommissioning Operations	Period 3 Site Restoration	Period 4 Dry Fuel Storage	Period 5 ISFSI Decommissioning	Totals
2020	24,791					24,791
2021	43,611	20,369				63,980
2022		100,471				100,471
2023		86,380				86,380
2024		74,298				74,298
2025		68,497				68,497
2026		37,888				37,888
2027		3,978	37,022			40,999
2028			16,754	2,186		18,939
2029				3,577		3,577
2030				3,577		3,577
2031				3,577		3,577
2032				3,587		3,587
2033				3,577		3,577
2034				3,577		3,577
2035				3,577		3,577
2036				3,587		3,587
2037				3,577		3,577
2038				3,577		3,577
2039				3,577		3,577
2040				3,587		3,587
2041				3,577		3,577
2042				3,577		3,577
2043				3,577		3,577
2044				3,587		3,587
2045				3,577		3,577
2046				15,611	5,997	21,607
	68,402	391,880	53,775	78,648	5,997	598,702

4. SCHEDULE ESTIMATE

The schedule for the decommissioning scenarios considered in this study follows the sequence presented in the AIF/NESP-036 study, with minor changes to reflect recent experience and site-specific constraints. In addition, the scheduling has been revised to reflect the required cooling period for the spent fuel.

A schedule or sequence of activities is presented in Figure 4.1. The schedule reflects the prompt decommissioning alternative and the start date consistent with a scheduled shutdown in 2016 for Unit 1 and 2020 for Unit 2. The sequence assumes that fuel will be removed from the spent fuel pool within the first five years. The key activities listed in the schedule do not reflect a one-to-one correspondence with those activities in the Appendix C cost table, but reflect dividing some activities for clarity and combining others for convenience. The schedule was prepared using the "Microsoft Project 2000" computer software.[21]

4.1 SCHEDULE ESTIMATE ASSUMPTIONS

The schedule was generated using a precedence network and associated software. Activity durations are based upon the actual man-hour estimates calculated for each area. The schedule was assembled by sequencing the work areas, considering work crew availability and material access/egress. The following assumptions were made in the development of the decommissioning schedule:

- The Fuel Handling Building will continue to serve as the spent fuel storage/transfer facility until such time that all spent fuel has been removed from site. The Fuel Handling Building is expected to operate for approximately five years after the cessation of operations.

- All work (except vessel and internals removal activities) will be 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.

- Multiple crews work parallel activities to the maximum extent possible, consistent with: optimum efficiency; adequate access for cutting, removal and laydown space; and 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.

4.2 PROJECT SCHEDULE

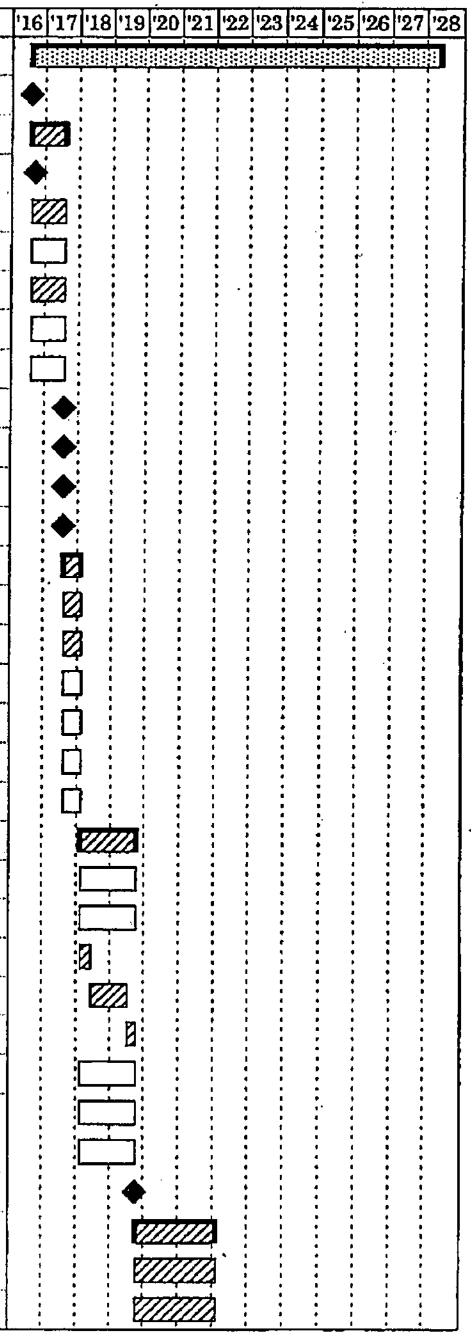
The period-dependent costs presented in Appendix C are based upon the durations developed in the schedule for the decommissioning of Salem Station. Durations are established between several milestones in each project period; these durations are used to establish a critical path for the entire project.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

Project timelines are shown in this section as Figure 4.2. Milestone dates are based on a 40-year plant operating life from the issuance of the operating license, a five-year wet storage period for the last core discharge, and continued operation of the ISFSI until DOE can complete the transfer.

FIGURE 4.1

DECOMMISSIONING ACTIVITY SCHEDULE

Task Name
Salem Unit 1 & 2 schedule
Shutdown Unit 1
Period 1a Unit 1 - Shutdown through transition
Certificate of permanent cessation of operations submitted
Fuel storage pool operations
Dry fuel storage operations
Reconfigure plant
Prepare activity specifications
Perform site characterization
PSDAR submitted
Written certificate of permanent removal of fuel submitted
Site specific decommissioning cost estimate submitted
DOC staff mobilized
Period 1b Unit 1 - Decommissioning preparations
Fuel storage pool operations
Reconfigure plant (continued)
Dry fuel storage operations
Prepare detailed work procedures
Decon NSSS
Isolate spent fuel pool
Period 2a Unit 1 - Large component removal
Fuel storage pool operations
Dry fuel storage operations
Preparation for reactor vessel removal
Reactor vessel & internals
Remaining large NSSS components disposition
Non-essential systems
Main turbine/generator
Main condenser
License termination plan submitted
Period 2b Unit 1 - Decontamination (wet fuel)
Fuel storage pool operations
Dry fuel storage operations



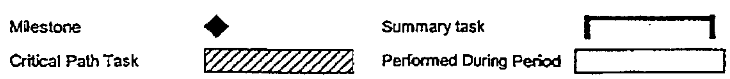


FIGURE 4.1

(continued)

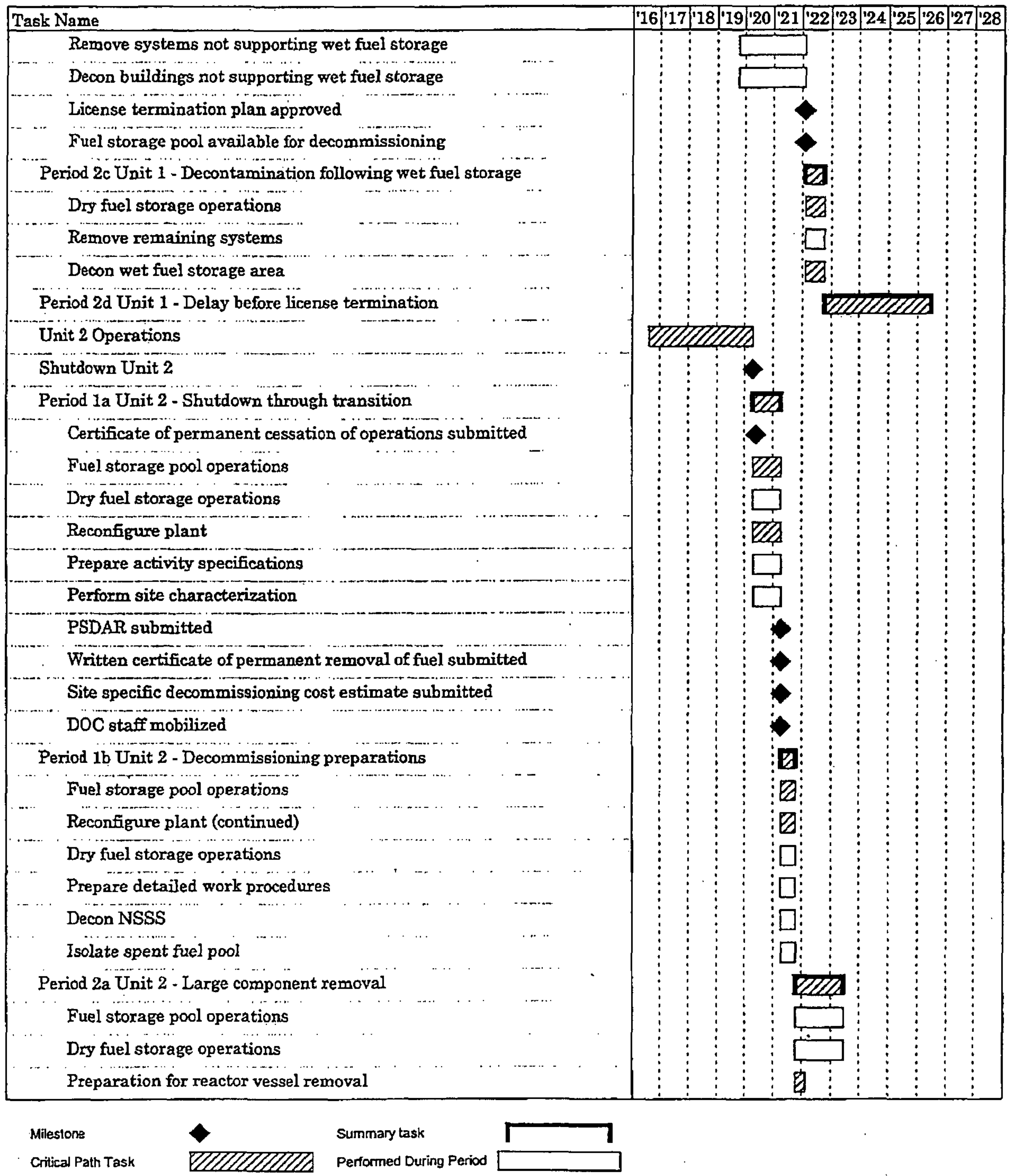
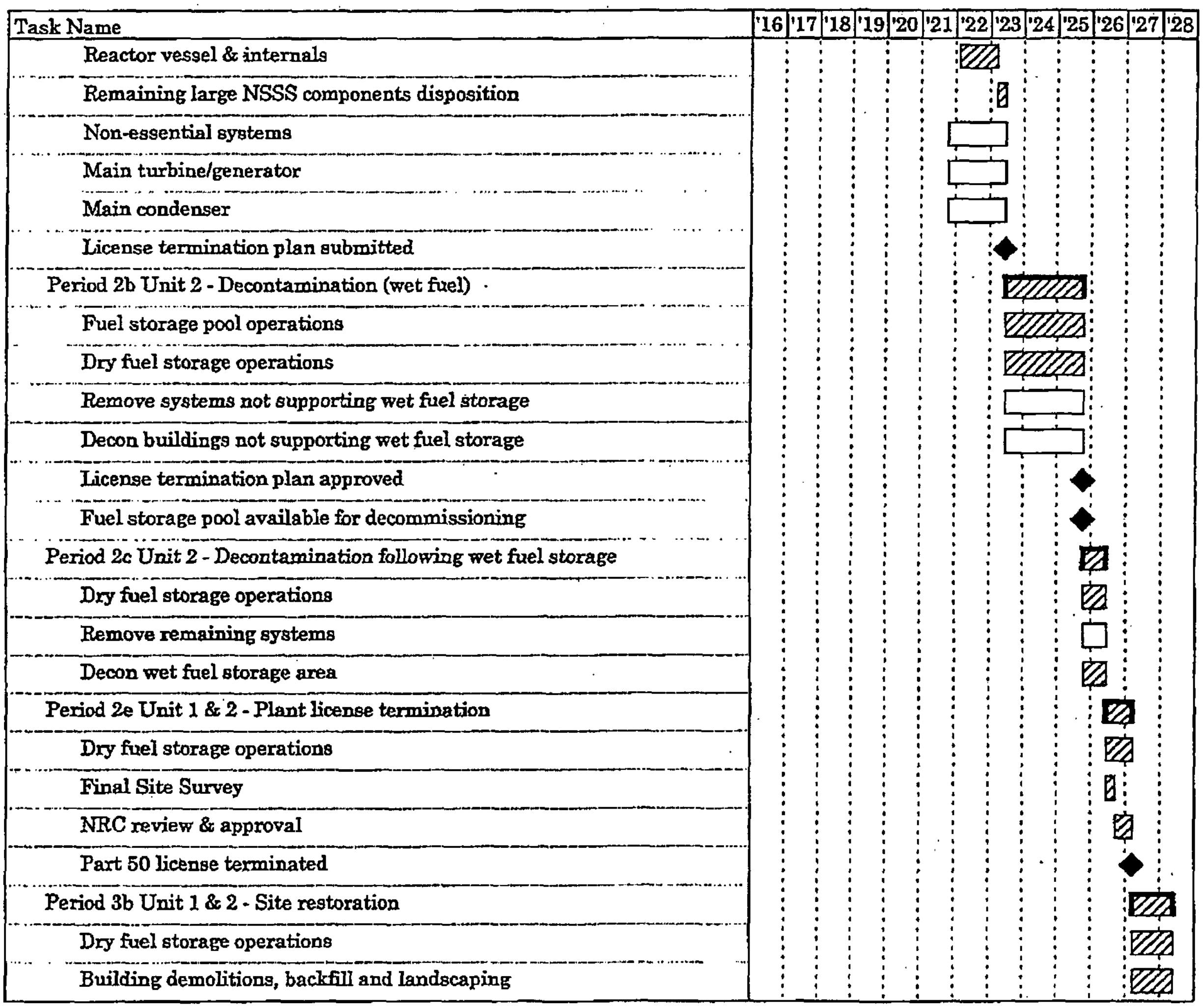


FIGURE 4.1

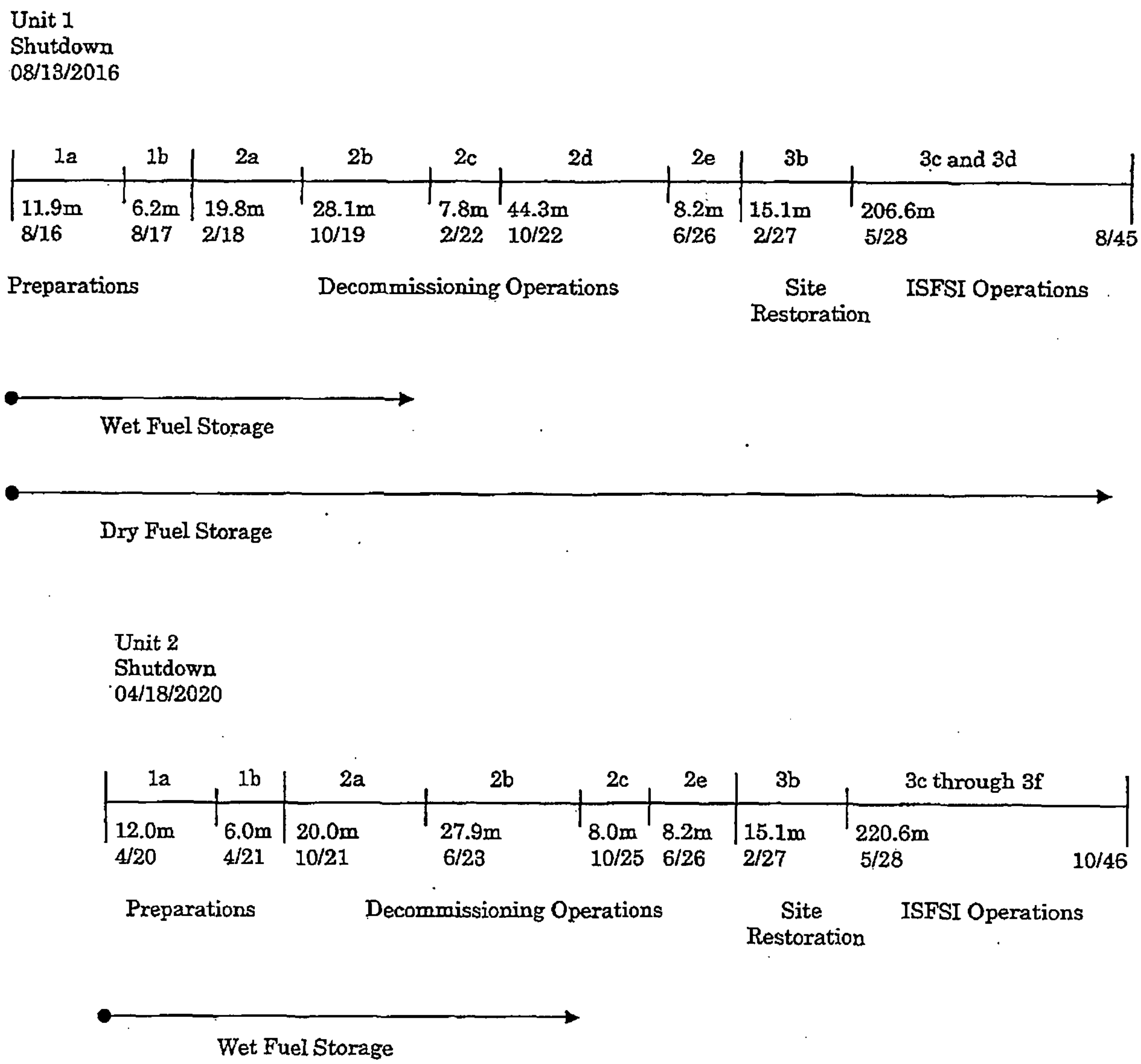
(continued)



Milestone ◆ Summary task
Critical Path Task Performed During Period

FIGURE 4.2

DECOMMISSIONING TIMELINE
(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,[22] 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 §71 defines radioactive material and 10 CFR §61 specifies its disposition.

Most of the materials being transported for controlled burial are categorized as Low Specific Activity (LSA) or Surface Contaminated Object (SCO) materials containing Type A quantities, as defined in 49 CFR §173-178. Shipping containers are required to be Industrial Packages (IP-1, IP-2 or IP-3). 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 Tables 5.1 and 5.2. The quantified waste volume summaries shown in these tables are consistent with §61 classifications. The volumes are calculated based on the exterior dimensions for containerized material. The volumes are calculated 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 and 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 canisters.

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 time 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 Salem Station will primarily be generated during Period 2. Material considered potentially contaminated when removed from the radiologically controlled area will be sent to processing facilities for conditioning and disposal at a unit cost of $2.00 per pound. Heavily contaminated components and activated materials will be routed for controlled disposal. The disposal volumes reported in the tables reflect the savings resulting from reprocessing and recycling.

For purposes of constructing the estimate, the rate schedule for the Barnwell facility was used as a proxy for the higher activity waste. This schedule was used to estimate the disposal fees for the majority of plant components and activated concrete deemed unsuitable for processing or recovery. An average disposal rate of $415 per cubic foot was used, with additional surcharges for activity, dose rate and/or handling added, as appropriate for the particular package.

The remaining volume of contaminated metallic and concrete debris will be disposed of at the Envirocare facility. This includes lower activity material such as miscellaneous steel, metal siding, scaffolding and structural steel. A rate of $298 per cubic foot was used for containerized waste, $70 per cubic foot for disposal of DAW, and approximately $20 per cubic foot for bulk material, e.g., concrete.

TABLE 5.1

DECOMMISSIONING WASTE SUMMARY - UNIT 1

	Waste Class[1]	Volume (cubic feet)	Weight (pounds)
Low-Level Radioactive Waste			
Barnwell, South Carolina (contaminated/activated metallic waste and concrete)			
	A	67,763	6,908,944
	B	13,149	1,959,703
	C	459	48,448
Envirocare, Utah (miscellaneous steel, contaminated/activated concrete)			
Containerized/DAW	A	5,186	444,519
Bulk	A	18,219	863,724
Geologic Repository (Greater-than Class C)			
	>C	613	126,165
Total [2]		105,389	10,351,503
Processed Waste (Off-Site)		72,765	
Scrap Metal			96,278,000

1 Waste is classified according to the requirements as delineated in Title 10 CFR, Part 61.55
2 Columns may not add due to rounding.

TABLE 5.2

DECOMMISSIONING WASTE SUMMARY - UNIT 2

	Waste Class[1]	Volume (cubic feet)	Weight (pounds)
Low-Level Radioactive Waste			
Barnwell, South Carolina (contaminated/activated metallic waste and concrete)			
	A	68,016	6,930,802
	B	13,167	1,961,982
	C	459	48,448
Envirocare, Utah (miscellaneous steel, contaminated/activated concrete)			
Containerized/DAW	A	12,184	1,244,448
Bulk	A	18,276	885,906
Geologic Repository (Greater-than Class C)			
	>C	613	126,165
Total [2]		112,714	11,197,751
Processed Waste (Off-Site)		74,384	
Scrap Metal			108,886,000

1 Waste is classified according to the requirements as delineated in Title 10 CFR, Part 61.55
2 Columns may not add due to rounding.

6. RESULTS

Costs were developed to decommission the Salem Station following a scheduled cessation of plant operations. The analysis relied upon the site-specific, technical information developed for a previous analysis prepared in 1995-96, then updated to reflect current plant conditions and operating assumptions. While not an engineering study, the estimates do provide PSEG Power 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, low-level radioactive waste disposal practices, high-level radioactive waste management options, and site restoration requirements. The decommissioning scenario assumes continued operation of the plant's spent fuel pool for approximately five years following the cessation of operations for continued cooling of the assemblies. An ISFSI will be used to safeguard the spent fuel, once sufficiently cooled, until such time that the DOE can complete the transfer of the assemblies to its repository. The scenarios also include the costs for the dismantling of non-essential structures and limited restoration of the site.

The costs projected to promptly decommission Salem Station are estimated to be $1,154.6 million. The majority of this cost (approximately 92.6%) is associated with the physical decontamination and dismantling of the nuclear units and caretaking of the spent fuel, so that the license could be terminated. The remaining 7.4% is for the demolition of the remaining structures and limited restoration of the site.

The primary cost contributors, identified in Tables 6.1 and 6.2, 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 PSEG Nuclear will oversee the decommissioning program, managing 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 have been terminated, the staff is substantially reduced for the conventional demolition and restoration of the site, and the long-term care of the spent fuel.

As described in this report, the spent fuel pools will remain operational for approximately five years following the cessation of plant operations. The pools will be isolated and independent spent fuel islands created. This will allow decommissioning operations to proceed in and around the Fuel Handling Building. Over the five-year period, the spent fuel will be packaged into transportable steel canisters for loading into a DOE-provided transport cask. The canisters will be stored in concrete overpacks at the ISFSI until DOE is able to receive them. Dry storage of the fuel under a separate license provides additional flexibility in the event DOE is not able to meet the current timetable for completing the transfer of assemblies to an off-site facility and minimizes the associated caretaking expenses incurred by PSEG Nuclear.

The cost for waste disposal includes only those costs associated with the controlled disposition of the low-level radioactive waste generated from decontamination and dismantling activities, including plant equipment and components, structural material, filters, resins and dry-active waste. As described in Section 5, disposal of the lower level material, including concrete and structural steel, will be at the Envirocare facility. The more highly radioactive material will be sent to the Barnwell facility, with the exception of selected reactor vessel components. 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.

A significant portion of the metallic waste is designated for additional processing and treatment at an off-site facility. Processing reduces the volume of material requiring controlled disposal through such techniques and processes as survey and sorting, decontamination and volume reduction. The material that cannot be unconditionally released will be packaged for controlled disposal at one of the currently operating facilities. The costs identified for processing are all-inclusive, incorporating the ultimate disposition of the material.

Removal costs reflect the labor-intensive nature of the decommissioning process and 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. The methods employed in decontamination and dismantling are generally destructive and indiscriminate in inflicting collateral damage. 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 could be more cost-effective than deferral, due to the ultimate deterioration of facilities (and therefore the working conditions).

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 estimate, material will be primarily moved overland by truck.

Decontamination will be used to reduce the plant's radiation fields and minimize worker exposure. Slightly contaminated material or material located within a contaminated area will be sent to an off-site processing center, i.e., this estimate does not assume that contaminated plant components and equipment could be economically decontaminated for uncontrolled release in-situ. Centralized processing centers have proven to be a more efficient means of handling the large volumes of material produced in the dismantling of a nuclear unit.

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 need to be confirmed and will add to the expense of surveying the facilities alone.

The remaining costs include allocations for heavy equipment and temporary services, and other expenses such as regulatory fees and the 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 or regulatory level.

TABLE 6.1

SUMMARY OF DECOMMISSIONING COST ELEMENTS
UNIT 1

Work Category	**Cost 2002$ (thousands)**	**Percent of Total Costs**
Decontamination	13,462.7	2.4
Removal	79,587.2	14.3
Packaging	11,726.5	2.1
Transportation	11,632.0	2.1
Waste Disposal	80,910.9	14.6
Off-site Waste Processing	16,802.4	3.0
Program Management (including Engineering and Security)	233,535.0	42.0
Spent Fuel Pool Isolation	9,060.3	1.6
ISFSI Related (including capital)	67,206.7	12.1
Insurance and Regulatory Fees	11,463.9	2.1
Energy	8,045.7	1.4
Characterization and Licensing Surveys	6,439.9	1.2
Misc. Equipment and Site Services	6,025.8	1.1
Total	555,898.9	100.0

Note: Columns may not add due to rounding

TABLE 6.2

SUMMARY OF DECOMMISSIONING COST ELEMENTS
UNIT 2

Work Category	Cost 2002$ (thousands)	Percent of Total Costs
Decontamination	13,577	2.3
Removal	100,874	16.8
Packaging	11,746	2.0
Transportation	11,734	2.0
Waste Disposal	82,039	13.7
Off-site Waste Processing	17,175	2.9
Program Management (including Engineering and Security)	272,325	45.5
Spent Fuel Pool Isolation	6,040	1.0
ISFSI Related (including capital)	53,776	9.0
Insurance and Regulatory Fees	9,209	1.5
Energy	7,344	1.2
Characterization and Licensing Surveys	6,440	1.1
Misc. Equipment and Site Services	6,423	1.1
Total	598,702	100.0

Note: Columns may not add due to rounding

7. REFERENCES

1. 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.

2. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," August 1990.

3. U.S. Code of Federal Regulations, Title 10, Parts 2, 50 and 51, "Decommissioning of Nuclear Power Reactors," Nuclear Regulatory Commission, Federal Register Volume 61 (p 39278 et seq.), July 29, 1996.

4. "Nuclear Waste Policy Act of 1982 and Amendments," U.S. Department of Energy's Office of Civilian Radioactive Management, 1982.

5. Maine Yankee Atomic Power Company, Connecticut Yankee Atomic Power Company, and Yankee Atomic Power Company v. United States, U.S. Court of Appeals for the Federal Circuit decision, Docket No. 99-5138, -5139, -5140, August 31, 2000.

6. U.S. Code of Federal Regulations, Title 10, Part 50 – Domestic Licensing of Production and Utilization Facilities, Subpart 54 (bb), "Conditions of Licenses," January 2001 Edition.

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

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9. "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," NUREG/CR-1575, EPA 402-R-97-016, December 1997.

10. "Decommissioning Cost Estimate for the Salem Generating Station," Document No. P07-1180-005, TLG Services, Inc., September 1996.

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

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

13. "Building Construction Cost Data 2002," Robert Snow Means Company, Inc., Kingston, Massachusetts.

14. Project and Cost Engineers' Handbook, Second Edition, p. 239, American Association of Cost Engineers, Marcel Dekker, Inc., New York, New York, 1984.

15. "Strategy for Management and Disposal of Greater-Than-Class C Low-Level Radioactive Waste," Federal Register Volume 60, Number 48 (p 13424 et seq.), March 1995.

16. U.S. Department of Transportation, Section 49 of the Code of Federal Regulations, "Transportation," Parts 173 through 178, 1996.

17. Tri-State Motor Transit Company, published tariffs, Interstate Commerce Commission (ICC), Docket No. MC-109397 and Supplements, 2000.

18. J.C. Evans et al., "Long-Lived Activation Products in Reactor Materials" NUREG/CR-3474, Pacific Northwest Laboratory for the Nuclear Regulatory Commission. August 1984.

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APPENDIX A

UNIT COST FACTOR DEVELOPMENT

APPENDIX A
UNIT COST FACTOR DEVELOPMENT

Example: Unit Factor for Removal of Contaminated Heat Exchanger < 3,000 lbs.

1. SCOPE

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

2. CALCULATIONS

Act ID	Activity Description	Activity Duration	Critical Duration
a	Remove insulation	60	(b)
b	Mount pipe cutters	60	60
c	Install contamination controls	20	(b)
d	Disconnect inlet and outlet lines	60	60
e	Cap openings	20	(d)
f	Rig for removal	30	30
g	Unbolt from mounts	30	30
h	Remove contamination controls	15	15
i	Remove, wrap in plastic, send to the waste processing area	60	60
	Totals (Activity/Critical)	355	255

Duration adjustment(s):	
+ Respiratory protection adjustment (50% of critical duration)	128
+ Radiation/ALARA adjustment (37.08% of critical duration)	95
Adjusted work duration	478
+ Protective clothing adjustment (30% of adjusted duration)	143
Productive work duration	621
+ Work break adjustment (8.33 % of productive duration)	52
Total work duration min	673 min

***** Total duration = 11.217 hr *****

APPENDIX A
(continued)

3. LABOR REQUIRED

Crew	Number	Duration (hr)	Rate ($/hr)	Cost
Laborers	3.00	11.217	40.61	1,366.57
Craftsmen	2.00	11.217	56.29	1,262.81
Foreman	1.00	11.217	60.17	674.93
General Foreman	0.25	11.217	67.66	189.74
Fire Watch	0.05	11.217	40.61	22.78
Health Physics Technician	1.00	11.217	45.90	514.86
Total labor cost				$4,031.69

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
-Gas torch consumables 1 @ $4.57/hr x 1 hr {1}	$4.57
-Blotting paper 50 @ $0.47 sq ft {2}	$23.50
-Plastic sheets/bags 50 @ $0.12/sq ft {3}	$6.00
Subtotal cost of equipment and materials	$34.07
Overhead & sales tax on equipment and materials @ 16.00 %	$5.45
Total costs, equipment & material	$39.52

TOTAL COST:

Removal of contaminated heat exchanger <3000 pounds: $4,071.21

Total labor cost:	$4,031.69
Total equipment/material costs:	$39.52
Total craft labor man-hours required per unit:	81.884

5. NOTES AND REFERENCES

- Work difficulty factors were developed in conjunction with the AIF (now NEI) program to standardize nuclear decommissioning cost estimates and are delineated in Volume 1, Chapter 5 of the "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

- References for equipment & consumables costs:

    1. R.S. Means (2002) Division 01590, Section 400-6360 pg 24
    2. McMaster-Carr Ed. 106 pg 1778
    3. R.S. Means (2002) Division 01540, Section 800-0200 pg 17

- Material and consumable costs were adjusted using the regional indices for Wilmington, Delaware.

APPENDIX B

UNIT COST FACTOR LISTING
(DECON: Power Block Structures Only)

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean instrument and sampling tubing, $/linear foot	0.46
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	4.80
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	6.93
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	13.70
Removal of clean pipe >8 to 14 inches diameter, $/linear foot	26.29
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	34.03
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	50.10
Removal of clean pipe >36 inches diameter, $/linear foot	59.60
Removal of clean valves >2 to 4 inches	91.18
Removal of clean valves >4 to 8 inches	136.96
Removal of clean valves >8 to 14 inches	262.88
Removal of clean valves >14 to 20 inches	340.30
Removal of clean valves >20 to 36 inches	501.04
Removal of clean valves >36 inches	595.95
Removal of clean pipe fittings >2 to 4 in	101.25
Removal of clean pipe fittings >4 to 8 in	160.64
Removal of clean pipe fittings >8 to 14 in	262.88
Removal of clean pipe fittings >14 to 20	340.30
Removal of clean pipe fittings > 20 to 36	501.04
Removal of clean pipe hangers for small bore piping	28.12
Removal of clean pipe hangers for large bore piping	103.45
Removal of clean pumps, <300 pound	227.86
Removal of clean pumps, 300-1000 pound	640.33
Removal of clean pumps, 1000-10,000 pound	2,542.96
Removal of clean pumps, >10,000 pound	4,906.95

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of clean pump motors, 300-1000 pound	271.14
Removal of clean pump motors, 1000-10,000 pound	1,061.82
Removal of clean pump motors, >10,000 pound	2,389.10
Removal of clean turbine-driven pumps > 10,000 pounds	6,577.50
Removal of clean heat exchanger <3000 pound	1,363.81
Removal of clean heat exchanger >3000 pound	3,417.62
Removal of clean feedwater heater/deaerator	9,646.37
Removal of clean moisture separator/reheater	19,849.31
Removal of clean tanks, <300 gallons	293.47
Removal of clean tanks, 300-3000 gallons	931.33
Removal of clean tanks, >3000 gallons, $/square foot surface area	7.81
Removal of clean electrical equipment, <300 pound	126.22
Removal of clean electrical equipment, 300-1000 pound	441.45
Removal of clean electrical equipment, 1000-10,000 pound	882.90
Removal of clean electrical equipment, >10,000 pound	2,112.91
Removal of clean electrical transformers < 30 tons	1,467.39
Removal of clean electrical transformers > 30 tons	4,225.80
Removal of clean standby diesel-generator, <100 kW	1,498.81
Removal of clean standby diesel-generator, 100 kW to 1 MW	3,345.43
Removal of clean standby diesel-generator, >1 MW	6,925.72
Removal of clean electrical cable tray, $/linear foot	11.66
Removal of clean electrical conduit, $/linear foot	5.08
Removal of clean mechanical equipment, <300 pound	126.22
Removal of clean mechanical equipment, 300-1000 pound	441.45
Removal of clean mechanical equipment, 1000-10,000 pound	882.90
Removal of clean mechanical equipment, >10,000 pound	2,112.91
Removal of clean HVAC equipment, <300 pound	126.22

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of clean HVAC equipment, 300-1000 pound	441.45
Removal of clean HVAC equipment, 1000-10,000 pound	882.90
Removal of clean HVAC equipment, >10,000 pound	2,112.91
Removal of clean HVAC ductwork, $/pound	0.48
Removal of contaminated instrument and sampling tubing, $/linear foot	1.42
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	18.49
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	32.88
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	52.70
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	103.92
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	125.17
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	174.16
Removal of contaminated pipe >36 inches diameter, $/linear foot	206.34
Removal of contaminated valves >2 to 4 inches	409.23
Removal of contaminated valves >4 to 8 inches	491.64
Removal of contaminated valves >8 to 14 inches	1,004.93
Removal of contaminated valves >14 to 20 inches	1,279.12
Removal of contaminated valves >20 to 36 inches	1,707.42
Removal of contaminated valves >36 inches	2,029.16
Removal of contaminated pipe fittings >2 to 4 inches	222.48
Removal of contaminated pipe fittings > 4 to 8 inches	562.42
Removal of contaminated pipe fittings > 8 to 14 inches	1,004.93
Removal of contaminated pipe fittings > 14 to 20 inches	1,279.12
Removal of contaminated pipe fittings >20 to 36 inches	1,707.42
Removal of contaminated pipe hangers for small bore piping	96.90
Removal of contaminated pipe hangers for large bore piping	317.71
Removal of contaminated pumps, <300 pound	872.56
Removal of contaminated pumps, 300-1000 pound	2,038.66
Removal of contaminated pumps, 1000-10,000 pound	6,721.04

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated pumps, >10,000 pound	16,369.44
Removal of contaminated pump motors, 300-1000 pound	856.70
Removal of contaminated pump motors, 1000-10,000 pound	2,726.06
Removal of contaminated pump motors, >10,000 pound	6,120.23
Removal of contaminated turbine-driven pumps < 10,000 pounds	18,918.88
Removal of contaminated heat exchanger <3000 pound	4,071.21
Removal of contaminated heat exchanger >3000 pound	11,752.21
Removal of contaminated feedwater heater / deaerator	28,760.26
Removal of contaminated moisture separator / reheater	63,002.71
Removal of contaminated tanks, <300 gallons	1,448.59
Removal of contaminated tanks, >300 gallons, $/square foot	28.80
Removal of contaminated electrical equipment, <300 pound	684.21
Removal of contaminated electrical equipment, 300-1000 pound	1,664.73
Removal of contaminated electrical equipment, 1000-10,000 pound	3,204.54
Removal of contaminated electrical equipment, >10,000 pound	6,299.81
Removal of electrical transformers < 30 tons	5,079.02
Removal of electrical transformers > 30 tons	12,470.88
Removal of standby diesel-generator, < 100 kW	4,387.47
Removal of standby diesel-generator, 100 kW to 1 MW	9,471.87
Removal of standby diesel-generator, >1 MW	20,474.76
Removal of contaminated electrical cable tray, $/linear foot	32.93
Removal of contaminated electrical conduit, $/linear foot	14.92
Removal of contaminated mechanical equipment, <300 pound	761.89
Removal of contaminated mechanical equipment, 300-1000 pound	1,841.14
Removal of contaminated mechanical equipment, 1000-10,000 pound	3,538.42

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated mechanical equipment, >10,000 pound	6,299.81
Removal of contaminated HVAC equipment, <300 pound	761.89
Removal of contaminated HVAC equipment, 300-1000 pound	1,841.14
Removal of contaminated HVAC equipment, 1000-10,000 pound	3,538.42
Removal of contaminated HVAC equipment, >10,000 pound	6,299.81
Removal of contaminated HVAC ductwork, $/pound	3.03
Removal of clean standard reinforced concrete, $/cubic yard	72.07
Removal of grade slab concrete, $/cubic yard	204.33
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	211.46
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	267.46
Removal of below-grade suspended floors, $/cubic yard	316.55
Removal of clean monolithic concrete structures, $/cubic yard	1,897.58
Removal of clean foundation concrete, $/cubic yard	626.97
Removal of clean hollow masonry block wall, $/cubic yard	75.24
Removal of clean solid masonry block wall, $/cubic yard	75.24
Placement of concrete for below-grade voids, $/cubic yard	99.90
Removal of subterranean tunnels/voids, $/ linear foot	141.76
Backfill of below grade voids, $/cubic yard	17.31
Excavation of clean material, $cubic yard	3.05
Removal of clean building metal siding, $/square foot	1.34
Removal of standard asphalt roofing, $/square foot	2.15
Removal of Galbestos panels, $/square foot	2.19
Scarifying contaminated concrete surfaces (drill & spall), $/square foot	12.54
Scabbling contaminated concrete floors, $/square foot	7.42
Scabbling contaminated concrete walls, $/square foot	8.15
Scabbling contaminated ceilings, $/square foot	73.38
Removal of clean overhead cranes/monorails < 10 ton capacity, each	623.14
Removal of contaminated overhead cranes/monorails < 10 ton capacity, ea.	1,734.71

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of clean overhead cranes/monorails >10-50 ton capacity, each	1,495.51
Removal of contaminated overhead cranes/monorails >10-50 ton capacity, each	4,162.61
Removal of polar cranes > 50 ton capacity, each	6,286.50
Removal of gantry cranes > 50 ton capacity, each	26,411.28
Removal of clean structural steel, $/pound	0.35
Removal of clean steel floor grating, $/square foot	3.19
Removal of contaminated steel floor grating, $/square foot	9.69
Removal of clean free-standing steel liner, $/square foot	33.75
Removal of clean concrete-anchored steel liner, $/square foot	5.85
Removal of contaminated concrete-anchored steel liner, $/square foot	39.31
Placement of scaffolding in clean areas, $/square foot	13.73
Placement of scaffolding in contaminated areas, $/square foot	22.10
Removal of chain link fencing, $/linear foot	2.10
Removal of asphalt pavement, $/square foot	1.05
Core drilling 2 to 4 inch diameter, linear foot	354.68

APPENDIX C

DETAILED COST ANALYSES

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	41	6	47	47	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	62	9	72	72	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	144	22	165	165	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	31	5	36	36	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	31	5	36	36	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	41	6	47	47	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	234	35	269	269	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	97	15	111	111	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Perform Site-Specific Cost Study	-	-	-	-	-	-	156	23	179	179	-	-	-	-	-	-	-	-	-	5,000
1a.1.15	Prepare/submit License Termination Plan	-	-	-	-	-	-	128	19	147	147	-	-	-	-	-	-	-	-	-	4,096
1a.1.16	Receive NRC approval of termination plan									a											
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	154	23	177	159	-	18	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	130	20	150	135	-	15	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	16	2	18	18	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	222	33	255	255	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	203	30	233	233	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Biological shield	-	-	-	-	-	-	16	2	18	18	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Steam generators	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	3,120
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	50	7	57	29	-	29	-	-	-	-	-	-	-	1,600
1a.1.17.9	Turbine & condenser	-	-	-	-	-	-	25	4	29	-	-	29	-	-	-	-	-	-	-	800
1a.1.17.10	Plant structures & buildings	-	-	-	-	-	-	97	15	112	56	-	56	-	-	-	-	-	-	-	3,120
1a.1.17.11	Waste management	-	-	-	-	-	-	144	22	165	165	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.12	Facility & site closeout	-	-	-	-	-	-	28	4	32	16	-	16	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	1,180	177	1,357	1,195	-	162	-	-	-	-	-	-	-	37,827
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	75	11	86	86	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svces	-	-	-	-	-	-	2,304	346	2,650	2,650	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	44	7	50	50	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	1,950	293	2,243	2,243	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	38	6	44	44	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	6,556	988	7,539	7,376	-	162	-	-	-	-	-	-	-	73,753
1a.2	Subtotal Period 1a Additional Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	731	73	804	804	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	331	-	-	-	-	-	83	413	413	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	349	-	-	-	-	-	52	401	401	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	10	3	-	37	-	11	61	61	-	-	-	535	-	-	-	10,725	131	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	949	142	1,092	1,092	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	302	30	332	332	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	34	3	37	-	37	-	-	-	-	-	-	-	-	-

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
	Period 1a Period-Dependent Costs (continued)																				
1a.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	951	143	1,093	-	1,093	-	-	-	-	-	-	-	-	-
1a.4.10	ISRA Compliance Staff	-	-	-	-	-	-	814	122	936	936	-	-	-	-	-	-	-	-	-	-
1a.4.11	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	23	3	26	-	26	-	-	-	-	-	-	-	-	-
1a.4.12	Security Staff Cost	-	-	-	-	-	-	528	79	607	607	-	-	-	-	-	-	-	-	-	27,189
1a.4.13	Utility Staff Cost	-	-	-	-	-	-	18,980	2,847	21,827	21,827	-	-	-	-	-	-	-	-	-	296,983
1a.4	Subtotal Period 1a Period-Dependent Costs	-	680	10	3	-	37	23,311	3,589	27,630	26,478	1,157	-	-	535	-	-	-	10,725	131	324,171
1a.0	TOTAL PERIOD 1a COST	-	680	10	3	-	37	29,868	4,572	35,168	33,849	1,157	162	-	535	-	-	-	10,725	131	397,924
	PERIOD 1b - Decommissioning Preparations																				
	Period 1b Direct Decommissioning Activities																				
	Detailed Work Procedures																				
1b.1.1.1	Plant systems	-	-	-	-	-	-	148	22	170	153	-	17	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	31	5	36	36	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	78	12	90	90	-	-	-	-	-	-	-	-	-	2,500
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	42	6	48	12	-	36	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	31	5	36	36	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	31	5	36	36	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	31	5	36	36	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	113	17	130	130	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	37	6	43	22	-	22	-	-	-	-	-	-	-	1,200
1b.1.1.10	Missile shields	-	-	-	-	-	-	14	2	16	16	-	-	-	-	-	-	-	-	-	450
1b.1.1.11	Biological shield	-	-	-	-	-	-	37	6	43	43	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.12	Steam generators	-	-	-	-	-	-	144	22	165	165	-	-	-	-	-	-	-	-	-	4,600
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	31	5	36	18	-	18	-	-	-	-	-	-	-	1,000
1b.1.1.14	Turbine & condensers	-	-	-	-	-	-	97	15	112	-	-	112	-	-	-	-	-	-	-	3,120
1b.1.1.15	Auxiliary building	-	-	-	-	-	-	85	13	98	88	-	10	-	-	-	-	-	-	-	2,730
1b.1.1.16	Reactor building	-	-	-	-	-	-	85	13	98	88	-	10	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	1,037	156	1,193	968	-	224	-	-	-	-	-	-	-	33,243
1b.1.2	Decon primary loop	1,134	-	-	-	-	-	-	567	1,701	1,701	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	1,134	-	-	-	-	-	1,037	722	2,893	2,669	-	224	-	-	-	-	-	-	1,067	33,243
	Period 1b Additional Costs																				
1b.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	5,252	788	6,040	6,040	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	696	104	800	800	-	-	-	-	-	-	-	-	-	-
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	5,948	892	6,840	6,840	-	-	-	-	-	-	-	-	-	-
	Period 1b Collateral Costs																				
1b.3.1	Decon equipment	710	-	-	-	-	-	-	107	817	817	-	-	-	-	-	-	-	-	-	-
1b.3.2	Process liquid waste	57	-	503	496	-	4,793	-	1,352	7,205	7,205	-	-	-	-	5,919	-	-	981,415	210	-
1b.3.3	Small tool allowance	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	-	-
1b.3.4	Pipe cutting equipment	-	911	-	-	-	-	-	137	1,048	1,048	-	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	767	912	503	496	-	4,793	-	1,596	9,070	9,070	-	-	-	-	5,919	-	-	981,415	210	-
	Period 1b Period-Dependent Costs																				
1b.4.1	Decon supplies	22	-	-	-	-	-	-	5	27	27	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	365	37	402	402	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 1b Period-Dependent Costs (continued)																					
1b.4.4	Health physics supplies	-	170	-	-	-	-	-	42	212	212	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	174	-	-	-	-	-	26	201	201	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	5	1	-	20	-	6	32	32	-	-	-	284	-	-	-	5,694	70	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	949	142	1,092	1,092	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	182	18	200	200	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	17	2	19	-	19	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	475	71	547	-	547	-	-	-	-	-	-	-	-	-
1b.4.11	ISRA Compliance Staff	-	-	-	-	-	-	407	61	468	468	-	-	-	-	-	-	-	-	-	-
1b.4.12	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	12	2	13	-	13	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	264	40	303	303	-	-	-	-	-	-	-	-	-	13,594
1b.4.14	Utility Staff Cost	-	-	-	-	-	-	9,490	1,423	10,913	10,913	-	-	-	-	-	-	-	-	-	148,491
1b.4	Subtotal Period 1b Period-Dependent Costs	22	344	5	1	-	20	12,161	1,876	14,430	13,851	578	-	-	284	-	-	-	5,694	70	162,086
1b.0	TOTAL PERIOD 1b COST	1,923	1,256	508	498	-	4,816	19,147	5,086	33,233	32,431	578	224	-	284	5,919	-	-	987,109	1,347	193,329
PERIOD 1 TOTALS		1,923	1,936	518	501	-	4,854	49,013	9,658	68,402	66,280	1,735	886	-	819	5,919	-	-	997,834	1,478	593,253
PERIOD 2a - Large Component Removal																					
Period 2a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
2a.1.1.1	Reactor Coolant Piping	280	255	30	20	-	906	-	436	1,928	1,928	-	-	-	2,038	-	-	-	185,321	10,107	-
2a.1.1.2	Pressurizer Relief Tank	30	26	5	3	-	179	-	67	310	310	-	-	-	329	-	-	-	36,553	527	-
2a.1.1.3	Reactor Coolant Pumps & Motors	81	90	43	1,843	107	3,376	-	1,204	6,744	6,744	-	-	248	3,192	-	-	-	690,870	3,580	-
2a.1.1.4	Pressurizer	44	56	371	460	-	1,487	-	514	2,933	2,933	-	-	-	2,589	-	-	-	304,295	2,845	-
2a.1.1.5	Steam Generators	373	2,136	870	5,391	-	16,902	100	5,842	31,613	31,613	-	-	-	31,467	-	-	-	3,456,553	13,321	-
2a.1.1.6	CRDMs/ICIs/Service Structure Removal	152	97	124	17	-	420	-	220	1,031	1,031	-	-	-	8,881	-	-	-	86,025	4,564	-
2a.1.1.7	Reactor Vessel Internals	118	1,871	4,979	537	-	4,726	214	5,812	17,857	17,857	-	-	-	1,377	903	459	-	326,029	31,608	1,396
2a.1.1.8	Reactor Vessel	90	3,433	1,504	365	-	5,672	214	5,955	17,233	17,233	-	-	-	6,511	2,254	-	-	948,723	31,608	1,396
2a.1.1	Totals	1,168	8,064	7,926	8,636	107	33,668	528	19,550	79,648	79,648	-	-	248	51,384	3,156	459	-	6,036,370	98,161	2,793
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	474	55	11	715	-	-	233	1,488	1,488	-	-	3,573	-	-	-	-	-	9,244	-
2a.1.3	Main Condensers	-	1,607	63	11	689	-	-	512	2,872	2,872	-	-	3,446	-	-	-	-	-	31,671	-
Disposal of Plant Systems																					
2a.1.4.1	Auxiliary Feedwater	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	892	-
2a.1.4.2	Auxiliary Feedwater (RCA)	-	281	2	4	293	-	-	115	697	697	-	-	1,466	-	-	-	-	-	5,393	-
2a.1.4.3	Bleed Steam & Heater Drains	-	140	-	-	-	-	-	21	162	-	-	162	-	-	-	-	-	-	2,984	-
2a.1.4.4	Circulating Water	-	229	-	-	-	-	-	34	264	-	-	264	-	-	-	-	-	-	4,757	-
2a.1.4.5	Circulating Water Sampling	-	5	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	104	-
2a.1.4.6	Condensate Polishing	-	904	6	12	761	-	-	343	2,025	2,025	-	-	8,806	-	-	-	-	-	17,777	-
2a.1.4.7	Condenser Air Removal & Priming	-	125	-	-	-	-	-	19	144	-	-	144	-	-	-	-	-	-	2,693	-
2a.1.4.8	Containment Spray	-	5	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	104	-
2a.1.4.9	Containment Spray (RCA)	-	106	4	7	481	-	-	100	699	699	-	-	2,403	-	-	-	-	-	2,075	-
2a.1.4.10	Equipment Vents & Drains - Contaminated	-	6	0	0	5	4	-	3	18	18	-	-	26	8	-	-	-	717	115	-
2a.1.4.11	Feedwater Chemical Treatment	-	9	-	-	-	-	-	1	10	-	-	10	-	-	-	-	-	-	182	-
2a.1.4.12	Generator Stator Cooling Water	-	27	-	-	-	-	-	4	31	-	-	31	-	-	-	-	-	-	568	-
2a.1.4.13	Heater Vents & Miscellaneous Drains	-	33	0	0	26	-	-	12	72	72	-	-	126	-	-	-	-	-	660	-
2a.1.4.14	Hydrogen & Carbon Dioxide	-	11	-	-	-	-	-	2	13	-	-	13	-	-	-	-	-	-	235	-
2a.1.4.15	Main & Reheat & Turbine By-Pass Steam	-	460	24	46	3,028	-	-	579	4,138	4,138	-	-	15,141	-	-	-	-	-	9,343	-

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
	Disposal of Plant Systems (continued)																				
2a.1.4.16	Main Turbine Lubricating Oil	-	101	-	-	-	-	-	15	116	-	-	116	-	-	-	-	-	-	2,099	-
2a.1.4.17	Miscellaneous Condensate	-	50	-	-	-	-	-	7	57	-	-	57	-	-	-	-	-	-	1,031	-
2a.1.4.18	Moisture Separator Rehtrs Steam & Drains	-	437	3	5	328	-	-	159	931	931	-	-	1,638	-	-	-	-	-	8,614	-
2a.1.4.19	Oil Water Separator	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	907	-
2a.1.4.20	Steam Gen Drains & Blowdown	-	182	1	2	102	-	-	61	348	348	-	-	512	-	-	-	-	-	3,566	-
2a.1.4.21	Steam Gen Drains & Blowdown (RCA)	-	35	0	0	18	-	-	12	66	66	-	-	90	-	-	-	-	-	694	-
2a.1.4.22	Steam Gen Feed Pump & Turbine Lube Oil	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	611	-
2a.1.4.23	Steam Generator Feed & Condensate	-	343	-	-	-	-	-	51	394	-	-	394	-	-	-	-	-	-	7,097	-
2a.1.4.24	Turbine Auxiliaries Cooling	-	168	-	-	-	-	-	25	193	-	-	193	-	-	-	-	-	-	3,594	-
2a.1.4.25	Turbine Drains	-	36	0	1	36	-	-	15	88	88	-	-	182	-	-	-	-	-	724	-
2a.1.4.26	Turbine Electro-Hydraulic Control	-	4	-	-	-	-	-	1	4	-	-	4	-	-	-	-	-	-	73	-
2a.1.4.27	Turbine Gland Sealing Steam & Leak-Off	-	75	-	-	-	-	-	11	87	-	-	87	-	-	-	-	-	-	1,654	-
2a.1.4.28	Waste Disposal - Gas	-	90	5	3	128	99	-	67	392	392	-	-	640	233	-	-	-	20,293	1,805	-
2a.1.4	Totals	-	3,981	46	81	5,206	103	-	1,678	11,096	9,473	-	1,622	26,032	241	-	-	-	21,010	60,312	-
2a.1.5	Scaffolding in support of decommissioning	-	821	4	1	49	11	-	216	1,103	1,103	-	-	247	34	-	-	-	3,069	18,470	-
2a.1	Subtotal Period 2a Activity Costs	1,168	14,948	8,085	8,740	6,767	33,781	628	22,188	96,206	94,584	-	1,622	33,547	51,659	3,156	459	-	6,060,448	237,759	2,793
	Period 2a Additional Costs																				
2a.2.1	Curie Surcharge (Excluding RPV)	-	-	-	-	-	1,374	-	344	1,718	1,718	-	-	-	-	-	-	-	-	-	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	1,374	-	344	1,718	1,718	-	-	-	-	-	-	-	-	-	-
	Period 2a Collateral Costs																				
2a.3.1	Process liquid waste	73	-	28	65	-	314	-	127	606	606	-	-	-	-	510	-	-	64,257	100	-
2a.3.2	Small tool allowance	-	219	-	-	-	-	-	33	252	227	-	25	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	73	219	28	65	-	314	-	160	858	833	-	25	-	-	510	-	-	64,257	100	-
	Period 2a Period-Dependent Costs																				
2a.4.1	Decon supplies	72	-	-	-	-	-	-	18	90	90	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	1,216	122	1,338	1,338	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	1,364	-	-	-	-	-	341	1,705	1,705	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	3,144	-	-	-	-	-	472	3,615	3,615	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	86	24	-	324	-	93	526	526	-	-	-	4,622	-	-	-	92,621	1,135	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	1,501	225	1,726	1,726	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	523	52	576	576	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	56	6	62	-	62	-	-	-	-	-	-	-	-	-
2a.4.10	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	1,464	220	1,684	-	1,684	-	-	-	-	-	-	-	-	-
2a.4.11	Spent Fuel Pool O&M	-	-	-	-	-	-	1,582	237	1,819	-	1,819	-	-	-	-	-	-	-	-	-
2a.4.12	ISRA Compliance Staff	-	-	-	-	-	-	1,354	203	1,558	1,558	-	-	-	-	-	-	-	-	-	-
2a.4.13	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	38	6	44	-	44	-	-	-	-	-	-	-	-	-
2a.4.14	Security Staff Cost	-	-	-	-	-	-	2,380	357	2,737	2,737	-	-	-	-	-	-	-	-	-	122,670
2a.4.15	Utility Staff Cost	-	-	-	-	-	-	44,673	6,701	51,374	51,374	-	-	-	-	-	-	-	-	-	671,640
2a.4	Subtotal Period 2a Period-Dependent Costs	72	4,607	86	24	-	324	54,788	9,052	68,853	65,245	3,609	-	-	4,622	-	-	-	92,621	1,135	794,310
2a.0	TOTAL PERIOD 2a COST	1,313	19,675	8,199	8,828	6,767	35,793	55,316	81,744	167,635	162,379	3,609	1,647	33,547	56,281	3,666	459	-	6,217,326	238,994	797,103

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	Building & Equipment Drains-Conventional	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	860	-
2b.1.1.2	Chem & Vol Ctrl - Boric Acid Recovery	519	507	41	8	218	845	-	636	2,774	2,774	-	-	1,088	2,376	-	-	-	172,868	19,342	-
2b.1.1.3	Chem & Vol Ctrl - Primary Water Recovery	353	347	28	6	158	565	-	432	1,890	1,890	-	-	788	1,630	-	-	-	115,643	13,399	-
2b.1.1.4	Chem & Vol Ctrl Operation	455	532	34	6	71	700	-	550	2,349	2,349	-	-	354	1,685	-	-	-	143,288	19,071	-
2b.1.1.5	Chilled Water	-	185	-	-	-	-	-	28	213	-	-	213	-	-	-	-	-	-	4,017	-
2b.1.1.6	Chilled Water (RCA)	-	197	1	2	138	-	-	70	408	408	-	-	689	-	-	-	-	-	3,683	-
2b.1.1.7	Component Cooling	-	16	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	345	-
2b.1.1.8	Component Cooling (RCA)	-	355	8	15	986	-	-	240	1,603	1,603	-	-	4,928	-	-	-	-	-	6,838	-
2b.1.1.9	Compressed Air	-	111	-	-	-	-	-	17	128	-	-	128	-	-	-	-	-	-	2,369	-
2b.1.1.10	Compressed Air (RCA)	-	78	0	1	85	-	-	25	189	189	-	-	174	-	-	-	-	-	1,654	-
2b.1.1.11	Control Air - Auxiliary Building	-	131	1	2	128	-	-	52	315	315	-	-	640	-	-	-	-	-	2,673	-
2b.1.1.12	Control Air - Containment Building	-	42	0	1	40	-	-	17	99	99	-	-	200	-	-	-	-	-	860	-
2b.1.1.13	Control Air - Penetration Area	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	672	-
2b.1.1.14	Control Air - Turbine Generator Area	-	46	-	-	-	-	-	7	53	-	-	53	-	-	-	-	-	-	965	-
2b.1.1.15	Demineralized Water - Restricted Areas	-	59	0	1	46	-	-	22	129	129	-	-	232	-	-	-	-	-	1,123	-
2b.1.1.16	Demineralized Water Make-up	-	437	-	-	-	-	-	66	503	-	-	503	-	-	-	-	-	-	9,096	-
2b.1.1.17	Diesel Engine Auxiliaries	-	128	-	-	-	-	-	19	148	-	-	148	-	-	-	-	-	-	2,602	-
2b.1.1.18	Electrical	-	3,421	-	-	-	-	-	513	3,934	-	-	3,934	-	-	-	-	-	-	69,784	-
2b.1.1.19	Electrical (RCA - Clean)	-	576	4	7	448	-	-	213	1,247	1,247	-	-	2,238	-	-	-	-	-	11,303	-
2b.1.1.20	Electrical (RCA)	-	190	1	3	176	-	-	74	444	444	-	-	880	-	-	-	-	-	3,808	-
2b.1.1.21	Fire Protection	-	256	-	-	-	-	-	38	294	-	-	294	-	-	-	-	-	-	5,488	-
2b.1.1.22	Fire Protection (CO2)	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	305	-
2b.1.1.23	Fire Protection (RCA)	-	178	1	2	109	-	-	61	351	351	-	-	544	-	-	-	-	-	3,349	-
2b.1.1.24	Floor Drains - Contaminated	-	165	8	1	16	163	-	85	439	439	-	-	81	372	-	-	-	33,319	3,228	-
2b.1.1.25	Fresh Water	-	284	-	-	-	-	-	43	327	-	-	327	-	-	-	-	-	-	5,906	-
2b.1.1.26	Fuel Oil	-	220	-	-	-	-	-	33	253	-	-	253	-	-	-	-	-	-	4,452	-
2b.1.1.27	HVAC - Auxiliary Building	-	265	2	3	188	27	-	102	587	587	-	-	941	62	-	-	-	5,534	4,912	-
2b.1.1.28	HVAC - Control Area	-	26	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	532	-
2b.1.1.29	HVAC - Diesel Generator Area	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	126	-
2b.1.1.30	HVAC - Fuel Handling Area	-	122	1	1	91	18	-	48	277	277	-	-	455	30	-	-	-	2,676	2,268	-
2b.1.1.31	HVAC - Miscellaneous	-	178	-	-	-	-	-	27	205	-	-	205	-	-	-	-	-	-	3,948	-
2b.1.1.32	HVAC - Reactor Containment	-	678	6	8	488	74	-	263	1,518	1,518	-	-	2,441	168	-	-	-	15,104	12,513	-
2b.1.1.33	Heating Steam & Cond Return	-	159	-	-	-	-	-	24	183	-	-	183	-	-	-	-	-	-	3,462	-
2b.1.1.34	Heating Steam & Cond Return (RCA)	-	128	1	1	86	-	-	45	261	261	-	-	432	-	-	-	-	-	2,398	-
2b.1.1.35	Heating Water	-	112	-	-	-	-	-	17	128	-	-	128	-	-	-	-	-	-	2,326	-
2b.1.1.36	Heating Water (RCA)	-	64	0	1	39	-	-	22	126	126	-	-	193	-	-	-	-	-	1,198	-
2b.1.1.37	Htng Boiler Air/Gas Flow & Ignition Gas	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	80	-
2b.1.1.38	Miscellaneous Reactor Coolant	-	58	1	0	11	9	-	19	98	98	-	-	56	20	-	-	-	1,814	1,247	-
2b.1.1.39	Non-Radioactive Liquid Waste Disposal	-	321	-	-	-	-	-	48	369	-	-	369	-	-	-	-	-	-	6,636	-
2b.1.1.40	Plumbing - Hot and Cold Water	-	45	-	-	-	-	-	7	52	-	-	52	-	-	-	-	-	-	988	-
2b.1.1.41	Plumbing - Sanitary	-	30	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	622	-
2b.1.1.42	Residual Heat Removal	140	157	50	10	129	1,126	-	417	2,028	2,028	-	-	643	2,570	-	-	-	230,393	3,603	-
2b.1.1.43	Safety Injection	528	564	49	10	225	997	-	694	3,068	3,068	-	-	1,125	2,713	-	-	-	204,105	20,512	-
2b.1.1.44	Sampling	-	122	3	1	53	72	-	57	310	310	-	-	267	164	-	-	-	14,718	2,623	-
2b.1.1.45	Service Water - Nuclear Area	-	856	21	39	2,521	-	-	600	4,037	4,037	-	-	12,604	-	-	-	-	-	15,744	-
2b.1.1.46	Service Water - Turbine Area	-	61	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	1,336	-
2b.1.1	Totals	1,995	12,505	265	130	6,399	4,591	-	5,664	31,649	24,496	-	7,053	31,993	11,790	-	-	-	939,462	285,358	-

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
2b.1.2	Scaffolding in support of decommissioning	-	1,027	5	1	62	13	-	270	1,379	1,379	-	-	309	43	-	-	-	3,836	23,088	-
	Decontamination of Site Buildings																				
2b.1.3.1	Reactor Containment	1,205	757	124	88	115	1,295	-	1,158	4,743	4,743	-	-	576	7,941	-	-	-	738,859	37,887	-
2b.1.3.2	Auxiliary Building	400	199	32	25	26	71	-	279	1,033	1,033	-	-	131	2,093	-	-	-	201,223	11,426	-
2b.1.3.3	Controlled Facilities Building	55	23	4	8	2	5	-	36	128	128	-	-	8	265	-	-	-	26,374	1,474	-
2b.1.3.4	Steam Generator Removal	12	2	0	0	5	0	-	7	27	27	-	-	24	2	-	-	-	142	288	-
2b.1.3	Totals	1,672	982	161	115	148	1,373	-	1,480	5,930	5,930	-	-	739	10,302	-	-	-	966,604	51,074	-
2b.1	Subtotal Period 2b Activity Costs	3,666	14,513	431	247	6,608	5,977	-	7,414	38,857	31,804	-	7,053	33,042	22,135	-	-	-	1,909,902	359,520	-
	Period 2b Collateral Costs																				
2b.3.1	Process liquid waste	202	-	183	281	-	1,883	-	632	3,181	3,181	-	-	-	-	2,652	-	-	385,235	315	-
2b.3.2	Small tool allowance	-	321	-	-	-	-	-	48	369	369	-	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	202	321	183	281	-	1,883	-	680	3,550	3,550	-	-	-	-	2,652	-	-	385,235	315	-
	Period 2b Period-Dependent Costs																				
2b.4.1	Decon supplies	642	-	-	-	-	-	-	161	803	803	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	687	69	756	756	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	1,997	-	-	-	-	-	499	2,496	2,496	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	4,563	-	-	-	-	-	684	5,247	5,247	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	86	24	-	323	-	93	525	525	-	-	-	4,612	-	-	-	92,423	1,132	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	1,650	247	1,897	1,897	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	680	68	748	748	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	78	8	86	-	86	-	-	-	-	-	-	-	-	-
2b.4.10	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	33,955	5,093	39,048	-	39,048	-	-	-	-	-	-	-	-	-
2b.4.11	Spent Fuel Pool O&M	-	-	-	-	-	-	2,203	330	2,533	-	2,533	-	-	-	-	-	-	-	-	-
2b.4.12	Radwaste Processing Equipment/Services	-	-	-	-	-	-	418	63	481	481	-	-	-	-	-	-	-	-	-	-
2b.4.13	ISRA Compliance Staff	-	-	-	-	-	-	1,886	283	2,169	2,169	-	-	-	-	-	-	-	-	-	-
2b.4.14	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	53	8	61	-	61	-	-	-	-	-	-	-	-	-
2b.4.15	Security Staff Cost	-	-	-	-	-	-	2,656	398	3,055	3,055	-	-	-	-	-	-	-	-	-	136,891
2b.4.16	Utility Staff Cost	-	-	-	-	-	-	60,723	9,108	69,832	69,832	-	-	-	-	-	-	-	-	-	915,840
2b.4	Subtotal Period 2b Period-Dependent Costs	642	6,560	86	24	-	323	104,989	17,118	129,736	88,008	41,728	-	-	4,612	-	-	-	92,423	1,132	1,052,731
2b.0	TOTAL PERIOD 2b COST	4,511	21,394	700	551	6,608	8,183	104,989	25,207	172,144	123,363	41,728	7,053	33,042	26,747	2,652	-	-	2,387,559	360,967	1,052,731
	PERIOD 2c - Decontamination Following Wet Fuel Storage																				
	Period 2c Direct Decommissioning Activities																				
2c.1.1	Remove spent fuel racks	505	62	132	11	416	144	-	379	1,638	1,638	-	-	2,081	457	-	-	-	41,012	1,189	-
	Disposal of Plant Systems																				
2c.1.2.1	Spent Fuel Cooling	-	186	38	9	197	851	-	294	1,575	1,575	-	-	986	1,941	-	-	-	174,052	3,764	-
2c.1.2.2	Waste Disposal - Liquid	352	351	45	9	180	934	-	530	2,402	2,402	-	-	901	2,407	-	-	-	191,109	12,951	-
2c.1.2.3	Waste Disposal - Solid	-	61	5	1	45	107	-	49	267	267	-	-	223	253	-	-	-	21,858	1,209	-
2c.1.2	Totals	352	598	88	19	422	1,891	-	874	4,244	4,244	-	-	2,110	4,601	-	-	-	387,019	17,925	-
	Decontamination of Site Buildings																				
2c.1.3.1	Fuel Handling Building	557	615	9	7	169	26	-	466	1,848	1,848	-	-	843	468	-	-	-	45,684	22,423	-
2c.1.3	Totals	557	615	9	7	169	26	-	465	1,848	1,848	-	-	843	468	-	-	-	45,684	22,423	-
2c.1.4	Scaffolding in support of decommissioning	-	205	1	0	12	3	-	54	276	276	-	-	62	9	-	-	-	767	4,618	-

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
2c.1	Subtotal Period 2c Activity Costs	1,414	1,470	230	37	1,019	2,063	-	1,772	8,006	8,006	-	-	5,096	5,535	-	-	-	474,483	46,155	-
	Period 2c Collateral Costs																				
2c.3.1	Process liquid waste	98	-	58	108	-	618	-	225	1,107	1,107	-	-	-	-	930	-	-	126,466	145	-
2c.3.2	Small tool allowance	-	52	-	-	-	-	-	8	59	59	-	-	-	-	-	-	-	-	-	-
2c.3.3	Decommissioning Equipment Disposition	-	-	48	13	540	117	-	117	835	835	-	-	2,700	373	-	-	-	33,507	739	-
2c.3	Subtotal Period 2c Collateral Costs	98	52	106	121	540	735	-	350	2,001	2,001	-	-	2,700	378	930	-	-	159,973	885	-
	Period 2c Period-Dependent Costs																				
2c.4.1	Decon supplies	97	-	-	-	-	-	-	24	121	121	-	-	-	-	-	-	-	-	-	-
2c.4.2	Insurance	-	-	-	-	-	-	111	11	122	122	-	-	-	-	-	-	-	-	-	-
2c.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2c.4.4	Health physics supplies	-	380	-	-	-	-	-	95	476	476	-	-	-	-	-	-	-	-	-	-
2c.4.5	Heavy equipment rental	-	1,308	-	-	-	-	-	196	1,504	1,504	-	-	-	-	-	-	-	-	-	-
2c.4.6	Disposal of DAW generated	-	-	25	7	-	95	-	27	155	155	-	-	-	1,359	-	-	-	27,233	334	-
2c.4.7	Plant energy budget	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	-
2c.4.8	NRC Fees	-	-	-	-	-	-	284	28	312	312	-	-	-	-	-	-	-	-	-	-
2c.4.9	Emergency Planning Fees	-	-	-	-	-	-	22	2	25	-	25	-	-	-	-	-	-	-	-	-
2c.4.10	Radwaste Processing Equipment/Services	-	-	-	-	-	-	240	36	275	275	-	-	-	-	-	-	-	-	-	-
2c.4.11	ISRA Compliance Staff	-	-	-	-	-	-	540	81	622	622	-	-	-	-	-	-	-	-	-	-
2c.4.12	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	15	2	18	-	18	-	-	-	-	-	-	-	-	-
2c.4.13	Security Staff Cost	-	-	-	-	-	-	761	114	875	875	-	-	-	-	-	-	-	-	-	39,227
2c.4.14	Utility Staff Cost	-	-	-	-	-	-	14,860	2,229	17,089	17,089	-	-	-	-	-	-	-	-	-	226,337
2c.4	Subtotal Period 2c Period-Dependent Costs	97	1,688	25	7	-	95	17,085	2,885	21,882	21,840	42	-	-	1,359	-	-	-	27,233	334	265,564
2c.0	TOTAL PERIOD 2c COST	1,609	3,210	361	165	1,559	2,894	17,085	5,007	31,889	31,847	42	-	7,796	7,267	930	-	-	661,688	47,373	265,564
	PERIOD 2e - License Termination																				
	Period 2e Direct Decommissioning Activities																				
2e.1.1	ORISE confirmatory survey	-	-	-	-	-	-	122	37	158	158	-	-	-	-	-	-	-	-	-	-
2e.1.2	Terminate license									a											
2e.1	Subtotal Period 2e Activity Costs	-	-	-	-	-	-	122	37	158	158	-	-	-	-	-	-	-	-	-	-
	Period 2e Additional Costs																				
2e.2.1	Final Site Survey	-	-	-	-	-	-	4,767	715	5,482	5,482	-	-	-	-	-	-	-	-	95,192	-
2e.2	Subtotal Period 2e Additional Costs	-	-	-	-	-	-	4,767	715	5,482	5,482	-	-	-	-	-	-	-	-	95,192	-
	Period 2e Period-Dependent Costs																				
2e.4.1	Insurance	-	-	-	-	-	-	113	11	125	125	-	-	-	-	-	-	-	-	-	-
2e.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2e.4.3	Health physics supplies	-	551	-	-	-	-	-	138	688	688	-	-	-	-	-	-	-	-	-	-
2e.4.4	Disposal of DAW generated	-	-	7	2	-	25	-	7	41	41	-	-	-	364	-	-	-	7,297	89	-
2e.4.5	Plant energy budget	-	-	-	-	-	-	223	33	257	257	-	-	-	-	-	-	-	-	-	-
2e.4.6	NRC Fees	-	-	-	-	-	-	288	29	317	317	-	-	-	-	-	-	-	-	-	-
2e.4.7	Emergency Planning Fees	-	-	-	-	-	-	23	2	25	-	25	-	-	-	-	-	-	-	-	-
2e.4.8	ISRA Compliance Staff	-	-	-	-	-	-	554	83	637	637	-	-	-	-	-	-	-	-	-	-
2e.4.9	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	16	2	18	-	18	-	-	-	-	-	-	-	-	-
2e.4.10	Security Staff Cost	-	-	-	-	-	-	428	64	492	492	-	-	-	-	-	-	-	-	-	22,054
2e.4.11	Utility Staff Cost	-	-	-	-	-	-	10,411	1,562	11,972	11,972	-	-	-	-	-	-	-	-	-	150,823
2e.4	Subtotal Period 2e Period-Dependent Costs	-	551	7	2	-	25	12,056	1,933	14,572	14,529	43	-	-	864	-	-	-	7,297	89	172,877

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
2e.0	TOTAL PERIOD 2e COST	-	551	7	2	-	25	16,944	2,684	20,212	20,169	43	-	-	364	-	-	-	7,297	95,281	172,877
PERIOD 2 TOTALS		7,433	44,830	9,267	9,546	14,934	46,895	194,934	64,642	391,880	337,758	45,422	8,700	74,384	90,659	7,248	469	-	9,273,870	742,616	2,288,275
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor Containment	-	5,755	-	-	-	-	-	863	6,618	993	-	5,626	-	-	-	-	-	-	72,497	-
3b.1.1.2	Administration Building	-	660	-	-	-	-	-	99	759	-	-	759	-	-	-	-	-	-	10,176	-
3b.1.1.3	Auxiliary Building	-	1,735	-	-	-	-	-	260	1,995	200	-	1,796	-	-	-	-	-	-	25,022	-
3b.1.1.4	Auxiliary Building Control Area	-	329	-	-	-	-	-	49	378	-	-	378	-	-	-	-	-	-	4,752	-
3b.1.1.5	Auxiliary Building Diesel Generator Area	-	108	-	-	-	-	-	16	124	-	-	124	-	-	-	-	-	-	1,810	-
3b.1.1.6	Barge Slip	-	961	-	-	-	-	-	144	1,105	-	-	1,105	-	-	-	-	-	-	7,269	-
3b.1.1.7	Chromate Demineralizer Enclosure	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	92	-
3b.1.1.8	Circulating Water Intake Structure	-	1,038	-	-	-	-	-	156	1,194	-	-	1,194	-	-	-	-	-	-	6,310	-
3b.1.1.9	Circulating Water Piping	-	1,873	-	-	-	-	-	281	2,154	-	-	2,154	-	-	-	-	-	-	36,524	-
3b.1.1.10	Clean Facilities Building	-	358	-	-	-	-	-	54	412	-	-	412	-	-	-	-	-	-	5,692	-
3b.1.1.11	Condensate Polishing Building	-	70	-	-	-	-	-	11	81	-	-	81	-	-	-	-	-	-	1,107	-
3b.1.1.12	Controlled Facilities Building	-	252	-	-	-	-	-	38	290	-	-	290	-	-	-	-	-	-	3,785	-
3b.1.1.13	Fire Pump House	-	57	-	-	-	-	-	9	65	-	-	65	-	-	-	-	-	-	874	-
3b.1.1.14	Guard House and Extension	-	88	-	-	-	-	-	13	101	-	-	101	-	-	-	-	-	-	1,401	-
3b.1.1.15	Heating Boiler Plant	-	83	-	-	-	-	-	12	95	-	-	95	-	-	-	-	-	-	1,138	-
3b.1.1.16	Main Steam Isolation Structure	-	184	-	-	-	-	-	28	211	-	-	211	-	-	-	-	-	-	2,551	-
3b.1.1.17	Miscellaneous Structures	-	1,884	-	-	-	-	-	283	2,167	-	-	2,167	-	-	-	-	-	-	24,441	-
3b.1.1.18	Non-Rad Liquid Waste Chem Treatment Bldg	-	81	-	-	-	-	-	12	94	-	-	94	-	-	-	-	-	-	1,193	-
3b.1.1.19	Non-Rad Liquid Waste Disposal Basin	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	239	-
3b.1.1.20	Non-Rad Liquid Waste Transfer House	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	84	-
3b.1.1.21	Penetration Area	-	286	-	-	-	-	-	43	329	-	-	329	-	-	-	-	-	-	3,526	-
3b.1.1.22	Service Building	-	520	-	-	-	-	-	78	598	-	-	598	-	-	-	-	-	-	8,811	-
3b.1.1.23	Service Water Intake Structure	-	578	-	-	-	-	-	87	664	-	-	664	-	-	-	-	-	-	3,761	-
3b.1.1.24	Sewage Treatment Facilities	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	89	-
3b.1.1.25	Steam Generator Removal	-	203	-	-	-	-	-	30	233	233	-	-	-	-	-	-	-	-	2,367	-
3b.1.1.26	Trash and Fish Removal Building	-	18	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	269	-
3b.1.1.27	Turbine Building	-	3,387	-	-	-	-	-	508	3,895	-	-	3,895	-	-	-	-	-	-	58,128	-
3b.1.1.28	Turbine Pedestal	-	644	-	-	-	-	-	97	741	-	-	741	-	-	-	-	-	-	7,237	-
3b.1.1.29	Water Pre-Treatment Building	-	122	-	-	-	-	-	18	140	-	-	140	-	-	-	-	-	-	1,629	-
3b.1.1.30	Fuel Handling Building	-	2,238	-	-	-	-	-	336	2,574	257	-	2,317	-	-	-	-	-	-	28,638	-
3b.1.1	Totals	-	23,544	-	-	-	-	-	3,532	27,076	1,683	-	25,398	-	-	-	-	-	-	321,415	-
Site Closeout Activities																					
3b.1.2	Remove Rubble	-	5,970	-	-	-	-	-	895	6,865	-	-	6,865	-	-	-	-	-	-	10,276	-
3b.1.3	Grade & landscape site	-	590	-	-	-	-	-	89	679	-	-	679	-	-	-	-	-	-	1,938	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	49	7	56	56	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	30,104	-	-	-	-	49	4,523	34,676	1,739	-	32,937	-	-	-	-	-	-	333,629	1,560
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	-	-	-	-	-	673	101	774	-	-	774	-	-	-	-	-	-	4,018	-
3b.2	Subtotal Period 3b Additional Costs	-	-	-	-	-	-	678	101	774	-	-	774	-	-	-	-	-	-	4,018	-

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	305	-	-	-	-	-	46	351	-	-	351	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	305	-	-	-	-	-	46	351	-	-	351	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Insurance	-	-	-	-	-	-	209	21	230	0	207	23	-	-	-	-	-	-	-	-
3b.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	3,344	-	-	-	-	-	502	3,845	-	-	3,845	-	-	-	-	-	-	-	-
3b.4.4	Plant energy budget	-	-	-	-	-	-	206	31	237	-	118	118	-	-	-	-	-	-	-	-
3b.4.5	NRC ISFSI Fees	-	-	-	-	-	-	100	10	110	-	110	-	-	-	-	-	-	-	-	-
3b.4.6	Emergency Planning Fees	-	-	-	-	-	-	42	4	47	-	47	-	-	-	-	-	-	-	-	-
3b.4.7	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	29	4	33	-	33	-	-	-	-	-	-	-	-	-
3b.4.8	Security Staff Cost	-	-	-	-	-	-	789	118	907	(0)	608	299	-	-	-	-	-	-	-	40,654
3b.4.9	Utility Staff Cost	-	-	-	-	-	-	10,926	1,639	12,565	-	6,283	6,283	-	-	-	-	-	-	-	156,716
3b.4	Subtotal Period 3b Period-Dependent Costs	-	3,844	-	-	-	-	12,802	2,329	17,975	(0)	7,406	10,569	-	-	-	-	-	-	-	197,370
3b.0	TOTAL PERIOD 3b COST	-	33,753	-	-	-	-	13,024	6,999	53,775	1,739	7,406	44,631	-	-	-	-	-	-	337,647	198,930
PERIOD 3c - Fuel Storage Operations/Shipping																					
Period 3c Direct Decommissioning Activities																					
	No direct activities in this period																				
Period 3c Period-Dependent Costs																					
3c.4.1	Insurance	-	-	-	-	-	-	2,604	260	2,864	-	2,864	-	-	-	-	-	-	-	-	-
3c.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3c.4.3	Plant energy budget	-	-	-	-	-	-	488	73	561	-	561	-	-	-	-	-	-	-	-	-
3c.4.4	NRC ISFSI Fees	-	-	-	-	-	-	1,448	145	1,593	-	1,593	-	-	-	-	-	-	-	-	-
3c.4.5	Emergency Planning Fees	-	-	-	-	-	-	612	61	673	-	678	-	-	-	-	-	-	-	-	-
3c.4.6	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	1,967	295	2,262	-	2,262	-	-	-	-	-	-	-	-	-
3c.4.7	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	410	62	472	-	472	-	-	-	-	-	-	-	-	-
3c.4.8	Security Staff Cost	-	-	-	-	-	-	7,594	1,139	8,733	-	8,733	-	-	-	-	-	-	-	-	391,380
3c.4.9	Utility Staff Cost	-	-	-	-	-	-	40,670	6,100	46,770	-	46,770	-	-	-	-	-	-	-	-	596,389
3c.4	Subtotal Period 3c Period-Dependent Costs	-	-	-	-	-	-	55,793	8,136	63,929	-	63,929	-	-	-	-	-	-	-	-	987,769
3c.0	TOTAL PERIOD 3c COST	-	-	-	-	-	-	55,793	8,136	63,929	-	63,929	-	-	-	-	-	-	-	-	987,769
PERIOD 3d - GTCC shipping																					
Period 3d Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
3d.1.1.1	Vessel & Internals GTCC Disposal	-	-	-	-	-	12,491	-	1,874	14,364	14,364	-	-	-	-	-	-	613	-	-	-
3d.1.1	Totals	-	-	-	-	-	12,491	-	1,874	14,364	14,364	-	-	-	-	-	-	613	-	-	-
3d.1	Subtotal Period 3d Activity Costs	-	-	-	-	-	12,491	-	1,874	14,364	14,364	-	-	-	-	-	-	613	-	-	-
Period 3d Period-Dependent Costs																					
3d.4.1	Insurance	-	-	-	-	-	-	6	1	6	-	6	-	-	-	-	-	-	-	-	-
3d.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3d.4.3	Plant energy budget	-	-	-	-	-	-	1	0	1	-	1	-	-	-	-	-	-	-	-	-
3d.4.4	NRC ISFSI Fees	-	-	-	-	-	-	5	0	5	-	5	-	-	-	-	-	-	-	-	-
3d.4.5	Emergency Planning Fees	-	-	-	-	-	-	2	0	2	-	2	-	-	-	-	-	-	-	-	-
3d.4.6	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	183	27	210	-	210	-	-	-	-	-	-	-	-	-
3d.4.7	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	1	0	1	-	1	-	-	-	-	-	-	-	-	-

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 3d Period-Dependent Costs (continued)																					
3d.4.8	Security Staff Cost	-	-	-	-	-	-	17	3	20	-	20	-	-	-	-	-	-	-	-	900
3d.4.9	Utility Staff Cost	-	-	-	-	-	-	94	14	108	-	108	-	-	-	-	-	-	-	-	1,371
3d.4	Subtotal Period 3d Period-Dependent Costs	-	-	-	-	-	-	309	46	355	-	355	-	-	-	-	-	-	-	-	2,271
3d.0	TOTAL PERIOD 3d COST	-	-	-	-	-	13,491	309	1,919	14,719	14,364	355	-	-	-	-	-	613	-	-	2,271
PERIOD 3e - ISFSI Decontamination																					
Period 3e Direct Decommissioning Activities																					
	No direct activities in this period																				
Period 3e Additional Costs																					
3e.2.1	ISFSI License Termination	-	1,011	10	78	-	312	956	487	2,855	-	2,855	-	-	6,997	-	-	-	799,883	16,537	1,696
3e.2	Subtotal Period 3e Additional Costs	-	1,011	10	78	-	312	956	487	2,855	-	2,855	-	-	6,997	-	-	-	799,883	16,537	1,696
Period 3e Collateral Costs																					
3e.3.1	Small tool allowance	-	13	-	-	-	-	-	2	15	-	15	-	-	-	-	-	-	-	-	-
3e.3	Subtotal Period 3e Collateral Costs	-	13	-	-	-	-	-	2	15	-	15	-	-	-	-	-	-	-	-	-
Period 3e Period-Dependent Costs																					
3e.4.1	Insurance	-	-	-	-	-	-	45	5	50	-	50	-	-	-	-	-	-	-	-	-
3e.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3e.4.3	Heavy equipment rental	-	82	-	-	-	-	-	12	94	-	94	-	-	-	-	-	-	-	-	-
3e.4.4	Plant energy budget	-	-	-	-	-	-	52	8	59	-	59	-	-	-	-	-	-	-	-	-
3e.4.5	NRC ISFSI Fees	-	-	-	-	-	-	75	8	83	-	83	-	-	-	-	-	-	-	-	-
3e.4.6	Security Staff Cost	-	-	-	-	-	-	67	10	77	-	77	-	-	-	-	-	-	-	-	3,450
3e.4.7	Utility Staff Cost	-	-	-	-	-	-	858	129	987	-	987	-	-	-	-	-	-	-	-	12,486
3e.4	Subtotal Period 3e Period-Dependent Costs	-	82	-	-	-	-	1,097	171	1,350	-	1,350	-	-	-	-	-	-	-	-	15,935
3e.0	TOTAL PERIOD 3e COST	-	1,106	10	78	-	312	2,053	660	4,220	-	4,220	-	-	6,997	-	-	-	799,883	16,637	17,632
PERIOD 3f - ISFSI Site Restoration																					
Period 3f Direct Decommissioning Activities																					
	No direct activities in this period																				
Period 3f Additional Costs																					
3f.2.1	ISFSI Site Restoration	-	1,075	-	-	-	-	23	272	1,370	-	1,870	-	-	-	-	-	-	-	4,904	106
3f.2	Subtotal Period 3f Additional Costs	-	1,075	-	-	-	-	23	272	1,370	-	1,870	-	-	-	-	-	-	-	4,904	106
Period 3f Collateral Costs																					
3f.3.1	Small tool allowance	-	4	-	-	-	-	-	1	5	-	5	-	-	-	-	-	-	-	-	-
3f.3	Subtotal Period 3f Collateral Costs	-	4	-	-	-	-	-	1	5	-	5	-	-	-	-	-	-	-	-	-
Period 3f Period-Dependent Costs																					
3f.4.1	Insurance	-	-	-	-	-	-	25	2	27	-	27	-	-	-	-	-	-	-	-	-
3f.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3f.4.3	Heavy equipment rental	-	32	-	-	-	-	-	5	36	-	36	-	-	-	-	-	-	-	-	-
3f.4.4	Plant energy budget	-	-	-	-	-	-	28	4	32	-	32	-	-	-	-	-	-	-	-	-
3f.4.5	Security Staff Cost	-	-	-	-	-	-	37	6	42	-	42	-	-	-	-	-	-	-	-	1,690
3f.4.6	Utility Staff Cost	-	-	-	-	-	-	229	34	264	-	264	-	-	-	-	-	-	-	-	3,330
3f.4	Subtotal Period 3f Period-Dependent Costs	-	32	-	-	-	-	319	51	402	-	402	-	-	-	-	-	-	-	-	5,220
3f.0	TOTAL PERIOD 3f COST	-	1,110	-	-	-	-	342	324	1,777	-	1,777	-	-	-	-	-	-	-	4,904	5,326
PERIOD 3 TOTALS		-	35,969	10	78	-	12,803	71,521	18,038	138,420	16,103	77,656	44,631	-	6,997	-	-	613	799,883	359,088	1,211,928

TABLE C-2
SALEM GENERATING STATION - UNIT 2
DETAILED COST ANALYSIS
(Thousands of 2002 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	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
	TOTAL COST TO DECOMMISSION	9,356	82,735	9,795	10,125	14,934	64,551	314,668	92,338	598,702	420,141	124,844	53,717	74,384	98,475	13,167	459	613	11,071,590	1,103,182	4,093,456

TOTAL COST TO DECOMMISSION WITH 18.24% CONTINGENCY:	$598,702	thousands of 2002 dollars
TOTAL NRC LICENSE TERMINATION COST IS 70.18% OR	$420,141	thousands of 2002 dollars
SPENT FUEL MANAGEMENT COST IS 20.85% OR:	$124,844	thousands of 2002 dollars
NON-NUCLEAR DEMOLITION COST IS 8.97% OR:	$53,717	thousands of 2002 dollars
TOTAL PRIMARY SITE RADWASTE VOLUME BURIED:	81,642	cubic feet
TOTAL SECONDARY SITE RADWASTE VOLUME BURIED:	30,460	cubic feet
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	618	cubic feet
TOTAL SCRAP METAL REMOVED:	54,443	tons
TOTAL CRAFT LABOR REQUIREMENTS:	1,103,182	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