EPRI

Preparing for Decommissioning: The Oyster Creek Experience

Technical Report

Preparing for Decommissioning: The Oyster Creek Experience

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Final Report, June 2000

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REPORT SUMMARY

This report chronicles the process of preparing GPU Nuclear's Oyster Creek Nuclear Generating Station for early retirement and decommissioning. The Oyster Creek experience has great relevance to the nuclear industry, as future decommissioning projects will benefit from the comprehensive preplanning work performed there.

Background

Planning for the decommissioning of Oyster Creek began in mid 1997 following an announcement by GPU Nuclear that one of the options they were considering for the future of the plant was to shutdown following the 2000 outage. GPU viewed the three-year planning process as a considerable cost benefit derived from a prompt and orderly transition from plant operation to decommissioning. With the recent purchase of this plant by AmerGen Energy, plant managers brought the decommissioning planning effort to a close and archived the work for future use.

Objective

To provide the utility industry with a guide to preparing for decommissioning based on one utility's experience.

Approach

Project managers organized the Oyster Creek Decommissioning Project into five distinct phases. Phase I, "Plan & Prepare for Decommissioning," incorporated 16 distinct preplanning activities including the development of fifty-two individual plans. Phase II, "Prepare and Modify the Plant for Decontamination and Dismantlement" would begin on plant shutdown. The other three phases cover decontamination and dismantlement, NRC site release and license termination, and dry spent fuel storage, following release of the rest of the site.

Results

The report includes discussions of the projects, studies, and strategic plans for areas of engineering, radiological/environmental controls, low level waste, spent fuel management and communications. The report also addresses the preparation activities related to the "people" issues of employee and community relations. It also includes a "planning model" (Attachment I), which summarizes the scheduling of various tasks and submission of licensing documents. The "Lessons Learned" chapter includes recommendations on management issues, licensing, engineering, site release, spent fuel and communications.

EPRI Perspective

GPU Nuclear was one of the first utilities in the United States to complete a comprehensive plan preparing for decommissioning before the scheduled plant closure. A committee of industry specialists reviewed this plan in detail on its completion. It provides an excellent basis for utilities beginning to plan for eventual plant closure.

With the decreased likelihood of more premature plant closures in the near future, emphasis in the EPRI program is shifting more towards providing guidance on longer term decommissioning issues. EPRI is publishing this report as part of a larger project to develop generic guidance on planning for decommissioning, with the objective of reducing delays and costs in moving to decommissioning status. The new product will be a preplanning manual, which will consider three planning stages: premature shutdown, planned shutdown in 3 to 5 years and long term operations considerations such as data collection and contingency planning. EPRI will publish an interim version of this manual in the fourth quarter of 2000.

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Key Words

Nuclear power plant decommissioning

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1 INTRODUCTION

This report chronicles the process of preparing the Oyster Creek Nuclear Generating Station for early retirement and decommissioning. The Oyster Creek experience has relevance for the commercial nuclear industry since a number of plants may be destined for shutdown in coming years, based either on license expiration or economics. The Oyster Creek process – planning for decommissioning prior to shutdown - has considerable cost benefits to the plant owners by having sufficient planning performed to allow a prompt and orderly transition from operations to decommissioning.

The Oyster Creek experience is being documented to provide the industry with a guide to be followed in preparing for decommissioning. The report includes a “planning model” (Attachment I), which summarizes when various tasks should be performed and licensing documents submitted.

2 BACKGROUND

Planning for the decommissioning of Oyster Creek commenced in mid 1997. This action was prompted by the announcement by GPU, Inc. of the possible early retirement of the plant in September 2000. The reason for the possible shutdown was due to the market driven competitive forces being brought to bear in the electric utility business. As New Jersey was moving towards deregulation, the concern was that Oyster Creek would not be able to compete in the competitive market place.

The major obstacle impacting Oyster Creek's ability to operate competitively is the fact that the plant is a single-unit boiling water reactor (BWR) with a relatively low power rating (620 MW_e). The plant is, therefore, at a competitive disadvantage with larger, multi-unit nuclear plants and large fossil plants that have lower operating and maintenance costs per unit of power generation. During the 1990's, plant performance improved markedly, particularly in the areas of capacity factor, worker radiation dose, outage duration, and human performance. Additionally, considerable improvements were made in safety and reliability. Thus, the shutdown and decommissioning of Oyster Creek was under consideration for economic reasons, not operational performance.

Another motivation for the possible shutdown was the strategic objective of GPU to exit the electric generation business to become a transmission and distribution utility. To this end, the company's generation fossil assets had been sold along with the Three Mile Island Unit I plant in Harrisburg, Pennsylvania.

In April 1997, GPU announced that three strategic options were under consideration for the future of the plant:

- Continue to run possibly until it's operating license expires in 2009
- Sale of the plant
- Premature shutdown of the plant in 2000, with immediate transitioning to decommissioning

In August 1999, GPU, Inc. announced that a buyer, AmerGen Energy Co., had agreed to purchase the plant. The Asset Purchase Agreement was signed in mid October and, as of this writing, closing is expected in May 2000. AmerGen Energy Co. also purchased TMI-1 with closing occurring in December 1999.

With the proposed sale of Oyster Creek, the decommissioning planing effort was brought to an orderly conclusion with all planning products archived for future use. The purpose of this report is to document the process that was followed in preparing Oyster Creek for the decommissioning with the expectation that the process may be used as a model for plants to follow in the future. The report includes discussions of the projects, studies, and strategic plans in the areas of engineering, radiological/environmental controls, low level waste, spent fuel management and communications. The report also addresses the preparation activities related to the “people” issues of employee and community relations. Lastly, the report provides a summary of the lessons learned and a model timeline to be followed for preparation of the various tasks.

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PLANT DESCRIPTION

Oyster Creek is a single unit BWR operated by GPU Nuclear, Inc. and located in the central coastal region of New Jersey. The plant produces 620 MW_e and became operational in 1969. It employs a "BWR-2" NSSS design, which is an early generation of the General Electric product line; there are relatively few operating plants using this design. The plant has a "MARK I" containment which is a common containment configuration for BWRs. Fig. 3.1 illustrates the overall plant configuration.

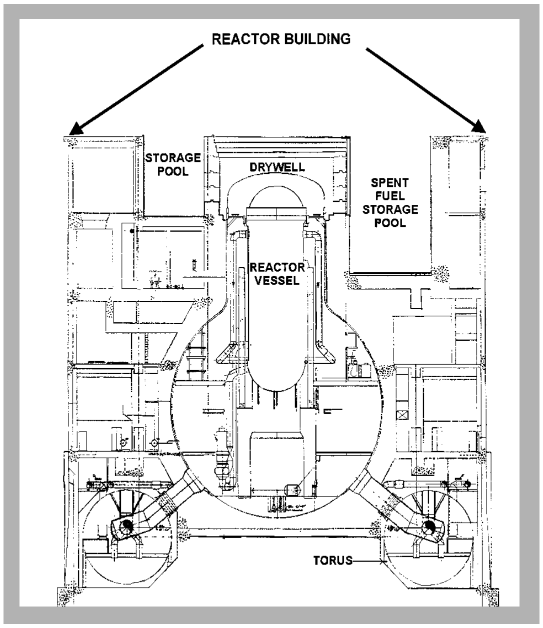

Figure 3-1
Oyster Creek Plant Configuration

The decommissioning of a relatively large, long-running BWR has not yet been accomplished in the United States. As decommissioning planning progressed, it appeared that there would be unique considerations for this type of plant. Most notable was the proximity of the spent fuel storage pool (SFSP) in the Mark I containment design to the reactor vessel. At the projected time of plant shutdown (September 2000), the plants SFSP would have been nearly full (2980 fuel assemblies) with no licensed dry storage capability on-site. GPU Nuclear, Inc. also had not made a final decision as to whether dry or wet storage would be used during decommissioning.

Another important aspect of the SFSP that affects decommissioning is its design basis. The design basis of the Oyster Creek SFSP appears to be unique in the industry in that analysis has not been performed to demonstrate that it would not fail in the event of boiling. This design basis was not a concern during plant operations because of the system redundancy and operating staff that are available to assess off-normal events. For decommissioning planning, a thorough review of the fuel pool design basis must be considered when designing new SFSP cooling systems for long term decommissioning use.

4 PROJECT MANAGEMENT

When planning for the Oyster Creek decommissioning commenced, there was no clear road map or model to follow for performing the myriad of projects, licensing submittals, strategies and planning documents which would be required to prepare for decommissioning. The new decommissioning rule was in place; however, the NRC guidance documents had not been issued. As a result, there was much uncertainty among industry and the NRC as to how a plant considering a future decommissioning might proceed under the new rule. Since 1997, however, progress has been made in providing clarity as to the regulatory regimen for decommissioning.

The strategy set forth in 1997 for Oyster Creek was to operate the plant until the fall of 2000, final shutdown, and immediately transition to decommissioning. The approach being taken – plan for decommissioning while operating the plant - appears to be the most cost-effective approach to decommissioning. A number of plants (Connecticut Yankee, Maine Yankee, Trojan, Rancho Seco and Yankee Rowe) were shutdown prematurely and then made decisions to prepare for decommissioning. This approach is costly because excessive personnel remain after shutdown, unnecessary regulatory commitments remain in place, and engineering that could have been done prior to shutdown must be initiated.

4.1 Planning Basis Assumptions

To proceed with an organized and strategic planning process for the Oyster Creek decommissioning, basic assumptions for the decommissioning were developed based on corporate direction provided with the April 1997 announcement:

- Final shutdown would occur in the fall of 2000.
- The “DECON” option was chosen because of the corporate commitment to “prompt dismantlement” after shutdown.
- The SFSP capacity would need to be sufficient for the entire core to be off-loaded at shutdown. Additional fuel assembly storage racks would be required to be installed prior to shutdown.
- Oyster Creek would be decontaminated to allow site release for unrestricted release in accordance with 10 CFR 20.1402.
- It was assumed that the Department of Energy (DOE) would not take custody of spent fuel until 2010 at the earliest.
- It was assumed that a low-level radioactive waste disposal site would be available when the plant is retired.

- It was assumed that in-house GPU Nuclear personnel would be utilized to the maximum extent possible. No definitive decision had been made as to whether GPU Nuclear would act as the Decommissioning Operations Contractor (DOC) or outsource this function to a contractor.
- The decommissioning trust fund balance at shutdown was assumed to be sufficient to allow the start of decommissioning.

4.2 Resources and Personnel Transition

4.2.1 Planning Organization

At the time of the April 1997 announcement, senior management set clear expectations as to the future of the plant; namely, to continue to run the plant safely and reliably until September 2000 while preparing for decommissioning. To ensure minimal distractions from the operations focus, a small decommissioning planning group was established, reporting outside of the plant department in the Engineering division. Attachment II shows the initial decommissioning organization.

These resources, supplemented with contractors, performed all of the planning tasks in the 1997 – 1998 timeframe. In 1999, this group was supplemented with two additional licensing resources and 12-14 engineering personnel to develop detailed licensing strategies and perform the modification engineering required to prepare the plant for D&D. These in-house personnel were available to be used in lieu of contractors because it was expected that the current cycle would be the last and no outage planning would be required.

4.2.2 Personnel Transition

A major financial benefit from decommissioning planning results from the ability to expedite the reduction in staffing following shutdown because significantly fewer personnel are required for decommissioning than for operations. At Oyster Creek, approximately 800 employees (site and corporate) supported the operation of the plant. Decommissioning staffing studies indicated staffing requirements of approximately 400 personnel shortly after final shutdown, with further reductions to approximately 300 at the start of major D&D activity.

To facilitate the transition, it was anticipated that the decommissioning position selections would begin two to three months prior to shutdown with the post shutdown staffing being achieved within three months following shutdown. A selection process was under development to choose personnel for positions with a “retention program” available to those employees not selected.

4.2.3 Personnel Retention Program

Because of the uncertainties created by the April 1997 announcement, it was assumed that attrition would increase, particularly among the younger employees. Accordingly, a retention plan was developed to provide financial incentives to employees to remain at Oyster Creek until their positions were eliminated. The plan offered one-year severance pay for all employees, a “bridge” to early retirement for those ages 47 to 54, and an early retirement package for those employees 55 and older. As part of the retention plan, career counseling and enhanced education programs were offered to help employees develop new skills to assist them in preparing for the future. This program proved to be highly successful in retaining personnel, assuring that the plant could be safely and reliably operated until September 2000.

4.2.4 Planning for the Paradigm Shift

As a plant prepares for decommissioning, an important consideration is how the plant culture will be impacted by the plant closing. To be successful, the workforce culture must change from a purely “nuclear mentality”, associated with the safe and reliable operation of a nuclear plant, to a more “industrial safety mentality” involved in what will be a construction site during decommissioning. If the cultural shift does not occur, the decommissioning will be impacted with higher costs and scheduling delays.

This issue is particularly important if the utility acts as its own DOC and plant personnel are used to perform the engineering, planning, and labor. If a large infusion of contractor personnel occurs, either at the DOC or staffing levels, the cultural transformation should be easier since contract personnel will not have the nuclear mindset inherent in plant personnel.

To prepare for the cultural shift, GPU Nuclear undertook a number of activities, including:

- Visits to plants undergoing decommissioning.
- A “process and culture” study was performed to identify skill sets and cultural changes required.
- Decommissioning goals and objectives were established.
- “Change management” plans were developed.
- Seminars to foster the change management process were planned.
- Job descriptions for bargaining unit workers were developed to identify the generic changes in skill sets during decommissioning.

4.2.5 Bargaining Unit Decommissioning Job Descriptions

The nature of the decommissioning process requires different work skills than those required for the operating plant. Although some skilled crafts (electrical, mechanical, instrumentation and operations) are required for D&D, far fewer personnel are needed than for the operating cycle. Thus, the work force transition scheme is from a highly skilled workforce during the operating cycle to basic labor skills for decommissioning bulk activity. Additionally, greater use of multi-skilled crafts are needed to provide maximum efficiency for decommissioning work.

At Oyster Creek, to facilitate greater flexibility, six new labor job descriptions were negotiated. These job descriptions would provide the necessary skilled crafts when needed while allowing the worker to perform more general laborer type work when not performing a specialized craft. The job classifications negotiated were:

- Decommissioning Radiological Safety & Health Technician
- Nuclear Mechanical Maintenance Technician-Decommissioning
- Electrical Maintenance “A” Nuclear-Decommissioning
- Instrument & Control Nuclear-Decommissioning
- Nuclear Plant Equipment Operator-Decommissioning
- Station Helper-Decommissioning

4.3 Decommissioning Project Planning

4.3.1 Decommissioning Project Plans (DPP’s)

The cornerstone of the planning process was the Decommissioning Project Plans (DPP’s). These documents delineated projects, strategies, studies, work activities, etc. that were needed to prepare for decommissioning and as a whole became the “Integrated Project Plan” for the Oyster Creek decommissioning. The 52 individual plans served as roadmaps to guide the planning process through the maze of initiatives being worked. The DPP’s also provided a means of projecting the resource requirements during the planning phase. As part of the planning closeout process following the proposed sale of the plant, each DPP was updated to include subsequent actions needed if the decommissioning planning process were reactivated. A listing and description of the DPP’s are shown in Attachment III.

4.3.2 Phases of Decommissioning

Early in the planning process, it was recognized that a logical phased approach to decommissioning planning and scheduling was needed. The following phases were developed:

Phase I – Plan & Prepare for Decommissioning

This period is considered as the initial planning period up to plant shutdown. Planning activities in this phase included the following:

- Planning assumptions and design bases
- Strategic and project plans
- Technical and feasibility studies to support projects
- Schedules
- Process modifications
- Key decisions and milestones

- Personnel transition plans
- Licensing submittals
- Plant design modifications
- Cost estimates
- Contingency Plans
- Low level waste plans
- Spent Fuel management
- Site characterization
- Communication with employees and stakeholders
- Labor agreements

Phase II – Prepare and Modify the Plant for Decontamination & Dismantlement (D&D)

Phase II begins at time of plant shutdown and continues until major D&D commences. During this phase, design modifications are implemented to the plant to prepare it for major D&D. Tasks conducted during this phase include:

- Asbestos removal
- Characterization and disposition of operating systems
- Chemical decontamination of the primary system
- Installation of decommissioning plant modifications, such as alternate power, alternate fuel pool cooling, monitoring station, alternate HVAC, radiation monitoring system
- Installation of temporary facilities
- Installation of radwaste processing systems
- System tagouts and draining

Phase III – Decontamination & Dismantlement

This phase includes removal and shipment of hardware for off-site disposal, decontamination of remaining components, and dismantlement of plant structures. Specific projects would include:

- Removal of large components, e.g., reactor pressure vessel, steam generators (for pressurized water reactors)
- Decontamination
- ISFSI design and construction
- Transfer of fuel to dry storage (if used)
- Liquid waste water processing

- Removal of activated concrete and structural material
- Consolidation of Greater than Class C Waste
- Area dismantlement

Phase IV – NRC Site Release and License Termination

Following dismantlement of plant structures, additional site characterization must be performed to ensure that the site may be released to unrestricted release in accordance with 10 CFR 20.1402. The License Termination Plan (LTP) must be submitted to the NRC two years prior to the plant license termination date. Once site release criteria have been met and confirmatory surveys completed, the plant's NRC license may be terminated.

Post Phase IV – Dry Spent Fuel Storage

This is the period following release of the site-protected area through removal of all spent fuel from the site.

5 REGULATORY PROCESS

For operating nuclear plants, there is a very structured and documented licensing process. 10 CFR regulations, regulatory guides, standard review plans, and regulatory positions have been developed over the last 30 years. However, from a regulatory perspective, decommissioning a nuclear plant is still in its infancy and does not have such an established structure. This presented a unique opportunity to develop an innovative and cost-effective licensing strategy for Oyster Creek.

NEI 98-02 (Reference 1) clearly explains the 10 CFR 50 Decommissioning Rule changes promulgated in 1996 and outlines industry experience with implementation of those rule changes. Few changes to the actual regulations for decommissioning have occurred since that time. This document provided a solid regulatory base for development of the Oyster Creek licensing strategy.

The NRC and the nuclear industry have, however, been very active in their efforts to improve the regulatory process. SECY 99-168 (Reference 2) reflects the NRC's overall plan for future decommissioning regulations. The SECY document also presented the NRC's plan to address the zircaloy fuel cladding fire issue.

5.1 Licensing Strategy

The Oyster Creek objective was to develop a licensing strategy that supported an expedited and cost-effective transition to decommissioning immediately following permanent shutdown. In order to accomplish this objective, the licensing approach developed included the following:

- Communicate openly and honestly with federal and state regulatory agencies.
- Propose a schedule for submittals that allowed maximum access to decommissioning funds as soon as possible.
- Ensure decommissioning licensing bases are in place at the time of final shutdown.
- For those submittals requiring NRC approval, submit as soon as possible after a decision to permanently cease operations has been made. Specify an effective date of 30 days after shutdown or upon certification of fuel removal, whichever is later.
- Assuming permanent shutdown in the fall of 2000, have all needed regulatory approvals by June 2000. Implementing plans and procedures should be developed in parallel with NRC's review.

- Request the maximum relief possible from regulatory requirements. This does not imply that all regulatory relief would be implemented by GPU Nuclear immediately upon NRC approval. The objective was to allow management the flexibility to revise programs, plans, and procedures during the rapidly changing conditions of decommissioning.
- Utilize the existing regulatory mechanisms available to accomplish our objective; i.e.
  - Changes in regulations affecting decommissioning.
  - Conditions of Licenses – 10 CFR 50.54 (i.e., changes which can be made without NRC approval).
  - Specific rule exemptions – 10 CFR 50.12.
  - Changes, tests and experiments – 10 CFR 50.59 (i.e., changes which can be made without NRC approval).
- Minimize NRC approvals as much as possible through the use of 10 CFR 50.54 and 10 CFR 50.59.
- Take advantage of NEI and other industry efforts and accomplishments.
- To the degree possible, incorporate risk based assessment of actions proposed in licensing submittals.
- Employ an integrated team approach for development of major submittals to ensure the various submittals and plans are consistent. Defueled License and Technical Specifications, Emergency Plan Exemption Requests/Defueled Emergency Plan, Security Plan Exemption Requests/Defueled Security Plan, Insurance Exemptions, and the Defueled Safety Analysis Report must be coordinated with regard to assumptions and implementation dates.
- Maintain effective working relationships with federal and state regulatory agencies. Initiate and maintain communication with key personnel of the regulatory agencies by the various levels of GPU Nuclear management.
- Work with NRC on approach and schedule of licensing submittals. Hold frequent status meetings (e.g., quarterly).
- State of New Jersey—Frequent status meetings.
- Develop and maintain applicable industry contacts.
- Utilize recent decommissioning experience (Maine Yankee, Big Rock Point, Trojan, Yankee Rowe, Millstone I, and Connecticut Yankee).

5.2 Licensing Submittals

5.2.1 Required Submittals

In accordance with 10 CFR 50.82, "Termination of license", the following licensing submittals are required to transition to the decommissioning mode and to terminate the license:

- Certification of Permanent Cessation of Operations (within 30 days after shutdown decision)
- Post-Shutdown Decommissioning Activities Report (PSDAR)
- Site Specific Decommissioning Cost Estimate
- Certification of Permanent Removal of Fuel
- License Termination Application and Plan

Decommissioning submittals required by other regulations include:

- Spent Fuel Management Program--50.54(bb)
- Defueled License and Technical Specifications--50.36(c)(6)
- Financial Assurance--50.75(f)

5.2.2 Cost Effective Submittals

Although not required, in order to ensure an efficient and cost-effective decommissioning effort, exemptions from other regulations or approval of alternate plans are necessary. It was anticipated that submittals would be made in the following areas:

- Emergency Plan Exemption Requests/Defueled Emergency Plan
- Security Plan Exemption Requests/Defueled Security Plan
- Defueled Quality Assurance Plan
- Defueled Operator Requalification and Staffing
- Nuclear Insurance Exemptions
- Defueled Safety Analysis Report

NEI 98-02 (Reference 1) describes the regulations governing the above submittals in detail, therefore there is no need to repeat that information here.

5.3 Phase I Licensing Submittals

As noted in section 4.3.2, decommissioning planning established four phases for decommissioning planning purposes. The regulatory submittals prepared during Phase I for the start of Phase II included:

- Certification of Permanent Cessation of Operations
- Post-Shutdown Decommissioning Activities Report (PSDAR)
- Site Specific Decommissioning Cost Estimate
- Certification of Permanent Removal of Fuel
- Defueled License and Technical Specifications

- Emergency Plan Exemption Requests
- Defueled Emergency Plan
- Security Plan Exemption Requests
- Defueled Security Plan
- Defueled Quality Assurance Plan
- Defueled Operator Requalification and Staffing
- Nuclear Insurance Exemptions
- Defueled Safety Analysis Report

These submittals assumed that the systems utilized would remain in their present configuration after shutdown. It was recognized that modifications to the plant would be installed within one year after shutdown and a revision to the Defueled Technical Specifications and the Defueled Safety Analysis Report would be necessary to reflect the Modified systems.

In the areas of Emergency Planning and Security, the intention was to submit the exemption requests to obtain the maximum relief possible from regulatory requirements. Based upon these exemptions, the Defueled Emergency Plan, Defueled Physical Security Plan, Guard Training and Qualification Plan, and Safeguards Contingency Plan would then be drafted and implemented after shutdown, without a reduction in effectiveness (10 CFR 50.54). This would eliminate NRC approval of future revisions as decommissioning progressed.

Although we would have the Security exemptions approved prior to shutdown, reductions would be gradually implemented during Phase 2 after major modifications to systems had been effected.

The Defueled Technical Specifications were drafted and formatted consistent with the improved Standard Technical Specifications (STS) and the proposed BWR improved STS for permanently defueled plants. The draft included a recalculation of potential decommissioning accidents to allow implementation of the Defueled Technical Specifications 30 days after permanent shutdown or when all fuel had been permanently removed from the Reactor Vessel whichever was longer. Implementation of the Defueled Security Plans, Insurance Reductions, Defueled Quality Assurance Plan, Operator Requalification and Staffing, Defueled Emergency Plan and Defueled Safety Analysis Report were to coincide with the Defueled Technical Specifications implementation.

Significant regulatory relief would, therefore, be available almost immediately after shut down (30 days). This allowed management the flexibility to revise programs, plans, and procedures and reduce personnel as decommissioning progressed.

5.3.1 Zircaloy Fire Consideration

In the permanently defueled condition, the risk associated with the plant has been significantly reduced. The calculated maximum off-site dose for the postulated releases evaluated in the Oyster Creek's Defueled Safety Analysis Report is well below 10 CFR 50, Part 100 and the U.S. Environmental Protection Agency Protective Action Guidelines (PAGs). In addition, it is believed that there are no credible beyond-design-basis accidents. Therefore, there is no need for off-site Emergency Planning functions and liability insurance requirements could be substantially reduced. The NRC, however, has required licensees to perform a site specific spent fuel heat-up analysis to determine the window for a possible zircaloy fuel cladding fire if the fuel pool is drained of all coolant.

The Zircaloy fire scenario was evaluated for Oyster Creek using the SHARP Code. The Brookhaven National Laboratory developed the SHARP Code and the NRC has employed it in evaluating the potential for and duration of a Zircaloy fire. The analysis for Oyster Creek using the SHARP Code yielded a Zircaloy minimum fire duration of approximately 3-4 months. During 1999, the NRC formed a Technical Working Group (TWG), at the Commission's direction to evaluate the Zircaloy fire/fuel pool accidents at decommissioned plants. NRC's plan is to finalize the risk assessment by March of 2000, and then proceed with rulemaking in the areas of Emergency Planning, Safeguards, and Insurance Requirements. Rulemaking may take an additional two years. Until that time, the Staff plans to continue to process exemption requests on a plant-specific, case by case basis.

Based on these recent NRC actions, Oyster Creek no longer had a basis for their exemption requests in the areas of Emergency Planning, Security, and Insurance requirements. They were dependent on the existence/duration of the Zircaloy fire window.

One potential criterion for reviewing exemptions is the determination that a zirconium fire is not credible. GPU Nuclear chose to initiate an evaluation of fuel pool drain down probability with the anticipation that fuel pool drain down would not be a credible event. The risk-based evaluation would form the basis for the exemption requests and would also help in determining what systems/ administrative controls/monitoring would be required to ensure fuel uncovery is not a credible event.

5.4 Phase II Licensing

Section 6.2 identifies the plant modifications that were planned to be completed in Phase II. Shortly after permanent shutdown, the Revised Defueled Technical Specifications that reflect the modifications should be submitted for NRC approval.

The Revised Defueled Safety Analysis Report should also be submitted for information purposes. Other changes to the Defueled Security Plan should be submitted after implementation.

The planning basis called for submittal of the Spent Fuel Management Program and the License Termination Application near the end of Phase II. Actual submittal should be dependent upon a number of factors such as regulatory environment, availability of a temporary/permanent storage facility, status of site characterization and health of local/ state relationship. These submittals can certainly be delayed, however, the sooner all requirements are solidified, planning for Phase III and IV can proceed with some degree of certainty.

6
ENGINEERING AND WORK PROCESSES

This section summarizes the engineering design basis analyses, plant modifications, and work process re-design that was conducted to support Oyster Creek decommissioning.

6.1 Design Bases Analyses

Approximately 30 months prior to the projected final shutdown, an engineering staff of four people was assembled to plan for decommissioning. The team members had no routine duties supporting plant operation although all were occasionally assigned to support unforeseen plant problems as they arose. This team, with the support of outside contractors, developed the DPPs associated with decommissioning engineering activities, defined the scope of system modifications needed to support decommissioning, and developed the design basis analyses that were needed to support system design and licensing submittals. DPP development is discussed in Section 4.3.1. System modifications will be discussed in Section 6.2.

As stated above, the initial engineering effort involved a small group of GPU Nuclear personnel and was supplemented by contract personnel. In general, specific engineering analysis projects were defined for competitive bid to contract organizations rather than "sole-sourcing" or augmenting staff with contract personnel. This gave GPU Nuclear the opportunity to evaluate the performance of a number of vendors and take best advantage of individual skills.

Table 6.1 summarizes the scope of the analyses that were initiated to establish the engineering decommissioning design bases.

Table 6-1
Design Bases Analyses and Decommissioning Usage

Analysis	Usage
Neutron activation	Establish basis for cost estimate, RPV disposition options
Accident analysis	Basis for public health and safety during decommissioning; decommissioning systems design, Zr fire considerations
Reactor pressure vessel removal and shipment feasibility	Major engineering challenge requiring long lead time. Needed to establish decommissioning schedule, evaluate cost-effective alternatives, and fuel-storage options
RPV chemical decontamination	Basis for personnel dose reduction; emerging technology evaluation
Site-specific cost estimate	Basis for revenue collections, top-level selection of decommissioning alternatives and overall decommissioning planning.
Personnel dose estimate	Basis for personnel health and safety during decommissioning; decommissioning systems design
Dismantlement sequence	Basis for most effectively conducting decommissioning activities
Work process and procedure redesign	Develop cost-effective work processes, eliminate unnecessary procedures, develop new procedures for decommissioning activities
Plant modifications scope	Defines scope of decommissioning-specific engineered systems and plant modifications

One insight should be noted here with regard to the timing of engineering analyses. Because the possibility of early shutdown of Oyster Creek was announced approximately three years prior to the shutdown date, GPU Nuclear had the opportunity to complete more decommissioning engineering work during its operating cycle than plants whose shutdown could not be foreseen. GPU Nuclear, in consultation with the decommissioning cost estimator, concluded that it would be cost-effective to complete the bulk of engineering design work prior to final shutdown so that a much reduced engineering organization would be required after final shutdown. During the post-shutdown period, the engineering staff would then be responsible primarily for implementation of modifications and emerging technical issues. The post-shutdown staffing levels in the cost-estimate reflected this assumption.

Most of the design bases analyses were completed 12 and 24 months before the projected final shutdown to assure that adequate time would be available to complete the design and modification of plant systems that would be used during decommissioning. The bulk of systems modifications, therefore, could be installed during the first year after shutdown.

6.2 Modification Design

To accommodate changed conditions after final shutdown, numerous plant system redesigns will occur. These new designs are required to support decommissioning activities, facilitate removal of systems designed to support plant operation, and prevent or mitigate potential decommissioning accidents.

As indicated earlier, there was a corporate commitment to perform as much decommissioning work as feasible with in-house personnel. To accomplish the initial design of the decommissioning systems, a group of approximately 12 engineers and designers were assembled with the sole responsibility of designing decommissioning systems. The group was relieved of responsibilities associated with plant operations and was provided with the guidance, regarding design criteria and modification scope, that evolved from the work discussed in Section 6.1.

The group of modification engineers was assembled, approximately 20 months prior to the projected shutdown. These personnel were available to support decommissioning because a refueling outage had recently been completed and it was anticipated that there would be no more significant plant modifications prior to final shutdown. (The modification-engineering group was disbanded when the asset purchase agreement for the sale of Oyster Creek was signed in Oct 1999.) The primary work product of the group was the conceptual design document (CDD). The CDDs were similar to other modification documents in that they provided design criteria, system layouts, and tie-ins to operating plant systems.

Table 6.2 summarizes engineered systems that were planned for Oyster Creek decommissioning and their design criteria. Those modifications were to be implemented during the period following plant shutdown and before bulk D&D; which was estimated to be about 15 months for Oyster Creek decommissioning.

The schedule for implementing plant modifications was driven by the opportunity to complete design engineering prior to final shutdown and the desire not to “overdesign” systems whose requirements would become less demanding throughout decommissioning. Thus, the earliest date for implementing plant modifications was tied to completion of engineering design and timely approval of licensing exemption requests. As discussed in Section 5.3, relief from regulatory requirements associated with plant operation was sought for 30 days after shutdown at which time plant modifications would begin (e.g., isolation of certain plant operating systems, environmental monitoring systems). Other plant modifications were scheduled to occur much later after plant shutdown. Examples of these are the spent fuel cooling system and radwaste processing systems which were scheduled to be implemented later to take best advantage of the exponential decrease in spent fuel decay heat and processing capacity, respectively. (It is noted that the timing for implementing some modifications appears more sensitive to work management and licensing issues than engineering constraints, e.g., the schedule for HVAC modifications was tied to the fact that plant modifications must continue throughout the dismantlement phase as system boundaries change.)

In addition to engineering systems that would be specific to decommissioning, an effort was initiated to “disposition” the systems that supported plant operations. This activity identified the time at which a system would no longer be required and the potential isolation point of the system from decommissioning activities. This activity was assigned to the team designing new modifications because of the importance of coordinating the installation and timing of new systems with the decommissioning of original plant systems.

Table 6-2
Engineered Systems for Decommissioning vs. Design Criteria

Engineered System	Design Criteria
Electrical Power	New system reduces personnel electrical hazards by eliminating need to identify and terminate leads of existing system prior to dismantlement activities Reduced decommissioning loads allow reduction in site power requirements Reduced credible accident spectrum allows reduction in redundancy and other “safety grade” characteristics
Radwaste Processing	New system allows dismantlement of operating plant systems which may include extensive piping and support systems New system designed to be dismantled
Spent Fuel Pool Cooling	New system allows dismantlement of operating plant systems which may include extensive piping and support systems New system sized to reduced heat loads. New system can be localized to fuel pool area
Heating, Ventilation, and Air Conditioning (HVAC)	New or modified systems designed to support dismantlement activities. Potential for localizing key components to fuel pool area to supply accident mitigation requirements
Fire Protection	Modifications consistent with dismantlement activities (e.g., industrial safety requirements may predominate)
Radiation and Environmental Monitoring	Modifications consistent with dismantlement activities (e.g., changing radiological control envelope)
Plant “Monitoring” Station	Monitoring station replaces control room of operating plant due to reduced operator action requirements after shutdown Monitoring station may be collocated with security station

6.3 Work Processes and Procedure Disposition

6.3.1 Work Process

As GPU Nuclear began the planning process for the potential early decommissioning of Oyster Creek, insights from other decommissioning projects were gathered. One of these insights was that most decommissioning activities should be conducted within an industrial or commercial framework rather than the perspective of nuclear power generation. The former is typically associated with fewer checks and balances because of its reduced potential health and safety hazards. This insight leads to the conclusion that simpler work processes could be developed, which would in turn lead to reducing the overall cost of decommissioning. Three work process initiatives were defined as indicated in Table 6.3:

Table 6-3
Work Process Initiatives & Objectives

Process	Objective
Design Criteria	Establish process for developing decommissioning design criteria and assure that modifications are integrated properly.
Modifications	Establish requirements for design and approval of modifications associated with decommissioning
Work Control	Establish process and associated work management system (e.g., software) for performing decommissioning work.

These work process initiatives began approximately 20 months before the projected final shutdown date. They were each performed by a designated team, but on a collateral duty basis as the plant support activities retained priority.

The idea that decommissioning modifications should be performed using these revised processes was discussed. However, it was judged that the processes would not be completed in a time frame that would allow their use for decommissioning modifications given that the modifications were intended to be engineered prior to shutdown. There was also reluctance to have two distinct types of processes in use simultaneously (i.e., operating and decommissioning). Finally, at the time decommissioning work was suspended, few “revolutionary” changes to processes had been identified; thus, the value of revised work processes may not have been as great as initially envisioned. It appears that a “graded” approach to applying the requirement of existing processes to decommissioning work may provide the desired benefits.

6.3.2 Procedure Disposition

The procedure is the document that translates management direction, licensing commitments, operating parameters, and other design bases information into personnel actions. There are approximately 1500 procedures used to operate Oyster Creek and maintaining all of these procedures during decommissioning would be unnecessary and costly. An initiative to revise the procedure structure was begun approximately 12 months prior to projected plant shutdown. The intent was to identify unnecessary procedures, identify the scope of new procedures, identify the effect of process changes, and define the mechanism for effecting the large number of procedure changes. The task was assigned to the plant review group chairman as a collateral duty. The project was terminated shortly after it began due to the potential sale of the plant to AmerGen.

7
PROJECT COST AND SCHEDULE

7.1 Decommissioning Cost

7.1.1 Planning Costs

Table 7.1 provides the costs incurred to accomplish the planning tasks identified throughout this report.

Table 7-1
Decommissioning Planning Costs 1997 – 1999

GPU Nuclear Internal Costs	
1997	306,000
1998	1,226,000
1999	4,461,000
Subtotal	5,993,000
Contractor Costs	1,587,000
TOTAL	7,580,000

7.1.2 Cost Estimate

As part of the decommissioning planning process, a site specific cost estimate was developed in 1997. A cost estimate had been performed in 1995 which was based on running the plant until 2009. The revised site specific cost estimate utilized different parameters including:

- Shutdown date of September, 2000
- Spent fuel dry storage
- Area-by-area D&D
- Revised low-level radwaste costs
- Revised labor costs

The revised cost estimate showed that the cost to decommission Oyster Creek would be $579 million in 1998 dollars for the DECON option. Estimates were also included for the SAFSTOR alternative, as well as various spent fuel options (e.g., dry vs. wet, on-site ISFSI vs. private fuel storage). ENTOMBMENT was not considered a viable option at the time the Oyster Creek cost estimate was performed. The estimate was performed by a contractor, and was submitted to the Board of Public Utilities as part of the deregulation restructuring filing.

10 CFR 50.82 requires that a site-specific cost estimate be submitted within two years of plant shutdown, thereby allowing full access to the decommissioning trust fund. As indicated in earlier sections, GPU Nuclear had planned to complete the planning activities to support decommissioning prior to final shutdown. Consistent with this philosophy, GPU Nuclear elected to submit a site-specific cost estimate after the PSDAR submittal and the required public meeting, but well in advance of permanent shutdown. Full access to the trust fund at shutdown would, therefore, be available.

7.2 Schedule

7.2.1 Base Case Schedule

The decommissioning schedule for a BWR of the Oyster Creek vintage is driven largely by the disposition plan for spent fuel. Unlike PWRs, the spent fuel pool is located in the reactor building on the refuel floor adjacent to the reactor vessel. Thus, the reactor building cannot be dismantled until all spent fuel has been removed from the pool and either stored in an ISFSI or removed to a permanent DOE storage repository.

The base case decommissioning schedule for Oyster Creek was to transfer spent fuel to dry storage in 2003 assuming a 2000 shutdown with all fuel moved to dry cask storage by 2007. This would then allow dismantlement of the reactor building by 2009 and release of the site by 2010 (except for the ISFSI). Schedule timeframes were as follows:

- Phase I – Planning 1997 – 2000
- Phase II – Plant Preparation for D&D 2000 – 2001
- Phase III – Decontamination & Dismantlement 2002 – 2009
- Phase IV – License Termination & Site Release 2007 – 2010
- Post Phase IV – Dry Spent Fuel Storage 2007 – 2023

7.2.2 Planning Scenarios

Attachment IV shows a timeline schedule based on two possible scenarios for disposition of fuel; dry storage in dual-purpose canisters and wet storage in the spent fuel pool. Although the base case was dry storage for disposition of spent fuel, a final decision had not been made so both wet and dry scenarios were being pursued. As noted in Attachment IV, the wet scenario would have lengthened the time for site release by approximately three years.

8
SITE RELEASE

8.1 Process Elements

Site release is a complex, multifaceted process with various stakeholders and areas of regulatory uncertainty. Given that many nuclear power plants are located in environmentally sensitive areas near major bodies of water, site release considerations should be an integral part of the decommissioning planning process. Current regulatory guidance appears to be fragmented with no clear roadmap to successful license termination existing under the latest rulemaking.

Figure 8.1 illustrates the overall site release process that Oyster Creek was using in planning for decommissioning. During the early stages of planning, site characterization is the primary focus along with scenario evaluation and dose modeling. The following sections discuss the planning for these areas. License termination and the final status survey were not addressed during the Phase I planning.

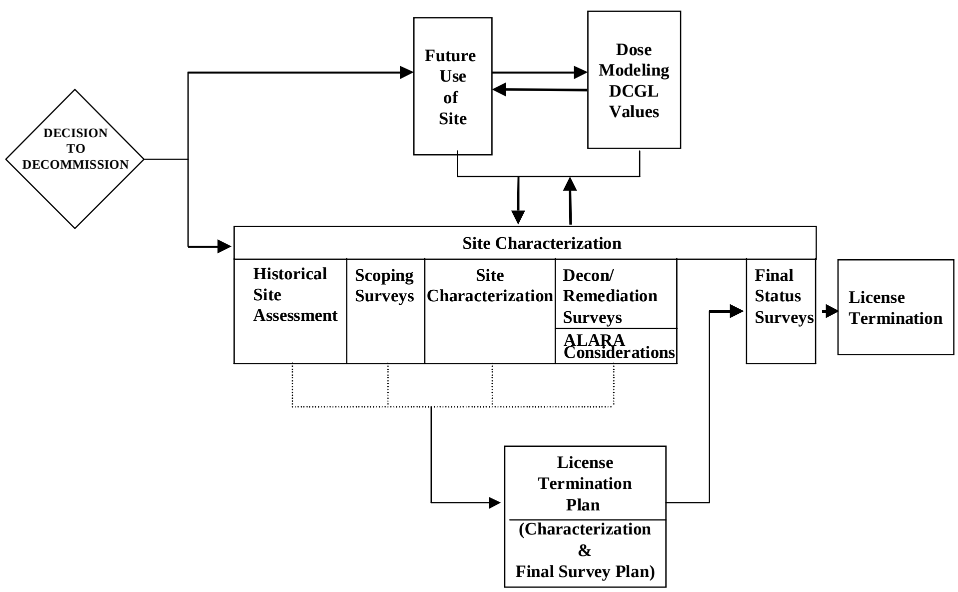

Figure 8-1
Site Release Process

8.1.1 Future Use of the Site

The potential future uses of the site should be considered in decommissioning planning. Various scenarios should be evaluated ranging from unrestricted to restricted release. The future value of the property may be determined to a large degree by the extent to which the site is decommissioned. Use of the rubblization scenario was being considered for Oyster Creek.

8.1.2 Dose Model/Release Criteria

On July 21, 1997, the NRC published its final rule on radiological criteria for license termination, 10 CFR 20, Subpart E (Reference 3). The rule allows termination of a license and release of a site for unrestricted use if the residual radioactivity (i.e. distinguishable from background radiation) results in a total effective dose equivalent to an average member of a critical group of less than 25 millirems per year and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). The rule also allows for license termination under restricted conditions.

EPA has a parallel rulemaking activity that would similarly define criteria for residual radioactivity levels required for license termination. Several of the state Departments of Environmental Protection have adopted the EPA standard or proposed their own radiological release criteria. Because of these various differences, it is important to begin discussions with the stakeholders early in the planning process to achieve a common understanding and agreement regarding which criteria and standards will be used.

Dose modeling is used to develop the derived concentration guideline limit (DCGL), which is the concentration of residual radioactivity that would result in a total effective dose equivalent of 25 millirems per year to an average member of the critical group. NUREG-1549 (Reference 4) describes acceptable methods to calculate DCGL values.

The NRC provided a screening table of unrestricted release values for building surface contamination of common beta/gamma emitting radionuclides in Federal Register Notice 64133, November 18, 1998. A similar table of screening values for soil was published on December 7, 1999 in Federal Register Notice 68395 for beta/gamma and transuranic radionuclides.

The computer code DandD (Reference 5) has been developed by the NRC to perform generic screening using default parameters to evaluate compliance with the unrestricted use dose limit. Other computer models such as RESRAD (Reference 6) and RESRAD Build (Reference 7) can also be used to calculate DCGL values. The use of site specific parameters which may be dose controlling should be evaluated when using these codes.

Dose modeling and calculation of DCGLs are iterative and should continue throughout the decommissioning process.

8.1.3 Site Characterization

The purpose of the Oyster Creek Characterization Plan centers on the need to obtain specific radiological and hazardous material data concerning areas of the site that may have become contaminated or activated during its operating history.

Site characterization is an ongoing process that involves the collection of information needed throughout decommissioning to accomplish the following objectives:

- Determine the type, isotopic mixtures, and extent of contamination in structures, systems, components, and environmental media.
- Determine what needs to be remediated.
- Assess decontamination techniques.
- Estimate decommissioning costs.
- Verify activation analyses.
- Determine waste classifications for packaging, shipping, and disposal.
- Support dose modeling to develop dose based site release criteria.
- Evaluate unknowns.
- Verify that the facility meets release criteria.
- Evaluate hard to detect nuclides.
- Provide the necessary information for the License Termination Plan to the NRC.

These objectives were developed based on input from customer's needs and data requirements from the LTP. The Data Quality Objective (DQO) approach was used to ensure that the type, quantity, and quality of data used in decision making will be appropriate for the intended applications.

Characterization can result in significant costs to the decommissioning project if not properly planned and implemented. Determining what constitutes adequate site characterization is dependent to a large extent on site-specific conditions and what information is already available.

The primary and ultimate goal of a site characterization program is to provide data such that release criteria for the facility can be developed and the scope of the required remediation work determined. The characterization plan uses the NRC screening values for the DCGL's to ensure compatibility with NRC dose-based release criteria and associated guidance.

The preparation of the Oyster Creek plan represents an improvement over previous plans. It was intended to be efficient and effective by applying lessons learned from previous experience, conducting the historical site assessment prior to survey design to maximize use of existing data, using scoping surveys for certain areas with the understanding that additional information may need to be obtained based on the results, using descriptive statistics, and scheduling characterization activities in a phased approach so as to begin work while still operating.

The plan divides characterization activities into three phases. It specifies site characterization activities to be conducted prior to plant shutdown, immediately after shutdown, and throughout the decommissioning process. Consideration was given to the influence of plant operations on measurements (elevated background levels), safe operation of the plant, decay of short lived radionuclides after shutdown, decon techniques that alter radiological conditions, access to areas only after certain D&D activities have been performed, etc.

Only limited guidance documents are available for site characterization, therefore, The Multi-Agency Radiation Survey & Site Investigation Manual (MARSSIM), (Reference 8) and the LTP requirements were used to develop the plan. The MARSSIM guidance for the final status survey is based on non-parametric statistics. Site characterization survey design does not necessarily use MARSSIM guidance; however, MARSSIM final status survey design requires input from site characterization. Even though MARSSIM non-parametric statistics are not used to determine site characterization sampling schemes, characterization data has to have statistical quality to support decision making. Characterization surveys should use judgmental sampling. Remedial action and final status surveys should use random sampling.

The initial phases of the characterization program are more of an exploratory nature vs. verification phase of the final status survey. Therefore, a decision rule is not needed at this time and the use of descriptive statistics is more appropriate. A decision rule and inferential statistics are however, appropriate for the final status survey. Consideration was given to areas such that if the survey design and implementation could satisfy final status survey requirements, then a decision rule was used in the characterization plan development.

The entire site has been divided into areas which are designated by exposure tracking numbers (ETNs). Site conceptual models for the structures and the environment were constructed based on extensive HSA information. This information was the basis for the survey design and the logic used for the protocol development, which are organized and summarized under each individual ETN.

The typical radiological data required to plan and carry on the decommissioning program include the following:

- Locations, spatial distribution, radioisotopic makeup, and contamination levels on structural surfaces.
- Depth of radioactive contamination penetration into surfaces.
- Location, volume, radioactivity levels, and radioisotopic makeup of contaminated environmental media (i.e., soil, sediment, and water).
- Location, distribution, radioisotopic makeup, and radioactivity levels in or on contaminated equipment, ducts, fixtures, etc.
- General area and equipment radiation dose rates.
- The confirmation of the calculation of radioactivity levels induced by neutron irradiation in reactor components and associated structures.

Development of the Oyster Creek plan was predicated on an extensive historical site assessment and the assumption that immediate DECON would be the option selected following plant shutdown. If SAFSTOR is the option selected or a decommissioning operations contractor (DOC) is used, this may affect the scope and schedule of the plan.

An implementation strategy should consider technical developments in instruments, methods, and technology that could potentially improve the cost-effectiveness of characterization as well as a method to handle large amounts of characterization data. Phase I can be implemented at any time prior to shutdown. This plan is also expected to be dynamic. As characterization data are acquired, based on what is learned, changes and adjustments may be required to the scope of work specified in this plan.

8.2 Non-Radiological Characterization

The typical hazardous material data that are required for decommissioning planning includes the following:

- Lead, asbestos, chromium, and PCBs in paints or other surface coatings.
- Presence and concentration of residues on structural and external surfaces of systems which could contain lead, chromates, PCBs, asbestos and petroleum products.
- The depth of penetration of these contaminants into structural surfaces.
- Presence and concentration of lead, chromate, PCBs, petroleum products, or volatile organic compound residues in systems or components.
- Presence and concentration of lead, chromates, PCBs, petroleum products or volatile organic compounds in site-soil, sediment, or groundwater.

The Industrial Sites Recovery Act (ISRA) in the state of New Jersey imposes certain preconditions on the sale, transfer or closure of industrial establishments. The intent of the act is to ensure that environmental concerns and liabilities are appropriately addressed and do not become a financial burden to the state.

As part of the Oyster Creek decommissioning planning efforts, a Preliminary Assessment report was prepared to identify the presence of any potentially contaminated areas of concern. A site investigation report was then prepared to determine if any contaminants are present at the site above remediation standards.

8.3 Partial Site Release

During decommissioning, it may be desirable to release non-impacted pieces of property prior to license termination. The NRC currently does not have regulations to address this situation. NRC plans to address this issue with rulemaking in the near future.

9
LOW LEVEL RADWASTE (LLRW) MANAGEMENT

An essential element of Oyster Creek decommissioning planning was the development of a LLRW Management Plan. The primary objective is to ensure all LLRW generated is dispositioned safely, cost effectively, as scheduled, and in full compliance with site licenses, procedures, policies and all applicable, local, state and federal regulations. The strategies also support the avoidance of unnecessary radwaste generation and disposition costs, ultimately keeping the LLRW disposition costs within the site characterization and cost estimate planning basis assumptions.

LLRW planning began in late 1997 with reviews of plant historical data and plant walk-downs in support of the development of the site characterization documentation and decommissioning cost estimate. The LLRW data collected consisted of waste types, volumes, weights and site waste stream historical data bases containing required radionuclide inventory and scaling factors that were used to characterize and classify each waste type pursuant to 10 CFR 61. This information was then used to develop the LLRW plan; the major elements of which are discussed below.

9.1 Chemical Decontamination

A system decontamination plan was developed to gather information relating to chemical decontamination of reactor primary and secondary systems. The primary goal of chemical decontamination is to reduce dose rates on system components, ultimately reducing personnel radiation exposure during component removal, packaging, and shipment. The reduction in dose rates and surface smearable or fixed contamination also increases the potential for a higher volume of waste to be shipped to Envirocare of Utah.

A bid specification was developed for competitive selection of a chemical decontamination process that would result in the highest decontamination factors, taking into consideration radwaste generation and total project cost. Primary plant component artifacts were obtained from previous refuel outages and saved for testing by each prospective bidder.

9.2 Alternate Liquid Waste Processing

An alternate liquid waste processing plan was developed to identify the required actions necessary to process and disposition liquid waste prior to and after plant shutdown. The plan considered the following:

- A zero liquid discharge policy to the environment currently in place at Oyster Creek
- Company credibility if it decides to discharge over board

- Overboard discharge technical specification limits
- Potential radioactivity concentration buildup in discharge canal sediment
- Public perception and opposition
- Industry experience
- Current system water processing capability
- Vendor system water processing capability
- A water inventory at plant shutdown of approximately 2,000,000 gallons
- Methods to reduce in leakage from ground and storm water
- Methods to process in leakage
- Reduction in inventory prior to plant shutdown
- Radionuclides and activity, specifically tritium
- Storage capabilities
- Total cost
- ALARA

The following disposition methods were considered:

- Process using existing plant systems or a vendor supplied system with radionuclide specific media to reduce activity to minimum detectable activity (MDA), except for tritium and then overboard discharge.
- Process using existing plant systems or vendor supplied systems and evaporate using plant system or vendor system and release through plant stack.
- Bulk ship in tank trucks to off site waste processing facility.
  - Use water inventory for make up to spent fuel pool due to evaporative losses.
  - Store for decay based on half life of tritium, process to MDA for all other radionuclides and release overboard.

After considerable evaluation of numerous options, the chosen method was to process the water on-site using existing plant or vendor supplied equipment and use the water for make up to spent fuel pool due to evaporative losses. The remaining inventory in the fuel pool after spent fuel is removed could be further volume reduced using a heat source to ALARA. Any remaining water could then be processed to MDA except tritium. The reduced volume can then be discharged overboard or sent to off-site waste processors.

Written plans were also developed to address and consider repairs to reduce and or eliminate ground and storm water in leakage to include a conceptual design for processing the in leakage from plant collection sumps. Ground and storm water in leakage is included in the site inventory projection of 2,000,000 gallons.

9.3 Loss of LLRW Disposal Capability

Having the ability to dispose of LLRW prior to and during decommissioning is critical when making the decision to immediately dismantle and decommission a nuclear power plant. Therefore, an evaluation on the loss of disposal capability must be performed and documented to support making that decision. For the Oyster Creek decommissioning, disposal capability was a key planning basis assumption. The evaluation for Oyster Creek considered the following:

- Waste types, volumes and NRC waste class
- The current events threatening the continued availability of current disposal sites
- The potential for future sites, both commercial and private
- Waste types, volumes and waste class distribution to waste processors and disposal sites
- Waste volumes exceeding Envirocare's license
- Denied access to Barnwell with continued disposition of waste to processors with blending for disposal at Envirocare
- Denied access to both Barnwell and Envirocare with continued disposition of waste to processors and return of remaining volume reduced waste to generator for storage.
- Storage on – site using the low level radwaste storage facility
- Continued access to waste processors

It was concluded that adequate capacity existed, assuming efficient use of off-site radwaste processing capability to store decommissioning LLW onsite.

9.4 On-Site Storage Capability for GTCC/Highly Irradiated Hardware

Oyster Creek, like other plants, increased its on-site LLRW storage capacity in the late 1980's in the event of closure of LLRW disposal facilities. To ensure the facility could support the storage of D&D waste, the following evaluation was performed:

- Current licensing status, permits, licensing and regulatory issues
- Facility storage configuration, storage capacity, volumes, weights, curies versus D&D waste volumes, curies, weights and configuration of waste returned
- Facility services pre and post D&D
- Modifications and Expansion
- Storage during D&D and post D&D storage costs
- Post decommissioning maintenance and inspection program

Irradiated hardware, including greater than Class "C" irradiated hardware would be stored with the spent fuel and the reactor pressure vessel, whole and or segmented will be stored within the foot print.

9.5 LLRW Broker

To determine the advantages and disadvantages of using a LLRW management broker versus using in-house staff, the following were considered:

- Waste management approach
- Attributes and qualifications of a broker
- Responsibilities of a broker
- Responsibilities of the owner/licensee
- Licensing issues
- In-house waste management costs

The following advantages and disadvantages were identified:

Advantages

- A broker provides a single focal point for radwaste management
- Broker experience in handling large volumes of waste and knowledge of packaging, transportation regulations and direct on-site involvement of sizing and segregation provides the potential for greater waste management efficiencies and potential for lowering overall disposal costs. The use of an on-site broker also eliminates repackaging of materials and personnel radiation exposure because sizing and or types of materials packaged do not meet waste processor acceptance criteria.
- A broker has access to large volumes of waste from multiple sites enabling the broker to negotiate lower bulk rate pricing. This provides for the passing of cost savings to the plant owner.
- Lower cost may be realized because the broker utilizes his or her own personnel. This minimizes delays waiting for support from other plant work groups and includes operating equipment such as trucks and forklifts.
- A broker has access to large volumes of waste from other facilities for blending to meet Envirocare's license limits. This optimizes the amount of waste shipped to Envirocare and minimizes waste shipped to Barnwell or return to the generator for storage.
- Transfers risks associated with the overall cost to manage LLRW to the broker

Disadvantages

- Use of a broker could cause jurisdictional disputes between plant union workers and contractor nonunion workers causing work stoppage, schedule delays and cost increases.
- Site owner does not get full benefit of resale of scrap material from dismantlement since the broker takes title and full benefit of resale.
- Waste shipments could be delayed, therefore, affecting the D&D schedule if the broker is denied access to a disposal site due to non- compliance to disposal site regulations.
- Closure of burial site will affect and change the broker scope of work

9.6 Radioactive/Mixed Waste Minimization

The reasons for radwaste minimization do not change because a plant is being decommissioned. Management at all levels must indorse and enforce a radwaste minimization plan prior to plant shutdown.

A plan was developed that documents those LLRW management guidelines that should be implemented to reduce LLRW cost, personnel radiation exposure and ultimately reduces the volume of LLRW at the source of generation. The guidelines used were those recommended in EPRI Solid Waste Management Guidelines TR-104583. The plan also takes advantage of current site waste minimization plan and controlling policies and procedures.

9.7 Mixed Waste Identification Plan

Having a mixed waste identification plan in place during plant operations and collecting data on plant equipment coatings and other potential sources of mixed waste, is preferred rather than obtaining data after the plant is shutdown. This will permit access to technically knowledgeable people prior to transition to a decommissioning status and will support the development of the site characterization decommissioning cost estimate.

9.8 Large Component Removal

Removing large components is a significant challenge which occurs early in the decommissioning plan. The following were considered in the development of the large component removal plan:

- Industry experience
- Criteria defining a large component
- Cost for removal whole or partial versus cutting up
- Site specifics such as lifting, rigging, personnel access, structural layout
- Maintaining area, building integrity during and after removal
- Radiological challenges and personnel radiation exposures, ALARA
- DOT, NRC package sub type, transportation and disposition methods

9.9 Waste Tracking

Having a waste tracking system to document the types, volumes, curies, NRC waste class disposition is important and required. The plan considered the following:

- Information is required for submittal of Regulatory Guide 1.21 report
- Provides data for management oversight

- Provides information to state regional compact commission
- Maintains historical information
- Data can be used to establish goals and objectives

10
SPENT FUEL MANAGEMENT

When planning for the long-term storage of high level waste, the utility must ensure that the spent fuel storage pool (SFSP) has the capacity to receive all spent fuel at shutdown. In 1996, Oyster Creek lost full core offload capability. The original plan was to transfer fuel to a dry fuel storage system in the spring of 1996. Oyster Creek had two issues; namely, the inability to handle the 100-ton transfer cask at power in the reactor building, and Quality Assurance issues associated with the vendors program. The campaign was delayed indefinitely and full core offload was lost. When the decision to begin planning for the potential early shutdown of Oyster Creek was made, the first task was to ensure full core offload was achievable. The Oyster Creek SFSP capacity is currently licensed for 2645 spent fuel assemblies. Two thousand four hundred twenty (2420) spent fuel assemblies are now stored in the SFSP. At shutdown in September of 2000, the total number of spent fuel assemblies to be stored in the SFSP would have been 2980. To accommodate core offload and the dismantlement schedule, GPU Nuclear has submitted for approval a license amendment request to increase SFSP capacity by 390 assemblies. The increased capacity will be achieved by the installation of additional fuel storage racks.

10.1 Spent Fuel Management Options

With the announcement that Oyster Creek would possibly shutdown in September of 2000 and begin immediate dismantlement, planning for long term disposition of spent fuel became a priority. The decommissioning staff looked at alternatives for long term storage. The alternatives included wet storage, onsite dry storage, off-site dry storage or a combination. The staff then looked at each option and how the option supported the decommissioning plan for early dismantlement. Each of the options identified is described below.

10.1.1 On-Site Interim Wet Storage

Existing SFSP's are licensed through plant life. The pools are proven technology for safe storage of irradiated fuel. However for BWR's, interim wet storage prohibits the immediate dismantlement of the SFSP, reactor building or fuel handling building. Dismantlement and site release become dependant on the ability for DOE to receive spent fuel at either an interim or permanent repository.

10.1.2 On-Site Interim Dry Storage

In addition to expanding in-pool storage capacity, utilities can increase site storage through dry storage at an on-site Independent Spent Fuel Storage Installation (ISFSI). ISFSI designs have primarily focused on dual-purpose systems for dry fuel storage. The dual-purpose system provides for the removal of all spent fuel from the spent fuel storage pool and safe interim on-site storage for up to forty years. Current vendor designs do not address the storage of Greater Than Class 'C' waste for on-site interim storage. A site-specific license for the storage of GTCC in a dry storage system must be submitted and approved by the utility.

10.1.3 Off-Site Interim Dry Storage

Off-site interim storage facilities allows the utility to store fuel in a dual-purpose system without the need to construct an on-site facility. Currently two facilities are in development and license review. These facilities would provide an alternative to on-site wet or dry storage. Using an approved dual-purpose system, irradiated fuel would be packaged, transported via rail, and stored for an interim duration at an annual storage rate per kilogram of spent fuel. However, neither of the licensees has applied for storage of GTCC waste. This will require the utility to provide interim storage on the licensee's site.

10.2 Long Term Storage

Each of the options discussed above are considered interim. Final disposal of all spent irradiated fuel and GTCC waste is the responsibility of DOE. Under the Nuclear Waste Policy Act, as amended, Congress directed the DOE to concentrate site characterization studies at Yucca Mountain in Nevada. The current schedule in the Office of Civilian Radioactive Waste Management program projects operation of the repository to commence in 2010. The schedule does not address transportation issues or allow time for intervention.

10.3 Wet vs. Dry - Advantages & Disadvantages

An evaluation of each option was performed. The review considered cost, schedule, system availability, site compatibility, and risk associated with each option. The results of the evaluation are identified in the following sections.

10.3.1 On-Site Interim Wet Storage

The option to maintain fuel wet is a proven technology that has the confidence of the general public. Maintaining fuel wet eliminates the requirement for major capital investments such as dry storage casks, canisters and the construction of an on-site ISFSI. However, there are disadvantages that for Oyster Creek outweigh the advantages. Immediate dismantlement will be delayed until DOE accepts spent fuel and greater than 'C' waste. The cost associated with maintaining the SFSP and associated systems is high. The initial capital investment for an ISFSI may appear higher, however, when considering spent fuel may remain on site for 20 to 30 years, the cost of maintaining the spent fuel storage pool is substantially higher. Oyster Creek estimated a cost to maintain the spent fuel storage pool at $6.0 million/year.

10.3.2 On-Site Interim Dry Storage

On-site interim dry storage provides the owner the ability to commence immediate dismantlement of the site. The initial cost estimate associated with dry fuel storage are high, ranging from $10-15,000 per assembly. However, long-term maintenance costs are considerably less. Oyster Creek's estimate is $2.2 million annually.

An ISFSI can be licensed under the vendor's general license certificate of conformance or may be licensed as site specific under 10 CFR 72. The advantage of a vendor's general license is that a NRC license approval is not required as long as the requirements of the general license are met. However, the licensee must maintain the sites 10 CFR Part 50 license for the duration of fuel on-site. Under the site-specific license, 10 CFR Part 72, the licensee may terminate the site's 10 CFR Part 50 license at the completion of dismantlement and site release. However, the licensing effort in obtaining a site-specific license can be challenging to the point of delaying fuel movement.

10.3.3 Off-Site Interim Dry Storage

The option of private fuel storage allows the licensee to transport spent fuel off-site for long term storage accelerating termination of the site license. There is no requirement to construct an ISFSI and the cost for long term storage is estimated to be lower then the overall cost for on-site storage over time. The estimated duration to transfer fuel off-site at Oyster Creek is ten years commencing three years after plant shutdown. To further accelerate site release, Oyster Creek considered construction of a smaller ISFSI under the vendor's general license allowing for off-site transfer in parallel with on-site dry storage. This option for Oyster Creek allows for all fuel to be removed from the spent fuel storage pool within six years of shutdown. However, the disadvantages with off-site interim storage is that no license has been obtained for the construction and storage of spent fuel. It is estimated that in the year 2001, Private Fuel Storage, LLC will receive the first interim storage license and the facility is to begin operation in 2003. However, even if the site becomes operational, the task of transporting fuel still must be addressed. The preferred method would be via rail.

10.4 Supporting Issues Related to Dry Fuel Storage

10.4.1 Heavy Load Issues

As mentioned, Oyster Creek placed on hold the original spent fuel transfer campaign not only do to vendor issues but also do to heavy load considerations related to cask handling within the reactor building. With the issuance of NRC bulletin 96-02 (Reference 9), Oyster Creek was not able to satisfactorily evaluate the consequences of a load drop at power. Oyster Creek is one of the few remaining nuclear power plants without a single failure proof crane in the reactor building. Additionally, the reactor building crane capacity is rated at 100 tons. All dual-purpose system casks exceed 100 tons, thereby requiring the site to upgrade the crane's capacity or utilize a system transfer cask for transport to an on-site ISFSI.

10.4.2 Spent Fuel Storage Pool Isolation

Consideration must be given to isolating the SFSP from the balance of plant. For BWR's the decommissioning team must deal with irradiated hardware such as control rod blades, fuel support castings, instrument tubes and guide tubes.

10.4.3 Damaged or Failed Fuel

The NRC definition of damaged fuel is any assembly with known or suspected cladding defects greater than a hairline crack or a pinhole leak. Failed fuel is defined as spent nuclear fuel with plutonium in excess of 20 curies per package in the form of debris, articles, loose pellets and fragmented rods or assemblies. The definition of damaged and failed fuel applies to both spent fuel storage and transportation.

At Oyster Creek, there are over two hundred assemblies that are considered damaged. Each of these assemblies will be inspected and packaged if required prior to plant shutdown. By planning in advance this activity will be complete prior to transfer and storage of irradiated hardware in the SFSP. By identifying in advance the utility has the advantage of developing an optimum loading plan for all spent fuel.

11
COMMUNITY AND EMPLOYER COMMUNICATIONS

When a plant shuts down and begins decommissioning, audiences need to have the same confidence in a decommissioning organization as in an operating company. Ineffective communications has the power to cause significant roadblocks during any phase of decommissioning.

For nearly three decades good relationships have been fostered at Oyster Creek due in large part to solid communications efforts with both employees and the public at large. However, when the announcement was made that the plant might be decommissioned early, the communications programs needed to be re-evaluated and a communications plan was developed.

11.1 Communication Plan

- The purpose of the plan was simple:
- Increase public understanding of the decommissioning plan to minimize concern and gain support.
- Increase employees' understanding of the decommissioning program to gain their active support in meeting company goals and objectives.
- Provide communication support to decommissioning project planning and during the workforce transition to a decommissioning organization.

A major element in drafting the plan was identifying the potential key issues that decommissioning would bring about including the following:

- Audiences do not understand the decommissioning process and its impact.
- The economic impact of closing Oyster Creek.
- Employees must have timely and accurate information.
- Low level and high level radioactive waste issues, including storage and transportation.
- What will the plant site be used for in the future?
- Health effects of radiation releases.
- Public participation during the project.
- Public trust of GPU Nuclear.
- Project cost – source of funding.

- Decommissioning methods.
- Final site release criteria.
- Present radioactive/non-radioactive contamination of the site.

Once potential issues were established, a listing of key messages was developed. These messages would be used in all communications with various audiences as follows:

- Decommissioning will not release significant amounts of radioactivity to the environment.
- No adverse health effects will be attributed to decommissioning.
- Technology exists to do the job safely.
- Other decommissioning projects have been completed safely.
- Continued commitment to the environment.
- The public will be informed about major activities.
- The public will serve in an advisory role during the project.
- The public will be informed promptly of any problems.
- GPU Nuclear can be trusted to the job safely.
- Sufficient funds will be available to complete the project.
- Prompt dismantlement is safe and economical.
- GPU Nuclear has the expertise and experience to complete the job safely and efficiently.

It was also important to identify key audiences, essentially the same groups who the Communications staff related with during regular operations. They are:

- Area residents
- Employees, including contractors
- Local, state, federal government officials
- Media
- Business and Opinion Leaders
- Regulators
- Educators and students
- Special interest groups
- Nuclear power industry

11.2 Communication Tools

These are the tangibles of public relationships. This is the work that people can actually hold in their hands. Many of these tools have and probably always will be part of routine communications efforts, but would take on a different focus during decommissioning. These tools would be used to effectively address the issues discussed previously and serve as a vehicle to launch key messages.

Publications:

- External newsletters
- Internal newsletters (including the plant's weekly newsletter for employees) and "news flashes" or "Special Editions")
- Brochures, special publications
- Articles for trade publications

Public Option Surveys

Videos

11.3 Citizen Involvement

It is vital that the relationships and efforts made to communicate with the general public are not reduced during a transitional period. In fact, efforts should be stepped up in order to accommodate all of the groups, organizations and individuals who want to know more about the process of decommissioning.

As a result, efforts were made to alter the company's existing program to reflect a decommissioning organization. They included:

- Small group meetings/public forums/open houses
- Tours
- Speakers Bureau
- Continued membership, participation in various civic/community organizations
- Special programs for educators
- Education Center displays about decommissioning
- Special tours and programs about decommissioning
- Assisting area educators in establishing curriculum related to decommissioning

A major success story that came from the Saxton case study is the premise of its Citizens Task Force. What Saxton communicators learned was that the best way to gain support for the decommissioning project was to actively get people involved in it. That's how the Citizens Task Force (CTF) was formed.

The CTF is a consortium of community representatives interacting with company officials on a regular basis. The group provides feedback, advice, ideas, and input on issues related to decommissioning and the transition of the plant from an operating facility to a decommissioning one. It is an excellent means of promoting two-way communication because in order to be most effective, the company must be receptive to group input and advice.

For Oyster Creek, the CTF membership includes:

- Government officials
- Business and community leaders
- Educators
- Religious leaders
- Neighbors
- Environmental group representatives

11.4 Communicating with Employees

Employees are ambassadors for any organization. At a nuclear power plant, they are also the individuals who will complete the weighty task of decommissioning. Oyster Creek employees would learn about decommissioning in these ways:

- Newsletter articles, features leading up to actual decommissioning
- Frequent employee meetings to provide information on decommissioning, organization and staffing requirements
- Special employee newsletter when decommissioning begins
- Periodic employee meetings during decommission process
- Decommissioning management met with small groups of employees to discuss the decommissioning process.

12 LESSONS LEARNED

In preparing Oyster Creek for decommissioning, the decommissioning staff learned much from the experiences of those plants engaged in decommissioning activities (Trojan, Rancho Seco, Dresdan I, Yankee Rowe, Connecticut Yankee, Maine Yankee, Big Rock Point and Saxton). At the same time, Oyster Creek's situation was different than these plants in that planning was being performed while the plant was operating with a possible shutdown date having been announced. This process will likely be the scenario followed for plants preparing for decommissioning in the future. For the Oyster Creek planning process, the following lessons learned are offered:

12.1 Management

- Decommissioning planning should start well before final plant shutdown. With a decommissioning plan in place prior to shutdown, there are opportunities for considerable savings to the overall cost of decommissioning. This is particularly important for plants that have been acquired since the decommissioning fund transferred to the buyer is typically fixed as part of the sale agreement. Thus, the opportunity to petition state regulators for additional funding to cover unanticipated decommissioning costs will not be an option for the new owner.
- Two to three years is a satisfactory period needed to prepare the plant for transition to the decommissioning mode. For the Phase I scheduling model shown in Attachment I, 30 months was chosen as the ideal planning time to prepare the necessary project plans, strategies, technical and engineering tasks and regulatory submittals.
- A dedicated staff should be established to manage and perform the decommissioning planning activities. Initially at Oyster Creek, a small group of 8-10 persons was organized as a separate group reporting to the V.P. of Engineering. The separate organization assures that decommissioning does not interfere with the plant organization's priority of safe and reliable operation. As the planning process progressed, the decommissioning staff kept the plant staff apprised on planning activities and obtained input from Operations as appropriate without conflicting with the plant's priorities.
- For Oyster Creek, the commitment to use in-house personnel for decommissioning planning provided potential long-term career opportunities for employees. This allowed GPU Nuclear to maintain the personnel needed to support the option for continuing to operate the plant.
- Stay focused on the "people issues". When an announcement of a shutdown is made, personnel attrition will sharply increase as employees begin to seek long-term opportunities elsewhere. If the departure of personnel is excessive, the ability to run the plant to the desired shutdown date may be in jeopardy. The key to retaining staff to shutdown is a personnel retention program. Ideally, this program needs to be in place when the shutdown

announcement is made or shortly thereafter. At Oyster Creek, the announcement was made in April 1997 and the retention plan was rolled out in July. During this period, approximately 70 employees left the company. Following the dissemination of the retention plan, attrition returned to normal and remained low throughout the planning period.

- Begin early to plan for the cultural transformation needed to move from an operating plant to the decommissioning mode. To be successful, decommissioning activities require major shifts in needed skill sets as well as cultural changes from that of the operating cycle.
- Decommissioning a large commercial reactor is a protracted process encompassing 6-10 years of activities. To be prepared for changes possibly affecting schedule, contingency planning should be an on-going part of the planning process. This is particularly necessary for such circumstances as closure of LLRW facilities, spent fuel disposition, and conditions that were not assumed in the cost estimate.

12.2 Licensing

- Some decommissioning submittals, although they require preparation time by licensing and perhaps other departments, are straightforward and have minimal impact on other departments. The Post-Shutdown Decommissioning Activities Report, Certifications of Permanent Cessation of Operations and Permanent Removal of Fuel, Certified Fuel Handler Program, Insurance Exemptions, and Emergency Plan Exemption Requests/Defueled Emergency Plan fall into this category. Eight to twelve months prior to permanent shutdown is sufficient to prepare these documents.
- The Defueled Technical Specifications, Defueled Safety Analysis Report, Defueled Quality Assurance Plan and Security Plan Exemption Requests/Defueled Security Plan should be in final draft form before certain other decommissioning activities are initiated. These documents are prerequisites for decommissioning modifications. Preparation of these regulatory submittals should begin 30 months prior to final shutdown. The goal is to have a "final draft" ready at the time modification work is initiated

12.3 Engineering

- The design bases work supporting decommissioning (e.g., activation analysis, accident analysis, LLW planning) can be effectively accomplished with a small group of utility personnel supplemented by contractors selected by competitive bidding.
- Conceptual design of plant modifications to support decommissioning can be effectively accomplished by in-house personnel normally assigned to develop operating cycle modifications. Staffing of this modification group can be done after the final refueling outage with completion of design work by final shutdown (assuming two-year cycle).
- Redesign of engineering processes had no effect on decommissioning engineering performed prior to shutdown. New processes were not available in the timeframe necessary to support pre-shutdown engineering and management elected not to use "dual" processes prior to shutdown.

12.4 Site Release

- The Historical Site Assessment (HSA) is needed to identify radiological and industrial contaminants around the facility. The HSA should be on going during operations along with records of spills as required by 10 CFR 50.75(g). If not in place, however, the HSA should be started early in the planing process.
- The characterization plan can be optimized by conducting the historical site assessment prior to survey design to maximize use of existing data. In addition, scoping surveys should be used for certain areas with the understanding that additional information may need to be obtained based on the results.
- Evaluate the release potential from underneath buildings and structures using site environmental information such as hydrogeology, stratigraphy, and building construction history.

12.5 Spent Fuel

- Evaluate heavy load issues related to crane capacity and floor loadings. The dual-purpose vendors offer a variety of designs and weights. The utility must compare the economics of upgrading the lifting capacity of the crane vs. the utilization of a lighter weighted cask.
- Site selection and community approval early is essential. Without the support of the local community, delays will be experienced in transferring fuel.

12.6 Communications

If not already in place during operations, a Citizens Task Force (CTF) should be established. Although the local citizens may be comfortable with the operating plant, decommissioning is unfamiliar and will represent major concerns to the local community, including impact on local businesses, increased truck traffic, release of large quantities of material from the plant, etc. The establishment of a CTF will allow the citizens to glean information as well as having input into the planning process.

13
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A
ATTACHMENTS

Attachment I

DECOMMISSIONING PLANNING

PHASE I

Quarters (30 Months)

1	2	3	4	5	6	7	8	9	10

Shutdown Announcement — **Final Refuel Outage** — **Shutdown**

Management:

- Decommissioning Organization
- Strategic Plans
- DOC Evaluation
- Project Plan
- Transition Plan Implementation
- Decommissioning Option
- Historical Site Assessment
- Site Characterization Plan
- Announce Retention Plan
- Communication Plan
- Decommissioning Job Classification

Plant Modifications/Process

- Process Redesign
- Design Base Analyses
- Modification Design
- Initial Work Package Development
- Cost Estimate
- Dismantlement Plan
- Procedure Redesign

Regulatory Requirements

Submit:
- Cert. Of Cessation of Operation

Submit:
- PSDAR

Submit:
- Site Specific Cost Estimate

Submit:
- Tech Specs*
- EP Exemptions*
- QA Plan *
- Security Exemptions*
- UFSAR
- Nuclear Insurance Exemptions*
- Ops Requal & Staff Program*

*Requires NRC Approval

Spent Fuel Management

- Issue Request for Proposal Dual Purpose Dry Fuel Storage System
- Award Contract Dry Fuel Storage
- Identify Options for Interim Storage
- Evaluate Heavy Load Issues Single Failure Proof Crane
- Inspect & Classify all Spent Fuel

Attachment I

DECOMMISSIONING PLANNING

PHASE II

Quarters (15 Months)

1	2	3	4	5

Shutdown **Transition to Phase III**

Management:

- Site Characterization
- Transition to Phase II Staffing Complete
- DOC Mobilization
- LLRW Broker Mobilization

Plant Modifications/Process

- Procedure Revisions complete.
- Modifications Installed 30 days post shutdown to one year; e.g. Modified Work Process in place.
- Major D&D Work Packages Complete

Regulatory Requirements

Submit:

- Cert. Of Fuel Removal

Implement:

- TS Changes
- Reduced Insurance
- Security Changes
- QA Plan Changes
- EP Changes
- Ops Requal & Staff Program

Submit as necessary:

- Revised Security Plan
- Revised TS*
- Revised DSAR

Submit:

- Spent Fuel Program
- License Termination App.*

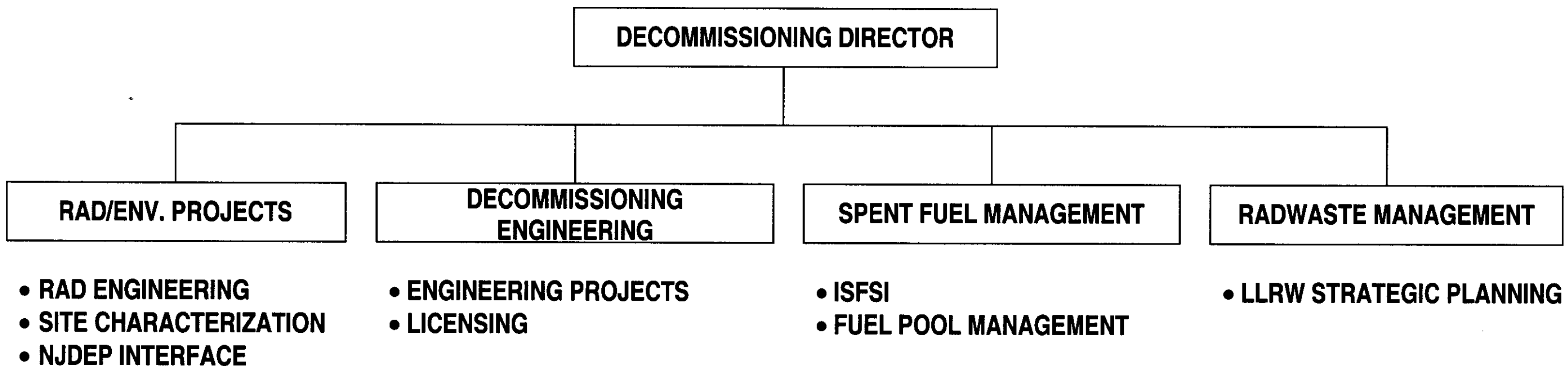
*Requires NRC Approval

Spent Fuel Management

- Core Offload Complete
- Procure Dual Purpose System Hardware
- Commence Work Package Development for Fuel Transfer
- ISFSI Construction
- Disposal of Irradiated Hardware
- Commence Refuel Large Component Removal

Attachment II

Oyster Creek Decommissioning Technical Planning Organization



Attachment III
DECOMMISSIONING PROJECT PLANS

DPP-01 **Decommissioning Strategic Plan**

Describes the overall strategic plan for decommissioning including, key assumptions and decisions, base case schedule, and cash flow and strategies.

DPP-02 **Decommissioning Tactical Plan**

Provides detailed information regarding the implementation of the major decommissioning strategies.

DPP-03 **Decommissioning Organization and Staffing Plan**

Describes the Decommissioning Project Organization and specifies duties and responsibilities of key organization members.

DPP-04 **Site Characterization Plan**

Describes the overall plan for accomplishing the radiological characterization for the OCNGS site. Includes activation analysis.

DPP-05 **Communications Plan**

Describes the important communication requirements that apply to the preparation and conduct of OCNGS Decommissioning. Establishes duties and responsibilities for accurate and effective communication of decommissioning information.

DPP-06 **Decommissioning Oversight Plan**

Establishes and charters an advisory committee of selected individuals who will review decommissioning activities from a senior overview perspective. This committee reports to the Director-Decommissioning.

DPP-07 **Decommissioning Integrated Schedule Plan**

This plan provides the overall plan for establishing the decommissioning integrated schedule. Includes the following major elements in the schedule: Key decisions, processes, plans and programs, modification and production.

DPP-08 **Decommissioning Required Permits Plan**

The purpose of this plan is to develop an understanding of all Federal, State, and Local permits that will be required over the course of decommissioning and to assure that these permits are properly recognized and integrated into work planning functions.

DPP-09 **Decommissioning Cost Estimate**

This plan describes the development of the site-specific cost estimate for Oyster Creek.

DPP-10 **Environmental Report Plan**

Provides review and update of OCNGS Environmental Report.

DPP-11 **Spent Fuel Pool Isolation Study Plan**

Develops requirements for modification of Spent Fuel Pool and supporting systems, structures and components. Includes those items and activities required in order to isolate the SFP and maximize Reactor Building decommissioning activities.

DPP-12 **Decontamination & Dismantlement Plan**

Using input from supporting DPP’s, this plan develops the sequence plan for decontamination and dismantlement of plant systems and structures.

DPP-13 **Decommissioning Support Systems Identification Plan**

This plan identifies existing and new systems that are required in support of the conduct of decommissioning work scope.

DPP-14 **<u>Decommissioning Power Study Plan</u>**

Plan determines electrical power requirements for decommissioning and spent fuel storage. Frees up large portions of the existing plant electrical system for D&D.

DPP-15 **<u>System Decontamination Study Plan</u>**

Plan evaluates chemical decontamination requirements for the reactor coolant system and related support systems, in order to achieve radiation levels that will accommodate conduct of decommissioning activities within the exposure requirements of the GEIS.

DPP-16 **<u>Low Level Solid RadWaste Plan</u>**

Details the methods for handling, packaging and shipping of the low level solid radwaste materials generated during decommissioning.

DPP-17 **<u>Training Requirements Plan</u>**

Defines the operator training requirements that are required following permanent cessation of operations, during the period that spent nuclear fuel is stored on site.

DPP-18 **<u>Decommissioning Accident Analysis Plan</u>**

This study develops the spectrum of credible accidents that must be postulated for on-site decommissioning activities.

DPP-19 **<u>Emergency Preparedness Plan</u>**

This plan evaluates and develops emergency planning requirements as the plant transitions from an operating plant into decommissioning.

DPP-20 **<u>Maintenance Rule Program Revision Plan</u>**

This plan defines the maintenance rule changes that will occur following permanent cessation of operations and permanent removal of fuel from the reactor.

DPP-21 **Security Program Plan**

This plan defines the security program requirement changes as the plant transitions into the decommissioning mode and beyond.

DPP-22 **Quality Assurance Plan**

This plan develops the quality assurance that will apply during decommissioning.

DPP-23 **Fire Protection Program Revision Plan**

This plan identifies the fire protection program revisions that will apply to the plant during decommissioning.

DPP-24 **Decommissioning Process and Activities Plan**

This plan develops the processes and procedures that will be utilized to accomplish decommissioning activities.

DPP-25 **System Quality Classification Plan**

This plan develops a method for reclassifying systems from nuclear safety related to non-QA and/or augmented QA category.

DPP-26 **Decommissioning Engineering Processes**

This plan details the engineering processes that will be utilized as the plant is decommissioned and dismantled.

DPP-27A **Personnel Cultural Transition Process Plan**

This plan will facilitate and schedule the various methods which will achieve the desired cultural transition and paradigm shifts that will take place during Phase I and Phase II and from Phase II to Phase II of decommissioning.

DPP-27B **<u>Personnel Transition and Culture Process Plan</u>**

This plan coordinates and refines input from various sources with the goal of establishing the personnel requirements throughout decommissioning planning and execution, such that the requisite number of staff, with the proper qualification and talent, are in place, and that personnel transitions are accomplished smoothly, efficiently and in a manner which does not negatively impact decommissioning operations.

DPP-28 **<u>PSDAR Preparation Plan</u>**

This plan identifies and coordinates all inputs that are required in order to produce the Oyster Creek Post Shutdown Decommissioning Activities Report. This report is a major activity associated with commencement of decommissioning and gaining access to the decommissioning trust fund for conduct of major decommissioning activities.

DPP-29 **<u>Decommissioning Licensing Requirements</u>**

This plan identifies and develops the required regulatory submittals to support decommissioning.

DPP-30 **<u>UFSAR Update Plan</u>**

This plan develops the decommissioning SAR to facilitate maximum utilization of the 10 CFR 50.59 process during decommissioning.

DPP-31 **<u>Reactor Pressure Vessel Removal Plan</u>**

This plan studies the various options for removal of the reactor vessel during decommissioning.

DPP-32 **<u>Hazardous Waste Plan</u>**

This plan develops the hazardous waste inventory and details the methodology for disposal.

DPP-33 <u>Decommissioning Exposure Estimate Plan</u>

Utilizing input from other DPP's, this plan develops the estimated person-rem exposure requirements for all aspects of OC decommissioning.

DPP-34 <u>Decommissioning Occupational Safety Plan</u>

Develops and details the occupational safety plan requirements that are applicable to decommissioning activities. Special attention is given to dismantlement and demolition type activities and the unique safety program challenges that are associated with this type of work scope.

DPP-35 <u>Low-Level Liquid Radwaste Plan</u>

Details the method for handling disposal of the low-level liquid radwaste generated during decommissioning.

DPP-36 <u>Reactor Pressure Vessel Shipment Plan</u>

This study addresses the shipment methods available for disposal of the reactor vessel. It will look at rail shipment and barge shipment as potential options.

DPP-37 <u>Vendor Selection and Asset Recovery Plan</u>

This plan addresses the activities necessary in order to competitively bid selected decommissioning work scope that is beyond the capability of the site work force.

DPP-38 <u>Insurance Exemptions Plan</u>

This plan identifies the various insurance adjustment periods that will occur as the plant transition from operational status into decommissioning and beyond.

DPP-39 <u>License Termination Plan</u>

This plan coordinates the preparation of the Oyster Creek License Termination Plan. Plan must be submitted at least two years prior to expected termination of the license.

DPP-40 **<u>Decommissioning Contingency Plan</u>**

Established and describes the contingency plan if OCNGS is sold to AmerGen and contingency plan if the sale does not take place.

DPP-41 **<u>Decommissioning Financial & Administrative Plan</u>**

Establishes and describes the decommissioning Project Controls functions, such as budgets, schedules, and other administrative requirements.

DPP-42 **<u>Industrial Site Recovery Act Plan</u>**

This plan identifies and coordinates compliance with New Jersey ISRA requirements.

DPP-43 **<u>Decommissioning Mission, Objectives, Strategies and Goals/Performance Indicators Plan</u>**

This plan establishes various performance indicators such as safety, budget, ALARA, radwaste control, etc. by which the performance of the decommissioning organization can be assessed.

DPP-44 **<u>Decommissioning Personnel Training Plan</u>**

This plan identifies the routine and specialized training requirements that will be needed by the decommissioning organization in order to safely and efficiently accomplish the decommissioning work scope.

DPP-45 **<u>Safety Review Process 10CFR50.59</u>**

This plan details the manner in which the 10 CFR 50.59 process will be applied during decommissioning.

DPP-46 **<u>Impacts, Issues, and Commitments Relating to Decommissioning</u>**

This plan provides the decommissioning organization with a mechanism for identifying and dispositioning issues and commitments, which may impact decommissioning.

DPP-47 **Strategy for Operations and Maintenance Activities Prior to Final Shutdown**

This plan identifies operations and maintenance activities that could be modified or deleted prior to cessation of operations, given advance notice of permanent shutdown. This plan also assesses the decommissioning issues and preparations of other utilities as they relate to OC decommissioning planning.

DPP-48 **Spent Fuel Strategy**

The purpose of this plan is to fully evaluate the companies spent fuel options in terms of decommissioning.

DPP-49 **Large Component Removal Plan**

The plan will identify the scope for large component intact removal, shipment and disposal.

DPP-50 **Procedure Review Plan**

This plan provides the basis for transitioning from procedures required during the operating cycle to those that will be required during decommissioning. Alternative procedure structures will be examined.

DPP-51 **Technical Specifications**

This plan describes the process for revising the Technical Specifications to reflect the permanently defueled condition of the facility.

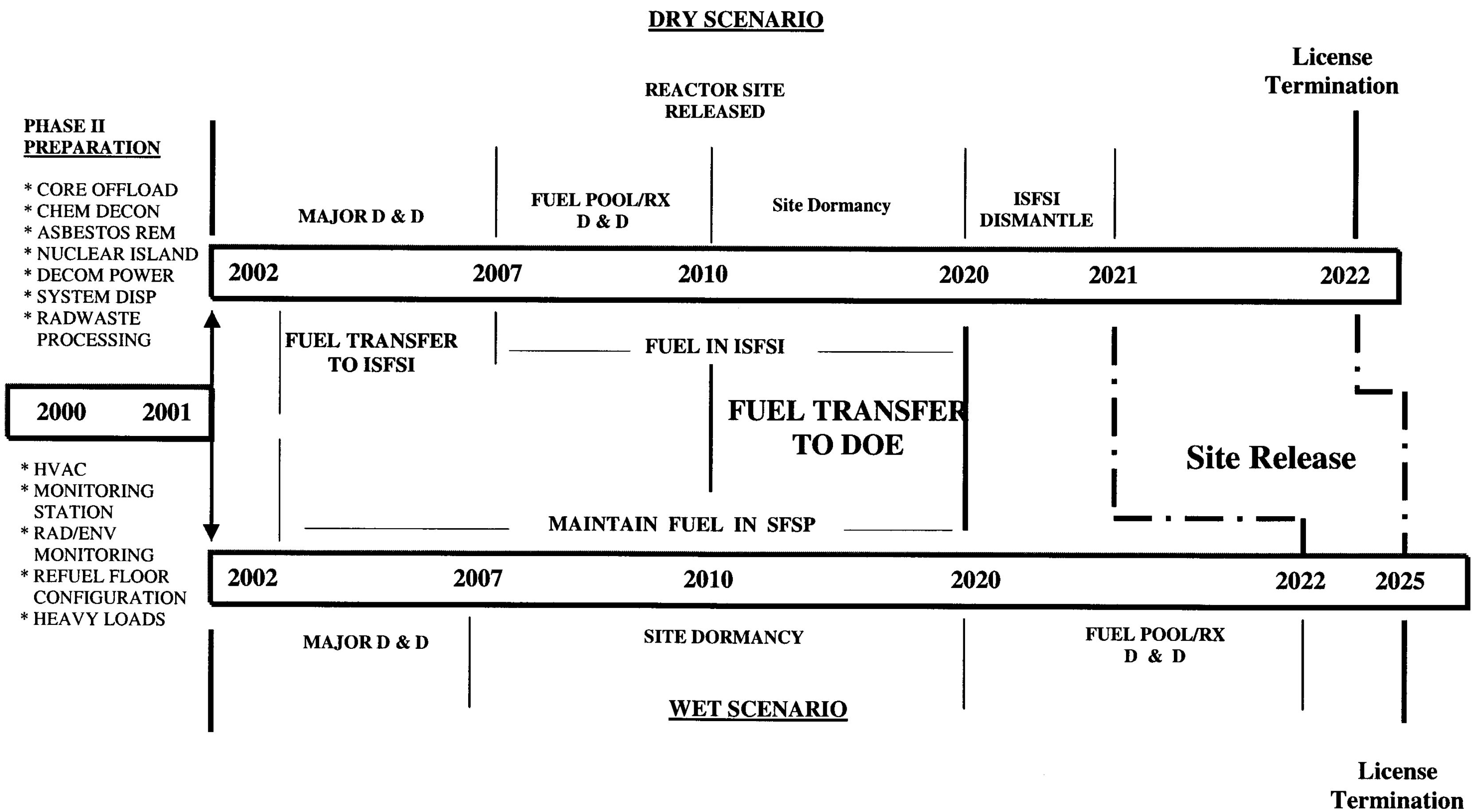
DPP-52 **DPIC Post Sale Report DPIC-PSR**

The plan documents the results of the Decommissioning Process Integration Committee (DPIC) which was established to review, modify, and integrate processes to be commensurate with decommissioning activities.

ATTACHMENT IV

DECOMMISSIONING SCHEDULE

PHASE III
DECONTAMINATION & DISMANTLEMENT



Target:
Nuclear Power

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